



**NIST GCR 01-821**

# **Comparison of the Seismic Provisions of Model Building Codes and Standards to the 1997 NEHRP Recommended Provisions**



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# **Comparison of the Seismic Provisions of Model Building Codes and Standards to the 1997 NEHRP Recommended Provisions**

Prepared for  
*U.S. Department of Commerce  
Building and Fire Research Laboratory  
National Institute of Standards and Technology  
Gaithersburg, MD 20899-8611*

By  
S. K. Ghosh  
Madhu Khuntia

*S. K. Ghosh Associates, Inc.  
1859 Walters Avenue, Suite 200  
Northbrook, IL 60062*

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U.S. Department of Commerce  
*Donald L. Evans, Secretary*

National Institute of Standards and Technology  
*Karen H. Brown, Acting Director*



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### **Project Participants**

**S.K. Ghosh Associates Inc.**

**S.K. Ghosh**

**Madhu Khuntia**

**Building and Fire Research Laboratory, NIST:**

**H.S. Lew**

**Stephen A. Cauffman**

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# 1.0 EXECUTIVE SUMMARY

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Executive Order 12699, *Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction*, requires that all new federally owned, leased, assisted, and other regulated buildings be designed and constructed in accordance with the appropriate seismic standards. The Interagency Committee on Seismic Safety in Construction (ICSSC) has recommended the use of building codes which are substantially equivalent to the 1997 *National Earthquake Hazards Reduction Program Provisions for the Development of Seismic Regulations for New Buildings* (NEHRP Provisions).

The objective of this study is to determine whether or not the seismic and material design provisions of the *International Building Code* (IBC) 2000 edition, the *International Residential Code for One- and Two-Family Dwellings* 2000 edition, and *ASCE 7-98 Minimum Design Loads for Buildings and Other Structures* are substantially equivalent to, or exceed, the 1997 NEHRP Provisions.

This report follows three previous reports prepared for the National Institute of Standards and Technology (NIST GCR 91-598, NIST GCR 95-674 and NIST GCR 98-755). Each previous report evaluated the equivalency of the latest edition of the NEHRP Provisions available at the time of the report and the latest editions of the following model codes and standards available at the time of the report: the *BOCA National Building Code* (BOCA/NBC), the *Standard Building Code* (SBC), the *Uniform Building Code* (UBC), *ASCE 7 Minimum Design Loads for Buildings and Other Structures* (ASCE 7) and *CABO One- and Two-Family Dwelling Code* (OFTDC).

The 1997 NEHRP Provisions provide the basis for the seismic design provisions of the 2000 IBC. However, changes have been made with input from the Code Resource Development Committee and the Code Resource Support Committee of the Building Seismic Safety Council and with public input. The documents were found to be equivalent in intent and equivalent in design values with some exceptions. The exceptions are detailed in Section 7.0 of this report.

The seismic provisions of ASCE 7-98 are based on the 1997 NEHRP Provisions; however, the IBC modifications to the 1997 NEHRP Provisions were also considered. Some of these modifications were adopted. Some other modifications were made as an inevitable result of the consensus process. The documents were found to be equivalent in intent and equivalent in design values with some exceptions. The exceptions are detailed in Section 8.0 of this report.

The technical content of the 1998 *International One and Two Family Dwelling Code* [formerly the CABO (Council of American Building Officials) One and Two Family Dwelling Code] was the starting point for the development of the IRC. The seismic design provisions of the 2000 IRC, however, are quite different from those of the 1998 *International One and Two Family Dwelling Code*. The provisions are heavily influenced by those of the 2000 IBC and the 1997 NEHRP Provisions. BSSC's Code Resource

Support Committee provided guidance to the IRC Drafting Committee in the development and refinement of the seismic design provisions. The IRC and the IBC seismic provisions were thus kept coordinated to the extent possible. The seismic design provisions of the 2000 IRC, when compared with those of the 1997 NEHRP Provisions, were found to be equivalent in intent and equivalent in design values with some exceptions. The exceptions are detailed in Section 9.0 of this report.

## 2.0 INTRODUCTION

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Executive Order 12699, *Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction*, requires that all new federally owned, leased, assisted, and other regulated buildings be designed and constructed in accordance with the appropriate seismic standards. The Interagency Committee on Seismic Safety in Construction (ICSSC) has recommended the use of building codes which are substantially equivalent to the 1997 *National Earthquake Hazards Reduction Program Provisions for the Development of Seismic Regulations for New Buildings* (NEHRP Provisions).

The objective of this study is to determine whether or not the seismic and material design provisions of the *International Building Code* (IBC) 2000 edition, the *International Residential Code for One- and Two-Family Dwellings* 2000 edition, and *ASCE 7-98 Minimum Design Loads for Buildings and Other Structures* are substantially equivalent to, or exceed, the 1997 NEHRP Provisions.

This report follows three previous reports prepared for the National Institute of Standards and Technology (NIST GCR 91-598, NIST GCR 95-674 and NIST GCR 98-755). Each previous report evaluated the equivalency of the latest edition of the NEHRP Provisions available at the time of the report and the latest editions of the following model codes and standards available at the time of the report: the *BOCA National Building Code* (BOCA/NBC), the *Standard Building Code* (SBC), the *Uniform Building Code* (UBC), *ASCE 7 Minimum Design Loads for Buildings and Other Structures* (ASCE 7) and *CABO One- and Two-Family Dwelling Code* (OFTDC).

Comparisons between the 1997 NEHRP Provisions, the IBC and the IRC are made on the basis of seismic provisions, material design provisions, foundation design requirements, quality assurance provisions, and non-structural element design requirements. In the comparisons, a model code or standard is judged equivalent if its provisions are equivalent to, or more stringent than the corresponding requirements in the 1997 Provisions. A document is judged not equivalent if the requirements of the 1997 NEHRP Provisions are more stringent than the requirements in the model code or standard.

In certain instances NEHRP includes provisions that the model codes or standards do not. When a model code or standard does not have specific provisions regarding criteria, elements or systems, the design is left to the discretion of the designer. Depending on the judgment of the designer, the design may or may not be equivalent to NEHRP. Therefore, when a model code or standard is silent on certain issues, equivalency may not be judged.

## 3.0 1997 NEHRP PROVISIONS

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### 3.1 Overview of NEHRP Provisions

The Federal Emergency Management Agency (FEMA) has contracted the Building Seismic Safety Council (BSSC) to develop the National Earthquake Hazards Reduction Program (NEHRP) Provisions for new buildings. One of the primary goals of the program is to reduce or mitigate losses from earthquakes. The NEHRP Recommended Provisions for Seismic Regulations for New Buildings are recommended provisions that have increasingly been adopted in recent times by model codes and standards. The first edition of the NEHRP Provisions was dated 1985. The document is updated on a 3- year cycle. The 1997 edition of the NEHRP provisions is the fourth update of the document. The seismic design provisions of the 2000 *International Building Code* are based on the 1997 NEHRP Provisions.

The NEHRP Provisions present a strength-based approach to design that represents the state of knowledge of seismic design. The seismic design provisions incorporate current research and knowledge from previous earthquakes. Seismicity maps are used to assess the seismic hazard at a particular site. Forces and seismic design requirements are increased with increasing seismic hazard. In the 1997 edition of the NEHRP Provisions, the seismic design category (SDC) of a structure, which is based on occupancy as well as on soil-modified seismic risk at the site of a structure, determines the level of detailing and design requirements. The seismic design category is used to obtain higher levels of performance; however, it does not influence the force level which is increased for structures in higher occupancy categories through an importance factor. In the design base shear equation, a factor  $R$  which accounts for system response and inelastic deformability, reduces the strength that would have been needed for elastic response to the design earthquake to a design level. Detailing requirements that are formulated to provide a commensurate amount of inelastic deformability are given in the materials chapters. The design base shear varies with  $1/T$ , where  $T$  is the elastic fundamental period of the structure.

### 3.2 Overview of Major Changes from NEHRP 1994 to 1997

The earthquake regulations of the 1997 NEHRP Provisions are substantially different from the corresponding requirements of the 1994 Provisions. The biggest change is in the design ground motion parameters which are now  $S_{DS}$  and  $S_{D1}$ , rather than the  $C_a$  and  $C_v$  of the 1994 Provisions and  $A_a$  and  $A_v$  of earlier Provisions.  $S_{DS}$  and  $S_{D1}$  are 5%-damped design spectral response accelerations at short periods and 1 sec. period, respectively.  $S_{DS}$  and  $S_{D1}$  are two-thirds of  $S_{MS}$  and  $S_{M1}$  which are soil-modified (Maximum Considered Earthquake) spectral response accelerations at short periods and 1 sec. period, respectively.  $S_{MS}$  and  $S_{M1}$  are obtained by multiplying mapped MCE spectral response accelerations  $S_S$  (at short periods) and  $S_1$  (at 1 sec. period), respectively, by  $F_a$ , the acceleration-related soil factor and  $F_v$ , the velocity-related soil factor, respectively. The maximum considered earthquake is the 2500- year return period earthquake (2%

probability of exceedance in 50 years) in most of the country, except that in coastal California, it is the largest (deterministic) earthquake that can be generated by the known seismic sources. The design earthquake of the 1997 NEHRP provisions is two-thirds of the MCE, whereas the design earthquake of the 1994 NEHRP Provisions has an average return period of 475 years (10% probability of exceedance in 50 years). The two-thirds is the reciprocal of 1.5 which is agreed to be the “seismic margin” built into structures designed by the 1994 and older editions of the NEHRP Provisions. In other words, a structure designed by the 1994 or older editions of the NEHRP Provisions is believed to have a low likelihood of collapse under an earthquake that is one and one-half times as large as the design earthquake of those documents. The redefinition of the design earthquake in the 1997 NEHRP Provisions is intended to provide a uniform level of safety across the country against collapse in the Maximum Considered Earthquake. This was not the case before because the MCE is only 50% larger than the design Earthquake of the 1994 NEHRP Provisions in coastal California, while it can be four or five times as large as the design earthquake of the 1994 Provisions in the Eastern United States.  $A_a$  and  $A_v$  of the 1994 NEHRP Provisions indicated the effective peak acceleration and the effective peak velocity-related acceleration of the ground corresponding to the design earthquake of the 1994 Provisions on Type  $S_B$  soil or soft rock. The mapped MCE spectral response accelerations  $S_s$  and  $S_1$  of the 2000 IBC are also mapped on Type  $S_B$  soil. The soil classification and the associated site coefficients first introduced in the 1994 NEHRP Provisions have been retained unchanged in the 1997 Provisions.

The second most important difference between the 1994 and the 1997 editions of the NEHRP Provisions is the replacement of the Seismic Performance Category (SPC) with the Seismic Design Category (SDC). In the 1994 and older editions of the NEHRP Provisions, restrictions on building height and structural irregularity, choice of analysis procedures that form the basis of seismic design, as well as the level of detailing required for a structure were all governed by the Seismic Performance Category. The SPC was a function of occupancy (called Seismic Hazard Exposure Group in the 1994 and older NEHRP editions) and of the seismic risk at the site of the structure in the form of  $A_v$ , the effective peak velocity-related acceleration coefficient. In the 1997 NEHRP Provisions, the level of detailing and the other restrictions are all governed by the Seismic Design Category which combines occupancy (called Seismic Use Group in the 1997 NEHRP Provisions) with the soil-modified seismic risk at the site of the structure, in the form of the design spectral response accelerations  $S_{DS}$  and  $S_{D1}$ . The 1997 NEHRP Provisions for the first time has made detailing as well as the other restrictions a function of the soil characteristics at the site of a structure. This is a major departure from current seismic design practice – a departure that has far-reaching financial and other consequences. The basis for categorizing structures into SDC E was also changed between 1994 and 1997 and a new SDC F was added. In 1994, Category E consisted of Group III structures (essential facilities) in regions anticipated to experience strong ground motion ( $A_v > 0.2$ ). In 1997, Category E consists of Seismic Use Group I and II structures (standard-occupancy structures and assembly buildings) located within a few kilometers of major active faults as indicated by the maximum considered earthquake spectral response maps ( $S_1 \geq 0.75g$ ). Category F includes Seismic Use Group III structures (essential facilities)

located within a few kilometers of major active faults. Most buildings assigned to Category E in the 1994 Provisions are assigned to Category D in the 1997 Provisions.

An occupancy Importance Factor,  $I$ , has long been a feature of the *Uniform Building Code* (UBC). An  $I$ -factor was not included in ATC 3, the predecessor document to the NEHRP Provisions, or in any of the NEHRP Provisions through its 1994 edition. ATC 3 and NEHRP opted instead for tighter drift limits and higher levels of detailing for structures in higher occupancy categories. An Occupancy Importance Factor – 1.5 and 1.25 for Seismic Use group III or II structures, respectively – has been brought into the 1997 NEHRP Provisions, increasing the design force level for higher occupancy categories. This is in addition to the requirements of tighter drift limits and higher levels of detailing for higher occupancy categories.

One notable change from the 1994 to the 1997 NEHRP Provisions is the proliferation of structural systems in Table 5.2.2 of the latest edition. The reason is a policy decision made with respect to the 1997 Provisions. In the 1994 Provisions, the bearing wall system with concrete shear walls was assigned  $R$ - and  $C_d$ -values of 4.5 and 4, respectively. These values did not change from the high to the low Seismic Performance Categories. In SPC D and E, the shear walls required special detailing, while in SPC A, B, and C, ordinary detailing was all that was needed. Thus, in effect, two different seismic force resisting systems with different levels of inelastic deformability went under the same name and were assigned the same  $R$  and  $C_d$  values. This situation needed improvement. For the 1997 NEHRP Provisions it was decided that each basic seismic force resisting system defined in Table 5.2.2 would have its own unique set of detailing requirements and commensurate  $R$ - and  $C_d$ -values assigned to it. Thus, four different types of concrete shear walls have been defined: ordinary plain concrete, detailed plain concrete, ordinary reinforced concrete, and special reinforced concrete. This obviously adds to the total number of structural systems defined in the table. There is an associated change that should be noted as well. In the 1994 Provisions, overstrength was recognized for the design of a limited number of elements such as columns supporting discontinued lateral-force-resisting elements, and was approximated by the factor  $2R/5$ . In the 1997 Provisions, a separate tabulated  $\Omega_0$  factor replaces the arbitrary  $2R/5$  value. The  $\Omega_0$  factors are intended to be approximate, upper-bound estimates of the probable overstrength inherent in the typical lateral-force-resisting systems of common structures.

Finally, the nonbuilding structures requirements which were in 1994 Section 2.6, appear as 1997 Chapter 14 and the requirements have been significantly expanded and modified to reflect the new design procedures for the 1997 Provisions. An appendix is included to provide the user with considerable extra guidance concerning nonbuilding structures for which no formal standards exist.

## 4.0 2000 INTERNATIONAL BUILDING CODE

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### 4.1 Overview of 2000 IBC

The three existing U. S. model codes, the *Uniform Building Code* (UBC), the *BOCA National Building Code* (BOCA/NBC), and the *Standard Building Code* (SBC) are published respectively by the International Conference of Building Officials (ICBO), Whittier, California; the Building Officials and Code Administrators International (BOCA), Country Club Hills, Illinois; and the Southern Building Code Congress International (SBCCI), Birmingham, Alabama. At the end of 1994, the three model code groups together formed the International Code Council (ICC) with the express purpose of developing a single set of construction codes for the entire country. Included in this family of *International Codes* is the *International Building Code* (IBC), the first edition of which was published in 2000.

Five Technical Subcommittees were formed in 1996 by the International Code Council. The intent of the Technical Subcommittees was to develop a Working Draft of a comprehensive building code that is consistent with and inclusive of the scope and content of the existing model codes.

The technical content of the latest building codes promulgated by BOCA, ICBO, and SBCCI was the nucleus for the development of the Working Draft. Other sources of relevant technical information were also considered. While there were a great many similarities among the three codes, careful consideration was given to identified differences. The Technical Subcommittees used certain principles as guidance in the resolution of technical differences. The principles were based on the intent to establish provisions consistent with the scope of a building code that adequately protects public health, safety, and welfare; provisions that do not increase construction costs unnecessarily; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction. The Working Draft was published in May 1997.

In order to gain views of building code users, industries and all other interested parties, a public forum was held in August 1997 in Denver at which the Technical Subcommittees considered close to 3000 submitted public comments, used to determine the content of the First Draft which was published in November 1997. The ICC subsequently appointed five Hearing Subcommittees responsible for the same IBC chapters as the five Technical Subcommittees. These five subcommittees held public hearings in April 1998 in Alexandria, VA, using ICC code development procedures except that successful Assembly votes replaced committee recommendations for text revisions in the Final Draft. Over 2000 code changes were processed. The Final Draft was published in July 1998.

The five ICC subcommittees held public hearings for a second time in March 1999 in Costa Mesa, California, to consider proposed changes to the Final Draft. The changes were processed using ICC code development procedures; any Assembly action was also recorded. The Committee recommendations and Assembly actions were published by the ICC in the "1999 Report of the Public Hearing on the International Building Code/Final Draft, ..., Held in Costa Mesa ,California, March 15-26, 1999." The Committee recommendations made at Costa Mesa and published in the above report were subject to challenges (or so-called Public Comment). The challenges submitted were published by the ICC in "1999 Final Action Agenda ...," and considered at a Joint Annual Business Meeting of the three model code groups in St. Louis in September 1999. At that meeting the challenged committee recommendations from Costa Mesa were either ratified or overturned by action of the memberships of the three model code groups. The outcome was published in the November-December issue of ICBO's *Building Standards* magazine. Unchallenged recommendations stood automatically ratified.

#### **4.2 Seismic Design Provisions of 2000 IBC**

The seismic design provisions were treated separately from the rest of the IBC in its development process. The seismic design provisions are not taken from the existing model codes. The Federal Emergency Management Agency set up a group called the Code Resource Development Committee (CRDC) under the auspices of the Building Seismic Safety Council (BSSC) and charged this group with the development of seismic design provisions of the 2000 IBC, based on the 1997 NEHRP provisions. The seismic design provisions of the Working Draft were thus based on the 1997 NEHRP Provisions, but also included a number of features of the 1997 UBC that were not included in the 1997 Provisions. Many changes have been made to the provisions of the Working Draft through the Public Forum and the two sets of public hearings. BSSC's Code Resource Support Committee (CRSC), a successor group to the CRDC, played an active role in this development by sponsoring changes of their own and by taking position on other submitted changes – positions that were carefully considered by the IBC Structural Subcommittee at the Forum and at the hearings. The seismic design provisions of the First Edition of the IBC are still based on the 1997 NEHRP Provisions, with a few of the features of the 1997 UBC also included.

## 5.0 ASCE 7-1998

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### 5.1 Overview of ASCE 7-1998

*Minimum Design Loads for Buildings and Other Structures* used to be Standard A58, then Standard A58.1 of the American National Standards Institute (ANSI). In 1985 the American Society of Civil Engineers (ASCE) assumed responsibility for the committee that develops and updates the above standard. The committee became ASCE Committee 7 and the first edition of the former ANSI A58.1 standard published under the ASCE banner was ASCE 7-88. An update was published in 1993 (ASCE 7-93) and another in 1995 (ASCE 7-95). The next update, ASCE 7-98 was published early in 2000.

### 5.2 Seismic Provisions of ASCE 7-1998

ASCE 7-88, published in 1990, had its seismic design provisions largely unchanged from those of ANSI A58.1-1982, which had been based on the 1979 edition of the *Uniform Building Code*. These grossly outdated provisions were replaced in ASCE 7-93 which adopted, with a few modifications, the 1991 edition of the NEHRP Provisions. In fact, the sole reason for the publication of ASCE 7-93 was to update the seismic provisions. Two years later, ASCE 7-95 updated to the 1994 NEHRP Provisions, again with a few modifications.

The decision was made quite some time ago that the seismic design provisions of ASCE 7-98 would be based on the 1997 NEHRP Provisions. However, changes made to the 1997 NEHRP Provisions for the IBC were considered by the ASCE 7 Committee. Some of these changes were adopted, sometimes with further modifications. Other changes were proposed and at times approved as part of the consensus process which includes public review and comments. ASCE 7-98 with its updated seismic design provisions was published in 2000.

## 6.0 2000 INTERNATIONAL RESIDENTIAL CODE

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### 6.1 Overview of 2000 IRC

As mentioned in Section 4.1, at the end of 1994, the three existing model code groups together formed the International Code Council (ICC) with the express purpose of developing a single set of construction codes for the entire country. Included in this family of *International Codes* is the *International Residential Code (IRC)*, the first edition of which is scheduled to be published in the spring of the year 2000.

In April 1996, the ICC Board of Directors established an ICC/NAHB (National Association of Home Builders) Task Force, and charged it with the examination of options related to the *One and Two Family Dwelling Code (OTFDC)* published by the American Council of Building Officials (CABO). This Task Force subsequently recommended to the ICC Board that the "ICC develop and maintain a stand-alone residential code that will cover the construction of detached one- and two- family dwellings and multiple single-family dwellings (i.e. townhouses) not more than 3 stories in height with separate means of egress. This code is to be called the *International Residential Code (IRC)*."

An IRC Drafting Committee was formed by the ICC, consisting of representatives of BOCA, ICBO, SBCCI, ICC and NAHB. The intent of the code drafting committee was to develop a draft of a comprehensive residential code that is consistent with and inclusive of the scope and content of the existing model building codes and the *International One and Two Family Dwelling Code* (formerly the CABO One and Two Family Dwelling Code).

The technical content of the 1998 *International One and Two Family Dwelling Code*, the other *International Codes* (including the *International Building Code/First Draft*) and the latest building codes promulgated by BOCA, ICBO and SBCCI formed the nucleus for the development of the new document. Other sources of relevant technical information were also considered. While there were great many similarities among the codes, careful consideration was given to identified differences. The code drafting committee used certain principles as guidance in the resolution of technical differences. The principles were based on the intent to establish provisions consistent with the scope of a residential code that adequately protects public health, safety and welfare; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction. The First Draft was published in April 1998.

In order to gain views of code users, industries and all other interested parties, a public forum was held in July 1998 in Kansas City, Missouri, at which the IRC Drafting

Committee considered a large number of public comments to determine the content of the Final Draft which was published in September 1998.

The IRC Drafting Committee held public hearings for a second time in March 1999 in Costa Mesa, California, to consider proposed changes to the Final draft. The changes were processed using ICC code development procedures; any Assembly action was also recorded. The Committee recommendations and Assembly actions were published by the ICC in the "1999 Report of the Public Hearing...Held in Costa Mesa, California, March 15-21, 1999." The Committee recommendations made at Costa Mesa and published in the above report were subject to challenges (or so-called Public Comment). The challenges submitted were published by the ICC in "1999 Final Action Agenda..." and were considered at a Joint Annual Business Meeting of the three model code groups, held in St. Louis in September 1999. At that meeting the challenged committee recommendations from Costa Mesa were either ratified or overturned by action of the memberships of the three model code groups. Unchallenged recommendations automatically stood ratified.

## **6.2 Seismic Design provisions of 2000 IRC**

The seismic design provisions of the 2000 IRC are significantly different from those of the 1998 *International One and Two Family Dwelling Code*. The provisions are heavily influenced by those of the 2000 IBC and the 1997 NEHRP Provisions. BSSC's Code Resource Support Committee, mentioned earlier under Section 4.2, provided cooperation to the IRC Drafting Committee in the development and refinement of the seismic provisions. One aim of such cooperation was to keep the IRC and the IBC seismic design provisions coordinated to the extent possible.

## **7.0 COMPARISON OF 2000 IBC TO 1997 NEHRP**

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Detailed chapter-by-chapter and side-by-side comparisons of the 1997 NEHRP Provisions and the seismic and material design provisions of the 2000 IBC are provided in Table 1. These are summarized below, and some overall conclusions are drawn based on the comparisons.

### **7.1 Chapter 1: General Provisions**

The 1997 NEHRP Provisions has a purpose statement that is not included in the seismic design provisions of the IBC. This in itself does not make the IBC non-equivalent. The IBC makes a number of exceptions to the applicability of its seismic design provisions that are broader than the exceptions made by 1997 NEHRP. These exceptions make the IBC less stringent than the NEHRP Provisions. The IBC provisions concerning additions to existing buildings are also somewhat less restrictive than those of the 1997 NEHRP Provisions. The IBC is equivalent to or more restrictive than the NEHRP Provisions in all other areas covered by Chapter 1.

### **7.2 Chapter 2: Glossary and Notations**

The glossary of NEHRP Section 2.1 is spread between two IBC sections: 1602.1 and 1613.1. Also, while notations are explained in the 1997 NEHRP Section 2.2, they are scattered throughout the IBC seismic design provisions, and are explained as they occur in the text. This chapter basically does not affect equivalency between the two documents.

### **7.3 Chapter 3: Quality Assurance**

IBC is somewhat less restrictive in the area of special inspection because it provides some exceptions to special inspection requirements. IBC is less restrictive when it comes to special inspection requirements for structural masonry, because many structures are exempt from some or all of the inspection requirements. IBC is also less restrictive with regards to special inspection requirements for architectural components, because of exceptions that are allowed. Concerning reporting and compliance procedures, IBC is less stringent because it does not detail reporting responsibilities of the contractor. In other areas, the IBC is equivalent or more stringent.

### **7.4 Chapter 4: Ground Motion**

As the detailed comparisons show, IBC Section 1615 entitled, "Earthquake Loads - Site Ground Motion," is entirely equivalent to this NEHRP chapter.

## **7.5 Chapter 5: Structural Design Criteria**

This chapter has enormous scope and in many ways forms the core of the 1997 NEHRP Provisions. The one item covered by the chapter on which the corresponding IBC provision is less stringent has to do with the upper- and lower-bound values on diaphragm design forces (NEHRP Section 5.2.5.4, IBC Section 1620.3.3). The IBC is also slightly less stringent when it comes to drift computations (NEHRP Sections 5.2.8 and 5.3.7). The IBC allows strength design as well as allowable stress design (ASD), whereas the NEHRP allows strength design only (NEHRP Section 5.2.7, IBC Section 1605). This by itself does not make the IBC less stringent, since ASD typically produces more conservative designs than strength design. It should also be noted that unlike in the *Uniform Building Code*, the effect of vertical earthquake ground motion is not regulated in ASD per the IBC. In every area not specifically mentioned above, the IBC is equivalent, if not more stringent.

## **7.6 Chapter 6: Architectural, Mechanical, and Electrical Components Design Requirements**

The IBC does not contain the NEHRP provision concerning overturning effects of equipment fastened to access floors (NEHRP Section 6.2.7.1); this makes the IBC less stringent in this limited area. The IBC provides an exception to the partition bracing requirement of NEHRP Section 6.2.8, which makes the IBC slightly less stringent. The IBC is also slightly less stringent when it comes to permitting the use of an elevator after the seismic switch has triggered, in facilities where the loss of the use of an elevator is a life-safety issue.

## **7.7 Chapter 7: Foundation Design Requirements**

IBC is less stringent because it allows 25% reduction in overturning moment when foundation is proportioned using strength design load combinations of IBC Section 1605.2. This is not allowed by NEHRP. Requirements concerning foundation ties are less stringent in the IBC than in the NEHRP Provisions (NEHRP Sections 7.4.3, 7.5.2). For uncased concrete piles in SDC C (NEHRP Section 7.4.4.1), the NEHRP Provisions contains a specific detailing requirement that, frankly speaking, is unrealistic. This requirement has been dropped from the IBC, which makes it, in terms of strict technicality, slightly less stringent. For precast concrete piles, the IBC has slightly more relaxed spacing requirement for the transverse reinforcement. The IBC is also somewhat less stringent when it comes to uncased concrete piles in SDC D, E or F (NEHRP Section 7.5.4.1).

## **7.8 Chapter 8: Steel Structure Design Requirements**

The steel chapters of the 2000 IBC and the 1997 NEHRP Provisions are equivalent, except when it comes to light-framed walls. Many of the IBC requirements in this area are applicable to structures assigned to Seismic Design Categories D, E, and F only,

whereas under the NEHRP Provisions basically the same provisions are applicable across the board.

### **7.9 Chapter 9: Concrete Structure Design Requirements**

The IBC has adopted a later edition of the reference standard, ACI 318, which generally makes it more stringent than NEHRP. There are two areas in which the IBC is less restrictive - deliberately and justifiably so. Unlike the NEHRP Provisions, the IBC does not require the use of reduced strength reduction factors with the strength design load combinations of Section 1605.2. Secondly, unlike the 1997 NEHRP Provisions, the IBC does not restrict splices in gravity columns to the middle half of the column height (NEHRP Section 9.1.1.15, IBC Section 1908.1.11). The IBC is also slightly less restrictive in that ordinary moment frames assigned to Seismic Design Category A do not have to conform with the additional detailing requirements of NEHRP Sections 9.3.1.1.1 and 9.3.1.1.2.

### **7.10 Chapter 10: Composite Steel and Concrete Structure Design Requirements**

This chapter and the 2000 IBC Section 2213 are equivalent.

### **7.11 Chapter 11: Masonry Structure Design Requirements**

The IBC is less stringent when it comes to minimum reinforcement requirements for masonry shear walls assigned to Seismic Design Category C and above. The 1997 NEHRP Provisions prohibit the use of Type N mortar and masonry cement in the basic structural system, whereas the IBC prohibits the use of Type N mortar and masonry cement only in the lateral-force-resisting system, which makes the IBC less stringent. The IBC is less stringent in minimum reinforcement requirements for masonry walls assigned to Seismic Design Category D, and in minimum reinforcement requirements for masonry walls using stack bond construction and assigned to Seismic Design Category D. The rectangular stress block used in design for flexure and axial loads is less stringent in the IBC than in the 1997 NEHRP Provisions. IBC is less stringent in its requirements concerning lateral ties in columns. Finally, dimensional limitations for wall frame beams are less stringent in the IBC than in the 1997 NEHRP Provisions. The IBC is less stringent with respect to the nominal moment strength to cracking moment strength ratio and minimum reinforcement ratio for wall frame columns. Under masonry veneer design, the 1997 NEHRP Provisions requires that for structures in SDC E, corrugated sheet metal anchors shall not be used. This requirement is not in the IBC, which makes it less restrictive.

### **7.12 Chapter 12: Wood Structure Design Requirements**

The NEHRP Provisions does not allow conventional construction of light frame structures of Seismic Use Group II in Seismic Design Category E. IBC does allow conventional construction for such structures, and is therefore somewhat less restrictive. The NEHRP Provisions does not allow conventional construction of light frame

structures that are classified as irregular under the provisions of the wood chapter and are assigned to SDC C. IBC does allow conventional construction for such structures, and is therefore somewhat less restrictive. The wall anchorage requirements for conventional light frame construction are somewhat less stringent in the IBC for structures assigned to Seismic Design Categories C, D, and E. Provisions concerning detailing for openings in diaphragms are somewhat more stringent in the NEHRP Provisions than in the IBC.

### **7.13 Chapter 13: Seismically Isolated Structures Design Requirements**

The 2000 IBC Section 1623 is equivalent to this 1997 NEHRP Chapter, except for one minor item. The IBC is slightly less stringent in its requirements concerning sequences and cycles for required tests of isolation systems.

### **7.14 Chapter 14: Nonbuilding Structure Design Requirements**

The 2000 IBC Section 1622 is equivalent to this 1997 NEHRP Chapter, except for one item. The IBC is slightly less stringent in that it introduces one exception to the NEHRP design requirements for nonbuilding structures similar to buildings.

### **7.15 Conclusions Regarding IBC**

The provisions with respect to which the 2000 IBC and the 1997 NEHRP Provisions are judged not equivalent are as follows:

- Exceptions to the applicability of the seismic design provisions of the IBC
- Provisions concerning additions to existing buildings
- Exceptions to special inspection requirements in general
- Exemptions from special inspection requirements for structural masonry
- Exceptions to special inspection requirements for architectural components
- Reporting responsibilities of the contractor
- Upper- and lower-bound values on diaphragm design forces
- Inclusion of torsional effects in drift computations
- Specific modeling requirements to be followed in drift computations by the static procedure
- Overturning effects of equipment fastened to access floors
- Partition bracing requirements
- Permitting use of elevator after seismic switch has triggered, in facilities where loss of use of elevator affects life-safety.
- Reduction in overturning moment when foundation is proportioned using strength design load combinations
- Detailing requirement for uncased concrete piles
- Transverse reinforcement spacing requirement for precast concrete piles
- Foundation tie requirements
- Special pile requirements, SDC D, E, and F
- Uncased concrete pile reinforcement, SDC D, E, and F

- Applicability of provisions concerning light-framed metal walls
- Requirement concerning use of reduced strength reduction factors in strength design of concrete
- Requirement concerning splice location in gravity columns of concrete
- Detailing requirements for ordinary moment frames of concrete in SDCA
- Minimum reinforcement requirements for masonry walls in SDC C and above
- Restrictions on Type N mortar and masonry cement
- Minimum reinforcement requirements for masonry walls in SDC D and above.
- Minimum reinforcement requirements for masonry walls using stack-bond construction in SDC D and above
- Rectangular stress block used in masonry design for flexure and axial loads
- Requirements concerning lateral ties in masonry columns
- Dimensional limitations for masonry wall frame beams
- Nominal moment strength to cracking moment strength ratio and minimum reinforcement ratio for masonry wall frame columns
- Use of corrugated sheet metal anchors for masonry veneers in SDC E
- Use of conventional construction for SUG II structures in SDC E
- Use of conventional construction for irregular structures in SDC C
- Wall anchorage requirements for conventional light frame construction for structures assigned to SDC C and above
- Requirements concerning detailing for openings in diaphragms
- Requirements concerning sequences and cycles for required tests of isolation systems
- Exception to design requirements for nonbuilding structures similar to buildings

The most significant differences between the seismic provisions of the 2000 IBC and the 1997 NEHRP Provisions are:

1. The NEHRP Provisions exempts detached one- and two- family dwellings located where  $S_{DS} \leq 0.4g$  from seismic design requirements. The IBC exempts detached one- and two- family dwellings in Seismic Design Categories A, B, and C (i.e., where  $S_{DS} \leq 0.50g$  and  $S_{D1} \leq 0.20g$ ) from seismic design requirements.
2. In the NEHRP Provisions, structures located where  $S_1 \leq 0.04g$  and  $S_s \leq 0.15g$  need to comply only with the requirements for SDC A structures. In the IBC, this relaxation is extended to structures located where  $S_{DS} \leq 0.167g$  and  $S_{D1} \leq 0.067g$ . Since  $S_{DS} = (2/3) F_a S_s$  and  $S_{D1} = (2/3) F_v S_1$ , the IBC exception may be rewritten as  $S_s \leq 0.25g/F_a$  and  $S_1 \leq 0.1g/F_v$ . At sites where  $F_a < 1.67$  and  $F_v < 2.5$  (stiffer soil sites and moderate- to high- seismicity areas), this would make the IBC less stringent.

3. IBC makes a number of exceptions to special inspection requirements in general, special inspection requirements for masonry and special inspection requirements for architectural components.
4. The horizontal spacing of vertical reinforcement for masonry walls in SDC C and above has been relaxed from 4 ft in the NEHRP Provisions to 10 ft in the IBC.

The differences that probably come next in terms of significance are:

5. The IBC allows a 25 percent reduction in overturning moment when a foundation is proportioned using strength design load combinations of IBC Section 1605.2.
6. The upper-bound and lower-bound diaphragm design forces are both lower in the IBC than in the NEHRP Provisions.
7. The IBC allows conventional construction for wood framed Seismic Use Group II structures in SDC E, the NEHRP Provisions does not.
8. The IBC allows conventional construction for irregular wood framed structures in SDC C; the NEHRP Provisions does not.

The other differences are relatively less significant.

## **8.0 COMPARISON OF ASCE 7-98 TO 1997 NEHRP**

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Detailed chapter-by-chapter and side-by-side comparisons of the 1997 NEHRP Provisions and the seismic and material design provisions of ASCE 7-98 are provided in Table 2. These are summarized below, and some overall conclusions are drawn based on the comparisons.

### **8.1 Chapter 1: General Provisions**

The ASCE 7-98 standard makes a number of exceptions to the applicability of its seismic design provisions that are broader than the exceptions made by 1997 NEHRP. These exceptions make ASCE 7 less stringent than the NEHRP Provisions. The 1997 NEHRP provision concerning building alterations has no counterpart in ASCE 7, which makes equivalency not possible to judge. ASCE 7-98 is equivalent to or more restrictive than the NEHRP Provisions in all other areas covered by Chapter 1.

### **8.2 Chapter 2: Glossary and Notations**

The 1997 NEHRP Sections 2.1 and 2.2 are essentially identical to Sections 9.2.1 and 9.2.2, respectively, of ASCE 7-98. Thus, NEHRP Chapter 2 and ASCE 7-98 Section 9.2 are equivalent.

### **8.3 Chapter 3: Quality Assurance**

As the detailed comparisons show, the 1997 NEHRP Chapter 3 and Section A.9.3 of ASCE 7-98 are essentially equivalent.

### **8.4 Chapter 4: Ground Motion**

As the detailed comparisons show, ASCE 7-98 Sections 9.4.1 and 9.4.2 are entirely equivalent to this NEHRP chapter.

### **8.5 Chapter 5: Structural Design Criteria**

The detailed comparisons show that this 1997 NEHRP Chapter and Section 9.5 of ASCE 7-98 are equivalent, except in two minor areas:

(1) ASCE 7-98 does not include the NEHRP requirement that in Seismic Design Category B, floor and roof diaphragms be designed to resist a minimum force equal to  $0.2S_{DS}$  times the weight of the diaphragm and other elements of the structure attached to it, plus the portion of the seismic shear force at that level,  $V_x$ , required to be transferred

to the components of the vertical seismic-force-resisting system because of offsets or changes in stiffness of the vertical components above and below the diaphragm.

(2) The ASCE-7 minimum design base shear of  $0.044 S_{DS}I$  is lower than the 1997 NEHRP minimum design base shear of  $0.1 S_{D1}I$  at locations where  $S_{DS} < 2.273 S_{D1}$ .

## **8.6 Chapter 6: Architectural, Mechanical, and Electrical Components Design Requirements**

The 1997 NEHRP Chapter 6 is equivalent to Section 9.6 of ASCE 7-98, except as indicated below. The NEHRP Provisions requires that: (1) where HVAC ductwork runs between structures that could displace relative to one another and for isolated structures where the HVAC ductwork crosses the isolation interface, (2) when piping systems are attached to structures that could displace relative to one another and for isolated structures, including foundations, where the piping system crosses the isolation interface, (3) when conduit, cable trays, or similar electrical distribution components are attached to structures that could displace relative to one another and for isolated structures where the conduit or cable trays cross the isolation interface, all such items must be designed to accommodate the seismic relative displacements specified in 1997 NEHRP section 6.1.4. No such requirement exists in ASCE 7-98.

## **8.7 Chapter 7: Foundation Design Requirements**

ASCE 7-98 has no special requirements for foundations of structures assigned to Seismic Design Category A, whereas NEHRP 1997 has some. This is the only foundation-related aspect in which ASCE 7-98 is somewhat less stringent than NEHRP.

## **8.8 Chapter 8: Steel Structure Design Requirements**

The steel chapters of NEHRP 1997 and ASCE 7-98 are equivalent.

## **8.9 Chapter 9: Concrete Structure Design Requirements**

ASCE 7-98 has adopted a later edition of the reference standard, ACI 318, which generally makes it more stringent than NEHRP. Unlike the 1997 NEHRP Provisions, ASCE 7-98 does not restrict splices in gravity columns to the middle half of the column height (ASCE 7-98 Section A.9.9.1.10). ASCE 7-98 is also slightly less restrictive in that ordinary moment frames assigned to Seismic Design Category A do not have to conform with the additional detailing requirements of NEHRP Sections 9.3.1.1.1 and 9.3.1.1.2. Finally, the horizontal spacing of vertical reinforcement in a Detailed Plain Concrete Shear Wall has been increased from a maximum of 4 ft to a maximum of 10 ft. This is obviously less restrictive.

## **8.10 Chapter 10: Composite Steel and Concrete Structure Design Requirements**

There is no counterpart of 1997 NEHRP Chapter 10 in ASCE 7-98. Equivalency cannot be judged.

### **8.11 Chapter 11: Masonry Structure Design Requirements**

ASCE 7-98 is less stringent when it comes to minimum reinforcement requirements for masonry shear walls assigned to Seismic Design Category C and above. The 1997 NEHRP Provisions prohibits the use of Type N mortar and masonry cement in the basic structural system, whereas ASCE 7-98 prohibits the use of Type N mortar and masonry cement only in the lateral-force-resisting system, which makes ASCE 7-98 less stringent. The IBC is less stringent in minimum reinforcement requirements for masonry walls assigned to Seismic Design Category D, and in minimum reinforcement requirements for masonry walls using stack bond construction and assigned to Seismic Design Category D. The NEHRP requirement (Section 11.3.7.1) that structural clay load-bearing wall tile shall not be used as part of the basic structural system is not included in ASCE 7-98, making it less stringent. NEHRP 1997 Section 11.3.10.4 imposes minimum and maximum limits on the compressive strength of masonry, which are not included in ASCE 7-98, making it less stringent. NEHRP 1997 Section 11.3.10.6 restricts specified yield strength of reinforcement to no more than 60,000 psi. This restriction is not included in ASCE 7-98, making it less restrictive. Restrictions concerning size of reinforcement are more relaxed in ASCE 7-98 than in NEHRP. ASCE 7-98 allows the bundling of bars; the NEHRP Provisions does not. The details of standard hooks are less stringent in ASCE 7-98 than in NEHRP. The 1997 NEHRP restrictions concerning lap splices are not part of ASCE 7-98, making it less stringent. Column reinforcement provisions are less stringent in ASCE 7-98 than in the NEHRP Provisions. The nominal flexural strength of a wall for out-of-plane bending is required in the 1997 NEHRP provisions to be at least 1.3 times the cracking moment strength of the wall. This restriction is not in ASCE 7-98, making it less stringent. Finally, ASCE 7-98 permits prestressed masonry construction in all Seismic Design Categories. This is not allowed in the 1997 NEHRP Provisions, thereby making ASCE 7-98 less restrictive.

### **8.12 Chapter 12: Wood Structure Design Requirements**

The wood chapter of ASCE 7-98 contains areas where equivalency with NEHRP 1997 is difficult to judge. In other areas where equivalency can be assessed, the two chapters have been found to be equivalent.

### **8.13 Chapter 13: Seismically Isolated Structures Design Requirements**

The ASCE 7-98 Section 9.13 is equivalent to this 1997 NEHRP Chapter, except for a few minor items. The IBC is slightly less stringent in its requirements concerning sequences and cycles for required tests of isolation systems. Also, the maximum and minimum vertical loads under which stability needs to be checked, and the maximum and minimum vertical loads under which vertical-load-carrying isolator units must be tested, are somewhat less restrictive in ASCE 7-98 than in the NEHRP Provisions.

## **8.14 Chapter 14: Nonbuilding Structure Design Requirements**

The ASCE 7-98 Section 9.14 is equivalent to this 1997 NEHRP Chapter, except for one item. The IBC is slightly less stringent in that it introduces one exception to the NEHRP design requirements for nonbuilding structures similar to buildings.

## **8.15 Conclusions Regarding ASCE 7-98**

The provisions with respect to which ASCE 7-98 and the 1997 NEHRP Provisions are judged not equivalent are as follows:

- Exceptions to the applicability of the seismic design provisions of the IBC
- Minimum design force for floor and roof diaphragms in Seismic Design Category B
- Minimum design base shear for long-period buildings
- Requirement that HVAC ductwork, piping systems, conduit, cable trays or similar electrical distribution components attached to structures that could displace relative to one another, and for isolated structures where such items cross the isolation interface, be designed to accommodate specified seismic relative displacements.
- Special requirements for foundations of structures assigned to Seismic design Category A.
- Requirement concerning splice location in gravity columns of concrete
- Detailing requirements for ordinary moment frames of concrete in SDCA
- Horizontal spacing of vertical reinforcement in a detailed plain concrete shear wall
- Minimum reinforcement requirements for masonry walls in SDC C and above
- Restrictions on Type N mortar and masonry cement
- Minimum reinforcement requirements for masonry walls in SDC D and above.
- Minimum reinforcement requirements for masonry walls using stack-bond construction in SDC D and above
- Restriction on structural clay load-bearing wall tile as part of the basic structural system
- Minimum and maximum limits on the compressive strength of masonry
- Restriction on specified yield strength of reinforcement in masonry construction
- Restrictions concerning size of reinforcement in masonry construction
- Bundling of bars in masonry construction
- Details of standard hooks in masonry construction
- Lap splices of reinforcing bars in masonry construction
- Masonry column reinforcement provisions
- Minimum ratio of nominal flexural strength to cracking strength of masonry wall in out-of-plane bending
- Prestressed masonry construction

- Requirements concerning sequences and cycles for required tests of isolation systems
- Requirements concerning maximum and minimum vertical loads under which: (1) stability needs to be checked, and (2) vertical-load-carrying isolator units must be tested
- Exception to design requirements for nonbuilding structures similar to buildings

The most significant differences between the seismic provisions of the ASCE 7-98 and the 1997 NEHRP Provisions are:

9. The NEHRP Provisions exempts detached one- and two- family dwellings located where  $S_{DS} \leq 0.4g$  from seismic design requirements. ASCE 7-98 exempts detached one- and two- family dwellings in Seismic Design Categories A, B, and C (i.e., where  $S_{DS} \leq 0.50g$  and  $S_{D1} \leq 0.20g$ ) from seismic design requirements.
10. ASCE 7-98 permits prestressed masonry construction in all Seismic design categories. This type of construction is not allowed by the 1997 NEHRP Provisions.
11. The horizontal spacing of vertical reinforcement for masonry walls in SDC C and above has been relaxed from 4 ft in the NEHRP Provisions to 10 ft in the IBC.

## 9.0 COMPARISON OF 2000 IRC TO 1997 NEHRP

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Detailed chapter-by-chapter and side-by-side comparisons of the seismic design provisions of the 2000 IRC and the 1997 NEHRP Provisions are provided in Table 3. The relevant portions of the following chapters of the IRC only are considered: Chapter 3 – Building Planning, Chapter 4 – Foundations, Chapter 5 – Floors, Chapter 6 – Wall Construction, Chapter 7 – Wall Covering, Chapter 8 – Roof-Ceiling Construction, Chapter 10 – Chimneys and Fireplaces. The other chapters do not contain material relevant to a seismic comparison. The totally different formats of the two documents (2000 IRC and 1997 NEHRP) make a side-by-side comparison rather difficult and challenging. The comparisons are summarized below. Some overall conclusions are drawn based on the comparisons.

### 9.1 IRC Chapter 3: Building Planning

The IRC makes an exception to the applicability of its seismic design provisions that is broader than the corresponding exception made by 1997 NEHRP. This exception makes the IRC less stringent than the NEHRP Provisions. The IBC Seismic Design Category D is split in the IRC into two Seismic Design Categories:  $D_1$  and  $D_2$ . That in itself has no impact on the equivalency of the two documents. IRC permits wood framed buildings up to three stories above grade in SDC  $D_1$  and up to 2 stories above grade in SDC  $D_2$ . NEHRP restricts conventional wood frame construction to 1 story above grade in SDC D. Thus the IRC is less restrictive in this regard. Every comparison, other than the restriction mentioned above, shows the IRC to be equivalent to the NEHRP Provisions or to be more stringent, with the sole exception of reclassification of SDC E buildings (IRC Section R301.2.2.2), as noted in Table 2.

### 9.2 IRC Chapter 4: Foundations

The detailed comparisons of Table 2 show that the foundation-related provisions of the IRC are more detailed than those of the 1997 NEHRP Provisions and are also generally more stringent.

### 9.3 IRC Chapter 5: Floors

The 1997 NEHRP Provisions does not regulate the items for which the IRC has specific provisions. This makes the IRC more stringent.

### 9.4 IRC Chapter 6: Wall Construction

The comparisons for wood-framed walls show the IRC to be equivalent to or more stringent than NEHRP, with one significant and one relatively minor exception. The required lengths of braced panels per IRC Section R602.10.4 are less than those

prescribed in NEHRP Table 12.5.2-1 for SDC C and above. The wall anchorage requirements are slightly less stringent in the IRC; however, this is unlikely to result in any effective difference in performance.

The comparisons for light-framed walls of steel are complicated by the fact that the bases are not always the same. The IRC provisions are prescriptive, whereas the NEHRP provisions, while also prescriptive, are more performance-oriented. In these cases, it is difficult to establish equivalency without running comparative numerical examples or designs. The NEHRP Provisions allows wood structural-use panels only for shear wall and diaphragm sheathing. The IRC allows gypsum wall boards and OSB in addition to plywood. Thus the IRC is less stringent in this respect.

The comparisons for masonry walls are complicated by the fact that the IRC has taken requirements out of the empirical design chapter of the referenced masonry standard, and made them generally applicable. Thus if the item concerned is a restriction, such as a minimum thickness requirement, this makes the IRC more stringent. However, if it is an allowance, such as permissible compressive stresses, this makes the IRC less stringent. In cases where an empirical design provision has been modified in the process of adoption into the IRC, equivalency becomes difficult to establish. In one respect, however, the IRC is definitely less stringent. The spacing of vertical reinforcement in masonry shear walls in SDC C and above has been relaxed from a maximum of 4 ft on center in the NEHRP Provisions to a maximum of 10 ft on center in the IRC.

There are no NEHRP provisions for insulating concrete form (ICF) walls. This is an item regulated by the IRC. Thus, the IRC is more stringent in this regard.

### **9.5 IRC Chapter 7: Wall Covering**

The stone and masonry veneer provisions are equivalent between the 2000 IRC and the 1997 NEHRP provisions.

### **9.6 IRC Chapter 8: Roof-Ceiling Construction**

There are no prescriptive NEHRP provisions for items regulated by this chapter of the IRC. The prescriptive IRC requirements are based on the engineered construction requirements of NEHRP Chapter 12, and are expected to be equivalent.

### **9.7 IRC Chapter 9: Chimneys and Fireplaces**

There are no NEHRP provisions governing seismic design of chimneys and fireplaces. Thus, the IRC is more restrictive.

### **9.8 Conclusions regarding IRC**

The provisions with respect to which the 2000 IBC and the 1997 NEHRP Provisions are judged not equivalent are as follows:

- Exceptions to the applicability of the seismic design provisions of the IRC
- Alternative determination of seismic design category
- Height limitations for wood framed buildings in SDC D<sub>1</sub> and D<sub>2</sub>
- Required length of braced wall panels in wood framed construction
- Wall anchorage requirement in wood framed construction
- Sheathing of diaphragms and shear walls in steel wall framed construction
- Allowable compressive stress requirements in masonry design
- Minimum reinforcement requirements for masonry shear walls in SDC C and above

The most significant differences between the seismic provisions of the 2000 IRC and the 1997 NEHRP Provisions are:

1. The NEHRP Provisions exempts detached one- and two- family dwellings located where  $S_{DS} \leq 0.40g$  from seismic design requirements. The IRC exempts one- and two- family dwellings in Seismic Design Categories A, B, and C (i.e., where  $S_{DS} \leq 0.50g$  and  $S_{D1} \leq 0.20g$ ) from seismic design requirements.
2. The IRC permits wood framed buildings up to three stories above grade in SDC D<sub>1</sub> and up to 2 stories above grade in SDC D<sub>2</sub>. NEHRP restricts conventional wood frame construction to one story above grade in SDC D.
3. The horizontal spacing of vertical reinforcement for masonry walls in SDC C and above has been relaxed from 4 ft in the NEHRP Provisions to 10 ft in the IRC.
4. The required length of braced wall panels in wood framed construction is somewhat less under the IRC than under the NEHRP Provisions.
5. The sheathing of shear walls and diaphragms in light-framed steel wall construction is restricted to wood structural-use panels in the NEHRP Provisions; the IRC also allows gypsum wall board and OSB sheathing.
6. The IRC allows SDC E buildings to be reclassified as being SDC D2 if certain conditions are met. Whether this is rally allowed by NEHRP is questionable.

## 10. CONCLUSIONS

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In this report, the 1997 NEHRP Provisions are compared to the seismic and material design provisions of the *International Building Code (IBC)* 2000 edition, *ASCE 7-98 Minimum Design Loads for Buildings and Other Structures*, and the *International Residential Code for One- and Two-Family Dwellings* 2000 edition.

The seismic and material design provisions of the 2000 IBC are based on the 1997 NEHRP Provisions. The documents are thus definitely equivalent in intent. However, changes have been made with input from the Code Resource Development Committee and the Code Resource Support Committee of the Building Seismic Safety Council and from the public. Detailed chapter-by-chapter side-by-side comparisons of the 1997 NEHRP Provisions and the seismic and material design provisions of the 2000 IBC are provided in this report. On the basis of these comparisons, the 2000 IBC is found to be equivalent in design values with the 1997 NEHRP Provisions with some exceptions. The exceptions are detailed in Section 7.0 of this report.

The seismic provisions of ASCE 7-98 are based on the 1997 NEHRP Provisions. The two documents are thus definitely equivalent in intent. However, changes made to the 1997 NEHRP Provisions for the IBC were considered by the ASCE 7 Committee. Some of these changes were adopted, sometimes with further modifications. Other changes were proposed and at times approved as part of the consensus process which includes public review and comments. Detailed chapter-by-chapter side-by-side comparisons of the 1997 NEHRP Provisions and the seismic and material design provisions of ASCE 7-98 are provided in this report. On the basis of these comparisons, ASCE 7-98 is found to be equivalent in design values with the 1997 NEHRP Provisions with some exceptions. The exceptions are detailed in Section 8.0 of this report.

The seismic design provisions of the 2000 IRC are significantly different from those of the 1998 *International One and Two Family Dwelling Code* (formerly the CABO One and Two Family Dwelling Code) which in many senses may be regarded as the source document. The provisions are heavily influenced by those of the 2000 IBC and the 1997 NEHRP Provisions. BSSC's Code Resource Support Committee provided guidance to the IRC Drafting Committee in the development and refinement of the seismic provisions. One aim of such collaboration was to keep the IRC and the IBC seismic design provisions coordinated to the extent possible. The IRC seismic provisions and the 1997 NEHRP Provisions are thus definitely equivalent in intent. Detailed chapter-by-chapter side-by-side comparisons of the 1997 NEHRP Provisions and the seismic and material design provisions of the 2000 IRC are provided in this report. On the basis of these comparisons, the 2000 IRC is found to be equivalent in design values with the 1997 NEHRP Provisions with some exceptions. The exceptions are detailed in Section 9.0 of this report.

# REFERENCES

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1. Assessment of the seismic Provisions of Model Building Codes. NIST GCR 91-598. Council of American Building Officials, July 1992.
2. Comparison of the Seismic Provisions of Model Building Codes and Standards to the 1991 NEHRP Recommended Provisions. NIST GCR 95-674. Melvyn Green & Associates, Inc., May 1995.
3. Comparison of the Seismic Provisions of Model Building Codes and Standards to the 1994 NEHRP Recommended Provisions. NIST GCR 98-755. Degenkolb Engineers, August 1998.

Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)

| 1997 NEHRP                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               | 2000 IBC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                     | Comments                                                         |
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| Section                                  | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Section                       | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                     |                                                                  |
| 1 GENERAL PROVISIONS                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                     |                                                                  |
| 1.1 PURPOSE                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | No corresponding provision                                                                                                                                                                                                                                                          | The lack of a purpose statement does not make IBC non-equivalent |
| 1.2 SCOPE AND APPLICATION<br>1.2.1 Scope | <p>These <i>Provisions</i> shall apply to the design and construction of <i>structures</i> including <i>additions</i>, change of use, and <i>alterations</i> to resist the effects of earthquake motions. Every <i>structure</i>, and portion thereof, shall be designed and constructed to resist the effects of earthquake motions as prescribed by these <i>Provisions</i>.</p> <p>Exceptions:</p> <p>1. Detached one- and two-family dwellings located where <math>S_{DS}</math> is less than 0.4g are exempt from all requirements of these <i>Provisions</i>.</p> <p>2. Detached one- and two-family wood frame dwellings located where <math>S_{DS}</math> is equal to or greater than 0.4g and that are designed and constructed in accordance with the conventional light frame construction provisions in Sec. 12.5 are exempt from all other requirements of these <i>Provisions</i>.</p> <p>3. Agricultural storage <i>structures</i> intended only for incidental human occupancy are exempt from all requirements of these <i>Provisions</i>.</p> <p>4. <i>Structures</i> located where <math>S_I</math> is less than</p> | 1614 EARTHQUAKE LOADS-GENERAL | <p>Exception to scope:</p> <p>Exception 1: Detached Group R-3 dwellings in SDC A, B and C (i.e., where <math>S_{DS} \leq 0.50g</math> and <math>S_{D1} \leq 0.20g</math>) are exempt from requirements of 1613-1622.</p> <p>Exception 2: The seismic force resisting system of wood frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in Section 1616.1.</p> <p>Exception 3: Unchanged</p> <p>Exception 4: Structures at locations with <math>S_1 \leq 0.04g</math> and <math>S_S \leq 0.15g</math> are only required to comply with Section 1616.4 (Design Requirements for SDC A)</p> <p>Exception 5: Structures at locations with <math>S_{DS} \leq 0.167g</math> and <math>S_{D1} \leq 0.067g</math> shall only be required to comply with Section 1616.4.</p> <p>Since <math>S_{DS} = (2/3) F_a S_S</math> and <math>S_{D1} = (2/3) F_v S_1</math>, exception 5 may be rewritten as:<br/><math>S_S \leq 0.25g / F_a</math> and <math>S_1 \leq 0.1g / F_v</math></p> | <p>IBC Exception 1 is less restrictive than NEHRP Exception 1</p> <p>Exceptions 2, 3, 4 are equivalent.</p> <p>IBC Exception 4 will be superseded by Exception 5 in areas where <math>F_a &lt; 1.67</math> and <math>F_v &lt; 2.5</math>, which makes the IBC less restrictive.</p> |                                                                  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                         |  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--|
|                     | or equal to 0.04g and $S_g$ is less than or equal to 0.15g shall only be required to comply with Sec. 5.2.6.1, (Design Requirements for SDC A).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                         |  |
| 1.2.2 Addition      | An <i>addition</i> that is not structurally independent from an existing <i>structure</i> shall be designed and constructed such that the entire <i>structure</i> conforms to the seismic-force- resistance requirements for new <i>structures</i> unless all of the following conditions are satisfied:<br>1.The <i>addition</i> conforms with the requirements for new <i>structures</i> , and<br>2. The <i>addition</i> does not increase the seismic forces in any structural <i>element</i> of the existing <i>structure</i> by more than 5 percent, unless the capacity of the <i>element</i> subject to the increased forces is still in compliance with these <i>Provisions</i> , and<br>3. The <i>addition</i> does not decrease the seismic resistance of any structural <i>element</i> of the existing <i>structure</i> to less than that required for a new <i>structure</i> . | 1614.1 Additions to Existing Buildings | Identical except:<br>Condition 3 has been removed and language of Condition 2 has been modified as follows: The addition does not increase the seismic forces in any structural element of the existing structure by more than 5 percent, unless the element has the capacity to resist the increased forces determined in accordance with Sections 1613 through 1622.                                                                 | IBC is less restrictive                                                 |  |
| 1.2.3 Change of Use | When a change of use results in a <i>structure</i> being reclassified to a higher <i>Seismic Use Group</i> , the <i>structure</i> shall conform to the requirements of Section 1.2.1 for a new <i>structure</i> .<br>Exception: When a change of use results in a <i>structure</i> being reclassified from <i>Seismic Use Group I</i> to <i>Seismic Use Group II</i> , compliance with these <i>Provisions</i> is not required if the <i>structure</i> is located where $S_{DS}$ is less than 0.3.                                                                                                                                                                                                                                                                                                                                                                                         | 1614.2 Change of Occupancy             | Identical; however exception has been changed to the following:<br>Specific detailing provisions required for new structure not required to be met when it can be shown an equivalent level of performance and seismic safety contemplated for new structure is obtained. Such analysis shall consider the regularity, overstrength, redundancy, and ductility of the structure within the context of the specific detailing provided. | Even with its exception, IBC is as restrictive as NEHRP, if not more so |  |
| 1.2.4 Alterations   | <i>Alterations</i> are permitted to be made to any <i>structure</i> without requiring the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1614.3 Alterations                     | IBC contains more specific restrictions.                                                                                                                                                                                                                                                                                                                                                                                               | IBC is more restrictive                                                 |  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                          |                                                                                                                                                                                                                                                                                                                                                                                                          |                                                              |                                                                                                                                                                                                                                                                                               |  |                                                                                                                      |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------|
|                                                          | structure to comply with these <i>Provisions</i> provided the <i>alterations</i> conform to that required for a new <i>structure</i> . <i>Alterations</i> shall not decrease the lateral-force resisting system strength or stiffness to less than that required by these <i>Provisions</i> . The <i>alteration</i> shall not cause the existing structural elements to be loaded beyond their capacity. |                                                              |                                                                                                                                                                                                                                                                                               |  |                                                                                                                      |
| 1.2.5 Alternate Materials and Means of Construction      |                                                                                                                                                                                                                                                                                                                                                                                                          | 1701.2 New Materials                                         | Essentially similar                                                                                                                                                                                                                                                                           |  | Essentially equivalent                                                                                               |
| 1.3 SEISMIC USE GROUPS                                   |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2 Seismic Use Groups (and Occupancy Importance Factors) | Essentially identical                                                                                                                                                                                                                                                                         |  | Equivalent                                                                                                           |
| 1.3.1 Seismic Use Group III                              |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2.3 Seismic Use Group III                               | Identical except that it can be designated by the building official                                                                                                                                                                                                                           |  | Equivalent                                                                                                           |
| 1.3.2 Seismic Use Group II                               |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2.2 Seismic Use Group II                                | Identical except: Seismic Use Group II – Day care facilities with capacity greater than 250 instead of 150 in NEHRP. In addition, for colleges or adult education facilities structures with capacity greater than 500 are in Gr. II. Also, group can be designated by the building official. |  | Essentially equivalent except for the designation by building official, which does not make the IBC less restrictive |
| 1.3.3 Seismic Use Group I                                |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2.1 Seismic Use Group I                                 |                                                                                                                                                                                                                                                                                               |  | Equivalent                                                                                                           |
| 1.3.4 Multiple Use                                       |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2.4 Multiple occupancies                                |                                                                                                                                                                                                                                                                                               |  | Equivalent                                                                                                           |
| 1.3.5 Seismic Use Group III Structures Access Protection |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2.3 Seismic Use Group III – Paragraph 2                 |                                                                                                                                                                                                                                                                                               |  | Equivalent                                                                                                           |
| 1.4 OCCUPANCY IMPORTANCE FACTOR                          |                                                                                                                                                                                                                                                                                                                                                                                                          | 1616.2 (Seismic Use Groups) and Occupancy Factors            |                                                                                                                                                                                                                                                                                               |  | Equivalent                                                                                                           |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                      |           | 2000 IBC                                                                                                    |                      | Comments              |
|---------------------------------|-----------|-------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|
| Section                         | Provision | Section                                                                                                     | Provision            |                       |
| <b>2 GLOSSARY AND NOTATIONS</b> |           |                                                                                                             |                      |                       |
| 2.1 GLOSSARY                    |           | 1602 DEFINITIONS AND NOTATIONS<br>1602.1 General<br>1613 EARTHQUAKE LOADS DEFINITIONS<br>1613.1 Definitions | Scattered            | Considered equivalent |
| 2.2 NOTATIONS                   |           |                                                                                                             | Scattered throughout | Considered equivalent |
|                                 |           |                                                                                                             |                      |                       |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                     |                                                                              | 2000 IBC                                                                                                                                                                                                                                                         |                                                                                                                                                                                                           | Comments                         |
|------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Section                                        | Provision                                                                    | Section                                                                                                                                                                                                                                                          | Provision                                                                                                                                                                                                 |                                  |
| <b>3 QUALITY ASSURANCE</b>                     |                                                                              |                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                           |                                  |
| <b>3.1 SCOPE</b>                               |                                                                              | 17. STRUCTURAL TESTS AND SPECIAL INSPECTIONS<br>1701.1 Scope                                                                                                                                                                                                     | IBC scope is broader and includes NEHRP scope.                                                                                                                                                            | Considered equivalent            |
|                                                | The terms used in NEHRP Chapter 3 are defined in NEHRP Section 2.1 Glossary. | 1702 DEFINITIONS                                                                                                                                                                                                                                                 |                                                                                                                                                                                                           | Considered equivalent            |
|                                                | Not in NEHRP                                                                 | 1703 APPROVALS                                                                                                                                                                                                                                                   |                                                                                                                                                                                                           | IBC is more stringent            |
| <b>3.2 QUALITY ASSURANCE</b>                   |                                                                              | 1704 QUALITY ASSURANCE<br>1704.1 SCOPE                                                                                                                                                                                                                           | IBC requires quality assurance plan for additional systems in SDC C, D, E and F, but waives quality assurance plan requirement for structures complying with 2308, conventional light-frame construction. | Overall, IBC is more restrictive |
| <b>3.2.1 Details of Quality Assurance Plan</b> |                                                                              | 1704.2 Quality assurance plan preparation                                                                                                                                                                                                                        | Essentially identical                                                                                                                                                                                     | Equivalent                       |
| <b>3.2.2 Contractor Responsibility</b>         |                                                                              | 1704.3 Contractor Responsibility                                                                                                                                                                                                                                 | Essentially identical                                                                                                                                                                                     | Equivalent                       |
| <b>3.3 SPECIAL INSPECTION</b>                  |                                                                              | 1706 SPECIAL INSPECTIONS<br>1706.1 General<br>1706.1.1 Building permit requirement<br>1706.1.2 Report requirement<br>1706.2 Inspection of fabricators<br>1706.2.1 Fabrication and implementation procedures<br>1706.14 Special inspection for seismic resistance | IBC is more detailed, provides some exceptions to special inspection requirements.                                                                                                                        | IBC is somewhat less restrictive |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                              |  |                                                                                                                                                                                                                                                        |                                                                                                                                                                   |                                |
|------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 3.3.1 Piers, Piles, Caissons |  | 1706.8 Pile foundations<br>1706.9 Pier foundations                                                                                                                                                                                                     | IBC has more detailed requirements but exempts pier foundations in SDC A and B.                                                                                   | Essentially equivalent         |
| 3.3.2 Reinforcing steel      |  | 1706.4 Concrete construction – Table 1706.4                                                                                                                                                                                                            | Item 1 of Table 1706.4 gives similar provisions that are somewhat more restrictive.                                                                               | IBC is more stringent          |
| 3.3.3 Structural concrete    |  | 1706.4 Concrete construction 1706.4.1 Materials                                                                                                                                                                                                        | IBC provisions are more detailed, and have a broader scope, even considering exceptions.                                                                          | IBC is more stringent          |
| 3.3.4 Prestressed Concrete   |  | 1706.4 Concrete construction – Table 1706.4                                                                                                                                                                                                            | Item 8 of Table 1706.4 gives essentially similar provisions.                                                                                                      | Equivalent                     |
| 3.3.5 Structural Masonry     |  | 1706.5 Masonry construction<br>1706.5.1 Empirically designed masonry, glass unit masonry, and masonry veneer in essential facilities<br>1706.5.2 Engineered masonry in non-essential facilities<br>1706.5.3 Engineered masonry in essential facilities | The provisions along with Tables 1706.5.1 and 1706.5.2 give more detailed requirements; however, many structures are exempt from some or all of the requirements. | IBC is less stringent          |
| 3.3.6 Structural Steel       |  | 1706.3 Steel construction<br>1706.3.1 Welding<br>1706.3.2 Details<br>1706.3.3 High-strength bolts<br>1706.14.1 Structural steel                                                                                                                        | The provisions along with Table 1706.3.1 give more detailed requirements.                                                                                         | Overall, IBC is more stringent |
| 3.3.7 Structural Wood        |  | 1706.6 Wood construction                                                                                                                                                                                                                               | Provisions in 1706.7.14.2 are identical to those in NEHRP Section 3.3.7.                                                                                          | Equivalent                     |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                           |                                                                                                                 |                         |  |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------|--|
|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1706.7.14.2 Structural wood                                                                                                                                                                               |                                                                                                                 |                         |  |
| 3.3.8 Cold-Formed Steel Framing             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1706.14.3 Cold-framed steel framing                                                                                                                                                                       | Identical                                                                                                       | Equivalent              |  |
| 3.3.9 Architectural Components              | <p><i>Special inspection for architectural components shall be as follows:</i></p> <p>1. <i>Periodic special inspection during the erection and fastening of exterior cladding, interior and exterior nonloadbearing walls, and veneer in Seismic Design Categories D, E, and F and</i></p> <p>2. <i>Periodic special inspection during the anchorage of access floors, suspended ceilings, and storage racks 8 feet (2.4 m) or greater in height in Seismic Design Categories D, E, and F.</i></p> | <p>1706.14.5 Architectural components</p> <p>1706.14.4 Storage racks and access floors</p>                                                                                                                | IBC allows two exceptions to requirement #1.                                                                    | IBC is less restrictive |  |
| 3.3.10 Mechanical and Electrical Components |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>1706.14.6 Mechanical and electrical components</p> <p>1706.14.6.1 Component inspection</p> <p>1706.14.6.2 Component and attachment testing</p> <p>1706.14.6.3 Component manufacturer certification</p> | Section 1706.14.6 is identical. Sections 1706.14.6.1, 1706.14.6.2 and 1706.14.6.3 give additional requirements. | IBC is more stringent   |  |
|                                             | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>1706.7 Soils</p> <p>1706.10 Wall panels and veneers</p> <p>1706.11 Sprayed fire-resistant materials</p> <p>1706.12 Exterior insulation and finish systems (EIFS)</p>                                   |                                                                                                                 | IBC is more stringent   |  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                      |                                             |                                                                                                                                                                                                                                                                                                                                        |                                                                                                              |                         |
|------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------|
| 3.3.11 Seismic Isolation System                      |                                             | 1706.13 Special cases<br>1706.14.7 Seismic isolation system                                                                                                                                                                                                                                                                            | Identical                                                                                                    | Equivalent              |
| 3.4 TESTING                                          |                                             | 1705 STRUCUTRAL TESTING<br>1705.1 Testing for seismic resistance                                                                                                                                                                                                                                                                       | More detailed                                                                                                | IBC is more restrictive |
| 3.4.1 Reinforcing and Prestressing Steel             |                                             | 1705.2 Reinforcing and prestressing steel                                                                                                                                                                                                                                                                                              | Identical                                                                                                    | Equivalent              |
| 3.4.2 Structural Concrete                            | Refers to ACI 318-95                        |                                                                                                                                                                                                                                                                                                                                        | IBC refers to ACI 318-99 testing requirements in Chapter 19.                                                 | Essentially equivalent  |
| 3.4.3 Structural Masonry                             | Refers to ACI 530-95/ASCE 5-95/TMS 402-95   | 1705.6 Quality assurance program<br>1705.6.1 Empirically designed masonry and glass unit masonry in non-essential facilities<br>1705.6.2 Empirically designed masonry and glass unit masonry in essential facilities<br>1705.6.3 Engineered masonry in non-essential facilities<br>1705.6.4 Engineered masonry in essential facilities | Refers to the 1999 edition of the same standard.                                                             | Essentially equivalent  |
| 3.4.4 Structural Steel<br>3.4.4.1 Base Metal Testing |                                             | 1705.3 Structural steel                                                                                                                                                                                                                                                                                                                | Essentially identical                                                                                        | Equivalent              |
| 3.4.5 Mechanical and Electrical Equipment            |                                             | 1705.4 Mechanical and electrical equipment                                                                                                                                                                                                                                                                                             | Identical                                                                                                    | Equivalent              |
| 3.4.6 Seismically Isolated Structures                | Provides a cross-reference to Section 13.9. | 1705.5 Seismically isolated structures                                                                                                                                                                                                                                                                                                 | Provides a cross-reference to Section 1623.8.                                                                | Equivalent              |
| 3.5 STRUCUTRAL OBSERVATIONS                          |                                             | 1707 STRUCUTRAL OBSERVATIONS                                                                                                                                                                                                                                                                                                           | IBC has additional reporting requirement. IBC requires structural observation for Seismic Group I structures | IBC is more stringent   |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                         |                                                                         |                                                                                                                                                                                                 |                                                                                                                                                                     |                             |
|-----------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 3.6 REPORTING AND COMPLIANCE PROCEDURES | Details reporting responsibilities of special inspector and contractor. | 1706.1.2 Report requirement                                                                                                                                                                     | greater than two stories height in SDC E, whereas corresponding NEHRP requirement extends to SDC E or F. This is believed to be an inadvertent omission in the IBC. | IBC is less stringent       |
|                                         | No corresponding provisions; the IBC requirements are non-seismic.      | 1708 DESIGN STRENGTHS OF MATERIALS<br>1709 ALTERNATIVE TEST PROCEDURES<br>1710 TEST SAFE LOAD<br>1711 IN-SITU LOAD TESTS<br>1712 PRECONSTRUCTION LOAD TESTS<br>1713 MATERIAL AND TEST STANDARDS | Details reporting responsibilities of special inspector that are essentially the same. Reporting responsibilities of contractor are not detailed.                   | Equivalency is not affected |
|                                         |                                                                         |                                                                                                                                                                                                 |                                                                                                                                                                     |                             |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                                                          |           | 2000 IBC                                                                                                          |                                                                                                                                                                                      | Comments                       |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Section                                                                                                                             | Provision | Section                                                                                                           | Provision                                                                                                                                                                            |                                |
| <b>4 GROUND MOTION</b>                                                                                                              |           |                                                                                                                   |                                                                                                                                                                                      |                                |
| 4.1 PROCEDURES FOR DETERMINING MAXIMUM CONSIDERED EARTHQUAKE AND DESIGN EARTHQUAKE GROUND MOTION ACCELERATIONS AND RESPONSE SPECTRA |           | 1615 EARTHQUAKE LOADS – SITE GROUND MOTION                                                                        | Identical except:<br>The site-specific procedure of Section 1615.2 shall be used for structures on sites classified as Site Class F <sub>1</sub> in accordance with Section 1615.1.1 | IBC is slightly more stringent |
| 4.1.1 Maximum Considered Earthquake Ground Motions                                                                                  |           |                                                                                                                   |                                                                                                                                                                                      |                                |
| 4.1.2 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations                    |           | 1615.1 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations | Identical                                                                                                                                                                            | Equivalent                     |
| 4.1.2.1 Site Class Definitions                                                                                                      |           | 1615.1.1 Site Class Definitions                                                                                   | Identical except:<br>It is given in tabular form.                                                                                                                                    | Equivalent                     |
| 4.1.2.2 Steps for Classifying a Site                                                                                                |           | 1615.1.5.1 Steps for Classifying a Site                                                                           | Identical                                                                                                                                                                            | Equivalent                     |
| 4.1.2.3 Definition of Site Class Parameters                                                                                         |           | 1615.1.5 Site Classification for Seismic Design                                                                   | Identical                                                                                                                                                                            | Equivalent                     |
| 4.1.2.4 Site Coefficients and Adjusted Maximum                                                                                      |           | 1615.1.2 Site Coefficients and Adjusted Maximum                                                                   | Identical                                                                                                                                                                            | Equivalent                     |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Considered Earthquake Spectral Response Acceleration Parameters            |                            | Considered Earthquake Spectral Response Acceleration Parameters             |           |                             |
|----------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------|-----------|-----------------------------|
| 4.1.2.5 Design Spectral Response Acceleration Parameters                   |                            | 1615.1.3 Design Spectral Response Acceleration Parameters                   | Identical | Equivalent                  |
| 4.1.2.6 General Procedure Response Spectrum                                |                            | 1615.1.4 General Procedure Response Spectrum                                | Identical | Equivalent                  |
| 4.1.3 Site-Specific Procedure for Determining Ground Motion Accelerations  |                            | 1615.2 Site-Specific Procedure for Determining Ground Motion Accelerations  | Identical | Equivalent                  |
| 4.1.3.1 Probabilistic Maximum Considered Earthquake                        |                            | 1615.2.1 Probabilistic Maximum Considered Earthquake                        | Identical | Equivalent                  |
| 4.1.3.2 Deterministic Limit on Maximum Considered Earthquake Ground Motion |                            | 1615.2.2 Deterministic Limit on Maximum Considered Earthquake Ground Motion | Identical | Equivalent                  |
| 4.1.3.3 Deterministic Maximum Considered Earthquake Ground Motion          |                            | 1615.2.3 Deterministic Maximum Considered Earthquake Ground Motion          | Identical | Equivalent                  |
| 4.1.3.4 (mis-printed as 4.1.3.5) Site-Specific Design Ground Motion        |                            | 1615.2.4 Site-Specific Design Ground Motion                                 | Identical | Equivalent                  |
|                                                                            | No corresponding provision | 1615.2.5 Design Spectral Response Coefficients                              |           | Does not affect equivalency |
| 4.2 SEISMIC DESIGN CATEGORY                                                |                            |                                                                             |           |                             |
| 4.2.1 Determination of                                                     |                            | 1616.3 Determination                                                        | Identical | Equivalent                  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Seismic Design Category                                     | Seismic Design Category                                                                                                                                                                    | of Seismic Design Category                                     | Seismic Design Category E or F                                                                                   | Considered equivalent |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------|
| 4.2.2 Site Limitation for Seismic Design Categories E and F | A structure assigned to <i>Seismic Design Category E or F</i> shall not be sited where there is the potential for an active fault to cause rupture of the ground surface at the structure. | 1616.3.1 Site Limitation for Seismic Design Categories E and F | A structure assigned to Seismic Design Category E or F shall not be sited over an identified active fault trace. |                       |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                  |                                                       | 2000 IBC                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Comments                                                   |
|---------------------------------------------|-------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Section                                     | Provision                                             | Section                                | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                            |
| <b>5 STRUCTURAL DESIGN CRITERIA</b>         |                                                       |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                            |
| 5.1 REFERENCE DOCUMENT                      | Refers to ASCE 7-95 for loads other than earthquakes. |                                        | IBC has its own provisions for loads other than earthquakes – sometimes adopted from ASCE 7-98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | IBC equivalent to more stringent                           |
| 5.2 DESIGN BASIS                            |                                                       |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                            |
| 5.2.1 General                               |                                                       | 1616.1 Structural Design Criteria      | Mostly equivalent with the following major addition:<br>Allowable Stress Design may be used to evaluate sliding, overturning, and soil bearing at the soil-structure interface regardless of the design approach used in the design of the structure, provided load combinations of Section 1605.3 are utilized.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IBC is more precise. For all practical purposes equivalent |
| 5.2.2 Basic Seismic-Force-Resisting Systems |                                                       | 1617.6 Seismic Force Resisting Systems | Table 1617.6 has the following changes from Table 5.2.2 of NEHRP:<br>(1) Detailed plain concrete shear walls (BW Systems) – building height changed from NL to NP in SDC C<br>(2) Special Reinforced masonry shear walls (BW Systems) – R changed from 3-1/2 to 5<br>(3) Intermediate Reinforced masonry shear walls (BW Systems) – R changed from 2-1/2 to 3-1/2<br>(4) Ordinary Reinforced masonry shear walls (BW Systems) – R changed from 2 to 2-1/2<br>(5) Detailed plain masonry shear walls (BW Systems) – building height changed from 160 ft to NP in SDC C<br>(6) Light frame walls with shear panels (BW Systems) : Wood structural panels – R changed from 6-1/2 to 6<br>(7) Ordinary Reinforced masonry shear walls (BW Systems) – building height changed from NP to 160 ft in SDC C<br>(8) Light frame walls with shear panels (BW Systems) : all other materials – Added<br>(9) Detailed plain concrete shear walls (BF Systems) – building height changed from NL to NP in SDC C | Considered equivalent                                      |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |                                                   |
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|                                         |                                                                                                                                                                                                                                                                                                   |                                                                                                                                               | <p>(10) Special Reinforced masonry shear walls (BF Systems) – R changed from 4-1/2 to 5-1/2</p> <p>(11) Intermediate Reinforced masonry shear walls (BF Systems) – R changed from 3 to 4</p> <p>(12) Ordinary Reinforced masonry shear walls (BF Systems) – R changed from 2-1/2 to 3; building height changed from NP to 160 ft in SDC C</p> <p>(13) Detailed plain masonry shear walls (BF Systems) – building height changed from 160 ft to NP in SDC C</p> <p>(14) Light frame walls with shear panels (BF Systems) : Wood structural panels– R changed from 7 to 6-1/2; building height limit changed from 160 ft to 65 ft in SDC D, E and F.</p> <p>(15) Light frame walls with shear panels (BF Systems) : all other materials – Added</p> <p>(16) Shear Wall-Frame Interactive System (Dual with IMRF Systems) – added</p> <p>(17) Ordinary Plain Concrete Shear Wall – building height changed from NL to NP in SDC B</p> <p>(18) Cantilevered Column Systems (in Inverted Pendulum System) - Added</p> |  |  | Equivalent                                        |
| 5.2.2.1 Dual System                     |                                                                                                                                                                                                                                                                                                   |                                                                                                                                               | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |                                                   |
| 5.2.2.2 Combinations of Framing Systems | Different seismic-force-resisting systems are permitted along the two orthogonal axes of the structure. Combinations of seismic-force-resisting systems shall comply with the requirements of this section.                                                                                       | 1617.6.1 Dual Systems                                                                                                                         | Identical except for the following changes:<br>(1) The sentence "For other than dual systems .... utilized in the same direction." has been placed under a separate Section 1617.6.2. "other than dual systems" has been modified to "other than dual systems and shearwall-frame interactive systems".                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  | IBC is more detailed and is considered equivalent |
| 5.2.2.2.1 R and $\Omega_o$ Factors      | The response modification coefficient, $R$ , in the direction under consideration at any story shall not exceed the lowest response modification factor, $R$ , for the seismic-force-resisting system in the same direction considered above that story excluding penthouses. For other than dual | <p>1617.6.3 Combinations of Framing Systems</p> <p>1617.6.2 Combinations along the same axis</p> <p>1617.6.3.1 Combination framing factor</p> | <p>(2) The sentence "If a system other than a dual system ...." has been modified to "In structures assigned to SDC D, E or F, if a system ...."</p> <p>(3) Exceptions have been modified as follows:<br/>1. Same as Exception 2<br/>2. The <math>R</math> and <math>\Omega_o</math> for supported structural systems with</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |                                                   |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                    |
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|                                                    | <p>systems where a combination of different structural systems is utilized to resist lateral forces in the same direction, the value of <math>R</math> used in that direction shall not be greater than the least value of any of the systems utilized in the same direction. If a system other than a dual system with a response modification coefficient, <math>R</math>, with a value of less than 5 is used as part of the seismic-force-resisting system in any direction of the structure, the lowest such value shall be used for the entire structure. The system overstrength factor, <math>\Omega_o</math>, in the direction under consideration at any story shall not be less than the largest value of this factor for the seismic-force-resisting system in the same direction considered above that story.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> <li>1. Supported structural systems with a weight equal to or less than 10 percent of the weight of the structure.</li> <li>2. Detached one- and two-family dwellings of light-frame construction.</li> </ol> |                                                       | <p>a weight <math>\leq 10\%</math> of the weight of the structure are permitted to be determined independent of the values of these parameters for the structure as a whole.</p> <ol style="list-style-type: none"> <li>3. The following two-stage static analysis is permitted to be used provided the structure complies with the following: <ol style="list-style-type: none"> <li>3.1 The flexible upper portion shall be designed as a separate structure using the appropriate values of <math>R</math> and <math>p</math>,</li> <li>3.2 The rigid lower portion shall be designed as a separate structure using the appropriate values of <math>R</math> and <math>p</math>. The reactions from the upper portion shall be those determined from the analysis of the upper portion amplified by the ratio of the <math>(R/p)</math> of the upper portion over <math>(R/p)</math> of the lower portion. This ratio shall not be taken less than 1.0;</li> <li>3.3 The lower portion shall have a stiffness at least 10 times the upper portion, and</li> <li>3.4 The period of the entire structure shall not be greater than 1.1 times the period of the upper portion considered as a separate structure fixed at the base.</li> </ol> </li> <li>(4) The following exception is added in 1617.6.2: For light frame, flexible diaphragm buildings, of Seismic Use Group I and two stories or less in height: Resisting elements are permitted to be designed using the least value of <math>R</math> for the different structural systems found on each independent line of resistance. The value of <math>R</math> used for design of diaphragms in such structures shall not be greater than the least value for any of the systems utilized in that same direction.</li> </ol> |                    |
| 5.2.2.2 Combination Framing Detailing Requirements |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1617.6.3.2 Combination framing detailing requirements | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Equivalent         |
| 5.2.2.3 Seismic Design                             | The structural framing system for                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       | It was considered unnecessary to state this explicitly in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Equivalency cannot |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Categories B and C                        | structures assigned to Seismic Design Categories B and C shall comply with the structure height and structural limitations in Table 5.2.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                       | the IBC.                                                                                                                                                                                                                                                                                                                                | be judged                      |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 5.2.2.4 Seismic Design Categories D and E |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1617.6.4 System Limitations for Seismic Design Categories D, E, and F |                                                                                                                                                                                                                                                                                                                                         |                                |
| 5.2.2.4.1 Limited Building Height         | The height limits in Table 5.2.2 is permitted to be increased to 240 ft (70 m) in buildings that have steel braced frames or concrete cast-in-place shear walls. Such buildings shall be configured such that the braced frames or shear walls arranged in any one plane conform to the following :<br>1. The braced frames or cast-in-place special reinforced concrete shear walls in any one plane shall resist no more than 60 percent of the total seismic forces in each direction, neglecting torsional effects, and<br>2. The seismic force in any braced frame or shear wall resulting from torsional effects shall not exceed 20 percent of the total seismic force in that braced frame or shear wall. | 1617.6.4.1 Limited building height                                    | Identical except for the following change:<br>In Condition 1, the share of shearwalls changed from 60% to 50%.                                                                                                                                                                                                                          | IBC is slightly more stringent |
| 5.2.2.4.2 Interaction Effects             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1617.6.4.2 Interaction effects                                        | Identical                                                                                                                                                                                                                                                                                                                               | Equivalent                     |
| 5.2.2.4.3 Deformational Compatibility     | Every structural component not included in the seismic-force-resisting system in the direction under consideration shall be designed to be adequate for the vertical load-carrying capacity and the induced moments and shears resulting from the design story drift, $\Delta$ , as determined in accordance with Sec. 5.3.7 (also see Sec.                                                                                                                                                                                                                                                                                                                                                                       | 1617.6.4.3 Deformational compatibility                                | Identical except for the following changes:<br>(1) Where allowable stress design is used, $\Delta$ shall be computed without dividing the earthquake force by 1.4.<br>(2) Exception changed to: Reinforced concrete frame members not designed as part of the seismic force resisting system shall comply with Section 21.9 of ACI 318. | IBC is more stringent          |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                       |                                                                                                                                                                                                                                                                                                                                    |                                                                                                      |  |
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|                                   | <p>5.2.7).<br/>Exception: Beams and columns and their connections not designed as part of the lateral-force-resisting system but meeting the detailing requirements for either <i>intermediate moment frames</i> or <i>special moment frames</i> are permitted to be designed to be adequate for the vertical load-carrying capacity and the induced moments and shears resulting from the deformation of the <i>building</i> under the application of the design seismic forces.</p> <p>When determining the moments and shears induced in <i>components</i> that are not included in the <i>seismic-force-resisting system</i> in the direction under consideration, the stiffening effects of adjoining rigid structural and nonstructural <i>elements</i> shall be considered and a rational value of member and restraint stiffness shall be used.</p> |                                                                       |                                                                                                                                                                                                                                                                                                                                    |                                                                                                      |  |
| 5.2.2.4.4 Special Moment Frames   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1617.6.4.4 Special moment frames                                      | Identical                                                                                                                                                                                                                                                                                                                          | Equivalent                                                                                           |  |
| 5.2.2.5 Seismic Design Category F | 5.2.2.4 applies. In addition, height limitation of 5.2.2.4.1 is reduced from 240 ft to 160 ft.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1617.6.4 System Limitations for Seismic Design Categories D, E, and F | Additional requirement is already included in 1617.6.4.1.                                                                                                                                                                                                                                                                          | Equivalent                                                                                           |  |
| 5.2.3 Structure Configuration     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1616.5 Building Configuration                                         |                                                                                                                                                                                                                                                                                                                                    |                                                                                                      |  |
| 5.2.3.1 Diaphragm Flexibility     | <i>Diaphragms</i> constructed of untopped steel decking, wood structural panels, or similar panelized construction shall be considered flexible in <i>structures</i> having concrete or masonry <i>shear walls</i> . <i>Diaphragms</i> constructed of wood structural panels shall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1602.1 General (Definitions and Notations)                            | A diaphragm is flexible for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is more than two times the average story drift of the associated story, determined by comparing the computed maximum in-plane deflection of the diaphragm itself under lateral load with | IBC gives the definition of diaphragm flexibility independent of the material of construction. It is |  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                |                                                                                                                                                                                                                               |                                       |
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|                                               | be considered rigid in light-frame structures using structural panels for lateral load resistance. <i>Diaphragms</i> of other types shall be considered flexible when the maximum lateral deformation of the diaphragm is more than two times the average story drift of the associated story. The loadings used for this calculation shall be those prescribed by Sec. 5.3.                                                                                                                              |                                                | the story drift of adjoining vertical-resisting elements under equivalent tributary lateral load.                                                                                                                             | more rigorous. IBC is more stringent. |
| 5.2.3.2 Plan Irregularity                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1616.5.1 Plan Irregularity                     | Essentially identical                                                                                                                                                                                                         | Equivalent                            |
| 5.2.3.3 Vertical Irregularity                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1616.5.2 Vertical Irregularity                 | Essentially identical                                                                                                                                                                                                         | Equivalent                            |
| 5.2.4 Redundancy                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1617.2 Redundancy                              | Identical                                                                                                                                                                                                                     | Equivalent                            |
| 5.2.4.1 Seismic Design Categories A, B, and C |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1617.2.1 Seismic Design Categories A, B, and C | Identical                                                                                                                                                                                                                     | Equivalent                            |
| 5.2.4.2 Seismic Design Category D             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1617.2.2 Seismic Design Categories D, E, and F | Combines both the Sections 5.2.4.2 and 5.2.4.3 of NEHRP 1997. In addition, a new paragraph is added to compute the reliability/redundancy factor of structures with vertical combinations of seismic force resisting systems. | Considered equivalent                 |
| 5.2.4.3 Seismic Design Categories E and F     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                |                                                                                                                                                                                                                               |                                       |
| 5.2.5 Analysis Procedures                     | A structural analysis shall be made for all structures in accordance with the requirements of this section. This section prescribes the minimum analysis procedure to be followed. Use of the procedure in Sec. 5.4 or, with the approval of the authority having jurisdiction, an alternate generally accepted procedure, including the use of an approved site-specific spectrum, is permitted for any structure. The limitations on the base shear stated in Sec. 5.4 apply to dynamic modal analysis. | 1616.6 Analysis Procedures                     | Essentially identical                                                                                                                                                                                                         | Equivalent                            |
| 5.2.5.1 Seismic Design                        | Regular and irregular structures assigned                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1616.4 Design                                  | In addition to the provisions for minimum lateral force,                                                                                                                                                                      | IBC is more detailed                  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Category A                                    | to Seismic Design Category A shall be analyzed for minimum lateral forces given by Eq. 5.2.5.1, applied independently, in each of two orthogonal directions:<br>$F_x = 0.01 w_x$ where:<br>$F_x$ = the design lateral force applied at Story x and $w_x$ = the portion of the total gravity load of the structure, $W$ , located or assigned to Level x where $W$ is as defined in Sec. 5.3.2.                                                                                                                                                                                        | Requirements for Seismic Design Category A     | IBC has provisions for connections and conventional light-frame construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | and considered equivalent                                                                                                  |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
|                                               | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1616.6.1 Simplified Analysis                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IBC gives optional simplified analysis for most residential structures in Seismic Use Group I. Equivalency is not affected |
| 5.2.5.2 Seismic Design Categories B and C     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1616.6.2 Seismic Design Categories B and C     | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Equivalent                                                                                                                 |
| 5.2.5.3 Seismic Design Categories D, E, and F | Follow Table 5.2.5.3 to determine the analysis procedure. The Table identifies 4 cases:<br>1. Structures designated as regular up to 240 feet (70 m)<br>2. Structures that have only vertical irregularities of Type 1a, 1b, 2, or 3 in Table 5.2.3.3 or plan irregularities of Type 1a or 1b of Table 5.2.3.2 and have a height exceeding 65 feet (20 m).<br>3. All other structures designated as having plan or vertical irregularities.<br>4. Structures in areas with $S_{D1}$ of 0.2 and greater with a period greater than $T_0$ located on Site Class F or Site Class E soils | 1616.6.3 Seismic Design Categories D, E, and F | Follow Table 1616.6.3 to determine the analysis procedure. The Table identifies 5 cases:<br>1. Seismic Use Group I buildings of light framed construction 3 stories or less in height and of other construction, 2 stories or less in height with flexible diaphragm at every level.<br>2. Same as Case 1 of NEHRP<br>3. Same as Case 2 of NEHRP except height exceeding 65 ft is modified to height exceeding 5 stories or 65 ft. Also structures exceeding 240 ft in height are included.<br>4. Same as Case 3.<br>5. Same as Case 4 with modification that $T_0$ is replaced by natural period $T$ of 0.7 sec. | Essentially equivalent                                                                                                     |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              |                                                                                                                                                                                                                 |                                             |
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| 5.2.5.4 Diaphragms                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1620.3.3 Diaphragms                                                                          | Identical except that:<br>1. The upper limit of diaphragm force was changed from $0.4S_{DS}W_{px}$ to $0.3S_{DS}W_{px}$<br>2. The lower limit of force was changed from $0.2S_{DS}W_{px}$ to $0.15S_{DS}W_{px}$ | IBC is somewhat less stringent              |
| 5.2.6 Design, Detailing Requirements, and Structural Component Load Effects |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1620 EARTHQUAKE LOADS – DESIGN, DETAILING REQUIREMENTS AND STRUCTURAL COMPONENT LOAD EFFECTS |                                                                                                                                                                                                                 |                                             |
| 5.2.6.1 Seismic Design Category A                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1616.4 Design Requirements for Seismic Design Category A                                     |                                                                                                                                                                                                                 |                                             |
| 5.2.6.1.1.1 Component Load Effects                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1616.4.1 Minimum Lateral Force                                                               | Part of the section in IBC is essentially identical.                                                                                                                                                            | Considered equivalent                       |
| 5.2.6.1.1.2 Connections                                                     | All parts of structure ... being connected. Any smaller portion of the structure shall be tied to the remainder of the structure with elements having a strength of 0.133 times $S_{DS}$ times the weight of the smaller portion or 5% of the portion's weight, whichever is greater.                                                                                                                                                                                  | 1616.4.2 Connections                                                                         | Identical with the deletion of $0.133S_{DS}$ .<br>More stringent for $S_{DS} \leq 0.375$                                                                                                                        | IBC is equivalent to more stringent         |
| 5.2.6.1.3 Anchorage of Concrete and Masonry Walls                           | Concrete and masonry walls shall be anchored to the roof and all floors and members that provide lateral support for the wall or which are supported by the wall. The anchorage shall provide a direct connection between the walls and the roof or floor construction. The connections shall be capable of resisting a seismic lateral force, $F_p$ , induced by the wall of 400 times the short period design spectral response acceleration coefficient $S_{DS}$ in | 1616.4.3 Anchorage of concrete or masonry walls                                              | Refers to Sec. 1604.8.2 which is essentially identical except the following change:<br>The minimum horizontal force was changed from $400S_{DS}$ lb/ft to 200 lb/ft.                                            | IBC is more stringent for $S_{DS} \leq 0.5$ |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                             |                                                                                                                                                                                                            |                                          |
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|                                              | pounds per lineal foot (5840 times $S_{DS}$ in $N/m$ ) of wall multiplied by the occupancy importance factor $I$ . Walls shall be designed to resist bending between anchors where the anchor spacing exceeds 4 ft (1.2 m).                                                                                                                                                                                                                                         |                                             |                                                                                                                                                                                                            |                                          |
| 5.2.6.2 Seismic Design Category B            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1620.1 Seismic Design Category B            |                                                                                                                                                                                                            |                                          |
| 5.2.6.2.1 Second-Order Effects               | In addition to meeting the requirements of Sec. 5.2.6.1.1, second-order effects shall be included where applicable.                                                                                                                                                                                                                                                                                                                                                 | 1620.1.1 Second order load effects          | Identical; however the condition for including second order effect is clearly spelt out as follows:<br>Where $\theta > 0.1$                                                                                | IBC more specific, considered equivalent |
| 5.2.6.2.2 Openings                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1620.1.2 Openings                           | Identical                                                                                                                                                                                                  | Equivalent                               |
| 5.2.6.2.3 Discontinuities in Vertical System | Structures with a discontinuity in lateral capacity, vertical irregularity Type 5 as defined in Table 5.2.3.3, shall not be over 2 stories or 30 ft (9 m) in height where the "weak" story has a calculated strength of less than 65 percent of the story above. Exception: Where the "weak" story is capable of resisting a total seismic force equal to 75 percent of the deflection amplification factor, $C_d$ , times the design force prescribed in Sec. 5.3. | 1620.1.3 Discontinuities in vertical system | Essentially identical                                                                                                                                                                                      | Equivalent                               |
| 5.2.6.2.4 Nonredundant Systems               | The design of a structure shall consider the potentially adverse effect that the failure of a single member, connection, or component of the seismic-force-resisting system would have on the stability of the structure.                                                                                                                                                                                                                                           |                                             | No corresponding provisions                                                                                                                                                                                | Equivalency cannot be judged             |
| 5.2.6.2.5 Collector Elements                 | Collector elements shall be provided that are capable of transferring the seismic forces originating in other portions of the structure to the element providing the resistance to those forces.                                                                                                                                                                                                                                                                    | 1620.1.6 Collector elements                 | Identical with the following addition:<br>Collector elements, splices and their connections to resisting elements shall have the design strength to resist the special load combinations of Section 1605.4 | IBC is more stringent                    |
| 5.2.6.2.6 Diaphragms                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1620.1.5 Diaphragms                         | IBC Eq. (1620.1-3) includes $I_E$ which is not present in the corresponding NEHRP provision.                                                                                                               | IBC is slightly more stringent           |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                         |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 5.2.6.2.7 Bearing Walls                                     | Exterior and interior bearing walls and their anchorage shall be designed for a force equal to 40 percent of the short period design spectral response acceleration $S_{DS}$ times the weight of wall, $W_C$ , normal to the surface, with a minimum force of 10 percent of the weight of the wall. Interconnection of wall elements and connections to supporting framing systems shall have sufficient ductility, rotational capacity, or sufficient strength to resist shrinkage, thermal changes, and differential foundation settlement when combined with seismic forces. | 1620.1.7 Bearing walls and shear walls                     | The IBC mentions bearing walls and shear walls and their anchorage. The first paragraph is identical except that IBC Eq. (1620.1-4) includes $I_E$ which is not part of the NEHRP Provision. The following second paragraph is not part of the 1997 NEHRP Section 5.2.6.2.7:<br><br>In addition, concrete and masonry walls shall be anchored to the roof and floors and members that provide lateral support for the wall or which are supported by the wall. The anchorage shall provide a direct connection between the wall and the supporting construction capable of resisting the greater of the force $F_p$ as given by Formula 1620.1-4 or (400 $S_{DS}$ I) pounds per linear foot of wall For SI: 5838 $S_{DS}$ /N/m. Walls shall be designed to resist bending between anchors where the anchor spacing exceeds 4 feet (1219 mm). Parapets shall conform to the requirements of Section 1621.2.1. | IBC is more stringent                                                   |
| 5.2.6.2.8 Inverted Pendulum-Type Structures                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1620.1.7 Inverted pendulum-type structures                 | Virtually identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                                                              |
| 5.2.6.2.9 Anchorage of Nonstructural Systems                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                            | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The NEHRP provision is basically redundant, does not affect equivalency |
| 5.2.6.2.10 Columns Supporting Discontinuous Walls or Frames | Columns supporting discontinuous walls or frames of structures having plan irregularity Type 4 of Table 5.2.3.2 or vertical irregularity Type 4 of Table 5.2.3.3 shall have the design strength to resist the maximum axial force that can develop in accordance with the special combination of loads of Sec. 5.2.7.1.                                                                                                                                                                                                                                                         | 1620.1.9 Elements Supporting Discontinuous Walls or Frames | Identical, but for the following exceptions:<br>(1) The quantity $E_m$ in Section 1617.1.2 need not exceed the maximum force that can be transmitted to the element by the lateral force-resisting system at yield.<br>(2) Concrete slab supporting light-frame walls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Considered equivalent                                                   |
| 5.2.6.3 Seismic Design Category C                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1620.2 Seismic Design Category C                           | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Equivalent                                                              |
| 5.2.6.3.1 Plan                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1620.1.10 Direction of                                     | IBC provides alternate means of combining effects in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Considered                                                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Irregularity                                            |                                                                                                                                                                                                                                                                                  | Seismic Load<br>1620.2.2 Direction of<br>Seismic Load                                                                                      | two orthogonal directions.                                                                                                                                                                                                                                               | equivalent               |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 5.2.6.3.2 Collector<br>Elements                         |                                                                                                                                                                                                                                                                                  | 1620.1.6 Collector<br>Elements                                                                                                             | Identical                                                                                                                                                                                                                                                                | Equivalent               |
| 5.2.6.3.3 Anchorage of<br>Concrete and Masonry<br>Walls |                                                                                                                                                                                                                                                                                  | 1620.2.1 Anchorage of<br>concrete and masonry<br>walls                                                                                     | Identical                                                                                                                                                                                                                                                                | Equivalent               |
| 5.2.6.4 Seismic Design<br>Category D                    |                                                                                                                                                                                                                                                                                  | 1620.3 Seismic<br>Design Category D                                                                                                        | Identical                                                                                                                                                                                                                                                                | Equivalent               |
| 5.2.6.4.1 Orthogonal<br>Load Effects                    |                                                                                                                                                                                                                                                                                  | 1620.3.5 Direction of<br>Seismic Load                                                                                                      | The IBC is a little more explicit.                                                                                                                                                                                                                                       | Considered<br>equivalent |
| 5.2.6.4.2 Collector<br>Elements                         |                                                                                                                                                                                                                                                                                  | 1620.3.4 Collector<br>Elements                                                                                                             | Identical                                                                                                                                                                                                                                                                | Equivalent               |
| 5.2.6.4.3 Plan or<br>Vertical Irregularities            |                                                                                                                                                                                                                                                                                  | 1620.3.1 Plan or<br>vertical irregularities                                                                                                | NEHRP has a general (vague), unenforceable first<br>paragraph that has been omitted from the IBC.                                                                                                                                                                        | Considered<br>equivalent |
| 5.2.6.4.4 Vertical<br>Seismic Forces                    |                                                                                                                                                                                                                                                                                  | 1620.3.2 Vertical<br>seismic forces                                                                                                        | Identical                                                                                                                                                                                                                                                                | Equivalent               |
|                                                         | No similar provisions in NEHRP                                                                                                                                                                                                                                                   | 1620.3.6 Building<br>Separations                                                                                                           |                                                                                                                                                                                                                                                                          | IBC more stringent       |
| 5.2.6.5 Seismic Design<br>Categories E and F            |                                                                                                                                                                                                                                                                                  | 1620.4 Seismic<br>Design Categories E<br>and F                                                                                             | Identical                                                                                                                                                                                                                                                                | Equivalent               |
| 5.2.6.5.1 Plan or<br>Vertical Irregularities            |                                                                                                                                                                                                                                                                                  | 1620.4.1 Plan or<br>vertical irregularities                                                                                                | Identical                                                                                                                                                                                                                                                                | Equivalent               |
| 5.2.7 Combination of<br>Load Effects                    | The effects on the structure and its<br>components due to gravity loads and<br>seismic forces shall be combined in<br>accordance with the factored load<br>combinations as presented in ASCE 7<br>except that the effect of seismic loads, E,<br>shall be as defined herein. ... | 1605 LOAD<br>COMBINATIONS<br>1605.1 General<br><br>1617.1 Seismic Load<br>Effect E and E <sub>m</sub><br>1617.1.1 Seismic Load<br>Effect E | Buildings and other structures and portions thereof shall<br>be designed to resist the load combinations specified in<br>Section 1605.2 or 1605.3 ...<br>Thus, Allowable Stress Design is allowed in the IBC in<br>addition to Strength Design.<br>Essentially identical | Considered<br>equivalent |
| 5.2.7.1 Special<br>Combination of Loads                 |                                                                                                                                                                                                                                                                                  | 1617.1.2 Maximum<br>Seismic Load Effect,<br>E <sub>m</sub>                                                                                 | Essentially identical with following addition:<br>Where allowable stress design methodologies are used<br>with the special load combinations of Section 1605.4,                                                                                                          | Considered<br>equivalent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 5.2.8 Deflection and Drift Limits                   | The design story drift, $\Delta$ , as determined in Sec. 5.3.7 or 5.4.6, shall not exceed the allowable story drift, $\Delta_a$ , as obtained from Table 5.2.8 for any story. For structures with significant torsional deflections, the maximum drift shall include torsional effects. All portions of the structure shall be designed and constructed to act as an integral unit in resisting seismic forces unless separated structurally by a distance sufficient to avoid damaging contact under total deflection, $\delta_x$ , as determined in Sec. 5.3.7.1. | 1617.3 Deflection and Drift Limits                                        | design strengths are permitted to be determined using an allowable stress increase of 1.7 and a resistance factor, $\phi$ , of 1.0. This increase shall not be combined with increases in allowable stresses or load combination reductions otherwise permitted by this code ... permitted in Chapter 23 is permitted.<br><br>Identical except that the sentence "For structures .... torsional effects" is not included. This is covered later, however, at least in part, in Section 1617.4.6.1. | IBC is slightly less stringent |
| 5.3 EQUIVALENT LATERAL FORCE PROCEDURE              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1617.4 Equivalent Lateral Force Procedure for Seismic Design of Buildings | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent                     |
| 5.3.1 General                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |
| 5.3.2 Seismic Base Shear                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1617.4.1 Seismic Base Shear                                               | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent                     |
| 5.3.2.1 Calculation of Seismic Response Coefficient | In addition to three equations to compute seismic response coefficient, $C_s$ , it is stated that $C_s$ shall not be taken less than: $C_s = 0.1 S_{D1}$                                                                                                                                                                                                                                                                                                                                                                                                            | 1617.4.1.1 Calculation of Seismic Response Coefficient                    | Identical except that $C_s$ shall not be less than: $C_s = 0.044 S_{D1}$ . In addition, the application of expression $C_s = 0.5 S_1/(R/I)$ has been changed from SDC E and F to SDC E or F, and those buildings and structures for which $S_1 \geq 0.6g$ .                                                                                                                                                                                                                                        | IBC is more stringent          |
| 5.3.3 Period Determination                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1617.4.2 Period Determination                                             | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                     |
| 5.3.3.1 Approximate Fundamental Period              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1617.4.2.1 Approximate fundamental period                                 | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                     |
| 5.3.4 Vertical                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1617.4.3 Vertical                                                         | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                     |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Distribution of Seismic Forces           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Distribution of Seismic Forces                   |                                                                                                                                                                                                                                                                                 |                                                        |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 5.3.5 Horizontal Shear Distribution      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1617.4.4 Horizontal Shear Distribution           | Identical                                                                                                                                                                                                                                                                       | Equivalent                                             |
|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1617.4.4.1 Rigid Diaphragms                      | Provision identical to that in NEHRP Section 5.3.5                                                                                                                                                                                                                              | Equivalent                                             |
|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1617.4.4.2 Flexible Diaphragms                   | No corresponding provision in NEHRP                                                                                                                                                                                                                                             | IBC is more stringent                                  |
| 5.3.5.1 Torsion                          | The design shall include the torsional moment, $M_t$ (kip ft or kN m), resulting from the location of the masses.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1617.4.4.3 Torsion                               | Where diaphragms are not flexible, the design shall include the torsional moment, $M_t$ (kip ft or kN.m), resulting from the difference in locations of the center of mass and the center of stiffness.                                                                         | IBC Provisions clearer, equivalent                     |
| 5.3.5.2 Accidental Torsion               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1617.4.4.4 Accidental torsion                    | Identical                                                                                                                                                                                                                                                                       | Equivalent                                             |
| 5.3.5.3 Dynamic Amplification of Torsion |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1617.4.4.5 Dynamic amplification of torsion      | Identical                                                                                                                                                                                                                                                                       | Equivalent                                             |
| 5.3.6 Overturning                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1617.4.5 Overturning                             | Identical                                                                                                                                                                                                                                                                       | Equivalent                                             |
| 5.3.7 Drift                              | Story drifts and, where required, member forces and moments due to <i>P-delta effects</i> shall be determined in accordance with this section. Determination of <i>story drifts</i> shall be based on the application of the design <i>seismic forces</i> to a mathematical model of the physical <i>structure</i> . The model shall include the stiffness and <i>strength</i> of all <i>elements</i> that are significant to the distribution of forces and <i>deformations</i> in the <i>structure</i> and shall represent the spatial distribution of the mass and stiffness of the <i>structure</i> . In addition, the model shall comply with the following:<br>1. Stiffness properties of <i>reinforced concrete</i> and masonry <i>elements</i> shall consider the effects of cracked sections and<br>2. For steel <i>moment resisting frame</i> | 1617.4.6 Drift Determination and P-Delta Effects | Frames and columns shall be designed to resist both brittle fracture and overturning instability during the maximum lateral excursion of each story, while supporting full dead and live load.<br><br>NEHRP text left out in the IBC is covered under Section 1618.1, Modeling. | NEHRP is more explicit. IBC is somewhat less stringent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                               | systems, the contribution of panel zone deformations to overall story drift shall be included.                                                                                                                                                                                                                                                                 |                                                                                                                                                                |                                                                                                                                                                                                                                                                                         |           |                                                                                                      |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------|
| 5.3.7.1 Story Drift Determination             |                                                                                                                                                                                                                                                                                                                                                                | 1617.4.6.1 Story drift determination                                                                                                                           | Identical except for the following addition:<br>Where allowable stress design is used, $\rho$ shall be computed using earthquake forces without dividing by 1.4.<br><br>The IBC explicitly states that in calculating drift, the redundancy coefficient $\Delta$ shall be taken as 1.0. | Identical | Considered equivalent                                                                                |
| 5.3.7.2 P-Delta Effects                       |                                                                                                                                                                                                                                                                                                                                                                | 1617.4.6.2 P-Delta effects                                                                                                                                     | Identical                                                                                                                                                                                                                                                                               | Identical | Equivalent                                                                                           |
|                                               | No corresponding provisions in NEHRP                                                                                                                                                                                                                                                                                                                           | 1617.5 Simplified Analysis Procedure for Seismic Design of Buildings<br>1617.5.1 Seismic Base Shear<br>1617.5.2 Vertical distribution<br>1617.5.3 Design Drift |                                                                                                                                                                                                                                                                                         |           | IBC has incorporated procedure from 1997 UBC that is not in 1997 NEHRP. Equivalency is not affected. |
| 5.4 MODAL ANALYSIS PROCEDURE<br>5.4.1 General | This chapter provides required standards for the modal analysis procedure of seismic analysis of structures. See Sec. 5.2.5 for requirements for use of this procedure. The symbols used in this method of analysis have the same meaning as those for similar terms used in Sec. 5.3, with the subscript $m$ denoting quantities in the $m^{\text{th}}$ mode. | 1618 DYNAMIC ANALYSIS PROCEDURE FOR THE SEISMIC DESIGN OF BUILDINGS                                                                                            | In addition to Modal Response Spectra Analysis, IBC addresses two other dynamic analysis procedures:<br>1. Linear Time History Analysis<br>2. Non-linear Time History Analysis                                                                                                          |           | IBC is more comprehensive, equivalent to more stringent                                              |
| 5.4.2 Modeling                                |                                                                                                                                                                                                                                                                                                                                                                | 1618.1 Modeling                                                                                                                                                | Identical                                                                                                                                                                                                                                                                               | Identical | Equivalent                                                                                           |
| 5.4.3 Modes                                   |                                                                                                                                                                                                                                                                                                                                                                | 1618.2 Modes                                                                                                                                                   | Identical                                                                                                                                                                                                                                                                               | Identical | Equivalent                                                                                           |
| 5.4.4 Modal Properties                        |                                                                                                                                                                                                                                                                                                                                                                | 1618.3 Modal Properties                                                                                                                                        | Identical                                                                                                                                                                                                                                                                               | Identical | Equivalent                                                                                           |
| 5.4.5 Modal Base Shear                        |                                                                                                                                                                                                                                                                                                                                                                | 1618.4 Modal Base Shear                                                                                                                                        | Identical except that the "Exception 2" has been deleted, as being potentially unconservative in some situations.                                                                                                                                                                       |           | Considered equivalent                                                                                |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                             |                                                                                                                                                                                                                                                 |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                               |                                     |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 5.4.6 Modal Forces, Deflections, and Drifts |                                                                                                                                                                                                                                                 | 1618.5 Modal Forces, Deflections, and Drifts                                                                                                                                            | Identical                                                                                                                                                                                                                                                                     | Equivalent                          |
| 5.4.7 Modal Story Shears and Moments        |                                                                                                                                                                                                                                                 | 1618.6 Modal Story Shears and Moments                                                                                                                                                   | Identical                                                                                                                                                                                                                                                                     | Equivalent                          |
| 5.4.8 Design Values                         |                                                                                                                                                                                                                                                 | 1618.7 Design Values                                                                                                                                                                    | Identical                                                                                                                                                                                                                                                                     | Equivalent                          |
| 5.4.9 Horizontal Shear Distribution         |                                                                                                                                                                                                                                                 | 1618.8 Horizontal Shear Distribution                                                                                                                                                    | Identical                                                                                                                                                                                                                                                                     | Equivalent                          |
| 5.4.10 Foundation Overturning               |                                                                                                                                                                                                                                                 |                                                                                                                                                                                         | No corresponding provision                                                                                                                                                                                                                                                    | IBC more stringent                  |
| 5.4.11 P-Delta Effects                      |                                                                                                                                                                                                                                                 | 1618.9 P-Delta Effects                                                                                                                                                                  | Identical                                                                                                                                                                                                                                                                     | Equivalent                          |
|                                             |                                                                                                                                                                                                                                                 | 1618.10 Time-History Analysis<br>1618.10.1 Time History<br>1618.10.1.2 Elastic time history analysis<br>1618.10.2 Nonlinear time history analysis<br>1618.10.2.1 Nonlinear time history | IBC introduces new more advanced approaches for lateral analysis.                                                                                                                                                                                                             | IBC is equivalent to more stringent |
| 5.5 SOIL-STRUCTURE INTERACTION EFFECTS      |                                                                                                                                                                                                                                                 | 1619 EARTHQUAKE LOADS - SOIL-STRUCTURE INTERACTION EFFECTS                                                                                                                              | Follow procedure given in Section 9.5.5 of ASCE 7-98.                                                                                                                                                                                                                         |                                     |
| 5.5.1 General                               | The requirements set forth in this section are permitted to be used to incorporate the effects of soil-structure interaction in the determination of the design earthquake forces and the corresponding lateral displacements and the secondary | *9.5.5.1 General                                                                                                                                                                        | If the option to incorporate the effects of soil-structure interaction is exercised, the requirements of this section shall be used in the determination of the design earthquake forces and the corresponding displacements of the building. The use of ... P-delta effects. | Considered equivalent               |

\*ASCE 7-98 Section numbers design values of the base shear, lateral forces, and overturning moments but may increase the computed values of the lateral displacements and the secondary

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                 | forces associated with the $P$ -delta effects. |                                                    |           |            |
|-------------------------------------------------|------------------------------------------------|----------------------------------------------------|-----------|------------|
| 5.5.2 Equivalent Lateral Force Procedure        |                                                | *9.5.5.2 Equivalent Lateral Force Procedure        |           |            |
| 5.5.2.1 Base Shear                              |                                                | *9.5.5.2.1 Base Shear                              | Identical | Equivalent |
| 5.5.2.1.1 Effective Building Period             |                                                | *9.5.5.2.1.1 Effective Building Period             | Identical | Equivalent |
| 5.5.2.1.2 Effective Damping                     |                                                | *9.5.5.2.1.2 Effective Damping                     | Identical | Equivalent |
| 5.5.2.2 Vertical Distribution of Seismic Forces |                                                | *9.5.5.2.2 Vertical Distribution of Seismic Forces | Identical | Equivalent |
| 5.5.2.3 Other Effects                           |                                                | *9.5.5.2.3 Other Effects                           | Identical | Equivalent |
| 5.5.3 Modal Analysis Procedure                  |                                                | *9.5.5.3 Modal Analysis Procedure                  |           |            |
| 5.5.3.1 Modal Base Shears                       |                                                | *9.5.5.3.1 Modal Base Shears                       | Identical | Equivalent |
| 5.5.3.2 Other Modal Effects                     |                                                | *9.5.5.3.2 Other Modal Effects                     | Identical | Equivalent |
| 5.5.3.3 Design Values                           |                                                | *9.5.5.3.3 Design Values                           | Identical | Equivalent |
|                                                 |                                                |                                                    |           |            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2000 IBC                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Comments              |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Section                                                                                     | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Section                                                                                                              | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |
| 6 ARCHITECTURE, MECHANICAL, AND ELECTRICAL DESIGN REQUIREMENTS                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1621 ARCHITECTURAL, MECHANICAL, AND ELECTRICAL COMPONENT SEISMIC DESIGN REQUIREMENTS                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |
| 6.1 GENERAL                                                                                 | Exception: The following components are exempt from the requirements of this chapter:<br><br>1.<br><br>2.<br><br>3.<br><br>4.<br><br>5. Mechanical and electrical components in <i>Seismic Design Categories D, E, and F</i> that are mounted at 4 ft (1.22 m) or less above a floor level and weigh 400 lb (1780 N) or less and are not critical to the continued operation of the structure, or<br><br>6. Mechanical and electrical components in <i>Seismic Design Categories C, D, E, and F</i> that weigh 20 lb (95 N) or less or, for distribution systems, weight 5 lb/ft (7 N/m) or less. | 1621.1 General<br>1621.1.1 Applicability to Components<br>1621.1.2 Applicability to Supported Nonbuilding Structures | IBC essentially identical to NEHRP except for the following changes:<br>(1) Exception 5 of NEHRP has been modified to "Mechanical and electrical components in all <u>Seismic Design Categories</u> , where <u><math>I_p = 1.0</math></u> and <u>flexible connections between the components and associated ductwork, piping and conduit are provided</u> , (in NEHRP the underlined words are replaced by: <i>Seismic Design Categories D, E, and F</i> ) that are mounted at 4 ft (1219 mm) or less above a floor level and weigh 400 lb or less, and are not critical to the continued operation of the structure", or<br>(2) Exception 6 of NEHRP has been modified to "Mechanical and electrical components in <i>Seismic Design Categories C, D, E, and F</i> , where $I_p = 1.0$ and flexible connections between the components and associated ductwork, piping and conduit are provided, that weigh 20 lb (89 N) or less". | Considered equivalent |
| 6.1.1 References and Standards<br>6.1.1.1 Consensus Standards<br>6.1.1.2 Accepted Standards |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Chapter 35<br>Referenced Standards                                                                                   | Some of the referenced items have been updated in the IBC. Consensus standards and accepted standards are not adopted into the IBC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Equivalent            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 6.1.2 Component Force Transfer       |                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1621.1.3 Component Force Transfer                          | Identical                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent            |
| 6.1.3 Seismic Forces                 |                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1621.1.4 Seismic Forces                                    | Essentially identical. The IBC has added the following to the definition of z:<br>For items at or above the roof, z is not required to be taken as greater than the roof height h.<br>The IBC has deleted the following sentence from the very end of the section:<br>Similarly when the building code horizontal loads exceed $F_p$ for interior partitions, these building code loads shall govern the design. | Equivalent            |
| 6.1.4 Seismic Relative Displacements |                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1621.1.5 Seismic Relative Displacements                    | Identical                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent            |
| 6.1.5 Component Importance Factor    |                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1621.1.6 Component Importance Factor                       | Identical                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent            |
| 6.1.6 Component Anchorage            | Components shall be anchored in accordance with the following provisions.<br>6.1.6.2: Anchors embedded in concrete or masonry shall be proportioned to carry the least of the following:<br>a. The design strength of the connected part,<br>b. 2 times the force in the connected part due to the prescribed forces, and<br>c. The maximum force that can be transferred to the connected part by the component structural system. | 1621.1.7 Component Anchorage                               | IBC identical to NEHRP except for the following modifications:<br>The term "expansion anchors" has been modified to "shallow expansion anchors."<br>6.1.6.2 (b) changed to 1.3 times (2 times in NEHRP) the force in the connected part as given by $F_p$ times $R_p$                                                                                                                                            | Considered equivalent |
| 6.1.7 Construction Documents         | Construction documents shall be prepared by a registered design professional in a manner consistent with the requirements of these <i>Provisions</i> , as indicated in Table 6.1.7, in sufficient detail for use by the owner, building officials, contractors, and inspectors.                                                                                                                                                     | 1621.1.8 Quality Assurance; Special Inspection and Testing | IBC has more general requirements, whereas NEHRP requirements are quite specific.                                                                                                                                                                                                                                                                                                                                | IBC is more stringent |
| 6.2 ARCHITECTURAL COMPONENT          |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| DESIGN                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2 Architectural Component Design                     | Basically identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Equivalent            |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 6.2.1 General                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Equivalent            |
| 6.2.2 Architectural Component Forces and Displacements     | Architectural components shall meet the force requirements of Sec. 6.1.3 and 6.4 and Table 6.2.2.<br>Exception: Components supported by chains or otherwise suspended from the structural system above are not required to meet the lateral seismic force requirements and seismic relative displacement requirements of this section provided that they cannot be damaged or cannot damage any other component when subject to seismic motion and they have ductile or articulating connections to the <i>structure</i> at the point of attachment.<br>The gravity design load for these items shall be three times their operating load. | 1621.2.1 Architectural Component Forces and Displacements | IBC identical to NEHRP with the following change in exception of NEHRP:<br>Components supported by chains or otherwise suspended from the structural system above are not required to meet the lateral seismic force requirements and seismic relative displacement requirements of this section provided that they are capable of moving a minimum of 12" (305 mm) or swing 45 degrees off vertical, without damage or contacting an obstruction. (in NEHRP the underlined words are replaced by: cannot be damaged or cannot damage any other component when subject to seismic motion and they have ductile or articulating connections to the <i>structure</i> at the point of attachment.) | Considered equivalent |
| 6.2.3 Architectural Component Deformation                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.2 Architectural Component Deformation              | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |
| 6.2.4 Exterior Nonstructural Wall Elements and Connections |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.3 Exterior Wall Elements and Connections           | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |
| 6.2.5 Out-of-Plane Bending                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.4 Out-of-Plane Bending                             | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |
| 6.2.6 Suspended Ceilings                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.5 Suspended Ceilings                               | IBC identical to NEHRP with the following exception added: Ceilings in buildings with an $I_p$ equal to 1.0 located in Seismic Design Category C and less than three stories in height.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Considered equivalent |
| 6.2.6.1 Seismic Forces                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.5.1 Seismic Forces                                 | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |
| 6.2.6.2 Industry Standard Construction                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.5.2 Industry Standard Construction                 | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |
| 6.2.6.2.1 Seismic                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1621.2.5.2.1 Seismic                                      | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Design Category C                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Design Category C                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.2.6.2.2 Seismic Design Categories D, E, and F |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1621.2.5.2.2 Seismic Design Categories D, E and F  | IBC identical to NEHRP with the following changes:<br>The sentence in Item c "the horizontal restraints shall be designed to minimize diaphragm loads." has been replaced in NEHRP by "the tributary areas of the horizontal restraints shall be approximately equal."<br>The sentence in Item d in NEHRP "each area shall be provided with closure angles in accordance with Item b and horizontal restraints or bracing in accordance with Item c" has been dropped in IBC. |
| 6.2.6.3 Integral ceiling/sprinkler construction |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1621.2.5.3 Integral ceiling/sprinkler construction | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 6.2.7 Access Floors                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1621.2.6 Access Floors                             | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 6.2.7.1 General                                 | Access floors shall be designed to meet the force provisions of Sec. 6.1.3 and the additional provisions of this section. The weight of the access floor, $W_p$ , shall include the weight of the floor system, 100 percent of the weight of all equipment fastened to the floor, and 25 percent of the weight of all equipment supported by, but not fastened to the floor. The seismic force, $F_p$ , shall be transmitted from the top surface of the access floor to the supporting structure.<br>Overturning effects of equipment fastened to the access floor panels also shall be considered. The ability of "slip on" heads for pedestals shall be evaluated for suitability to transfer overturning effects of equipment.<br>When checking individual pedestals for overturning effects, the maximum concurrent axial load shall not exceed the | 1621.2.6 Access Floors                             | IBC identical to NEHRP except that the following sentence in Paragraph 2 of NEHRP "The ability of ....overturning effects of equipment" has been deleted.                                                                                                                                                                                                                                                                                                                     |
|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    | IBC is slightly less stringent                                                                                                                                                                                                                                                                                                                                                                                                                                                |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                    | portion of $W_p$ assigned to the pedestal under consideration.                                                                                                                                                                                                                                                                                                                                                                              |                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                            |  |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--|
| 6.2.7.2 Special Access Floors                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1621.2.6.1 Special Access Floors                                      | IBC identical to NEHRP except that the underlined words have been added to Item 4 in IBC "Electrical tubing shall not be used for bracing or pedestals."                                                                                                                                                                                                                                                                                    | Considered equivalent                      |  |
| 6.2.8 Partitions                                                   | Partitions that are tied to the ceiling and all partitions greater than 6 ft (1.8 m) in height shall be laterally braced to the building structure. Such bracing shall be independent of any ceiling splay bracing. Bracing shall be spaced to limit horizontal deflection at the partition head to be compatible with ceiling deflection requirements as determined in Sec. 6.2.6 for suspended ceilings and Sec. 6.2.2 for other systems. | 1621.2.7 Partitions                                                   | Identical except that the following exception has been added:<br>Exception: Partitions not taller than 9 feet (2743 mm) when the horizontal seismic load does not exceed 5 psf (0.24 kN/m <sup>2</sup> ) required in Section 1607.13.                                                                                                                                                                                                       | IBC is slightly less stringent             |  |
| 6.2.9 Steel Storage Racks                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1621.2.8 Steel Storage Racks                                          | IBC identical to NEHRP. The paragraph "Steel storage racks supported above grade shall be designed to meet the general requirements of Sections 1622.1, 1622.2, and the specific requirements of Section 1622.3.4. Steel Storage Racks supported at grade shall be designed in accordance with Section 2210." has been replaced by "Steel storage racks shall be designed to meet the force requirements of Chapter 14." In NEHRP.          | Considered equivalent                      |  |
| 6.3 MECHANICAL AND ELECTRICAL COMPONENT DESIGN<br>6.3.1 General    |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1621.3 Mechanical and Electrical Component Design                     | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                   | Equivalent                                 |  |
| 6.3.2 Mechanical and Electrical Component Forces and Displacements | Mechanical and electrical components shall meet the force and seismic relative displacement requirements of Sec. 6.1.3, Sec. 6.1.4, and Table 6.3.2.<br>Some complex equipment such as valves and valve operators, turbines and generators, and pumps and motors are permitted to be functionally connected by                                                                                                                              | 1621.3.1 Mechanical and Electrical Component Forces and Displacements | IBC identical to NEHRP with following changes:<br>Powder-actuated fasteners (shot pins) shall not be used for component anchorage in tension applications in SDC D, E, or F. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction. The lateral design force for the restraint shall be taken as $2F_p$ .<br>In addition, the $A_p$ and $R_p$ factor in Table 1621.3 have | IBC provisions are slightly more stringent |  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                         | mechanical links not capable of transferring the seismic loads or accommodating seismic relative displacements and may require special design considerations such as a common rigid support or skid.                                                                                                                                                                                                                                                                      |                                                            | been changed from 1.0 and 3.5 for General Electrical distribution systems (bus ducts, conduit, cable tray) to 2.5 and 5.0, respectively. |                       |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 6.3.3 Mechanical and Electrical Component Period        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.2 Mechanical and Electrical Component Period        | Identical                                                                                                                                | Equivalent            |
| 6.3.4 Mechanical and Electrical Component Attachments   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.3 Mechanical and Electrical Component Attachments   | Identical                                                                                                                                | Equivalent            |
| 6.3.5 Component Supports                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.4 Component Supports                                | Identical                                                                                                                                | Equivalent            |
| 6.3.6 Component Certification                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.5 Component Certification                           | Essentially identical                                                                                                                    | Equivalent            |
| 6.3.7 Utility and Service Lines at Structure Interfaces |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.6 Utility and Service Lines at Structure Interfaces | Identical                                                                                                                                | Equivalent            |
| 6.3.8 Site-Specific Considerations                      | The possible interruption of utility service shall be considered in relation to designated seismic systems in <i>Seismic Use Group III</i> as defined in Sec. 1.3.1. Specific attention shall be given to the vulnerability of underground utilities and utility interfaces between the <i>structure</i> and the ground in all situations where <i>Site Class E</i> or <i>F</i> soil is present and where the seismic coefficient $C_a$ is equal to or greater than 0.15. | 1621.3.7 Site-Specific Considerations                      | Basically identical. The following sentence in NEHRP has been dropped in IBC:<br>"Specific attention ..... 0.15."                        | Considered equivalent |
| 6.3.9 Storage Tanks                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.8 Storage Tanks                                     | Identical                                                                                                                                | Equivalent            |
| 6.3.10 HVAC Ductwork                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.9 HVAC Ductwork                                     | Identical                                                                                                                                | Equivalent            |
| 6.3.11 Piping Systems                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1621.3.10 Piping                                           | Identical                                                                                                                                | Equivalent            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                    |  | Systems                                                               |           |            |
|--------------------------------------------------------------------|--|-----------------------------------------------------------------------|-----------|------------|
| 6.3.11.1 Fire Protection Sprinkler Systems                         |  | 1621.3.10.1 Fire protection sprinkler systems                         | Identical | Equivalent |
| 6.3.11.2 Other Piping Systems                                      |  | 1621.3.10.2 Other piping systems                                      | Identical | Equivalent |
| 6.3.11.2.1 Supports and Attachments for Other Piping               |  | 1621.3.10.2.1 Supports and attachments for other piping               | Identical | Equivalent |
| 6.3.12 Boilers and Pressure Vessels                                |  | 1621.3.11 Boilers and Pressure Vessels                                | Identical | Equivalent |
| 6.3.12.1 ASME Boilers and Pressure Vessels                         |  | 1621.3.11.1 ASME boilers and pressure vessels                         | Identical | Equivalent |
| 6.3.12.2 Other Boilers and Pressure Vessels                        |  | 1621.3.11.2 Other boilers and pressure vessels                        | Identical | Equivalent |
| 6.3.12.3 Supports and Attachments for Boilers and Pressure Vessels |  | 1621.3.11.3 Supports and attachments for boilers and pressure vessels | Identical | Equivalent |
| 6.3.13 Mechanical Equipment, Attachments, and Supports             |  | 1621.3.12 Mechanical Equipment, Attachments, and Supports             | Identical | Equivalent |
| 6.3.13.1 Mechanical Equipment                                      |  | 1621.3.12.1 Mechanical equipment                                      | Identical | Equivalent |
| 6.3.13.2 Attachments and Supports for Mechanical Equipment         |  | 1621.3.12.2 Attachments and supports for mechanical equipment         | Identical | Equivalent |
| 6.13.14 Electrical Equipment, Attachments, and Supports            |  | 1621.3.12.3 Electrical Equipment Attachments and Supports             | Identical | Equivalent |
| 6.3.14.1 Electrical                                                |  | 1621.3.13.1 Electrical                                                | Identical | Equivalent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Equipment                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equipment                                                              |                                                                                                                                                                                                                           |                                                                                            |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 6.3.14.2 Attachments and Supports for Electrical Equipment          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1621.3.13.2 Attachments and supports for electrical equipment          | Identical                                                                                                                                                                                                                 | Equivalent                                                                                 |
| 6.3.15 Alternative Seismic Qualification Methods                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                        | No corresponding provisions                                                                                                                                                                                               | By not providing for alternative qualification methods, IBC in fact becomes more stringent |
| 6.3.16 Elevator Design Requirements                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1621.3.14 Elevator Design Requirements                                 | Identical                                                                                                                                                                                                                 | Equivalent                                                                                 |
| 6.3.16.1 Elevators and Hoistway Structural System                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1621.3.14.1 Elevators and hoistway structural systems                  | Identical                                                                                                                                                                                                                 | Equivalent                                                                                 |
| 6.3.16.2 Elevator Machinery and Controller Supports and Attachments |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1621.3.14.2 Elevator machinery and controller supports and attachments | Identical                                                                                                                                                                                                                 | Equivalent                                                                                 |
| 6.3.16.3 Seismic Controls                                           | In facilities where the loss of the use of an elevator is a life-safety issue, the elevator may be used after the seismic switch has triggered provided that:<br>1. The elevator shall operate no faster than the service speed,<br>2. The elevator shall be operated remotely from top to bottom and back to top to verify that it is operable, and<br>3. The individual putting the elevator back in service should ride the elevator from top to bottom and back to top to verify acceptable performance. | 1621.3.14.3 Seismic controls                                           | IBC identical to NEHRP except that: Item 3 of NEHRP (The individual putting the elevator back in service should ride the elevator from top to bottom and back to top to verify acceptable performance.) has been deleted. | IBC is slightly less stringent                                                             |
| 6.3.16.4 Retainer Plates                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1621.3.14.4 Retainer plates                                            | Identical                                                                                                                                                                                                                 | Equivalent                                                                                 |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                 |                                                                                                                                                                                                                                                                                                                                                                                                  | 2000 IBC                                                                                                |                                                                                                                                                                                                                                                                        | Comments                     |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Section                                    | Provision                                                                                                                                                                                                                                                                                                                                                                                        | Section                                                                                                 | Provision                                                                                                                                                                                                                                                              |                              |
| <b>7 FOUNDATION DESIGN REQUIREMENTS</b>    |                                                                                                                                                                                                                                                                                                                                                                                                  | <b>18 SOILS AND FOUNDATIONS</b>                                                                         |                                                                                                                                                                                                                                                                        |                              |
| 7.1 GENERAL                                | Scope limited to seismic requirements. Assumes compliance with other basic requirements.                                                                                                                                                                                                                                                                                                         | 1801 GENERAL<br>1801.1 Scope<br><br>1801.2 Design<br>1801.2.1 Foundation design for seismic overturning | The scope is broader, not limited to seismic resistance only.<br>Does not fit into NEHRP scope.<br>Allows 25% reduction in overturning moment when foundation is proportioned using strength design load combinations of Section 1605.2. This is not allowed in NEHRP. | IBC is less stringent        |
| 7.2 STRENGTH OF COMPONENTS AND FOUNDATIONS | The resisting capacities of the foundations, subjected to the prescribed <i>seismic forces</i> of Chapters 1, 4 and 5, shall meet the requirements of this chapter.                                                                                                                                                                                                                              |                                                                                                         | NEHRP requirement is general – not included in the IBC, at least in the same form.                                                                                                                                                                                     | Equivalency cannot be judged |
| 7.2.1 Structural Materials                 | The <i>strength</i> of foundation <i>components</i> subjected to <i>seismic forces</i> alone or in combination with other prescribed loads and their detailing requirements shall conform to the requirements of Chapter 8, 9, 10, 11, or 12. The <i>strength</i> of foundation <i>components</i> shall not be less than that required for forces acting without <i>seismic forces</i> .         |                                                                                                         | NEHRP requirement is general – not included in the IBC, at least in the same form.                                                                                                                                                                                     | Equivalency cannot be judged |
| 7.2.2 Soil Capacities                      | The capacity of the foundation soil in bearing or the capacity of the soil interface between pile, pier, or caisson and the soil shall be sufficient to support the <i>structure</i> with all prescribed loads, without <i>seismic forces</i> , taking due account of the settlement that the <i>structure</i> can withstand. For the load combination including earthquake as specified in Sec. | 1804 ALLOWABLE LOADBEARING VALUES OF SOILS                                                              | NEHRP requirement is general – not included in the IBC, at least in the same form. Presumptive loadbearing values given.                                                                                                                                               | Equivalency cannot be judged |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       | 5.2.7, the soil capacities must be sufficient to resist loads at acceptable strains considering both the short duration of loading and the dynamic properties of the soil.                                                                                                                                                                                                                                                                                                                                                                   |                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 7.3 SEISMIC DESIGN CATEGORIES A AND B | Any construction meeting the requirements of Sec. 7.1 and 7.2 is permitted to be used for <i>structures</i> assigned to <i>Seismic Design Category A</i> or <i>B</i> .                                                                                                                                                                                                                                                                                                                                                                       |                                                                               |  | Not included, unnecessary.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 7.4 SEISMIC DESIGN CATEGORY C         | Foundations for <i>structures</i> assigned to <i>Seismic Design Category C</i> shall conform to all of the requirements for <i>Seismic Design Categories A</i> and <i>B</i> and to the additional requirements of this section.                                                                                                                                                                                                                                                                                                              |                                                                               |  | Not included, unnecessary.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 7.4.1 Investigation                   | Authority having jurisdiction may require investigation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1802 FOUNDATION AND SOILS INVESTIGATION<br>1802.2.6 Seismic Design Category C |  | Same investigation is mandatory.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 7.4.2 Pole-Type Structures            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | IBC does not contain specific requirement.                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 7.4.3 Foundation Ties                 | Individual pile caps, drilled piers, or caissons shall be interconnected by ties. All ties shall be capable of carrying, in tension or compression, a force equal to the product of the larger pile cap or column load times $S_{DS}$ divided by 4 unless it can be demonstrated that equivalent restraint can be provided by <i>reinforced concrete beams</i> within slabs on grade or <i>reinforced concrete</i> slabs on grade or confinement by competent rock, hard cohesive soils, very dense granular soils, or other approved means. | 1807.2.23 Seismic design of piers or piles<br>1807.2.23.1 SDC C               |  | Identical, except that minimum tie strength is larger pile cap or column load times $S_{DS}/10$ , rather than $S_{DS}/4$ , as in NEHRP. Although this would appear to be less conservative, it is in fact a correction of error. $C_u/4$ of 1994 NEHRP should have translated into $S_{DS}/10$ , rather than $S_{DS}/4$ .<br>NEHRP allows, "Other approved means" of providing equivalent restraint, IBC does not. IBC allows some exceptions to requirement; NEHRP does not. |
| 7.4.4 Special Pile Requirements       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1807.2.23 Seismic design of piers or piles<br>1807.2.23.1 SDC C               |  | IBC has the same requirements as in NEHRP, and significant additional ones.                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | Equivalency cannot be judged                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | Equivalency cannot be judged                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | IBC is more stringent                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | Equivalency cannot be judged                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | IBC is less stringent                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |  | IBC is more stringent                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                             |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 7.4.4.1 Uncased Concrete Piles     | A minimum reinforcement ratio of 0.0025 shall be provided for uncased cast-in-place concrete drilled piles, drilled piers, or caissons in the top one-third of the pile length or a minimum length of 10 ft (3 m) below the ground. There shall be a minimum of four bars with closed ties (or equivalent spirals) of a minimum 1/4 in. (6 mm) diameter provided at 16-longitudinal-bar-diameter maximum spacing with a maximum spacing of 4 in. (102 mm) in the top 2 ft (0.6 m) of the pile. Reinforcement detailing requirements shall be in conformance with Sec. 9.6.2. | 1809.1.2.1 Reinforcement in SDC C                                                                                                          | Identical except for the following changes:<br>A maximum spacing of 6 in. (152 mm) or 8-longitudinal-bar-diameters, whichever is lesser, shall be provided within a distance equal to 2 times the least pile dimension of the bottom of the pile cap.<br>IBC also has the following additional requirement: "The minimum reinforcement ratio, but no less than that ratio required by rational analysis, shall be continued throughout the flexural length of the pile."<br>IBC does not include the last sentence of the NEHRP requirement. | Exclusion of the last sentence, however unrealistic it may be, makes the IBC less stringent |
| 7.4.4.2 Metal-Cased Concrete Piles |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1809.5 Steel-cased piles<br>1809.5.4 Reinforcement<br>1809.5.4.1 Seismic reinforcement                                                     | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent                                                                                  |
| 7.4.4.3 Concrete-Filled Pipe       | Minimum reinforcement 0.01 times the cross-sectional area of the pile concrete shall be provided in the top of the pile with a length equal to two times the required cap embedment anchorage into the pile cap.                                                                                                                                                                                                                                                                                                                                                             | 1809.6 Concrete-filled steel pipe and tube piles                                                                                           | Identical with following additions:<br>Minimum ... pile cap, but not less than the tension development length of the reinforcement. The wall thickness of the steel pipe shall not be less than 3/16 in. (5 mm).                                                                                                                                                                                                                                                                                                                             | IBC is more stringent                                                                       |
| 7.4.4.4 Precast Concrete Piles     | Longitudinal reinforcement shall be provided for precast concrete piles with a minimum steel ratio of 0.01. Ties or equivalent spirals shall be provided at a maximum 16-bar-diameter spacing with a maximum spacing of 4 in. (102 mm) in the top 2 ft (0.6 m). Reinforcement shall be full length.                                                                                                                                                                                                                                                                          | 1808.2 Precast nonprestressed piles<br>1808.2.2.2 Minimum reinforcement<br>1808.2.2.2.1 Seismic reinforcement in Seismic Design Category C | Identical, except that: maximum spacing of 4 in. has been changed to 6 in.<br>IBC Section includes the following additional sentence: "The longitudinal reinforcement shall be confined with closed ties or equivalent spirals of a minimum of a 1/4 in. (6.4 mm) diameter." Also, IBC requires reinforcement including ties to be full length.                                                                                                                                                                                              | IBC is less stringent for maximum spacing                                                   |
| 7.4.4.5 Precast-Prestressed Piles  | The upper 2 ft (0.6 m) of the pile shall have No. 3 ties minimum at not over 4-in. (102 mm) spacing or equivalent spi-                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1808.2.3 Precast prestressed piles<br>1808.2.3.2.1 Design in                                                                               | IBC deleted the sentence "The upper ... spirals". The IBC requires a minimum volumetric ratio of spiral reinforcement in the ductile region.                                                                                                                                                                                                                                                                                                                                                                                                 | Considered equivalent                                                                       |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
|                                                     | <p>raels. The pile cap connection is permitted to be by means of dowels as required in Sec. 7.4.4.. Pile cap connection is permitted to be by means of developing pile reinforcing strand if a ductile connection is provided.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Seismic Design Category C                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |
| 7.5 Seismic Design Categories D, E, and F           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |
| 7.5.1 Investigation                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1802 FOUNDATION AND SOILS INVESTIGATIONS 1802.2.7 Seismic Design Categories D, E and F. | IBC has the NEHRP requirements. It has additional requirements that are covered under NEHRP Section 7.5.3.                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Equivalent            |
| 7.5.2 Foundation Ties                               | <p>Individual spread footings founded on soil defined in Sec. 4.1.2 as <i>Site Class E</i> or <i>F</i> shall be interconnected by ties. Ties shall conform to Sec. 7.4.3.</p> <p>7.4.3: Individual pile caps, drilled piers, or caissons shall be interconnected by ties. All ties shall be capable of carrying, in tension or compression, a force equal to the product of the larger pile cap or column load times <math>S_{ps}</math> divided by 4 unless it can be demonstrated that equivalent restraint can be provided by <i>reinforced concrete</i> beams within slabs on grade or <i>reinforced concrete</i> slabs on grade or confinement by competent rock, hard cohesive soils, very dense granular soils, or other approved means.</p> | 1805.4 FOOTINGS AND FOUNDATIONS 1805.4.2.2 Footing seismic ties                         | Where a structure is assigned to SDC D, E, or F in accordance with Section 1616, individual spread footings founded on soil defined in Sec. 1615.1.1 as <i>Site Class E</i> or <i>F</i> shall be interconnected by ties. Ties shall be capable of carrying, in tension or compression, a force equal to the product of the larger footing load times the seismic coefficient $S_{ps}$ divided by 10 unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade. | IBC is less stringent |
| 7.5.3 Liquefaction Potential and Soil Strength Loss |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1802 FOUNDATION AND SOILS INVESTIGATION 1802.2.7 Seismic Design Categories D, E, and F  | Item 2 of 1802.2.7 along with the Exception is identical.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalent            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 7.5.4 Special Pile Requirements    | Piling shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and <i>structure</i> response. Curvatures shall include free-field soil strains (without the <i>structure</i> ) modified for soil-pile- <i>structure</i> interaction coupled with pile deformations induced by lateral pile resistance to <i>structure seismic forces</i> . Concrete piles in <i>Site Class E or F</i> shall be designed and detailed in accordance with Sec. 9.3.3.3 within seven pile diameters of the pile cap and the interfaces of soft to medium stiff clay or liquefiable strata.<br>[ Section 9.3.3.3. does not exist. The correct section no. appears to be 9.3.13 ] | 1807.2.23.2 Seismic design Categories D, E, and F                                                                 | IBC includes the same provisions and goes on to more specific requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Equivalent            |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 7.5.4.1 Uncased Concrete Piles     | A minimum reinforcement ratio of 0.005 shall be provided for uncased cast-in-place concrete piles, drilled piers, or caissons in the top one-half of the pile length or a minimum length of 10 ft (3 m) below ground. There shall be a minimum of four bars with closed ties or equivalent spirals provided at 8-longitudinal-bar-diameter maximum spacing with a maximum spacing of 3 in. (76 mm) in the top 4 ft (1.2 m) of the pile. Ties shall be a minimum of No. 3 bars for up to 20-in.-diameter (500 mm) piles and No. 4 bars for piles of larger diameter.                                                                                                                                           | 1809 CAST-IN-PLACE CONCRETE PILE FOUNDATIONS<br>1809.1.2.2 Reinforcement in Seismic Design Categories D, E, and F | Identical with following changes:<br>There shall be a minimum of four bars with closed ties or equivalent spirals provided at 6-longitudinal-bar-diameter maximum spacing with a maximum spacing of 4 in. (102 mm) within seven times the least pile dimension of the bottom of the pile cap in Class E or F sites and at the interfaces of soft to medium stiff clay or liquefiable strata, and three times the least pile dimension at all other sites. Tie spacing throughout the remainder of the concrete section shall not exceed 12-longitudinal-bar-diameters, one-half the least dimension of the section, nor 12 inches (305 mm). | IBC is less stringent |
| 7.5.4.2 Metal-Cased Concrete Piles |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1809.5 Steel-cased piles<br>1809.5.4 Reinforcement<br>1809.5.4.1 Seismic reinforcement                            | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent            |
| 7.5.4.3 Precast                    | Ties in precast concrete piles shall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1808 Precast concrete                                                                                             | " ...the requirements for Seismic Design Category C in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | IBC is more           |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Concrete Piles                    | conform to the requirements of Chapter 9 for at least the top half of the pile.<br>Note that requirements are vague, not clearly defined.                                                                                                                                                                                                                                                                                     | piles<br>1808.2 Precast nonprestressed piles<br>1802.2.2.2 Minimum reinforcement<br>1802.2.2.2.2 Seismic reinforcement in Seismic Design Categories D, E, and F | Section 1808.2.2.2.1 shall be met. Ties or equivalent spirals shall be provided at a maximum 6-longitudinal-bar-diameter spacing not to exceed a maximum of 4 inches (102 mm) on center. In addition, ties in precast concrete piles shall be provided for at least the top half of the pile. | stringent                    |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 7.5.4.4 Precast-Prestressed Piles | For the body of fully embedded foundation piling subjected to vertical loads only, or where the design bending moment does not exceed $0.20M_{nb}$ (where $M_{nb}$ is the unfactored ultimate moment capacity at balanced strain conditions as defined in Ref. 6-1, Sec. 10.3.2), spiral reinforcing shall be provided such that $\rho_s \geq 0.006$ .<br>Pile cap connection shall not be made by developing exposed strand. | 1808.2.3 Precast prestressed piles<br>1808.2.3.2.2 Design in Seismic Design Categories D, E, and F                                                              | The provisions of NEHRP deleted. Instead, IBC gives more elaborate and specific provisions.                                                                                                                                                                                                   | IBC is more stringent        |
| 7.5.4.5 Steel Piles               | The connection between the pile cap and steel piles or unfilled steel pipe piles shall be designed for a tensile force equal to 10 percent of the pile compression capacity.                                                                                                                                                                                                                                                  | 1808.3 Structural Steel piles                                                                                                                                   | IBC does not contain NEHRP provisions. Instead, it gives more elaborate provisions concerning capacity and dimensions.                                                                                                                                                                        | Equivalency cannot be judged |
|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                               |                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                    |                                                                              | 2000 IBC                                                                                                        |                                                                                                                                                                                                    | Comments                            |
|-----------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Section                                       | Provision                                                                    | Section                                                                                                         | Provision                                                                                                                                                                                          |                                     |
| <b>8. STEEL STRUCTURE DESIGN REQUIREMENTS</b> |                                                                              | <b>22. STEEL</b>                                                                                                |                                                                                                                                                                                                    |                                     |
| 8.1 REFERENCE DOCUMENTS                       |                                                                              | 35 REFERENCE STANDARDS                                                                                          | NEHRP Ref. 8.1 has been adopted into IBC including Supplement No. 1, January 1998, Parts I, II, III of NEHRP Ref. 8-3 have been adopted into the IBC. IBC has adopted a few additional references. | IBC is more up-to-date, equivalent  |
| 8.2 SEISMIC REQUIREMENTS FOR STEEL STRUCTURES |                                                                              | 2212 SEISMIC REQUIREMENTS FOR STRUCTURAL STEEL CONSTRUCTION<br>2212.1 Seismic Requirements for Steel Structures | Identical                                                                                                                                                                                          | Equivalent                          |
| 8.3 SEISMIC DESIGN CATEGORIES A, B, and C     |                                                                              | 2212.1.1 Seismic Design Categories A, B, and C                                                                  | Essentially identical, except design and detail according to AISC Seismic Part III is allowed.                                                                                                     | Equivalent                          |
| 8.4 SEISMIC DESIGN CATEGORIES D, E, and F     |                                                                              | 2212.1.2 Seismic Design Categories D, E, and F                                                                  | Essentially identical, except design and detail according to AISC Seismic Part III is allowed.                                                                                                     | Equivalent                          |
| 8.5 COLD-FORMED STEEL SEISMIC REQUIREMENTS    |                                                                              | 2205 COLD-FORMED STEEL<br>2205.1 General<br>2205.2 Composite slabs on steel decks                               | Section 2205.1 of IBC is essentially identical to Sec. 8.5 of NEHRP.                                                                                                                               | Equivalent                          |
| 8.5.1 Modifications to Ref. 8-4               | Seismic load combinations shall be as determined by these provisions.        |                                                                                                                 | Although this modification is not included, it is presumed, indeed required by Sec. 1605, that IBC seismic design load combinations are to be used.                                                | Equivalent                          |
| 8.5.2 Modifications Ref. 8-5                  | Substitute a load factor of 1.0 in place of 1.5 for nominal earthquake load. |                                                                                                                 | Although this modification is not included, it is presumed, indeed required by Sec. 1605, that IBC seismic design load combinations are to be used.                                                | Equivalent                          |
| 8.6 LIGHT-FRAMED WALLS                        |                                                                              | 2211 WIND AND SEISMIC                                                                                           | IBC is more detailed. NEHRP Sec. 8.6 is a subset of IBC Sec. 2211.                                                                                                                                 | Entire sections are not comparable. |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                             |                                                                                                                                                                                                | REQUIREMENTS<br>FOR LIGHT FRAMED<br>COLD-FORMED<br>STEEL WALLS                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                        | Subsections are<br>compared below |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 8.6.1 Boundary<br>Members   |                                                                                                                                                                                                | 2211.7 Seismic<br>Design Categories D,<br>E, and F.<br>2211.7.1 Boundary<br>elements                                                                                                                                                   | Essentially identical, but requirements apply to SDC D,<br>E, and F only.                                                                                                                                                                                                                                                                                                                                              | IBC is less stringent             |
| 8.6.2 Connections           |                                                                                                                                                                                                | 2211.6.2 Connections                                                                                                                                                                                                                   | Identical, but requirements apply to SDC D, E, and F<br>only.                                                                                                                                                                                                                                                                                                                                                          | IBC is less stringent             |
| 8.6.3 Braced Bay<br>Members | ... In vertical <i>diaphragm</i> systems, the<br>vertical boundary members shall be<br>anchored so the bottom track is not<br>required to resist uplift forces by bending<br>of the track web. | 2211.6.3 Braced bay<br>members                                                                                                                                                                                                         | Vertical boundary elements and anchorage thereto shall<br>have the strength to resist the forces determined from<br>the application of load combinations per Section 1605.4.<br>(Rest is identical). Additional IBC requirement is in<br>NEHRP Sec. 8.6.5. IBC requirements apply to SDC D,<br>E, and F only.                                                                                                          | IBC is less stringent             |
| 8.6.4 Diagonal Braces       | Provision shall be made for pretensioning<br>or other methods of installation of tension-<br>only bracing to guard against loose<br>diagonal straps.                                           | 2211.6.5 Diagonal<br>bracing                                                                                                                                                                                                           | When diagonal bracing is provided for lateral resistance<br>it shall comply with the requirements of this section. The<br>l/r of the brace is permitted to exceed 200. Provisions<br>shall be made for pretensioning or other methods of<br>installing tension-only bracing shall be used to guard<br>against loose diagonal straps.<br>IBC has more detailed restrictions, but they apply to<br>SDC D, E, and F only. | Equivalency cannot<br>be judged   |
| 8.6.5 Shear Walls           | Nominal shear values ... concrete<br>connection.                                                                                                                                               | 2211.1 General<br>2211.2 Conditions of<br>Application<br>2211.2.1 Limitations<br>for Systems in Tables<br>2211.1.1, 2211.1.2<br>and 2211.1.3<br>2211.3 Wood<br>structural panel<br>sheathing<br>2211.4 Gypsum board<br>panel sheathing | IBC is broader in scope. Includes wind in addition to<br>earthquake forces. Considers gypsum board and sheet<br>steel sheathing in addition to wood sheathing.<br>Table 2211.1.3 is much more extensive than NEHRP<br>Table 8.6.                                                                                                                                                                                       | IBC is more<br>stringent          |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                    | Panel thicknesses ... seismic loads determined by Eq. 2.2.6-3 and Eq. 2.2.6-4. | 2211.5 Sheet steel sheathing<br>2211.7.4 Wood structural panel sheathing                     | Essentially the same, but requirements apply to SDC D, E, and F only. | IBC is less stringent        |
|----------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------|
| 8.7 SEISMIC REQUIREMENTS FOR STEEL DECK DIAPHRAGMS |                                                                                |                                                                                              | No corresponding provisions                                           | Equivalency cannot be judged |
| 8.8 STEEL CABLES                                   |                                                                                | 2207 STEEL CABLE STRUCTURES<br>2207.1 General<br>2207.2 Seismic requirements for steel cable | IBC Sec. 2207.2 is the same as NEHRP Sec. 8.8.                        | Equivalent                   |
|                                                    |                                                                                |                                                                                              |                                                                       |                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                          |                                                                                                           | 2000 IBC                                                                                                |                                                                                                                                                                                                                                          | Comments                                                                                 |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Section                                                             | Provision                                                                                                 | Section                                                                                                 | Provision                                                                                                                                                                                                                                |                                                                                          |
| <b>CHAPTER 9<br/>CONCRETE<br/>STRUCTURE DESIGN<br/>REQUIREMENTS</b> |                                                                                                           | <b>CHAPTER 19<br/>CONCRETE</b>                                                                          |                                                                                                                                                                                                                                          |                                                                                          |
| 9.1 REFERENCE DOCUMENTS                                             | ACI 318-95, excluding Appendix A, is adopted by reference, subject to modifications made in this chapter. | 1901 GENERAL<br>1901.1 Scope<br>1901.2 Plain and reinforced concrete<br>1901.3 Source and Applicability | ACI 318-99 is adopted by reference, subject to modifications made in this chapter; major parts of Chapters 2-7 of ACI 318-99 are reproduced.                                                                                             | IBC adopts a later edition of the reference standard, generally making it more stringent |
|                                                                     |                                                                                                           | 1901.4 Construction documents                                                                           | Reproduces much of Section 1.2.1 of ACI 318-99. Three items have been added to the list beyond ACI 318-95. In addition, the term "welded splice" has been replaced by "mechanical and welded splice" in Item 7.                          | IBC is more stringent                                                                    |
|                                                                     |                                                                                                           | 1901.5 Special inspection                                                                               | Formally refers to the special inspection requirements of Chapter 17. Special inspection is covered under Chapter 3 of NEHRP, although no formal reference to it is made in Chapter 9.                                                   | Has no effect on equivalency                                                             |
|                                                                     |                                                                                                           | 1902 DEFINITIONS                                                                                        | Reproduces Chapter 2 of ACI 318-99. Some definitions have been added beyond ACI 318-95.                                                                                                                                                  | Has no effect on equivalency                                                             |
|                                                                     |                                                                                                           | 1903 SPECIFICATIONS FOR TESTS AND MATERIALS                                                             | Parts of Chapter 3 of ACI 318-99 are reproduced. Changes in Chapter 3 from ACI 318-95 to ACI 318-99 are minor. One modification is made to Section 3.2 of ACI 318-99. Cement complying with ASTM C1157 is permitted by the IBC.          | Has little effect on equivalency                                                         |
|                                                                     |                                                                                                           | 1904 DURABILITY REQUIREMENTS                                                                            | Reproduces Chapter 4 of ACI 318-99. There are no changes in this chapter from ACI 318-95 to ACI 318-99. One exception is added to Section 1904.2.2, incorporating Fig. 1904.2.2 and Table 1904.2.2 (2) which are not part of ACI 318-99. | Has little effect on equivalency                                                         |
|                                                                     |                                                                                                           | 1905 CONCRETE QUALITY, MIXING AND PLACING                                                               | Reproduces most of Chapter 5 of ACI 318-99. In Section 1905.1.1, one modification is made to ACI 318-99 Section 5.1.1. For concrete designed and constructed in accordance with Chapter 19, $f_c'$ is                                    | IBC is more stringent                                                                    |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                 |                                                                                            |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                              |
|---------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
|                                 |                                                                                            |                                                             | <p>required to be not less than 2500 psi. ACI 318-99 has made one important modification to ACI 318-95 provision by adding a new Section 5.6.1 (IBC Section 1905.6.1) and renumbering 5.6.1 through 5.6.4 to 5.6.2 through 5.6.5.</p> <p>1905.6.1 Qualified technicians. Concrete shall be tested in accordance with the requirements in Sections 1905.6.3 through 1905.6.5. Qualified field testing technicians shall perform tests on fresh concrete at the job site, prepare specimens required for curing under field conditions, prepare specimens required for testing in the laboratory, and record the temperature of the fresh concrete when preparing specimens for strength tests. Qualified laboratory technician shall perform all required laboratory tests.</p> |                                              |
|                                 |                                                                                            | 1906 FORMWORK, EMBEDDED PIPES, AND CONSTRUCTION JOINTS      | <p>Reproduces parts of Chapter 6 of ACI 318-99. There are no changes in this chapter from ACI 318-95 to ACI 318-99.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Has no effect on equivalency                 |
|                                 |                                                                                            | 1907 DETAILS OF REINFORCEMENT                               | <p>Reproduces parts of Chapter 7 of ACI 318-99. There are at least two significant changes in this chapter from ACI 318-95 to ACI 318-99. A reduction has been made in the allowable spacing of prestressing strands for transfer strengths of 4000 psi or greater. Lap splice lengths have been modified for epoxy-coated and plain spirals; full welded or mechanical splices are now allowed.</p>                                                                                                                                                                                                                                                                                                                                                                           | IBC is somewhat more stringent               |
| 9.1.1 Modifications to Ref. 9-1 |                                                                                            | 1908 MODIFICATIONS TO ACI 318<br>1908.1 General<br>1908.1.1 | <p>Prohibits use of Alternate Design Method of Appendix A in seismic design of concrete structure. Prohibition is already included in Section 9.1 of NEHRP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Equivalent                                   |
| 9.1.1.1                         | Requires the use of reduced $\phi$ factors with seismic strength design load combinations. | 1908.1.2                                                    | <p>The use of reduced <math>\phi</math> factors is not required for justifiable reasons.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IBC is less restrictive, but justifiably so. |
|                                 |                                                                                            | 1908.1.3                                                    | <p>ACI 318-99 Section 18.9.3, minimum bonded</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Has no appreciable                           |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                    |                                                                                                                                                                                                                                                                                                                                                     |                                        |  | reinforcement, is modified to apply to all two-way slabs, not just flat plates.                                                                                                                                                                                                                                                 | effect on equivalency                    |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 9.1.1.2                            | Adds notation to ACI 318-95, required by modifications made in Section 9.1.1                                                                                                                                                                                                                                                                        | 1908.1.4                               |  | Adds notation to ACI 318-99, required by modifications made in Section 1908.1                                                                                                                                                                                                                                                   | Equivalent                               |
| 9.1.1.3, 9.1.1.5, 9.1.1.6, 9.1.1.9 | Add design requirements for precast concrete structures assigned to high seismic design categories to ACI 318-95. Column-face connection (9.1.1.9) – Any strong connection ... test results. Any mechanical connector ... shall develop ... at least 40% of the specified yield strength, $f_y$ , of the bar. [40% is an error, it should be 140%.] | 1908.1.5, 1908.1.6, 1908.1.7, 1908.1.9 |  | Add the same provisions to ACI 318-99.<br><br>Column-face connection. Any strong connection ... test results. Any mechanical connector located within such a column-face strong connection shall be a Type 2 mechanical splice as defined in Section 12.14.3.6. (i.e., specified tensile strength of connector to be developed) | Equivalent                               |
| 9.1.1.4                            | Replaces Sections 21.2.1.3 and 21.2.1.4 of ACI 318-95 with requirements of Sections 9.4-9.7 (comparable to IBC Section 1910)                                                                                                                                                                                                                        |                                        |  | This modification is unnecessary in view of changes made in Sections 21.2.1.3 and 21.2.1.4 of ACI 318-99.                                                                                                                                                                                                                       | Equivalent                               |
| 9.1.1.7                            | Permits prestressing tendons to be used to resist earthquake-induced flexural and axial forces in frame members subject to restrictions of this section.                                                                                                                                                                                            | 1908.1.8                               |  | Essentially identical                                                                                                                                                                                                                                                                                                           | Equivalent                               |
| 9.1.1.8                            | Makes modifications to splicing requirements of Section 21.2.6.1 of ACI 318-95.                                                                                                                                                                                                                                                                     |                                        |  | Sections 21.2.6 and 21.2.7 of ACI 318-99 have new provisions for mechanical and welded splices, respectively, which make this modification unnecessary.                                                                                                                                                                         | IBC is more stringent                    |
| 9.1.1.10                           | Makes a modification to the design axial strength requirement for columns of Section 21.4.5.3 of ACI 318-95 - a modification taken from the 1997 UBC                                                                                                                                                                                                |                                        |  | This modification was considered and found to be unnecessary and unwarranted by ACI 318. So it was not included in ACI 318-99.                                                                                                                                                                                                  | Does not affect equivalency              |
| 9.1.1.11                           | Requires use of strength design load combinations of ASCE 7-95 in seismic design of concrete structures.                                                                                                                                                                                                                                            | 1908.1.2                               |  | Requires use of strength design load combinations of ASCE 7-98, as adopted into IBC Section 1605.2, in seismic design of concrete structures.                                                                                                                                                                                   | IBC has updated requirements, equivalent |
| 9.1.1.12                           | Makes modifications to diaphragm design requirements of Section 21.6.4 of ACI 318-95                                                                                                                                                                                                                                                                |                                        |  | This provision is not needed since Section 21.7 of ACI 318-99 includes updated diaphragm design provisions.                                                                                                                                                                                                                     | IBC is more stringent                    |
| 9.1.1.13                           | Design of shear walls for flexure and axial loads is changed from the procedure of ACI 318-95 to essentially that of 1997                                                                                                                                                                                                                           |                                        |  | Section 21.6 of ACI 318-99 has updated shearwall design provisions which make this modification unnecessary.                                                                                                                                                                                                                    | Equivalent                               |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                       | UBC                                                                                                                     |                                                                                            |  |                                                                                                                                                                                                                                                                         | Equivalent                                                |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 9.1.1.14                                              | Adds design requirements for coupling beams to ACI 318-95.                                                              |                                                                                            |  | Coupling beam design requirements have been added to Section 21.6 of ACI 318-99, making this modification unnecessary.                                                                                                                                                  | Equivalent                                                |
| 9.1.1.15                                              | Modifies the requirements of ACI 318-95 Section 21.7 for frame members assumed not to contribute to lateral resistance. | 1908.1.11                                                                                  |  | The NEHRP modifications are now unnecessary, in view of changes made in Section 21.9 of ACI 318-99. However, IBC makes a different modification to Section 21.9, not requiring lap splices in gravity columns to be restricted to the middle half of the column height. | IBC is slightly less restrictive, but justifiably so      |
|                                                       | No corresponding requirement                                                                                            | 1908.1.10                                                                                  |  | Gives design requirements for wall piers and wall segments that are taken from UBC 1997 and are not part of ACI 318-99.                                                                                                                                                 | IBC is more restrictive                                   |
|                                                       | No corresponding requirement                                                                                            | 1912 ANCHORAGE                                                                             |  | Gives provisions for allowable stress design of headed bolts and headed stud anchors cast in normal weight concrete.                                                                                                                                                    | IBC is more stringent                                     |
| 9.2 BOLTS AND HEADED STUD ANCHORS IN CONCRETE         | Gives strength design provisions for headed bolts and headed stud anchors cast in concrete                              | 1913 ANCHORAGE TO CONCRETE-STRENGTH DESIGN                                                 |  | Contains completely different provisions, based on work-in-progress for eventual incorporation into ACI 318.                                                                                                                                                            | Equivalency cannot be judged without comparative designs. |
|                                                       |                                                                                                                         | 1909 STRUCTURAL PLAIN CONCRETE                                                             |  | Reproduces parts of, and adds one exception to, Chapter 22 of ACI 318-99, which is the same as Chapter 22 of ACI 318-95, which in turn is adopted into 1997 NEHRP                                                                                                       | Equivalent                                                |
| 9.3 CLASSIFICATION OF SEISMIC-FORCE-RESISTING SYSTEMS |                                                                                                                         | 1910 SEISMIC DESIGN PROVISIONS<br>1910.2 Classification of seismic force resisting systems |  | Identical, except that Sections 9.3.1.1.1 and 9.3.1.1.2, modifying definition of ordinary moment frame, are part of 1910.3 (Seismic Design Category B)                                                                                                                  | IBC is slightly less restrictive                          |
| 9.4 SEISMIC DESIGN CATEGORY A                         |                                                                                                                         |                                                                                            |  | No explicit provision for SDC A                                                                                                                                                                                                                                         | Does not affect equivalency                               |
| 9.5 SEISMIC DESIGN CATEGORY B                         |                                                                                                                         | 1910.3 Seismic Design Category B                                                           |  | Identical, except that NEHRP Sections 9.3.1.1.1, 9.3.1.1.2 are incorporated here, as mentioned above.                                                                                                                                                                   | Equivalent                                                |
| 9.6 SEISMIC DESIGN CATEGORY C                         |                                                                                                                         | 1910.4 Seismic Design Category C                                                           |  | Detailed plain concrete walls are not allowed as part of seismic force resisting system, while NEHRP allows such usage. There are more restrictions than in NEHRP on the use of structural plain concrete walls.                                                        | IBC is more restrictive                                   |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                                             |                                   |                                              |                                                                                                                                                                  |                              |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 9.6.3.2 Footings (in SDC C)                                                                                 |                                   | 1910.3.2.2 Footings (in SDC B)               | Identical with following differences:<br>1. Addition of Exception 2 to Paragraph 2.<br>2. Addition of requirements for footing which exceeds 8 in. in thickness. | IBC is more stringent        |
| 9.7 SEISMIC DESIGN CATEGORIES D, E, OR F                                                                    |                                   | 1910.5 Seismic Design Categories D, E, and F | Essentially the same                                                                                                                                             | Equivalent                   |
| Appendix to Chapter 9 REINFORCED CONCRETE STRUCTURAL SYSTEMS COMPOSED FROM INTERCONNECT-ED PRECAST ELEMENTS |                                   |                                              | The provisions of this appendix are not included in the IBC.                                                                                                     | Equivalency cannot be judged |
|                                                                                                             | No corresponding NEHRP provisions | 1911 MINIMUM SLAB PROVISIONS                 | Beyond the scope of ACI 318                                                                                                                                      | IBC is more restrictive      |
|                                                                                                             | No corresponding NEHRP provisions | 1914 SHOTCRETE                               | Beyond the scope of ACI 318                                                                                                                                      | IBC is more restrictive      |
|                                                                                                             | No corresponding NEHRP provisions | 1915 REINFORCED GYPSUM CONCRETE              | Beyond the scope of ACI 318                                                                                                                                      | IBC is more restrictive      |
|                                                                                                             | No corresponding NEHRP provisions | 1916 CONCRETE-FILLED PIPE COLUMNS            | Beyond the scope of ACI 318                                                                                                                                      | IBC is more restrictive      |
|                                                                                                             |                                   |                                              |                                                                                                                                                                  |                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                                                            |           | 2000 IBC                                                                                                                           |                       | Comments   |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------|
| Section                                                                                                                               | Provision | Section                                                                                                                            | Provision             |            |
| Chapter 10<br>COMPOSITE STEEL<br>AND CONCRETE<br>STRUCTURE DESIGN<br>REQUIREMENTS<br>10.1 REFERENCE<br>DOCUMENTS<br>10.2 REQUIREMENTS |           | 2213 SEISMIC<br>REQUIREMENTS<br>FOR COMPOSITE<br>CONSTRUCTION<br>2213.1 General<br>2213.2 Seismic<br>Design Category D, E<br>and F | Essentially identical | Equivalent |
|                                                                                                                                       |           |                                                                                                                                    |                       |            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                      |                                                                                                                                                                                                                                                        | 2000 IBC                                               |                                                                                                                                                                                                                                                          | Comments                                              |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Section                                         | Provision                                                                                                                                                                                                                                              | Section                                                | Provision                                                                                                                                                                                                                                                |                                                       |
| <b>11 MASONRY STRUCTURE DESIGN REQUIREMENTS</b> |                                                                                                                                                                                                                                                        | <b>21 MASONRY</b>                                      |                                                                                                                                                                                                                                                          |                                                       |
| <b>11.1 GENERAL</b>                             |                                                                                                                                                                                                                                                        | <b>2101 GENERAL</b>                                    |                                                                                                                                                                                                                                                          |                                                       |
| 11.1.1 Scope                                    |                                                                                                                                                                                                                                                        | 2101.1 Scope                                           |                                                                                                                                                                                                                                                          | Equivalent                                            |
| 11.1.2 Reference Documents                      | ACI 530-95 and ACI 530.1-95 are the primary reference documents.                                                                                                                                                                                       | 35 REFERENCED STANDARDS                                | Primary reference documents updated to ACI 530-99, ACI 530.1-99.                                                                                                                                                                                         | Equivalent. IBC is more up-to-date                    |
| 11.1.3 Definitions                              |                                                                                                                                                                                                                                                        | 2102 Definitions                                       | IBC is more comprehensive.                                                                                                                                                                                                                               | Considered equivalent                                 |
| 11.1.4 Notations                                |                                                                                                                                                                                                                                                        | 2102 Definitions                                       | Notations are part of Definitions.                                                                                                                                                                                                                       | Considered equivalent                                 |
| <b>11.2 CONSTRUCTION REQUIREMENTS</b>           |                                                                                                                                                                                                                                                        | <b>2104 CONSTRUCTION</b>                               |                                                                                                                                                                                                                                                          |                                                       |
| 11.2.1 General                                  | Per the requirements of ACI 530.1-95.                                                                                                                                                                                                                  | 2104.1 Masonry construction                            | Per the requirements of ACI 530.1-99 and Sections 2104.1.1 and 2104.5                                                                                                                                                                                    | IBC is more stringent                                 |
| 11.2.2 Quality Assurance                        |                                                                                                                                                                                                                                                        | 2105 QUALITY ASSURANCE                                 | Essentially similar; IBC is more detailed.                                                                                                                                                                                                               | Considered equivalent                                 |
| <b>11.3 GENERAL REQUIREMENTS</b>                |                                                                                                                                                                                                                                                        | <b>2106 SEISMIC DESIGN</b>                             |                                                                                                                                                                                                                                                          |                                                       |
| 11.3.1 Scope                                    | Masonry structures and components shall comply with requirements of reinforced masonry design, plain (unreinforced) masonry design, empirical design, design for architectural components of masonry, design of glass unit masonry and masonry veneer. | 2106.1 Seismic design requirements for masonry         | Masonry structures and components shall comply with 2106.1.1 (Basic seismic force resisting system) and 2106.2 (SDC A), 2106.3 (SDC B), 2106.4 (SDC C), 2106.5 (SDC D), 2106.6 (SDC E, F), except that masonry designed by WSD may comply with 2106.1.2. | Organized differently, equivalency difficult to judge |
| 11.3.2 Empirical Masonry Design                 | The requirements of Chapter 9 of ACI 530-95 shall apply to the empirical design of masonry.                                                                                                                                                            | 2101.2.3 Empirical design                              | IBC provides the alternative of complying with Secs. 2106 and 2109, instead of Chapters 1 and 5 of ACI 530-99.                                                                                                                                           | Considered equivalent                                 |
| 11.3.3 Plain (Unreinforced) Masonry Design      |                                                                                                                                                                                                                                                        | 2108.10 Design of Plain (Unreinforced) masonry Members | Essentially identical                                                                                                                                                                                                                                    | Equivalent                                            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                  |                                                                                                                                |                                                                                     |                                                                                                                                             |                              |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.3.4 Reinforced Masonry Design |                                                                                                                                | 2108.9 Reinforced Masonry<br>2108.9.1 Design assumptions                            | IBC gives much more comprehensive design assumptions.                                                                                       | Considered equivalent        |
| 11.3.5 Seismic Design Category A |                                                                                                                                | 2106.2 Seismic Design Category A                                                    | Same requirements as in NEHRP; empirical design per Sec. 2109, WSD of plain masonry and WSD of reinforced masonry are additionally allowed. | Considered equivalent        |
|                                  | No corresponding provision                                                                                                     | 2106.2.1 Anchorage of Masonry Walls                                                 | Provides just a cross-reference to Sec. 1616.4.3.                                                                                           | Equivalency is not affected  |
| 11.3.6 Seismic Design Category B | Lateral-force-resisting system shall comply with Sec. 11.3.3 (plain masonry design) or Sec. 11.3.4 (reinforced masonry design) | 2106.3 Seismic Design Category B<br>2106.3.1 Masonry Shear Walls                    | Masonry shear walls shall be ordinary plain masonry shear walls or ordinary reinforced masonry shear walls.                                 | Equivalent                   |
| 11.3.7 Seismic Design Category C |                                                                                                                                | 2106.4 Seismic Design Category C                                                    | Identical                                                                                                                                   | Equivalent                   |
| 11.3.7.1 Material Requirements   |                                                                                                                                |                                                                                     | No corresponding provision                                                                                                                  | Equivalency cannot be judged |
|                                  |                                                                                                                                | 2106.4.1 Design of Elements that are not part of the Lateral Force-Resisting System |                                                                                                                                             |                              |
|                                  | No corresponding provision                                                                                                     | 2106.4.1.1 Load-bearing frames or columns                                           |                                                                                                                                             | IBC is more stringent        |
|                                  | No corresponding provision                                                                                                     | 2106.4.1.2 Masonry partition walls                                                  |                                                                                                                                             | IBC is more stringent        |
|                                  | No corresponding provision                                                                                                     | 2106.4.1.3 Reinforcement Requirements for Masonry Elements                          |                                                                                                                                             | IBC is more stringent        |
|                                  |                                                                                                                                | 2106.4.2 Design of Elements that are Part of the Lateral Force-Resisting System     |                                                                                                                                             |                              |
|                                  | No corresponding provision                                                                                                     | 2106.4.2.1 Connections to                                                           |                                                                                                                                             | IBC is more stringent        |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 11.3.7.2 Masonry Shear Walls        | Masonry shear walls shall comply with the requirements for <i>detailed plain masonry shear walls</i> (Sec. 11.11.2), <i>intermediate reinforced masonry shear walls</i> (Sec. 11.11.4), or <i>special reinforced masonry shear walls</i> (Sec. 11.11.5).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | masonry Shear Walls<br>2106.4.2.3 Masonry Shear Walls                   | Masonry shear walls shall comply with the requirements for intermediate reinforced masonry shear walls. Detailed plain masonry shear walls are not permitted. Although special reinforced masonry shear wall are not specifically mentioned, they are understood to be permitted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IBC more stringent           |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.3.7.3 Minimum Wall Reinforcement | <p>Vertical reinforcement of at least 0.20 in.<sup>2</sup> (129 mm<sup>2</sup>) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening, at the ends of walls and at a maximum spacing of 4 feet (1219 mm) apart horizontally throughout the walls. Horizontal reinforcement not less than 0.20 in.<sup>2</sup> (129 mm<sup>2</sup>) in cross section shall be provided as follows:</p> <ol style="list-style-type: none"> <li>At the bottom and top of wall openings extending not less than 24 in. (610 mm) nor less than 40 bar diameters past the opening,</li> <li>Continuously at structurally connected roof and floor levels and at the top of walls,</li> <li>At the bottom of load-bearing walls or in the top of foundations when doweled to the wall,</li> <li>At maximum spacing of 120 in. (3048 mm) unless uniformly distributed joint reinforcement is provided.</li> </ol> <p>Reinforcement at the top and bottom of openings, when used in determining the maximum spacing specified in Item d above, shall be continuous in the wall.</p> | 2106.4.2.3.1 Minimum Reinforcement Requirements for Masonry Shear Walls | <p>Vertical reinforcement of at least 0.20 in.<sup>2</sup> (129 mm<sup>2</sup>) in cross-sectional area shall be provided at corners, within 16 in. (406 mm) of each side of openings, within 8 in. (203 mm) of each side of movement joints, within 8 in. (203 mm) of the ends of walls, and at a maximum spacing of 10 ft (3048 mm).</p> <p>Horizontal joint reinforcement shall consist of at least two wires of W1.7 spaced not more than 16 in. (406 mm); or bond beam reinforcement shall be provided of at least 0.2 in.<sup>2</sup> (129 mm<sup>2</sup>) in cross-sectional area spaced not more than 10 ft (3048 mm). Horizontal reinforcement shall also be provided at the bottom and top of the wall openings and shall exceed not less than 24 in. (610 mm) nor less than 40 bar diameters past the openings; continuously at structurally connected roof and floor levels; within 16 in. (406 mm) of the top of the walls.</p> <p>The big difference is 10 ft maximum spacing of vertical reinforcement in the IBC versus 4 ft maximum spacing in NEHRP.</p> | IBC is less stringent        |
| 11.3.7.4 Stack Bond Construction    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                         | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Equivalency cannot be judged |
| 11.3.7.5 Multiple                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                         | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Equivalency cannot           |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Wythe Walls Not Acting Compositely                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                               |                                                                                                                                                                                                                                                              | be judged                    |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.3.7.6 Walls Separated from the Basic Structural System |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                               | No corresponding provision                                                                                                                                                                                                                                   | Equivalency cannot be judged |
| 11.3.7.7 Connections to Masonry Columns                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | 2106.4.2.2 Connections to Masonry Columns                     | Identical, except IBC invokes Sec. 2.1.6 of ACI 530.                                                                                                                                                                                                         | Equivalent                   |
| 11.3.8 Seismic Design Category D                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | 2106.5 Seismic Design Category D                              | Identical                                                                                                                                                                                                                                                    | Equivalent                   |
| 11.3.8.1 Material Requirements                            | Prohibits use of Type N mortar and masonry cement in basic structural system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  | 2106.5.5 Material Requirements                                | Prohibits use of Type N mortar and masonry cement in lateral-force-resisting system                                                                                                                                                                          | IBC is less restrictive      |
| 11.3.8.2 Masonry Shear Walls                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | 2106.5.3 Masonry Shear Walls                                  | Identical                                                                                                                                                                                                                                                    | Equivalent                   |
| 11.3.8.3 Minimum Wall Reinforcement                       | All walls ..... 48 in. (1219 mm). Except for joint reinforcement, the bar size shall not be less than a No. 3 (10-mm diameter). Reinforcement shall be continuous around wall corners and through intersections, unless the intersecting walls are separated. Only horizontal reinforcement that is continuous in the wall or element shall be included in computing the area of horizontal reinforcement. Reinforcement spliced in accordance with Sec. 11.4.5.6 shall be considered as continuous reinforcement. Architectural components of masonry shall be exempt from this reinforcement requirement. |  | 2106.5.2 Minimum Reinforcement Requirements for Masonry Walls | The NEHRP text reproduced is not part of IBC.                                                                                                                                                                                                                | IBC is less stringent        |
| 11.3.8.4 Stack Bond Construction                          | Where masonry is laid in stack bond, the minimum amount of horizontal reinforcement shall be 0.0015 times the gross cross-sectional area of the wall. If open-end units are used and grouted solid, the minimum amount of horizontal                                                                                                                                                                                                                                                                                                                                                                        |  | 2106.5.2 Minimum Reinforcement Requirements for Masonry Walls | Wythes of stack bond masonry shall be constructed of fully grouted hollow open-end units, fully grouted hollow units laid with full head joints or solid units. Maximum spacing of reinforcement for walls with stack bond masonry shall be 24 in. (610 mm). | IBC is less stringent        |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                          |                                                                                                                                                                                                                                                |                                                                                     |                                                                                                                                                                          |                              |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
|                                          | reinforcement shall be 0.0007 times the gross cross-sectional area of the wall. The maximum spacing of horizontal reinforcement shall not exceed 24 in. (610 mm). Architectural components of masonry shall be exempt from these requirements. |                                                                                     |                                                                                                                                                                          |                              |
| 11.3.8.5 Minimum Wall Thickness          |                                                                                                                                                                                                                                                |                                                                                     | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.8.6 Minimum Column Reinforcement    |                                                                                                                                                                                                                                                | 2106.5.4 Minimum Reinforcement for Masonry Columns                                  | Essentially identical                                                                                                                                                    | Equivalent                   |
| 11.3.8.7 Minimum Column Dimension        |                                                                                                                                                                                                                                                |                                                                                     | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.8.8 Separation Joints               |                                                                                                                                                                                                                                                |                                                                                     | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.9 Seismic Design Categories E and F |                                                                                                                                                                                                                                                | 2106.6 Seismic Design Category E and F                                              | Identical requirements                                                                                                                                                   | Equivalent                   |
| 11.3.9.1 Material Requirements           |                                                                                                                                                                                                                                                |                                                                                     | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.9.2 Masonry Shear Walls             |                                                                                                                                                                                                                                                | 2106.6.2.1 Masonry Shear Walls                                                      | Identical                                                                                                                                                                | Equivalent                   |
| 11.3.9.3 Stack Bond Construction         | 11.3.9.3.1<br>11.3.9.3.2 Reinforced hollow unit construction shall be grouted solid and all head joints shall be made solid by the use of open end units.                                                                                      | 2106.6.1 Design of Elements that are not Part of the Lateral Force-Resisting System | Essentially the text of NEHRP Sec. 11.3.9.3.1, plus: These elements shall be solidly grouted and shall be constructed of hollow open units or two wythes of solid units. | Equivalent                   |
|                                          | No corresponding provision                                                                                                                                                                                                                     | 2106.6.2 Design of Elements that are Part of the Lateral Force-Resisting System     |                                                                                                                                                                          | Equivalency cannot be judged |
|                                          | No corresponding provision                                                                                                                                                                                                                     | 2106.6.2.2 Reinforced hollow unit masonry                                           |                                                                                                                                                                          | Equivalency cannot be judged |
| 11.3.10 Properties of Materials          |                                                                                                                                                                                                                                                | 2108.7 Properties of materials                                                      |                                                                                                                                                                          |                              |
| 11.3.10.1 Steel                          |                                                                                                                                                                                                                                                | 2108.7.1 Modulus of                                                                 | Identical                                                                                                                                                                | Equivalent                   |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Reinforcement<br>Modulus of Elasticity               |                                                                                                                                                                                                                                                                               | elasticity of steel<br>reinforcement      |                                                                                                                                                                                                            |                       |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 11.3.10.2 Masonry<br>Modulus of Elasticity           | The modulus of elasticity of masonry ( $E_m$ ) shall be determined in accordance with Eq. 11.3.10.2 or shall be based on the modulus of elasticity determined by prism test and taken between 0.05 and 0.33 times the masonry prism strength:<br>$E_m = 750 f_m'$ (11.3.10.2) | 2108.7.2 Modulus of elasticity of masonry | The Eqn. 11.3.10.2 has been modified as follows:<br>$E_m = 700 f_m'$ for clay masonry<br>$E_m = 900 f_m'$ for concrete masonry                                                                             | Considered equivalent |
| 11.3.10.3 Modulus of Rigidity of Masonry             |                                                                                                                                                                                                                                                                               | 2108.7.3 Modulus of rigidity of masonry   | Identical                                                                                                                                                                                                  | Equivalent            |
| 11.3.10.4 Masonry Compressive Strength               |                                                                                                                                                                                                                                                                               | 2108.7.4 Masonry compressive strength     |                                                                                                                                                                                                            |                       |
| 11.3.10.4.1                                          | The specified compressive strength of masonry, $f_m'$ shall equal or exceed 1,500 psi (10 MPa).                                                                                                                                                                               | 2108.7.4.1 Minimum compressive strength   | Identical except for architectural components of masonry.                                                                                                                                                  | Considered equivalent |
| 11.3.10.4.2                                          |                                                                                                                                                                                                                                                                               | 2108.7.4.2 Maximum compressive strength   | Identical                                                                                                                                                                                                  | Equivalent            |
| 11.3.10.5 Modulus of Rupture                         |                                                                                                                                                                                                                                                                               | 2108.7.5 Modulus of rupture               |                                                                                                                                                                                                            |                       |
| 11.3.10.5.1 Out-of-Plane Bending                     |                                                                                                                                                                                                                                                                               | 2108.7.5.1 Out-of-plane-bending           | Identical for plain masonry elements; however for reinforced masonry, separate provisions are given for the modulus of rupture of reinforced masonry, to be used for calculating service load deflections. | Considered equivalent |
| 11.3.10.5.2 In-Plane Bending                         |                                                                                                                                                                                                                                                                               | 2108.7.5.2 In-Plane bending               | Identical                                                                                                                                                                                                  | Equivalent            |
| 11.3.10.6 Reinforcement strength                     |                                                                                                                                                                                                                                                                               | 2108.7.6 Reinforcement strength           | Identical                                                                                                                                                                                                  | Equivalent            |
| 11.3.11 Section Properties<br>11.3.11.1<br>11.3.11.2 |                                                                                                                                                                                                                                                                               | 2108.8 Section properties                 | Identical                                                                                                                                                                                                  | Equivalent            |
| 11.3.12 Headed and Bent-Bar Anchor Bolts             |                                                                                                                                                                                                                                                                               | 2108.6 Headed and bent-bar anchor bolts   | Essentially identical                                                                                                                                                                                      | Equivalent            |
| 11.3.12.1                                            |                                                                                                                                                                                                                                                                               | 2108.6.1 Axial                            | Essentially identical                                                                                                                                                                                      | Equivalent            |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                               |                            | strength of headed anchor bolts                                        |                                                                                                                                                                                                                           |  |                              |
|-------------------------------|----------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------|
| 11.3.12.1.1                   |                            | 2108.6.1.1 Projected area of masonry                                   | Identical except for: Eqn. 11.3.12.1.1-2 has been dropped.                                                                                                                                                                |  | Considered equivalent        |
| 11.3.12.1.2                   |                            | 2108.6.1.2 Effective embedment length of headed anchor bolts           | Identical                                                                                                                                                                                                                 |  | Equivalent                   |
| 11.3.12.1.3                   |                            | 2108.6.1.2.1 Minimum effective embedment length of headed anchor bolts | Identical                                                                                                                                                                                                                 |  | Equivalent                   |
| 11.3.12.2                     |                            | 2108.6.2 Axial strength of bent-bar anchor bolts                       | The constant in the second term of NEHRP (Eqn. 11.3.12.2-3) has been changed from 200 to 300 with the added provision that the term shall be included only if continuous special inspection is provided during placement. |  | Equivalent                   |
| 11.3.12.2.1                   |                            | 2108.6.2.1 Projected area of masonry                                   | Identical except for: Eqn. 11.3.12.2.1-2 has been deleted.                                                                                                                                                                |  | Considered equivalent        |
| 11.3.12.2.2                   |                            | 2108.6.2.2 Effective embedment length of bent-bar anchor bolts         | Identical                                                                                                                                                                                                                 |  | Equivalent                   |
| 11.3.12.2.3                   |                            | 2108.6.2.2.1                                                           | Identical                                                                                                                                                                                                                 |  | Equivalent                   |
| 11.3.12.3                     |                            | 2108.6.3 Shear strength of headed and bent-bar anchor bolts            | Identical except for: NEHRP Eqn. 11.3.12.3-1 has been replaced by $B_v = 4\phi A_{pv} \sqrt{f_m'}$                                                                                                                        |  | Considered equivalent        |
|                               | No corresponding provision | 2108.6.3.1 Projected area of masonry                                   | New expression suggested for $A_{pv}$                                                                                                                                                                                     |  | Equivalency cannot be judged |
| 11.3.12.4                     |                            | 2108.6.4 Combined axial and shear strength of anchor bolts             | Identical                                                                                                                                                                                                                 |  | Equivalent                   |
|                               | No corresponding provision | 2108.6.5 Anchor bolt placement                                         |                                                                                                                                                                                                                           |  | Equivalency cannot be judged |
| 11.4 DETAILS OF REINFORCEMENT |                            | 2108.9.2 Reinforcement requirements and                                |                                                                                                                                                                                                                           |  |                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                           |                                                                                                                                                      | details                        |                                                                                                                                                                    |                                                                                                                      |                                           |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 11.4.1 General                            |                                                                                                                                                      |                                |                                                                                                                                                                    |                                                                                                                      |                                           |
| 11.4.2 Size of Reinforcement              |                                                                                                                                                      |                                |                                                                                                                                                                    |                                                                                                                      |                                           |
| 11.4.2.1                                  |                                                                                                                                                      |                                | 2108.9.2.1 Reinforcing bar size                                                                                                                                    | Identical; IBC additionally requires that no more than two bars shall be placed in a cell of a wall or a wall frame. | Considered equivalent                     |
| 11.4.2.2                                  | Longitudinal and cross wire joint reinforcement shall be a minimum W1.1, (0.011 mm <sup>2</sup> ) and shall not exceed one-half the joint thickness. | 2108.9.2.2 Joint reinforcement | Identical with following addition: Joint reinforcement shall not be used to satisfy the minimum shear reinforcing area requirements in members in SDC D, E, and F. |                                                                                                                      | Considered equivalent to more restrictive |
| 11.4.3 Placement Limits for Reinforcement |                                                                                                                                                      |                                |                                                                                                                                                                    |                                                                                                                      |                                           |
| 11.4.3.1                                  |                                                                                                                                                      |                                | 2108.9.2.3 Clear distance between parallel bars                                                                                                                    | Identical                                                                                                            | Equivalent                                |
| 11.4.3.2                                  |                                                                                                                                                      |                                | 2108.9.2.4 Clear distance between vertical bars in columns and piers                                                                                               | Identical                                                                                                            | Equivalent                                |
| 11.4.3.3                                  |                                                                                                                                                      |                                | 2108.9.2.5 Clear distance between spliced bars                                                                                                                     | Identical                                                                                                            | Equivalent                                |
| 11.4.3.4                                  |                                                                                                                                                      |                                | 2108.9.2.6 Bundling of reinforcing bars                                                                                                                            | Identical                                                                                                            | Equivalent                                |
| 11.4.4 Cover for reinforcement            |                                                                                                                                                      |                                |                                                                                                                                                                    |                                                                                                                      |                                           |
| 11.4.4.1                                  |                                                                                                                                                      |                                | 2108.9.2.7 Reinforcing bar cover                                                                                                                                   | Identical                                                                                                            | Equivalent                                |
| 11.4.4.2                                  |                                                                                                                                                      |                                |                                                                                                                                                                    | No corresponding provision                                                                                           | Equivalency cannot be judged              |
| 11.4.4.3                                  |                                                                                                                                                      |                                |                                                                                                                                                                    | No corresponding provision                                                                                           | Equivalency cannot be judged              |
| 11.4.4.4                                  |                                                                                                                                                      |                                |                                                                                                                                                                    | No corresponding provision                                                                                           | Equivalency cannot be judged              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                                                        |                                                                                                                                                                                                                                                |                                                       |                                                                                                                                                                            |                              |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.4.5 Development of Reinforcement<br>11.4.5.1 General<br>11.4.5.2 Embedment of Reinforcing Bars and Wires in Tension |                                                                                                                                                                                                                                                | 2108.9.2.10 Development                               | Essentially identical                                                                                                                                                      | Equivalent                   |
| 11.4.5.3 Standard Hooks                                                                                                |                                                                                                                                                                                                                                                | 2108.9.2.8 Standard hooks                             | Essentially identical, except that IBC does not explicitly state, as in NEHRP, that the effect of hooks for bars in compression shall be neglected in design computations. | Considered equivalent        |
| 11.4.5.4 Minimum Bend Diameter for Reinforcing Bars                                                                    |                                                                                                                                                                                                                                                | 2108.9.2.9 Minimum bend diameter for reinforcing bars | Essentially identical                                                                                                                                                      | Equivalent                   |
| 11.4.5.5 Development of Shear Reinforcement                                                                            |                                                                                                                                                                                                                                                | 2108.9.2.12 Development of shear reinforcement        | Identical                                                                                                                                                                  | Equivalent                   |
| 11.4.5.6 Splices of Reinforcement                                                                                      |                                                                                                                                                                                                                                                | 2108.9.2.11 Splices                                   |                                                                                                                                                                            |                              |
| 11.4.5.6.1 Lap Splices                                                                                                 | Lap splices shall not be used in plastic hinge zones. The length of the plastic hinge zone shall be taken as at least 0.15 times the distance between the point of zero moment and the point of maximum moment.                                |                                                       | No corresponding provision                                                                                                                                                 | Equivalency cannot be judged |
| 11.4.5.6.1.1                                                                                                           | The minimum length of lap, $l_{d\ell}$ for bars in tension or compression shall be equal to the development length, $l_{d\ell}$ as determined by Eq. 11.4.5.2 but shall not be less than 12 in. (305 mm) for bars and 6 in. (152 mm) for wire. | 2108.9.2.11 Item 1                                    | Identical except for:<br>The minimum length has been modified to 15 inches.                                                                                                | IBC is more stringent        |
| 11.4.5.6.1.2                                                                                                           |                                                                                                                                                                                                                                                | 2108.9.2.11 Item 1 Paragraph 2                        | Identical                                                                                                                                                                  | Equivalent                   |
| 11.4.5.6.2 Welded Splices                                                                                              |                                                                                                                                                                                                                                                | 2108.9.2.11 Item 2                                    | Identical                                                                                                                                                                  | Equivalent                   |
| 11.4.5.6.3 Mechanical Connections                                                                                      |                                                                                                                                                                                                                                                | 2108.9.2.11 Item 3                                    | Identical                                                                                                                                                                  | Equivalent                   |
| 11.4.5.6.4 End Bearing                                                                                                 |                                                                                                                                                                                                                                                |                                                       | No corresponding provision                                                                                                                                                 | Equivalency cannot           |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Splices                                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                 | be judged                         |
|-----------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------|
| 11.5 STRENGTH AND DEFORMATION REQUIREMENTS    |  | 2108 STRENGTH DESIGN OF MASONRY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                 |                                   |
| 11.5.1 General                                |  | 2108.1 General                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                 | Not comparable                    |
|                                               |  | 2108.2 Quality assurance provisions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | This is a repeat of Section 2105.1.                                                             | Does not affect equivalency       |
| 11.5.2 Required strength                      |  | 2108.3 Required strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | IBC Sec. 2108.3 combines the requirements of NEHRP Secs. 11.5.2 and 11.6.2.3.                   | Equivalent                        |
| 11.5.3 Design Strength                        |  | 2108.4 Design strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | IBC Sec. 2108.4 combines the requirements of NEHRP Secs. 11.5.3 and 11.7.2.2.                   | IBC is more restrictive           |
| Table 11.5.3 Strength Reduction Factor $\phi$ |  | 2108.4.1 Beams, piers and columns<br>2108.4.1.1 Flexure<br>2108.4.1.2 Shear<br>2108.4.2 Wall design for out-of-plane loads<br>2108.4.2.1 Walls with unfactored axial load stress of $0.04f_m$ or less<br>2108.4.2.2 Walls with unfactored axial load stress greater than $0.04f_m$<br>2108.4.3 Wall design for in-plane loads<br>2108.4.3.1 Axial load<br>2108.4.3.2 Shear<br>2108.4.4 Moment-resisting wall frames<br>2108.4.4.1 Flexure with or without axial load<br>2108.4.4.2 Shear<br>2108.4.5 Anchor bolts<br>Tension headed | IBC has much more elaborate and more specific provisions concerning strength reduction factors. | IBC is generally more restrictive |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                           |                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                           |                                                                                                                                                                                                                                                                                                                                                                                                              |  | <p>anchor bolts</p> <p>Bent-bar anchor bolts</p> <p>Shear</p> <p>2108.4.6</p> <p>Reinforcement</p> <p>2108.4.6.1</p> <p>Development</p> <p>2108.4.6.2 Splices</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
| 11.5.4 Deformation Requirements                           |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.5 Deformation requirements                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
| 11.5.4.1                                                  |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.5.1 Story drifts                                                                                                                                             | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                                                                          |
| 11.5.4.1.1                                                |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.5.1.1 Cantilever shear walls                                                                                                                                 | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Equivalent                                                                          |
| 11.5.4.2                                                  |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.5.2 Deflection-Plain masonry members                                                                                                                         | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Equivalent                                                                          |
| 11.5.4.3                                                  |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.5.3 Deflection - reinforced masonry                                                                                                                          | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                                                                          |
| 11.5.4.4                                                  |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.5.3 Paragraph 2                                                                                                                                              | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                                                                          |
| 11.6 FLEXURE AND AXIAL LOADS                              |                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
| 11.6.1 Scope                                              |                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
| 11.6.2 Design Requirements for Reinforced Masonry Members |                                                                                                                                                                                                                                                                                                                                                                                                              |  | 2108.9 Reinforced masonry                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
| 11.6.2.1                                                  | <p>Strength design of members for flexure and axial loads shall be in accordance with principles of engineering mechanics, and in accordance with the following design assumptions:</p> <p>a. Strain in reinforcement and masonry shall be assumed directly proportional to the distance from the neutral axis, except for deep flexural members with overall depth to clear span ratio greater than 2/5</p> |  | 2108.9.1 Design assumptions                                                                                                                                       | <p>Essentially the same except for the following changes:</p> <ol style="list-style-type: none"> <li>1. The parameters of rectangular stress block (in Item e of NEHRP) has been modified: <ol style="list-style-type: none"> <li>(1) masonry stress changed from <math>0.8 f_m'</math> to <math>0.85 f_m'</math>.</li> <li>(2) the parameter "a" has been changed from <math>0.80 c</math> to <math>0.85 c</math>.</li> </ol> </li> <li>2. "except for deep flexural members..." in NEHRP item a is not included.</li> <li>3. Includes an additional explicitly stated assumption.</li> </ol> | <p>The modification of the stress block makes the IBC slightly less restrictive</p> |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                 |                                         |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <p>11.6.2.2</p> | <p>for continuous span members and 4/5 for simple span members where a nonlinear distribution of strain shall be considered.<br/> b. Maximum usable strain, <math>\epsilon_{mu}</math>, at the extreme masonry compression fiber shall be assumed equal to 0.0025 for concrete masonry and 0.0035 for clay-unit masonry.<br/> c. Stress in reinforcement below the <i>specified</i> yield strength, <math>f_y</math>, shall be taken as the modulus of elasticity, <math>E_s</math>, times the steel strain. For strains greater than those corresponding to the <i>specified</i> yield strength, <math>f_y</math>, the stress in the reinforcement shall be considered independent of strain and equal to the <i>specified</i> yield strength, <math>f_y</math>.<br/> d. Tensile strength of masonry shall be neglected in calculating the flexural strength of a <i>reinforced masonry</i> cross section.<br/> e. Flexural compression in masonry shall be assumed to be an equivalent rectangular stress block. Masonry stress of 0.80 times the <i>specified</i> compressive strength, <math>f_m</math>, shall be assumed to be uniformly distributed over an equivalent compression zone bounded by edges of the cross section and a straight line located parallel to the neutral axis at a distance <math>a = 0.80 c</math> from the fiber of maximum compressive strain.</p> |  | <p>Reinforcement is completely surrounded by and bonded to masonry material so that they work together as a homogeneous material.</p>                                                                                                           | <p>IBC is somewhat more restrictive</p> |
|                 | <p>2108.9.2.13 Maximum Reinforcement Percentages<br/> 2108.9.2.13.1 Method</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | <p>Method A of IBC is essentially identical to NEHRP provisions except for the following change:<br/> It is applicable when the story drift <math>\leq 0.1\epsilon_{sx}</math> and when extreme compressive fiber strains are below certain</p> |                                         |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                             |                            | A<br>2108.9.2.13.2 Method<br>B                                                 | specific values. In addition, Method B has been added<br>for the case when the story drift $\leq 0.013h_{sx}$                                                                                                                                                 |                                |
|-------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 11.6.2.3                                                    |                            | 2108.3 Required<br>strength                                                    | Identical                                                                                                                                                                                                                                                     | Equivalent                     |
| 11.6.3 Design of Plain<br>(Unreinforced)<br>Masonry Members |                            | 2108.10 Design of<br>Plain (Unreinforced)<br>Masonry Members                   |                                                                                                                                                                                                                                                               |                                |
|                                                             | No corresponding provision | 2108.10.1 General                                                              |                                                                                                                                                                                                                                                               |                                |
|                                                             | No corresponding provision | 2108.10.1.1 Strength<br>for Resisting Loads                                    |                                                                                                                                                                                                                                                               | Does not affect<br>equivalency |
|                                                             | No corresponding provision | 2108.10.1.2 Strength<br>Contribution from<br>Reinforcement                     |                                                                                                                                                                                                                                                               | Does not affect<br>equivalency |
|                                                             | No corresponding provision | 2108.10.1.3 Design<br>Criteria                                                 |                                                                                                                                                                                                                                                               | Does not affect<br>equivalency |
| 11.6.3.1                                                    |                            | 2108.10.2 Flexural<br>Strength of Plain<br>(Unreinforced)<br>Masonry Members   | Identical                                                                                                                                                                                                                                                     | Equivalent                     |
| 11.6.3.2                                                    |                            | 2108.10.3 Axial Load<br>strength of Plain<br>(Unreinforced)<br>Masonry Members | Identical, except $\phi$ may be slightly different, as noted<br>earlier.                                                                                                                                                                                      | Considered<br>equivalent       |
| 11.6.3.3                                                    |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.6.3.4                                                    |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.7 SHEAR                                                  |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.7.1 Scope                                                |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.7.2 Shear strength                                       |                            | 2108.4 Design<br>strength                                                      | Essentially identical                                                                                                                                                                                                                                         | Equivalent                     |
| 11.7.2.1                                                    |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.7.2.2                                                    |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.7.3 Design of<br>Reinforced masonry<br>Members           |                            | 2108.9.3.5.2 Nominal<br>Shear Strength                                         | Identical, except that NEHRP makes it clear that values<br>of $V_n$ given by Eqs. (11.7.3.1-2) and (1.7.3.1-3) are<br>maximum values. The same clarification could be made<br>by changing the = sign in Eqs. (2108.9.3.5.3) and<br>(2108.9.3.5.4) to $\geq$ . | Equivalent                     |
| 11.7.3.1                                                    |                            |                                                                                |                                                                                                                                                                                                                                                               |                                |
| 11.7.3.2                                                    |                            | 2108.9.3.5.2.1<br>Nominal Masonry                                              | Identical                                                                                                                                                                                                                                                     | Equivalent                     |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                         |                            |                                                                                                                                            |                                                                                   |                                                          |
|-------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------|
| 11.7.3.3                                                                |                            | Shear Strength<br>2108.9.3.5.2.2<br>Nominal Shear<br>Strength Provided by<br>Reinforcement                                                 | Identical                                                                         | Equivalent                                               |
| 11.7.4 Design of Plain<br>(Unreinforced)<br>Masonry Members<br>11.7.4.1 |                            | 2108.10.4 Shear<br>Strength of Plain<br>(Unreinforced)<br>Masonry Members<br>2108.10.4.1 Nominal<br>Shear strength                         | Identical                                                                         | Equivalent                                               |
| 11.8 SPECIAL<br>REQUIREMENTS<br>FOR BEAMS                               |                            | 2108.9.3.9 Beams<br>2108.9.3.9.1 Scope                                                                                                     | The factored axial compressive force on a beam shall not exceed $0.05 A_e f'_m$ . | IBC is more stringent                                    |
| 11.8.1                                                                  |                            | 2108.9.3.8 (1.2)                                                                                                                           | Essentially identical                                                             | Equivalent                                               |
| 11.8.2                                                                  |                            |                                                                                                                                            | No corresponding provisions                                                       | Equivalency cannot be judged                             |
| 11.8.3                                                                  |                            | 2108.9.3.9.2<br>Longitudinal<br>reinforcement                                                                                              | Different provision                                                               | Equivalency cannot be judged without comparative designs |
|                                                                         | No corresponding provision | 2108.9.3.9.3<br>Transverse<br>reinforcement                                                                                                |                                                                                   | IBC is more stringent                                    |
| 11.8.4 Deep Flexural<br>Members<br>11.8.4.1<br>11.8.4.2<br>11.8.4.3     |                            |                                                                                                                                            | No corresponding provision                                                        | Equivalency cannot be judged                             |
|                                                                         | No corresponding provision | 2108.9.3.10 Piers<br>2108.9.3.10.1 Scope<br>2108.9.3.10.2<br>Longitudinal<br>reinforcement<br>2108.9.3.10.3<br>Transverse<br>reinforcement |                                                                                   | IBC is more stringent                                    |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 11.9 SPECIAL REQUIREMENTS FOR COLUMNS |                                                                                                                                                                  | 2108.9.3.11 Columns<br>2108.9.3.11.1 Scope                                                                                                                                                                                                                                                                                                     |                                                                                                                                                |                              |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.9.1                                | Area of longitudinal reinforcement for <i>columns</i> shall be not less than 0.005 nor more than 0.04 times cross-sectional area of the <i>column</i> .          | 2108.9.3.11.2 Longitudinal reinforcement                                                                                                                                                                                                                                                                                                       | Identical, except that the upper limit on reinforcement ratio has been changed from 0.04 to 0.03 times the cross-sectional area of the column. | IBC is more stringent        |
| 11.9.2                                | There shall be a minimum of four longitudinal bars in <i>columns</i> .                                                                                           | 2108.9.3.11.2 Longitudinal reinforcement                                                                                                                                                                                                                                                                                                       | Identical                                                                                                                                      | Equivalent                   |
| 11.9.3                                | Lateral ties shall be provided to resist shear and shall comply with the following:<br>...                                                                       | 2108.9.3.11.3 Lateral ties                                                                                                                                                                                                                                                                                                                     | NEHRP provisions are much more detailed and comprehensive.                                                                                     | Equivalency cannot be judged |
|                                       | No corresponding provision                                                                                                                                       | 2108.9.3.11.4 Construction                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                | IBC is more restrictive      |
| 11.10 SPECIAL REQUIREMENTS FOR WALLS  |                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                |                              |
| 11.10.1                               | The nominal flexural strength of the <i>wall</i> for out-of-plane flexure shall be at least equal to 1.3 times the cracking moment strength of the <i>wall</i> . |                                                                                                                                                                                                                                                                                                                                                | NEHRP has just this one provision for walls subject to out-of-plane loads. IBC has no corresponding provision.                                 | Equivalency cannot be judged |
|                                       | No corresponding provisions                                                                                                                                      | 2108.9.4 Wall design for out-of-plane loads<br>2108.9.4.1 General<br>2108.9.4.2 Maximum reinforcement<br>2108.9.4.3 Moment and deflection calculations<br>2108.9.4.4 Walls with unfactored axial load stress of $0.04f_m$ or less<br>2108.9.4.5 Walls with unfactored axial load stress greater than $0.04f_m$<br>2108.9.4.6 Deflection design |                                                                                                                                                | IBC is more stringent        |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 11.11 SPECIAL REQUIREMENTS FOR SHEAR WALLS          |                            |                                                                                                                   |                                                                                  |  |                                         |
|-----------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--|-----------------------------------------|
| 11.11.1 Ordinary Plain masonry Shear Walls          |                            | 2106.1.1.1 Ordinary plain masonry shear walls                                                                     | Essentially similar                                                              |  | Considered equivalent                   |
| 11.11.2 Detailed Plain Masonry Shear Walls          |                            | 2106.1.1.3 Detailed Plain Masonry Shear Walls                                                                     | Essentially similar                                                              |  | Considered equivalent                   |
| 11.11.3 Ordinary Reinforced Masonry Shear Walls     |                            | 2106.1.1.2 Ordinary Reinforced Masonry Shear Walls                                                                | Essentially similar                                                              |  | Considered equivalent                   |
| 11.11.4 Intermediate Reinforced Masonry Shear Walls |                            | 2106.1.1.4 Intermediate Reinforced Masonry Shear Walls                                                            | Essentially similar                                                              |  | Considered equivalent                   |
| 11.11.5 Special Reinforced Masonry Shear Walls      |                            | 2106.1.1.5 Special Reinforced Masonry Shear Walls                                                                 | Essentially similar                                                              |  | Considered equivalent                   |
| 11.11.5.1 Vertical Reinforcement                    |                            | 2106.5.3.1 Shear Wall Reinforcement Requirements                                                                  | Essentially identical                                                            |  | Equivalent                              |
| 11.11.5.2 Horizontal Reinforcement                  | No corresponding provision | 2106.5.3.1 Shear Wall Reinforcement Requirements<br>2106.5.2 Minimum Reinforcement Requirements for Masonry Walls | Essentially identical, except stack bond masonry is covered under Sec. 2106.5.2. |  | Equivalent<br><br>IBC is more stringent |
| 11.11.5.3 Shear Keys                                |                            |                                                                                                                   | No corresponding provisions                                                      |  | Equivalency cannot be judged            |
|                                                     |                            | 2108.9.5 Wall design for in-plane loads<br>2108.9.5.1 General<br>2108.9.5.2 Reinforcement                         |                                                                                  |  | Does not affect equivalency             |
|                                                     | No corresponding provision |                                                                                                                   |                                                                                  |  | IBC is more stringent                   |
|                                                     | No corresponding provision |                                                                                                                   |                                                                                  |  | IBC is more stringent                   |
|                                                     | No corresponding provision | 2108.9.5.3 Design                                                                                                 |                                                                                  |  | IBC is more                             |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                            |                                                                                                                                                                 | strength                                             |                                                                                                                                   | stringent                    |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------|
|                                            | No corresponding provision                                                                                                                                      | 2108.9.5.4 Axial strength                            |                                                                                                                                   | IBC is more stringent        |
|                                            | No corresponding provision                                                                                                                                      | 2108.9.5.5 Shear strength                            |                                                                                                                                   | IBC is more stringent        |
| 11.11.6 Flanged Shear Walls                |                                                                                                                                                                 |                                                      | No corresponding provisions                                                                                                       | Equivalency cannot be judged |
| 11.11.7 Coupled Shear Walls                |                                                                                                                                                                 |                                                      | No corresponding provision                                                                                                        | Equivalency cannot be judged |
| 11.11.7.1 Design of Coupled Shear Walls    |                                                                                                                                                                 |                                                      |                                                                                                                                   |                              |
| 11.11.7.2 Shear Strength of Coupling Beams |                                                                                                                                                                 |                                                      | No corresponding provision                                                                                                        | Equivalency cannot be judged |
| 11.12 SPECIAL MOMENT FRAMES OF MASONRY     |                                                                                                                                                                 | 2108.9.6 Special Masonry Moment Frames (Wall Frames) |                                                                                                                                   |                              |
| 11.12.1 Calculation of Required Strength   |                                                                                                                                                                 | 2108.9.6.1                                           | Identical                                                                                                                         | Equivalent                   |
| 11.12.2 Flexural Yielding                  |                                                                                                                                                                 | 2108.9.6.1.2                                         | Identical                                                                                                                         | Equivalent                   |
| 11.12.3 Reinforcement                      |                                                                                                                                                                 | 2108.9.6.2 Reinforcement                             |                                                                                                                                   |                              |
| 11.12.3.1                                  |                                                                                                                                                                 | 2108.9.6.2.1                                         | Identical                                                                                                                         | Equivalent                   |
| 11.12.3.2                                  |                                                                                                                                                                 | 2108.9.6.2.2                                         | Identical                                                                                                                         | Equivalent                   |
| 11.12.3.3                                  |                                                                                                                                                                 | 2108.9.6.2.3                                         | Identical                                                                                                                         | Equivalent                   |
| 11.12.3.4                                  | Reinforcement shall have a specified yield strength of 60,000 psi (414 MPa). The actual yield strength shall not exceed 1.5 times the specified yield strength. | 2108.9.6.2.4                                         | Identical except for the following change:<br>The actual yield strength shall not exceed 1.25 times the specified yield strength. | IBC is more stringent        |
| 11.12.4 Wall Frame Beams                   |                                                                                                                                                                 | 2108.9.6.3 Wall Frame Beams                          |                                                                                                                                   |                              |
| 11.12.4.1                                  |                                                                                                                                                                 | 2108.9.6.3.1                                         | Identical                                                                                                                         | Equivalent                   |
| 11.12.4.2                                  |                                                                                                                                                                 | 2108.9.6.3.2                                         | Identical                                                                                                                         | Equivalent                   |
| 11.12.4.3                                  | Clear span for the beam shall not be less than 4 times its depth.                                                                                               | 2108.9.6.3.3                                         | Clear span for the beam shall not be less than 2 times its depth.                                                                 | IBC is less stringent        |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                      |                                                                                                                                                                 |                                                    |                                                                                                                                                                                                                                                                                                                                      |                                                          |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 11.12.4.4                            | Nominal depth of the beam shall not be less than 4 units or 32 in. (813 mm), whichever is greater. The nominal depth to nominal width ratio shall not exceed 4. | 2108.9.6.3.4                                       | Nominal depth of the beam shall not be less than 2 units or 16 in. (813 mm), whichever is greater. The nominal depth to nominal width ratio shall not exceed 6.                                                                                                                                                                      | IBC is less stringent                                    |
| 11.12.4.5                            |                                                                                                                                                                 | 2108.9.6.3.5                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.6 Longitudinal reinforcement |                                                                                                                                                                 | 2108.9.6.4<br>Longitudinal Reinforcement for Beams |                                                                                                                                                                                                                                                                                                                                      |                                                          |
| 11.12.4.6.1                          |                                                                                                                                                                 | 2108.9.6.4.1                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.6.2                          |                                                                                                                                                                 | 2108.9.6.4.2                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.6.3                          | In lieu of the limitations of Sec. 11.8.2, the minimum reinforcement ratio shall be $130/f_y$                                                                   | 2108.9.6.4.3                                       | Modified to: The nominal flexural strength of a beam shall not be less than 1.5 times the nominal cracking moment strength of the beam. The modulus of rupture for this calculation shall be assumed to be 235 psi.                                                                                                                  | Equivalency cannot be judged without comparative design. |
| 11.12.4.6.4                          |                                                                                                                                                                 | 2108.9.6.4.4                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.7 Transverse Reinforcement   |                                                                                                                                                                 | 2108.9.6.5 Transverse Reinforcement for Beams      |                                                                                                                                                                                                                                                                                                                                      | Equivalent                                               |
|                                      | No corresponding provisions                                                                                                                                     | 2108.9.6.5.1                                       | The shear $V_u$ shall not be less than that which results from development of the plastic moment strength at each restrained end of the member and shall include the effects of gravity loads. The plastic moment strength shall be calculated using 1.25 times the specified yield strength of the reinforcing and a $\phi$ of 1.0. | IBC is more stringent                                    |
| 11.12.4.7.1                          |                                                                                                                                                                 | 2108.9.6.5.2                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.7.2                          |                                                                                                                                                                 | 2108.9.6.5.3                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.7.3                          |                                                                                                                                                                 | 2108.9.6.5.4                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.7.4                          |                                                                                                                                                                 | 2108.9.6.5.5                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.4.7.5                          |                                                                                                                                                                 | 2108.9.6.5.6                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.5 Wall Frame Columns           |                                                                                                                                                                 | 2108.9.6.6 Wall Frame Columns                      |                                                                                                                                                                                                                                                                                                                                      |                                                          |
| 11.12.5.1                            |                                                                                                                                                                 | 2108.9.6.6.1                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.5.2                            |                                                                                                                                                                 | 2108.9.6.6.2                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.5.3                            |                                                                                                                                                                 | 2108.9.6.6.3                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |
| 11.12.5.4                            |                                                                                                                                                                 | 2108.9.6.6.4                                       | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                                               |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                 |                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                      |                             |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 11.12.5.5 Longitudinal Reinforcement            |                                                                                                                                                                                | 2108.9.6.7 Longitudinal Reinforcement for Columns |                                                                                                                                                                                                                                                                                                                                      |                             |
| 11.12.5.5.1                                     |                                                                                                                                                                                | 2108.9.6.7.1                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.5.5.2                                     |                                                                                                                                                                                | 2108.9.6.7.2                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.5.5.3                                     | The nominal moment strength at any section along a member shall be not less than 1.6 times the cracking moment strength and the minimum reinforcement ratio shall be $130/f_y$ | 2108.9.6.7.3                                      | The nominal moment strength at any section along a member shall be not less than 1.5 times the cracking moment strength                                                                                                                                                                                                              | IBC is less stringent       |
| 11.12.5.5.4                                     |                                                                                                                                                                                | 2108.9.6.7.4                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.5.6 Transverse Reinforcement              |                                                                                                                                                                                | 2108.9.6.8 Transverse Reinforcement for Columns   |                                                                                                                                                                                                                                                                                                                                      |                             |
|                                                 | No corresponding provisions                                                                                                                                                    | 2108.9.6.8.1                                      | The shear $V_u$ shall not be less than that which results from development of the plastic moment strength at each restrained end of the member and shall include the effects of gravity loads. The plastic moment strength shall be calculated using 1.25 times the specified yield strength of the reinforcing and a $\phi$ of 1.0. | IBC is more stringent       |
| 11.12.5.6.1                                     |                                                                                                                                                                                | 2108.9.6.8.2                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.5.6.2                                     |                                                                                                                                                                                | 2108.9.6.8.3                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.5.6.3                                     |                                                                                                                                                                                | 2108.9.6.8.4                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.6 Wall Frame Beam-Column Intersection     |                                                                                                                                                                                | 2108.9.6.9 Wall Frame Beam-Column Intersection    |                                                                                                                                                                                                                                                                                                                                      |                             |
| 11.12.6.1                                       |                                                                                                                                                                                | 2108.9.6.9.1                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.12.6.2                                       |                                                                                                                                                                                | 2108.9.6.9.2                                      | Identical                                                                                                                                                                                                                                                                                                                            | Equivalent                  |
| 11.13 GLASS-UNIT MASONRY AND MASONRY VENEER     |                                                                                                                                                                                | 2110 GLASS UNIT MASONRY<br>2101.2.4 Glass masonry |                                                                                                                                                                                                                                                                                                                                      |                             |
| 11.13.1 Design Lateral Forces and Displacements |                                                                                                                                                                                |                                                   | No corresponding provision                                                                                                                                                                                                                                                                                                           | Does not affect equivalency |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 11.13.2 Glass-Unit Masonry Design                                                  | Refers to Chapter 11 of ACI 530-95. | 2110 GLASS UNIT MASONRY             | Essentially similar provisions                                                                                                                                                                                    | Considered equivalent        |
|------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.13.3 Masonry Veneer Design                                                      | Refers to Chapter 12 of ACI 530-95. | 2101.2.5 Masonry Veneer             | Basically the same, refers to Chapter 6 of ACI 530-99 for seismic provisions, except NEHRP Sec. 11.13.3.2 contains a specific restriction. However, design was based on SDC instead of SPC as used in ACI 530-95. | Considered equivalent        |
| Appendix to Chapter 11 ALTERNATIVE PROVISIONS FOR THE DESIGN OF MASONRY STRUCTURES |                                     |                                     | Not included in the IBC                                                                                                                                                                                           | Equivalency cannot be judged |
|                                                                                    | No corresponding provision          | 2111 MASONRY CHIMNEYS               |                                                                                                                                                                                                                   | IBC is more restrictive      |
|                                                                                    | No corresponding provision          | 2112 FACTORY BUILT CHIMNEYS         | Non-seismic provisions                                                                                                                                                                                            | Equivalency is not affected  |
|                                                                                    | No corresponding provision          | 2113 MASONRY FIREPLACES             |                                                                                                                                                                                                                   | IBC is more restrictive      |
|                                                                                    | No corresponding provision          | 2114 FACTORY BUILT FIREPLACES       | Non-seismic provisions                                                                                                                                                                                            | Equivalency is not affected  |
|                                                                                    | No corresponding provision          | 2115 FACTORY BUILT FIREPLACE STOVES | Non- seismic provisions                                                                                                                                                                                           | Equivalency is not affected  |
|                                                                                    | No corresponding provision          | 2116 COMBUSTION AIR SUPPLY          | Non- seismic provisions                                                                                                                                                                                           | Equivalency is not affected  |
|                                                                                    |                                     | 2117 MASONRY HEATERS                |                                                                                                                                                                                                                   | IBC is more restrictive      |
|                                                                                    |                                     |                                     |                                                                                                                                                                                                                   |                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                                                                            |                                                                                                                                                       | 2000 IBC                                       |                                                                                   | Comments                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------|
| Section                                                                                                                                               | Provision                                                                                                                                             | Section                                        | Provision                                                                         |                              |
| <b>Chapter 12 WOOD STRUCTURE DESIGN REQUIREMENTS</b>                                                                                                  |                                                                                                                                                       | <b>CHAPTER 23 WOOD</b>                         |                                                                                   |                              |
| 12.1 General<br>12.1.1 Scope                                                                                                                          | Limited to seismic design only.                                                                                                                       | 2301 General<br>2301.1 Scope                   | Materials, design, construction, and quality of wood members and their fasteners. | IBC scope is broader         |
| 12.1.2 Reference Documents<br>12.1.2.1 Engineered Wood Construction<br>12.1.2.1 Conventional Light-Frame Construction<br>12.1.2.3 Materials Standards |                                                                                                                                                       | CHAPTER 35<br>REFERENCE STANDARDS              | Some standards have been updated.                                                 | Considered equivalent        |
| 12.1.3 Notations                                                                                                                                      |                                                                                                                                                       |                                                | Notations are explained as they occur in the text.                                | Considered equivalent        |
| 12.2 DESIGN METHODS                                                                                                                                   | LRFD and Conventional Construction only.                                                                                                              | 2301.2 General design requirements             | The IBC permits ASD in addition to LRFD and conventional construction.            | Equivalent                   |
| 12.2.1 Engineered Wood Design                                                                                                                         |                                                                                                                                                       | 2301.2.2 Load and resistance factor design     | Essentially identical                                                             | Equivalent                   |
| 12.2.2 Conventional Light-Frame Construction                                                                                                          |                                                                                                                                                       | 2301.2.3 Conventional light-frame construction | Essentially identical                                                             | Equivalent                   |
| 12.2.2.1                                                                                                                                              | Provides for cases where a structure of otherwise conventional construction contains structural elements not conforming to conventional construction. |                                                | No corresponding provision                                                        | Equivalency cannot be judged |
| <b>12.3 ENGINEERED WOOD CONSTRUCTION</b>                                                                                                              |                                                                                                                                                       |                                                |                                                                                   |                              |
| 12.3.1 General                                                                                                                                        |                                                                                                                                                       | 2304.1 General                                 | Basically the same in substance                                                   | Considered equivalent        |
| 12.3.2 Framing                                                                                                                                        |                                                                                                                                                       | 2304.9.7 Framing                               | Identical                                                                         | Equivalent                   |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Requirements                                                                                  | requirements                                                                                                    | No corresponding provision                                                                                                                   | Equivalency cannot be judged |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 12.3.3 Deformation Compatibility Requirements                                                 |                                                                                                                 |                                                                                                                                              |                              |
| 12.3.4 Design Limitations                                                                     |                                                                                                                 |                                                                                                                                              |                              |
| 12.3.4.1 Wood Members Resisting Horizontal Seismic Forces Contributed by Masonry and Concrete | 2305.1.5 Wood members resisting horizontal seismic forces contributed by masonry and concrete                   | Identical                                                                                                                                    | Equivalent                   |
| 12.3.4.2 Horizontal Distribution of Shear                                                     | 2305.2.5 Rigid diaphragms<br>2302 Definitions                                                                   | Identical                                                                                                                                    | Equivalent                   |
| 12.3.4.3 Framing and Anchorage Limitations                                                    | 2305.1.2 Framing<br>2305.1.2.1 Framing members                                                                  | Essentially similar                                                                                                                          | Considered equivalent        |
| 12.3.4.4 Shear Wall Anchorage                                                                 |                                                                                                                 | No corresponding provision                                                                                                                   | Equivalency cannot be judged |
| 12.4 DIAPHRAGMS AND SHEAR WALLS                                                               |                                                                                                                 |                                                                                                                                              |                              |
| 12.4.1 Diaphragm and Shear Wall Aspect Ratios                                                 | 2305.3.3 Shearwall aspect ratios<br>2305.3.4 Shearwall height definition<br>2305.3.5 Shearwall width definition | Similar provisions                                                                                                                           | Considered equivalent        |
| 12.4.2 Shear Resistance Based on Principles of Mechanics                                      | 2305.1.1 Shear resistance based on principles of mechanics                                                      | Essentially identical                                                                                                                        | Equivalent                   |
| 12.4.3 Sheathing Requirements                                                                 | 2304.6.1.1 Wood structural panel sheathing                                                                      | Paragraph 3 of Sec. 12.4.3.1 of NEHRP identical. Other paragraphs scattered in IBC. Tables in NEHRP organized differently from those in IBC. | Considered equivalent        |
| 12.4.3.1 Structural-Use Panel Sheathing                                                       |                                                                                                                 |                                                                                                                                              |                              |
| 12.4.3.2 Other Panel Sheathing Materials                                                      | 2306.4.5 Shearwalls sheathed with other                                                                         | IBC Provisions are more detailed and by Allowable Stress Design.                                                                             | Equivalency cannot be judged |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                                                                      |                                                                                                      | materials                                                                                                                                 |  |                                                                                                      | Considered equivalent        |
|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------|------------------------------|
| 12.4.3.3 Single Diagonally Sheathed Lumber Diaphragms and Shear Walls                                                                |                                                                                                      | 2306.3.4 Single diagonally sheathed lumber diaphragms<br>2306.3.4.1 End joints<br>2306.3.4.2 Single diagonally sheathed lumber diaphragms |  | Essentially similar, but uses ASD.                                                                   | Considered equivalent        |
| 12.4.3.4 Double Diagonally Sheathed Lumber Diaphragms and Shear Walls                                                                |                                                                                                      | 2306.3.5 Double diagonally sheathed lumber diaphragms                                                                                     |  | Essentially similar, but uses ASD.                                                                   | Considered equivalent        |
| 12.5 CONVENTIONAL LIGHT-FRAME CONSTRUCTION                                                                                           |                                                                                                      | 2308 CONVENTIONAL LIGHT-FRAME CONSTRUCTION                                                                                                |  |                                                                                                      |                              |
| 12.5.1 Scope                                                                                                                         |                                                                                                      | 2308.2 Limitations<br>2308.11.2 Concrete or masonry                                                                                       |  | Essentially similar with more limitations in IBC provisions.                                         | IBC is more stringent        |
| 12.5.1.1 Irregular Structures<br>12.5.1.1.1<br>12.5.1.1.2<br>12.5.1.1.3<br>12.5.1.1.4<br>12.5.1.1.5<br>12.5.1.1.6 Diaphragm Openings |                                                                                                      | 2308.12.6 Irregular structures                                                                                                            |  | Essentially identical                                                                                | Equivalent                   |
| 12.5.1.1.7 Stepped Foundation                                                                                                        |                                                                                                      |                                                                                                                                           |  | No such irregularity provision in IBC                                                                | Equivalency cannot be judged |
| 12.5.2 Braced Walls                                                                                                                  |                                                                                                      | 2308.3 Braced wall lines                                                                                                                  |  |                                                                                                      |                              |
| 12.5.2.1 Spacing Between Braced Wall Lines                                                                                           | Interior and exterior braced wall lines shall be located at the spacing indicated in Table 12.5.1-1. | 2308.3.1 Spacing<br>2308.12.3 Braced wall line spacing                                                                                    |  | Essentially identical                                                                                | Considered equivalent        |
| 12.5.2.2 Braced Wall Line Sheathing                                                                                                  |                                                                                                      | 2308.12.4 Braced wall line sheathing                                                                                                      |  | NEHRP Table 12.5.2-1 (Conventional Light Frame Construction Braced Wall Requirements) has a footnote | IBC is less stringent        |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Requirements                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                    |  | indicating that conventional construction is not permitted where $S_{DS} > 1.0g$ . The corresponding IBC Table 2308.12.4 gives minimum length of wall bracing for $S_{DS} \geq 1.0g$ .<br><br>Some additional requirements for cripple wall bracing                                                                               | IBC is more stringent<br><br>Equivalency cannot be judged<br><br>Equivalency cannot be judged<br><br>IBC is less stringent |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 12.5.2.3 Attachment<br>12.5.2.3.1<br>12.5.2.3.2<br>12.5.2.3.3 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2308.12.5 Attachment of sheathing                  |  | Nailing for diagonal board sheathing (which in 12.5.2.3.2 of NEHRP) was dropped in IBC.<br><br>Table 2304.9.1 is written in different format from Table 12.4.3-2 of NEHRP.<br><br>Table 2308.12.4 of IBC permits conventional construction in locations with $S_{DS} > 1.0g$ , which is not permitted in Table 12.5.2-1 of NEHRP. | Equivalency cannot be judged<br><br>Equivalency cannot be judged<br><br>IBC is less stringent                              |
| 12.5.3 Detailing Requirements                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                    |  |                                                                                                                                                                                                                                                                                                                                   |                                                                                                                            |
| 12.5.3.1 Wall Anchorage                                       | Anchorage of braced wall line sills to concrete or masonry foundations shall be provided. Such anchorage shall conform to the requirements in Figure 403.1a of Sec. 403 of Ref 12-5, except that such anchors shall be spaced at not more than 4 ft. (1220 mm) on center for structures over two stories in height. For <i>Seismic Design Categories</i> C, D, and E, plate washers, a minimum of ¼ inch by 3 inches by 3 inches in size, shall be provided between the foundation sill plate and the nut. Other anchorage devices having equivalent capacity shall be permitted. | 2308.3.3 Sill anchorage<br>2308.12.8 Plate Washers |  | Essentially identical except for:<br>The plate washer shall be provided for SDC D and E instead of C, D and E.<br>Exception allowed in 2308.12.8 that are not in NEHRP                                                                                                                                                            | IBC is less stringent                                                                                                      |
| 12.5.3.2 Top Plates                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2308.9.2.1 Top Plates                              |  | IBC is more detailed with some exceptions.                                                                                                                                                                                                                                                                                        | Considered equivalent                                                                                                      |
| 12.5.3.3 Bottom Plates                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2308.9.2.4 Plates or sills                         |  | Identical                                                                                                                                                                                                                                                                                                                         | Equivalent                                                                                                                 |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                   |  |                                                                                   |                                                                                                                                                                                                                                                    |                       |
|---------------------------------------------------|--|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 12.5.3.4 Braced Wall Panel Connections            |  | 2308.3.2 Braced wall panel connections                                            | Essentially identical                                                                                                                                                                                                                              | Equivalent            |
| 12.5.3.5 Foundation Supporting Braced Wall Panels |  | 2308.3.4 Braced wall line support<br>2308.3.3.1 Anchorage to all-wood foundations | Essentially identical                                                                                                                                                                                                                              | Equivalent            |
| 12.5.3.6 Stepped Footings                         |  | 2308.11.3.2 Stepped footings                                                      | Identical                                                                                                                                                                                                                                          | Equivalent            |
| 12.5.3.7 Detailing for Openings in Diaphragms     |  | 2308.11.3.3 Openings in horizontal diaphragms                                     | Essentially identical                                                                                                                                                                                                                              | Equivalent            |
| 12.6 SEISMIC DESIGN CATEGORY A                    |  |                                                                                   |                                                                                                                                                                                                                                                    |                       |
| 12.7 SEISMIC DESIGN CATEGORY B, C, AND D          |  | 2308.11 Additional requirements for conventional construction in SDC B and C      |                                                                                                                                                                                                                                                    |                       |
| 12.5.1                                            |  | 2308.11.1 Number of stories                                                       | Identical                                                                                                                                                                                                                                          | Equivalent            |
| Table 12.5.1-1                                    |  | 2308.11.2 Concrete or masonry                                                     | Identical                                                                                                                                                                                                                                          | Equivalent            |
| 12.5.1                                            |  | 2308.11.3 Framing and connection details                                          |                                                                                                                                                                                                                                                    |                       |
| 12.5.3.1                                          |  | 2308.11.3.1 Anchorage                                                             | IBC more detailed                                                                                                                                                                                                                                  | IBC is more stringent |
| 12.5.3.6                                          |  | 2308.11.3.2 Stepped footings                                                      | Identical                                                                                                                                                                                                                                          | Equivalent            |
| 12.5.3.7                                          |  | 2308.11.3.3 Opening in horizontal diaphragms                                      | Provisions are identical. However, NEHRP Provisions appear to apply to openings with dimensions larger than 4 ft in SDC B, C and to all openings in SDC D, E. IBC provisions apply to opening with dimensions larger than 4 ft in SDC C and above. | IBC less stringent    |
| 12.8 SEISMIC DESIGN CATEGORY                      |  | 2308.12 Additional requirements for                                               |                                                                                                                                                                                                                                                    |                       |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| E AND F                       |                                                                                  | conventional construction in SDC D and E |                                                                                                                                                 |                                              |
|-------------------------------|----------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 12.5.1<br>Table 12.5.1-1      | Conventional construction is allowed only for SUG I structures in SDC E          | 2308.12.1 Number of stories              | Same height limits, except that conventional construction is allowed for SUG II structures in SDC E                                             | IBC less restrictive                         |
| 12.5.1                        |                                                                                  | 2308.12.2 Concrete or masonry            | Identical                                                                                                                                       | Equivalent                                   |
| 12.5.2.1<br>Table 12.5.1-1    |                                                                                  | 2308.12.3 Braced wall line spacing       | Identical                                                                                                                                       | Equivalent                                   |
| 12.5.2.2                      |                                                                                  | 2308.12.4 Braced wall line sheathing     | Conventional construction allowed for $S_{DS} \geq 0.1g$<br>Some additional cripple wall bracing requirements                                   | IBC less restrictive<br>IBC more restrictive |
| 12.5.2.3                      |                                                                                  | 2308.12.5 Attachment of sheathing        | Nailing for diagonal board sheathing (which in 12.5.2.3.2 of NEHRP) was dropped in IBC.                                                         | Equivalency cannot be judged                 |
|                               |                                                                                  |                                          | Table 2304.9.1 is written in different format from Table 12.4.3-2 of NEHRP.                                                                     | Equivalency cannot be judged                 |
|                               |                                                                                  |                                          | Table 2308.12.4 of IBC permits conventional construction in locations with $S_{DS} > 1.0g$ , which is not permitted in Table 12.5.2-1 of NEHRP. | IBC is less stringent                        |
| 12.5.1.1 Irregular structures | Irregular structures of conventional construction not allowed in SDC C, D, and E | 2308.12.6 Irregular structures           | Irregular structures of conventional construction not allowed in SDC D and E                                                                    | IBC less restrictive                         |
|                               | No corresponding requirement                                                     | 2308.12.7 Exit facilities                |                                                                                                                                                 | IBC more restrictive                         |
| 12.5.3.1                      | 1/4x3x3 washers required in SDC C, D, and E                                      | 2308.12.8 Plate Washers                  | 1/4x3x3 washers required in D and E only.<br>Exception allowed, which is not in NEHRP                                                           | IBC less restrictive                         |
|                               | No corresponding requirement                                                     | 2308.12.9 Anchorage in SDC E             |                                                                                                                                                 | IBC more restrictive                         |
|                               |                                                                                  |                                          |                                                                                                                                                 |                                              |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                |           | 2000 IBC                                                                                     |                       | Comments                 |
|-------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------|-----------------------|--------------------------|
| Section                                                                                   | Provision | Section                                                                                      | Provision             |                          |
| <b>CHAPTER 13<br/>SEISMICALLY<br/>ISOLATED<br/>STRUCTURES<br/>DESIGN<br/>REQUIREMENTS</b> |           | <b>1623 SEISMICALLY<br/>ISOLATED<br/>STRUCTURES</b>                                          |                       |                          |
| 13.1 General                                                                              |           | 1623 Paragraphs 1<br>and 2                                                                   | Identical             | Equivalent               |
| 13.2 CRITERIA<br>SELECTION                                                                |           |                                                                                              |                       |                          |
| 13.2.1 Basis for<br>Design                                                                |           | 1623.1 Determination<br>of Seismic<br>Characteristics and<br>Selection of Design<br>Criteria | Essentially identical | Considered<br>equivalent |
| 13.2.2 Stability of the<br>Isolation System                                               |           | 1623 Paragraph 3                                                                             | Identical             | Equivalent               |
| 13.2.3 Seismic Use<br>Group                                                               |           | 1623.1.1 Seismic Use<br>Group                                                                | Identical             | Equivalent               |
| 13.2.4 Configuration<br>Requirements                                                      |           | 1623.1.2 Configuration                                                                       | Identical             | Equivalent               |
| 13.2.5 Selection of<br>Lateral Response<br>Procedure                                      |           | 1623.1.3 Selection of<br>Lateral Response<br>Procedure                                       | Identical             | Equivalent               |
| 13.2.5.1 General                                                                          |           |                                                                                              |                       |                          |
| 13.2.5.2 Equivalent<br>Lateral Force<br>Procedure                                         |           | 1623.1.3.1 Equivalent<br>Lateral Force<br>Procedure                                          | Identical             | Equivalent               |
| 13.2.5.3 Dynamic<br>Analysis                                                              |           | 1623.1.3.2 Dynamic<br>Lateral Response<br>Procedure                                          | Identical             | Equivalent               |
| 13.2.5.3.1 Response-<br>Spectrum Analysis                                                 |           | 1623.1.3.3 Response-<br>Spectrum Analysis                                                    | Identical             | Equivalent               |
| 13.2.5.3.2 Time-                                                                          |           | 1623.1.3.4 Time-                                                                             | Identical             | Equivalent               |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| History Analysis                                                                   | History Analysis                                                                     | Identical | Equivalent |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------|------------|
| 13.2.5.3.3 Site-Specific Design Spectra                                            | 1623.1.3.5 Site-Specific Design Spectra                                              | Identical | Equivalent |
| 13.3 EQUIVALENT LATERAL FORCE PROCEDURE                                            | 1623.2 Equivalent Lateral Force Procedure                                            | Identical | Equivalent |
| 13.3.1 General                                                                     |                                                                                      |           |            |
| 13.3.2 Deformation Characteristics of the Isolation System                         | 1623.2.1 Deformation Characteristics of the Isolation System                         | Identical | Equivalent |
| 13.3.3 Minimum Lateral Displacements                                               | 1623.2.2 Minimum Lateral Displacements                                               |           |            |
| 13.3.3.1 Design Displacement                                                       | 1623.2.2.1 Design Displacement                                                       | Identical | Equivalent |
| 13.3.3.2 Effective Period                                                          | 1623.2.2.2 Effective Period at Design Displacement                                   | Identical | Equivalent |
| 13.3.3.3 Maximum Displacement                                                      | 1623.2.3 Maximum Lateral Displacement                                                | Identical | Equivalent |
| 13.3.3.4 Effective Period at maximum Displacement                                  | 1623.2.3.1 Effective Period at maximum Displacement                                  | Identical | Equivalent |
| 13.3.3.5 Total Displacement                                                        | 1623.2.4 Total Lateral Displacement                                                  | Identical | Equivalent |
| 13.3.4 Minimum Lateral Forces                                                      | 1623.2.5 Minimum Lateral Forces                                                      |           |            |
| 13.3.4.1 Isolation System and Structural Elements At or Below the Isolation System | 1623.2.5.1 Isolation System and Structural Elements At or Below the Isolation System | Identical | Equivalent |
| 13.3.4.2 Structural Elements Above the Isolation System                            | 1623.2.5.2 Structural Elements Above the Isolation System                            | Identical | Equivalent |
| 13.3.4.3 Limits on $V_s$                                                           | 1623.2.5.3 Limits on $V_s$                                                           | Identical | Equivalent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                       |                                                                                         |                       |            |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------|------------|
| 13.3.5 Vertical Distribution of Force                                                 | 1623.2.6 Vertical Distribution of Force                                                 | Identical             | Equivalent |
| 13.3.6 Drift Limits                                                                   | 1623.2.7 Drift Limits                                                                   | Identical             | Equivalent |
| 13.4 DYNAMIC LATERAL RESPONSE PROCEDURE                                               | 1623.3 Dynamic Lateral Response Procedure                                               | Identical             | Equivalent |
| 13.4.1 General                                                                        |                                                                                         |                       |            |
| 13.4.2 Isolation System and Structural Elements Below the Isolation System            | 1623.3.1 Isolation System and Structural Elements Below the Isolation System            | Identical             | Equivalent |
| 13.4.3 Structural Elements Above the Isolation System                                 | 1623.3.2 Structural Elements Above the Isolation System                                 | Identical             | Equivalent |
| 13.4.4 Ground Motion                                                                  | 1623.3.3 Ground Motion                                                                  |                       |            |
| 13.4.4.1 Design Spectra                                                               | 1623.3.3.1 Design Spectra                                                               | Essentially identical | Equivalent |
| 13.4.4.2 Time Histories                                                               | 1623.3.3.2 Time Histories                                                               | Identical             | Equivalent |
| 13.4.5 Mathematical Model                                                             | 1623.3.4 Mathematical Model                                                             | Identical             | Equivalent |
| 13.4.5.1 General                                                                      |                                                                                         |                       |            |
| 13.4.5.2 Isolation System                                                             | 1623.3.4.1 Isolation System                                                             | Identical             | Equivalent |
| 13.4.5.3 Isolated Building                                                            | 1623.3.4.2 Structural Elements Above the Isolation System                               |                       |            |
| 13.4.5.3.1 Displacement                                                               | 1623.3.4.2.1 Displacement                                                               | Identical             | Equivalent |
| 13.4.5.3.2 Forces and Displacements in Elements of the Lateral-Force-Resisting System | 1623.3.4.2.2 Forces and Displacements in Elements of the Lateral-Force-Resisting System | Identical             | Equivalent |
| 13.4.6 Description of                                                                 | 1623.3.5 Response-                                                                      | Identical             | Equivalent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                                                   |  |                                                                                                                        |           |            |
|-------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------|-----------|------------|
| Analysis Procedures<br>13.4.6.1 General                                                                           |  | Spectrum and Time-<br>History Analysis<br>Procedure                                                                    |           |            |
| 13.4.6.2 Input<br>Earthquake                                                                                      |  | 1623.3.5.1 Input<br>Earthquake                                                                                         | Identical | Equivalent |
| 13.4.6.3 Response-<br>Spectrum Analysis                                                                           |  | 1623.3.5.2 Response-<br>Spectrum Analysis                                                                              | Identical | Equivalent |
| 13.4.6.4 Time-History<br>Analysis                                                                                 |  | 1623.3.5.3 Time-<br>History Analysis                                                                                   | Identical | Equivalent |
| 13.4.7 Design Lateral<br>Force                                                                                    |  | 1623.3.6 Design<br>Lateral Force                                                                                       | Identical | Equivalent |
| 13.4.7.1 Isolation<br>System and Structural<br>Elements At or Below<br>the Isolation System                       |  | 1623.3.6.1 Isolation<br>System                                                                                         | Identical | Equivalent |
| 13.4.7.2 Structural<br>Elements Above the<br>Isolation System                                                     |  | 1623.3.6.2 Structural<br>Elements Above the<br>Isolation System                                                        | Identical | Equivalent |
| 13.4.7.3 Scaling of<br>Results                                                                                    |  | 1623.3.6.3 Scaling of<br>Results                                                                                       | Identical | Equivalent |
| 13.4.7.4 Drift Limits                                                                                             |  | 1623.3.6.4 Drift Limits                                                                                                | Identical | Equivalent |
| 13.5 LATERAL LOAD<br>ON ELEMENTS OF<br>STRUCTURES AND<br>NONSTRUCTURAL<br>COMPONENTS<br>SUPPORTED BY<br>BUILDINGS |  | 1623.4 LATERAL<br>LOAD ON ELEMENTS<br>OF STRUCTURES<br>AND<br>NONSTRUCTURAL<br>COMPONENTS<br>SUPPORTED BY<br>BUILDINGS | Identical | Equivalent |
| 13.5.1 General                                                                                                    |  |                                                                                                                        |           |            |
| 13.5.2 Forces and<br>Displacements                                                                                |  | 1623.4.1 Forces and<br>Displacements                                                                                   |           |            |
| 13.5.2.1 Components<br>At or Above the<br>Isolation Interface                                                     |  | 1623.4.1.1<br>Components At or<br>Above the Isolation<br>Interface                                                     | Identical | Equivalent |
| 13.5.2.2 Components<br>Crossing the Isolation                                                                     |  | 1623.4.1.2<br>Components Crossing                                                                                      | Identical | Equivalent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Interface                                         |  | the Isolation Interface                             |           |            |
|---------------------------------------------------|--|-----------------------------------------------------|-----------|------------|
| 13.5.2.3 Components Below the Isolation Interface |  | 1623.4.1.3 Components Below the Isolation Interface | Identical | Equivalent |
| 13.6 DETAILED SYSTEM REQUIREMENTS                 |  |                                                     |           |            |
| 13.6.1 General                                    |  | 1623.5 Detailed System Requirements                 | Identical | Equivalent |
| 13.6.2 Isolation System                           |  | 1623.5.1 Isolation System                           |           |            |
| 13.6.2.1 Environmental Conditions                 |  | 1623.5.1.1 Environmental Conditions                 | Identical | Equivalent |
| 13.6.2.2 Wind Forces                              |  | 1623.5.1.2 Wind Forces                              | Identical | Equivalent |
| 13.6.2.3 Fire Resistance                          |  | 1623.5.1.3 Fire Resistance                          | Identical | Equivalent |
| 13.6.2.4 Lateral- Restoring Force                 |  | 1623.5.1.4 Lateral- Restoring Force                 | Identical | Equivalent |
| 13.6.2.5 Displacement Restraint                   |  | 1623.5.1.5 Displacement Restraint                   | Identical | Equivalent |
| 13.6.2.6 Vertical-Load Stability                  |  | 1623.5.1.6 Vertical-Load Stability                  | Identical | Equivalent |
| 13.6.2.7 Overturning                              |  | 1623.5.1.7 Overturning                              | Identical | Equivalent |
| 13.6.2.8 Inspection and Replacement               |  | 1623.5.1.8 Inspection and Replacement               | Identical | Equivalent |
| 13.6.2.9 Quality Control                          |  | 1623.5.1.9 Quality Control                          | Identical | Equivalent |
| 13.6.3 Structural System                          |  | 1623.5.2 Structural System                          |           |            |
| 13.6.3.1 Horizontal Distribution of Force         |  | 1623.5.2.1 Horizontal Distribution of Force         | Identical | Equivalent |
| 13.6.3.2 Building Separations                     |  | 1623.5.2.2 Building Separations                     | Identical | Equivalent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                                                                          |                             |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 13.6.3.3 Nonbuilding Structures             |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.5.2.3 Nonbuilding Structures             | Identical                                                                                                                                | Equivalent                  |
| 13.7 FOUNDATIONS                            |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.6 Foundations                            | Identical                                                                                                                                | Equivalent                  |
| 13.8 DESIGN AND CONSTRUCTION REVIEW         |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.7 Design And Construction Review         | Identical                                                                                                                                | Equivalent                  |
| 13.8.1 General                              |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                                                                          |                             |
| 13.8.2 Isolation System                     |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                                                                          |                             |
| 13.9 REQUIRED TESTS OF THE ISOLATION SYSTEM |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.8 Required Tests of The Isolation System | Identical                                                                                                                                | Equivalent                  |
| 13.9.1 General                              |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                                                                          |                             |
| 13.9.2 Prototype Tests                      |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.8.1 Prototype Tests                      | Identical                                                                                                                                | Equivalent                  |
| 13.9.2.1 General                            |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                                                                                                                          |                             |
| 13.9.2.2 Record                             |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.8.1.1 Record                             | Identical                                                                                                                                | Equivalent                  |
| 13.9.2.3 Sequence and Cycles:               | The following sequence of tests shall be performed for the prescribed number of cycles at a vertical load equal to the average <i>dead load</i> plus one-half the effects due to <i>live load</i> on all isolator units of a common type and size:<br>1.<br>2.<br>3. and<br>4. $30S_{D1}B_D/S_{DS}$ , but not less than ten, fully reversed cycles of loading at 1 <i>total design displacement</i> , $1.0D_{TD}$ | 1623.8.1.2 Sequences and Cycles               | IBC identical to NEHRP except for the following change:<br>Item 4 of NEHRP was changed from $30S_{D1}B_D/S_{DS}$ to $15S_{D1}B_D/S_{DS}$ | IBC slightly less stringent |
| 13.9.2.4 Units Dependent on Loading Rates   |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.8.1.3 Units Dependent on Loading Rates   | Identical                                                                                                                                | Equivalent                  |
| 13.9.2.5 Units Dependent on Bilateral Load  |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.8.1.4 Units Dependent on Bilateral Load  | Identical                                                                                                                                | Equivalent                  |
| 13.9.2.6 Maximum and                        |                                                                                                                                                                                                                                                                                                                                                                                                                   | 1623.8.1.5 Maximum                            | Identical                                                                                                                                | Equivalent                  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| Minimum Vertical Load                                     |  | and Minimum Vertical Load                                  |                                                                                                                                                          |                             |
|-----------------------------------------------------------|--|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 13.9.2.7 Sacrificial-Wind-Restraint Systems               |  | 1623.8.1.6 Sacrificial-Wind-Restraint Systems              | Identical                                                                                                                                                | Equivalent                  |
| 13.9.2.8 Testing Similar Units                            |  | 1623.8.1.7 Testing Similar Units                           | Identical                                                                                                                                                | Equivalent                  |
| 13.9.3 Determination of Force-Deflection Characteristics  |  | 1623.8.2 Determination of Force-Deflection Characteristics | Identical                                                                                                                                                | Equivalent                  |
| 13.9.4 Test Specimen Adequacy                             |  | 1623.8.3 Test Specimen Adequacy                            | IBC identical to NEHRP except for the following change:<br>In items 2, and 3 of NEHRP the term $30S_{Df}B_d/S_{Ds}$ was modified to $15S_{Df}B_d/S_{Ds}$ | IBC slightly less stringent |
| 13.9.5 Design Properties of the Isolation System          |  | 1623.8.4 Design Properties of the Isolation System         |                                                                                                                                                          |                             |
| 13.9.5.1 Maximum and Minimum Effective Stiffness          |  | 1623.8.4.1 Maximum and Minimum Effective Stiffness         | Identical                                                                                                                                                | Equivalent                  |
| 13.9.5.2 Effective Damping                                |  | 1623.8.4.2 Effective Damping                               | Identical                                                                                                                                                | Equivalent                  |
| Appendix to Chapter 13 PASSIVE ENERGY DISSIPATION SYSTEMS |  |                                                            | No corresponding provisions                                                                                                                              | Does not affect equivalency |
|                                                           |  |                                                            |                                                                                                                                                          |                             |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                                                |                                                                                                                                                                                                                                                                                                 | 2000 IBC                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Comments              |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Section                                                                                                                   | Provision                                                                                                                                                                                                                                                                                       | Section                                                                                                                  | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |
| <b>Chapter 14</b><br><b>NONBUILDING</b><br><b>STRUCTURE DESIGN</b><br><b>REQUIREMENTS</b><br>14.1 GENERAL<br>14.1.1 Scope |                                                                                                                                                                                                                                                                                                 | <b>1622</b><br><b>NONBUILDING</b><br><b>STRUCTURES</b><br><b>SEISMIC DESIGN</b><br><b>REQUIREMENTS</b><br>1622.1 General | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Equivalent            |
| 14.1.2 Nonbuilding Structures Supported by Other Structures                                                               |                                                                                                                                                                                                                                                                                                 | 1622.1.1 Nonbuilding Structures Supported by Other Structures                                                            | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent            |
| 14.1.3 Architectural, Mechanical, and Electrical Components                                                               |                                                                                                                                                                                                                                                                                                 | 1622.1.2 Architectural, Mechanical, and Electrical Components                                                            | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent            |
|                                                                                                                           |                                                                                                                                                                                                                                                                                                 | 1622.2 Seismic Design Requirements                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                       |
| 14.1.4 Loads                                                                                                              |                                                                                                                                                                                                                                                                                                 | 1622.2.1 Weight                                                                                                          | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent            |
| 14.1.5 Fundamental Period                                                                                                 |                                                                                                                                                                                                                                                                                                 | 1622.2.2 Fundamental Period                                                                                              | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent            |
| 14.1.6 Drift Limitations                                                                                                  |                                                                                                                                                                                                                                                                                                 | 1622.2.3 Drift Limitations                                                                                               | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent            |
| 14.1.7 Materials Requirements                                                                                             |                                                                                                                                                                                                                                                                                                 | 1622.2.4 Seismic Requirements of Materials                                                                               | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Equivalent            |
| 14.2 STRUCTURAL DESIGN REQUIREMENTS<br>14.2.1 Design Basis                                                                | Nonbuilding structures ..... with the following additions and exceptions:<br>1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7. Where an approved standard provides a basis for the earthquake resistant design of a particular type of <i>nonbuilding structure</i> such a standard may be used subject to | 1622.2.5 Minimum Seismic Forces                                                                                          | IBC identical to NEHRP with following additions:<br>(1) For nonbuilding systems with response modification coefficients, R, provided in Table 1622.2.5-1, the minimum value specified in Formula (1617.4.1-4) shall be replaced by the following: $C_s = 0.14 S_{Ds} I/R$ (1622.2.5-1)<br>and the minimum value specified in Formula (1617.4.1-5) shall be replaced by the following: $C_s = 0.8 S_1 I/R$ (1622.2.5-2)<br>(2) Another clause has been added to Item 7 of NEHRP as given below:<br>Where seismic force is determined in accordance with | IBC is more stringent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                               |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                               |                                                 |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <p>14.2.1.1 Seismic Factors<br/>14.2.1.2 Importance Factors and Seismic Use Group Classifications</p> | <p>the following limitations:<br/>a. The seismic ground acceleration and seismic coefficient shall be in conformance with the requirements of Sec. 4.1 and 4.2, respectively.<br/>b. The values for total lateral force and total base overturning moment used in design shall not be less than 80 percent of the base shear value and overturning moment, each adjusted for the effects of soil-structure interaction that would be obtained using these Provisions.<br/>8.</p> | <p>Table 1622.2.5-1<br/>Table 1622.2.5-2</p>                                                                                  | <p>an approved national standard, it shall not be taken as less than 80 percent of that in Section 1622.2.5.</p> | Identical                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalent                                      |
|                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                               |                                                                                                                  | Identical                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalent                                      |
| 14.2.2 Rigid Nonbuilding Structures                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1622.2.6 Rigid Nonbuilding Structures                                                                                         |                                                                                                                  | Identical                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalent                                      |
| 14.2.3 Deflection Limits and Structure Separation                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1622.2.7 Deflection Limits and Structure Separation                                                                           |                                                                                                                  | Identical                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalent                                      |
| 14.3 NONBUILDING STRUCTURES SIMILAR TO BUILDINGS<br>14.3.1 General                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1622.3 Nonbuilding Structures Similar to Buildings<br><br>1622.3.1 Design Basis<br>1622.3.2 Determination of Seismic Effect E |                                                                                                                  | Essentially identical with the following exception:<br>Intermediate moment frames of reinforced concrete in Seismic Use Group I or II are permitted to be used at sites where the seismic coefficient $S_{DS}$ , as determined in Section 1615.1 or 1615.2, is greater than or equal to 0.50 provided that both of the following conditions are met:<br>1. The nonbuilding structure is less than 50 feet (15 | The exception makes IBC slightly less stringent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                                            |  |                                                                                                      | 240 mm) in height.<br>2. $R \leq 3.0$ is used for design.                                                                                                                                                                                                       |                       |
|--------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 14.3.2 Pipe Racks<br>14.3.2.1 Design Basis                                                 |  | 1622.3.3 Pipe Racks                                                                                  | Identical                                                                                                                                                                                                                                                       | Equivalent            |
| 14.3.3 Steel Storage Racks                                                                 |  | 1622.3.4 Steel Storage Racks                                                                         | IBC provides more detailed and specific guidance.                                                                                                                                                                                                               | IBC is more stringent |
| 14.3.3.1 General Requirements                                                              |  | 1622.3.4.1 General                                                                                   | Essentially identical                                                                                                                                                                                                                                           | Equivalent            |
| 14.3.3.2 Operating Weight                                                                  |  | 1622.3.4.2 Operating weight                                                                          | Identical                                                                                                                                                                                                                                                       | Equivalent            |
| 14.3.3.3 Vertical Distribution of Seismic Forces                                           |  | 1622.3.4.3 Vertical Distribution of Seismic Forces                                                   | Identical                                                                                                                                                                                                                                                       | Equivalent            |
| 14.3.3.4 Seismic Displacements                                                             |  | 1622.3.4.4 Seismic Displacements                                                                     | Essentially identical                                                                                                                                                                                                                                           | Equivalent            |
| 14.3.4 Electrical Power Generating Facilities<br>14.3.4.1 General<br>14.3.4.2 Design Basis |  | 1622.3.5 Electrical Power Generating Facilities                                                      | Identical                                                                                                                                                                                                                                                       | Equivalent            |
| 14.3.5 Structural Towers for Tanks and Vessels<br>14.3.5.1 General                         |  | 1622.3.6 Structural Towers for Tanks and Vessels                                                     | Identical, with following addition:<br>When the sloshing period of the stored liquid is within 70% to 150% of the fundamental period of the supporting structure, the effects of sloshing shall be included in the design of the tank and supporting structure. | IBC is more stringent |
| 14.3.6 Piers and Wharves<br>14.3.6.1 General<br>14.3.6.2 Design Basis                      |  | 1622.3.7 Piers and Wharves                                                                           | Identical                                                                                                                                                                                                                                                       | Equivalent            |
| 14.4 NONBUILDING STRUCTURES NOT SIMILAR TO BUILDINGS<br>14.4.1 General                     |  | 1622.4 Nonbuilding Structures Not Similar to Buildings<br>1622.4.1 Determination of Seismic Effect E | Essentially identical                                                                                                                                                                                                                                           | Equivalent            |
| 14.4.2 Earth Retaining Structures                                                          |  | 1622.4.2 Earth-Retaining Structures                                                                  | IBC provides more detailed and specific guidance.                                                                                                                                                                                                               | IBC is more stringent |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

|                                                                         |                                                                                       |                                       |  |                                                   |  |                             |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------|--|---------------------------------------------------|--|-----------------------------|
| 14.4.2.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.3 Tanks and Vessels                                                | ... shall be designed in accordance with Sec. 6.3.9 which simply refer to Chapter 14. | 1622.4.3 Tanks and Vessels            |  | IBC provides more detailed and specific guidance. |  | IBC is more stringent       |
| 14.4.3.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.3.2 Design Basis                                                   | No corresponding provisions                                                           | 1622.4.3.1 Above-grade storage tanks  |  |                                                   |  | IBC is more stringent       |
| 14.4.3.3 Additional Requirements                                        |                                                                                       | 1622.4.3.2 At-grade storage tanks     |  | Identical                                         |  | Equivalent                  |
| 14.4.4 Electrical Transmission, Substation, and Distribution Structures |                                                                                       |                                       |  | No corresponding provisions                       |  | Does not affect equivalency |
| 14.4.4.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.4.2 Design Basis                                                   |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.5 Telecommunication Towers                                         |                                                                                       | 1622.4.4 Telecommunication Towers     |  | Identical                                         |  | Equivalent                  |
| 14.4.5.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.5.2 Design Basis                                                   |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.6 Stacks and Chimneys                                              |                                                                                       | 1622.4.5 Stacks and Chimneys          |  | Essentially identical                             |  | Equivalent                  |
| 14.4.6.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.6.2 Design Basis                                                   |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.7 Amusement Structures                                             |                                                                                       | 1622.4.6 Amusement Structures         |  | Essentially identical                             |  | Equivalent                  |
| 14.4.7.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.7.2 Design Basis                                                   |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.8 Special Hydraulic Structures                                     |                                                                                       | 1622.4.7 Special Hydraulic Structures |  | Identical                                         |  | Equivalent                  |
| 14.4.8.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.8.2 Design Basis                                                   |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.9 Buried Structures                                                |                                                                                       | 1622.4.8 Buried Structures            |  | Identical                                         |  | Equivalent                  |
| 14.4.9.1 General                                                        |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.9.2 Design Basis                                                   |                                                                                       |                                       |  |                                                   |  |                             |
| 14.4.10 Inverted                                                        |                                                                                       | 1622.4.9 Inverted                     |  | Essentially identical                             |  | Equivalent                  |

**Table 1. Detailed Comparison of Structural Provisions of 2000 IBC to 1997 NEHRP (continued)**

Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)

| 1997 NEHRP                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1998 ASCE 7                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                | Comments   |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------|
| Section                   | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Section                                                                                                                                                                                                                                                                                                                                                                                | Provision                                                                                                                      |            |
| 1 GENERAL PROVISIONS      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9.0 EARTHQUAKE LOADS                                                                                                                                                                                                                                                                                                                                                                   | It is noted that the section is based on the 1997 NEHRP Provisions.                                                            |            |
|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9.1 GENERAL PROVISIONS                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                |            |
| 1.1 PURPOSE               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9.1.1 Purpose                                                                                                                                                                                                                                                                                                                                                                          | Essentially similar                                                                                                            | Equivalent |
| 1.2 SCOPE AND APPLICATION |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9.1.2 Scope and Application                                                                                                                                                                                                                                                                                                                                                            | Essentially identical with the following changes:<br>Exception 1: Same as Exception 4 of NEHRP.                                | Equivalent |
| 1.2.1 Scope               | These Provisions shall apply to the design and construction of <i>structures</i> including <i>additions</i> , change of use, and <i>alterations</i> to resist the effects of earthquake motions. Every <i>structure</i> , and portion thereof, shall be designed and constructed to resist the effects of earthquake motions as prescribed by these Provisions.<br>Exceptions:<br>1. Detached one- and two-family dwellings located where $S_{DS}$ is less than 0.4g are exempt from all requirements of these Provisions.<br>2. Detached one- and two-family wood frame dwellings located where $S_{DS}$ is equal to or greater than 0.4g and that are designed and constructed in accordance with the conventional light frame construction provisions in Sec. 12.5 are exempt from all other requirements of these Provisions.<br>3. Agricultural storage structures intended only for incidental human occupancy are exempt from all requirements of these Provisions.<br>4. Structures located where $S_1$ is less than | Exception 2: Applicable where $S_s < 0.4g$ . In addition, it applies to dwellings in SDC A, B and C (i.e., where $S_{Ds} \leq 0.50g$ and $S_{D1} \leq 0.20g$ ).<br><br>Exception 3: Detached one- and two-family wood frame dwellings with no more than two stories above grade, that conform to the provisions of Section A9.12.10.<br><br>Exception 4: Same as Exception 3 of NEHRP. | ASCE Exception 2 is less restrictive than NEHRP Exception 1.<br><br>Equivalent or slightly more restrictive.<br><br>Equivalent |            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                 |                              |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------|
| 1.2.2 Addition      | <p>or equal to 0.04g and <math>S_g</math> is less than or equal to 0.15g shall only be required to comply with Sec. 5.2.6.1.</p> <p>An <i>addition</i> that is not structurally independent from an existing <i>structure</i> shall be designed and constructed such that the entire <i>structure</i> conforms to the seismic-force- resistance requirements for new <i>structures</i> unless all of the following conditions are satisfied:</p> <ol style="list-style-type: none"> <li>1. The <i>addition</i> conforms with the requirements for new <i>structures</i>, and</li> <li>2. The <i>addition</i> does not increase the seismic forces in any structural element of the existing <i>structure</i> by more than 5 percent, unless the capacity of the element subject to the increased forces is still in compliance with these <i>Provisions</i>, and</li> <li>3. The <i>addition</i> does not decrease the seismic resistance of any structural element of the existing <i>structure</i> to less than that required for a new <i>structure</i>.</li> </ol> | 9.1.2.2 Additions to Existing Structures | Identical                                                                                       | Equivalent                   |
| 1.2.3 Change of Use | <p>When a change of use results in a <i>structure</i> being reclassified to a higher Seismic Use Group, the <i>structure</i> shall conform to the requirements of Section 1.2.1 for a new <i>structure</i>.</p> <p>Exception: When a change of use results in a <i>structure</i> being reclassified from Seismic Use Group I to Seismic Use Group II, compliance with these <i>Provisions</i> is not required if the <i>structure</i> is located where <math>S_{DS}</math> is less than 0.3.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.1.2.3 Change of Use                    | Nearly identical; however the limit on $S_{DS}$ in the exception was changed from 0.3 to 0.333. | Considered equivalent        |
| 1.2.4 Alterations   | Alterations are permitted to be made to any <i>structure</i> without requiring the <i>structure</i> to comply with these <i>Provisions</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                          | No corresponding provisions.                                                                    | Equivalency cannot be judged |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                 |                                                                                                                                                                                                                                                                                                                           |                                                                   |                                                                                                                                                                                       |                             |  |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--|
|                                                                 | provided the alterations conform to that required for a new structure. <i>Alterations</i> shall not decrease the lateral-force resisting system strength or stiffness to less than that required by these Provisions. The alteration shall not cause the existing structural elements to be loaded beyond their capacity. |                                                                   |                                                                                                                                                                                       |                             |  |
|                                                                 | No corresponding provisions                                                                                                                                                                                                                                                                                               | 9.1.2.4 Application of Provisions                                 | The applicability of Chapter 9 is indicated.                                                                                                                                          | Does not affect equivalency |  |
|                                                                 | No corresponding provisions                                                                                                                                                                                                                                                                                               | 9.1.2.4.1 New Buildings                                           | The scope of Chapter 9 is outlined in more detail.                                                                                                                                    | Does not affect equivalency |  |
| 1.2.5 Alternate Materials and Means and Methods of Construction |                                                                                                                                                                                                                                                                                                                           | 9.1.2.5 Alternate Materials and Means and Methods of Construction | Essentially similar                                                                                                                                                                   | Equivalent                  |  |
| 1.3 SEISMIC USE GROUPS                                          |                                                                                                                                                                                                                                                                                                                           | 9.1.3 Seismic use Groups                                          | ASCE 7 defines these by means of a table in terms of Occupancy Categories which do not exist in the NEHRP Provisions. Substance is similar, although there are differences in detail. | Considered equivalent       |  |
| 1.3.1 Seismic Use Group III                                     |                                                                                                                                                                                                                                                                                                                           |                                                                   |                                                                                                                                                                                       |                             |  |
| 1.3.2 Seismic Use Group II                                      |                                                                                                                                                                                                                                                                                                                           |                                                                   |                                                                                                                                                                                       |                             |  |
| 1.3.3 Seismic Use Group I                                       |                                                                                                                                                                                                                                                                                                                           |                                                                   |                                                                                                                                                                                       |                             |  |
| 1.3.4 Multiple Use                                              |                                                                                                                                                                                                                                                                                                                           | 9.1.3.4 Multiple Use                                              | Identical                                                                                                                                                                             | Equivalent                  |  |
| 1.3.5 Seismic Use Group III Structures Access Protection        |                                                                                                                                                                                                                                                                                                                           | 9.1.3.1.1                                                         | Identical                                                                                                                                                                             | Equivalent                  |  |
|                                                                 | No corresponding provisions                                                                                                                                                                                                                                                                                               | 9.1.3.1.2                                                         | Explicitly requires continued functionality of designated seismic systems in SUG III structures.                                                                                      | ASCE is more stringent      |  |
| 1.4 OCCUPANCY IMPORTANCE FACTOR                                 |                                                                                                                                                                                                                                                                                                                           | 9.1.4 Occupancy Importance Factor                                 | Identical                                                                                                                                                                             | Equivalent                  |  |

Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)

| 1997 NEHRP               |           | 1998 ASCE 7       |                       | Comments   |
|--------------------------|-----------|-------------------|-----------------------|------------|
| Section                  | Provision | Section           | Provision             |            |
| 2 GLOSSARY AND NOTATIONS |           |                   |                       |            |
| 2.1 GLOSSARY             |           | 9.2.1 Definitions | Essentially identical | Equivalent |
| 2.2 NOTATIONS            |           | 9.2.2 Symbols     | Essentially identical | Equivalent |
|                          |           |                   |                       |            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                   |           | 1998 ASCE 7                                                                   |                                                                                                         | Comments              |
|----------------------------------------------|-----------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------|
| Section                                      | Provision | Section                                                                       | Provision                                                                                               |                       |
| <b>3 QUALITY ASSURANCE</b>                   |           | 9.4.3 Quality Assurance                                                       | Refers to Appendix A.9.3 for supplementary provisions.                                                  |                       |
| 3.1 SCOPE                                    |           | A.9.3 Quality Assurance                                                       | Identical                                                                                               | Equivalent            |
| 3.2 QUALITY ASSURANCE                        |           | A.9.3.1 Scope                                                                 | Essentially identical. In addition, ASCE specifies some reference standards for inspection and testing. | Considered equivalent |
| 3.2.1 Details of Quality Assurance Plan      |           | A.9.3.2 Quality Assurance Plan<br>A.9.3.2.1 Details of Quality Assurance Plan | Identical                                                                                               | Equivalent            |
| 3.2.2 Contractor Responsibility              |           | A.9.3.2.2 Contractor Responsibility                                           | Identical                                                                                               | Equivalent            |
| 3.3 SPECIAL INSPECTION                       |           | A.9.3.3 Special Inspection                                                    | Essentially identical                                                                                   | Equivalent            |
| 3.3.1 Piers, Piles, Caissons                 |           | A.9.3.3.1 Foundations                                                         | Identical                                                                                               | Equivalent            |
| 3.3.2 Reinforcing Steel                      |           | A.9.3.3.2 Reinforcing Steel<br>A.9.3.3.2.1<br>A.9.3.3.2.2                     | Identical                                                                                               | Equivalent            |
| 3.3.3 Structural Concrete                    |           | A.9.3.3.3 Structural Concrete                                                 | Identical                                                                                               | Equivalent            |
| 3.3.4 Prestressed Concrete                   |           | A.9.3.3.4 Prestressed Concrete                                                | Identical                                                                                               | Equivalent            |
| 3.3.5 Structural Masonry                     |           | A.9.3.3.5 Structural Masonry<br>A.9.3.3.5.1<br>A.9.3.3.5.2                    | Identical                                                                                               | Equivalent            |
| 3.3.6 Structural Steel<br>3.3.6.1<br>3.3.6.2 |           | A.9.3.3.6 Structural Steel<br>A.9.3.3.6.1<br>A.9.3.3.6.2                      | Identical                                                                                               | Equivalent            |
| 3.3.7 Structural Wood                        |           | A.9.3.3.7 Structural                                                          | Identical                                                                                               | Equivalent            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                             |                                           | Wood                                           |                                           |                        |
|---------------------------------------------|-------------------------------------------|------------------------------------------------|-------------------------------------------|------------------------|
| 3.3.8 Cold-Formed Steel Framing             |                                           | A9.3.3.8 Cold-Formed Steel Framing             | Identical                                 | Equivalent             |
| 3.3.9 Architectural Components              |                                           | A9.3.3.9 Architectural Components              | Identical                                 | Equivalent             |
| 3.3.10 Mechanical and Electrical Components |                                           | A9.3.3.10 Mechanical and Electrical Components | Identical                                 | Equivalent             |
| 3.3.11 Seismic Isolation System             |                                           | A9.3.3.11 Seismic Isolation System             | Identical                                 | Equivalent             |
| 3.4 TESTING                                 |                                           | A9.3.4 Testing                                 | Identical                                 | Equivalent             |
| 3.4.1 Reinforcing and Prestressing Steel    |                                           | A9.3.4.1 Reinforcing and Prestressing Steel    | Identical                                 | Equivalent             |
| 3.4.2 Structural Concrete                   | Refers to ACI 318-95                      | A9.3.4.2 Structural Concrete                   | Refers to ACI 318-99                      | Essentially equivalent |
| 3.4.3 Structural Masonry                    | Refers to ACI 530-95/ASCE 5-95/TMS 402-95 | A9.3.4.3 Structural Masonry                    | Refers to ACI 530-99/ASCE 5-99/TMS 402-99 | Essentially equivalent |
| 3.4.4 Structural Steel                      |                                           | A9.3.4.4 Structural Steel                      | Identical                                 | Equivalent             |
| 3.4.4.1 Base Metal Testing                  |                                           | A9.3.4.4.1 Base Metal Testing                  |                                           |                        |
| 3.4.5 Mechanical and Electrical Equipment   |                                           | A9.3.4.5 Mechanical and Electrical Equipment   | Identical                                 | Equivalent             |
| 3.4.6 Seismically Isolated Structures       |                                           | A9.3.4.6 Seismically Isolated Structures       | Identical                                 | Equivalent             |
| 3.5 STRUCTURAL OBSERVATIONS                 |                                           | A9.3.5 Structural Observations                 | Identical                                 | Equivalent             |
| 3.6 REPORTING AND COMPLIANCE PROCEDURES     |                                           | A9.3.6 Reporting And Compliance Procedures     | Identical                                 | Equivalent             |
|                                             |                                           |                                                |                                           |                        |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                                                          |           | 1998 ASCE 7                                                                                                                           |                                                                                                                                                          | Comments   |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Section                                                                                                                             | Provision | Section                                                                                                                               | Provision                                                                                                                                                |            |
| <b>4 GROUND MOTION</b>                                                                                                              |           |                                                                                                                                       |                                                                                                                                                          |            |
| 4.1 PROCEDURES FOR DETERMINING MAXIMUM CONSIDERED EARTHQUAKE AND DESIGN EARTHQUAKE GROUND MOTION ACCELERATIONS AND RESPONSE SPECTRA |           | 9.4.1 Procedures For Determining Maximum Considered Earthquake And Design Earthquake Ground Motion Accelerations And Response Spectra | Identical                                                                                                                                                | Equivalent |
| 4.1.1 Maximum Considered Earthquake Ground Motions                                                                                  |           | 9.4.1.1 Maximum Considered Earthquake Ground Motions                                                                                  |                                                                                                                                                          |            |
| 4.1.2 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations                    |           | 9.4.1.2 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations                    | Essentially identical, except ASCE omits NEHRP paragraph stating that accelerations need not be determined where $S_s \leq 0.15g$ and $S_1 \leq 0.04g$ . | Equivalent |
| 4.1.2.1 Site Class Definitions                                                                                                      |           | 9.4.1.2.1 Site Class Definitions                                                                                                      | Essentially identical. ASCE refers to certain standards, which is not done in NEHRP.                                                                     | Equivalent |
| 4.1.2.2 Steps for Classifying a Site                                                                                                |           | 9.4.1.2.2 Steps for Classifying a Site                                                                                                | Essentially identical                                                                                                                                    | Equivalent |
| 4.1.2.3 Definition of Site Class Parameters                                                                                         |           | 9.4.1.2.3 Definition of Site Class Parameters                                                                                         | Identical                                                                                                                                                | Equivalent |
| 4.1.2.4 Site Coefficients and Adjusted Maximum Considered                                                                           |           | 9.4.1.2.4 Site Coefficients and Adjusted Maximum Considered Earthquake                                                                | Identical                                                                                                                                                | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Earthquake Spectral Response Acceleration Parameters                       | Spectral Response Acceleration Parameters                                    |           |            |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------|------------|
| 4.1.2.5 Design Spectral Response Acceleration Parameters                   | 9.4.1.2.5 Design Spectral Response Acceleration Parameters                   | Identical | Equivalent |
| 4.1.2.6 General Procedure Response Spectrum                                | 9.4.1.2.6 General Procedure Response Spectrum                                | Identical | Equivalent |
| 4.1.3 Site-Specific Procedure for Determining Ground Motion Accelerations  | 9.4.1.3 Site-Specific Procedure for Determining Ground Motion Accelerations  | Identical | Equivalent |
| 4.1.3.1 Probabilistic Maximum Considered Earthquake                        | 9.4.1.3.1 Probabilistic Maximum Considered Earthquake                        | Identical | Equivalent |
| 4.1.3.2 Deterministic Limit on Maximum Considered Earthquake Ground Motion | 9.4.1.3.2 Deterministic Limit on Maximum Considered Earthquake Ground Motion | Identical | Equivalent |
| 4.1.3.3 Deterministic Maximum Considered Earthquake Ground Motion          | 9.4.1.3.3 Deterministic Maximum Considered Earthquake Ground Motion          | Identical | Equivalent |
| 4.1.3.4 (mis-printed as 4.1.3.5) Site-Specific Design Ground Motion        | 9.4.1.3.4 Site-Specific Design Ground Motion                                 | Identical | Equivalent |
| 4.2 SEISMIC DESIGN CATEGORY                                                | 9.4.2 SEISMIC DESIGN CATEGORY                                                |           |            |
| 4.2.1 Determination of Seismic Design Category                             | 9.4.2.1 Determination of Seismic Design Category                             | Identical | Equivalent |
| 4.2.2 Site Limitation for Seismic Design Categories E and F                | 9.4.2.2 Site Limitation for Seismic Design Categories E and F                | Identical | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Section                                     | 1997 NEHRP |                                                       | 1998 ASCE 7                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Comments              |
|---------------------------------------------|------------|-------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
|                                             | Section    | Provision                                             | Section                                                      | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                       |
| <b>5 STRUCTURAL DESIGN CRITERIA</b>         |            |                                                       | 9.5 STRUCTURAL DESIGN CRITERIA, ANALYSIS & PROCEDURES        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                       |
| 5.1 REFERENCE DOCUMENT                      |            | Refers to ASCE 7-95 for loads other than earthquakes. |                                                              | The ASCE is itself ASCE 7-98, i.e., an updated version of the document referenced by NEHRP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Considered equivalent |
| 5.2 DESIGN BASIS<br>5.2.1 General           |            |                                                       | 9.5.2 Structural Design Requirements<br>9.5.2.1 Design Basis | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Equivalent            |
| 5.2.2 Basic Seismic-Force-Resisting Systems |            |                                                       | 9.5.2.2 Basic Seismic-Force-Resisting Systems                | Table 1617.6 has the following changes from Table 5.2.2 of NEHRP:<br>(1) Detailed plain concrete shear walls (BW Systems) – building height changed from NL to NP in SDC C<br>(2) Special Reinforced concrete shear walls (BW Systems) – building height limit changed from 100 to 160 ft. in SDC F<br>(3) Special Reinforced masonry shear walls (BW Systems) – R changed from 3-1/2 to 5<br>(4) Intermediate Reinforced masonry shear walls (BW Systems) – R changed from 2-1/2 to 3-1/2<br>(5) Detailed plain masonry shear walls (BW Systems) – building height changed from 160 ft to NP in SDC C<br>(6) Light frame walls with shear panels (BW Systems) : Wood structural panels – R changed from 6-1/2 to 6<br>(7) Ordinary Reinforced masonry shear walls (BW Systems) – building height changed from NP to 160 ft in SDC C<br>(8) Light frame walls with shear panels (BW Systems): all other materials – Added<br>(9) Detailed plain concrete shear walls (BF Systems) – building height changed from NL to NP in SDC C<br>(10) Special Reinforced masonry shear walls (BF | Considered equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                      |  |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |  |
|----------------------|--|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--|
|                      |  |                       | <p>Systems) – R changed from 4-1/2 to 5-1/2</p> <p>(11) Intermediate Reinforced masonry shear walls (BF Systems) – R changed from 3 to 4</p> <p>(12) Intermediate Reinforced masonry shear walls (BF Systems) – <math>C_d</math> changed from 2-1/2 to 4</p> <p>(13) Intermediate Reinforced masonry shear walls (BF Systems) – building height changed from 160 ft, 160 ft, 100 ft to NP, NP, NP in SDCs D, E, and F, respectively.</p> <p>(14) Ordinary Reinforced masonry shear walls (BF Systems) – building height changed from NP to 160 ft in SDC C</p> <p>(15) Detailed plain masonry shear walls (BF Systems) – building height changed from 160 ft to NP in SDC C</p> <p>(16) Light frame walls with shear panels (BF Systems): Wood structural panels– R changed from 7 to 6-1/2; building height limit changed from 160 ft to 65 ft in SDC D, E and F.</p> <p>(17) Light frame walls with shear panels (BF Systems): all other materials – Added</p> <p>(18) Intermediate reinforced masonry shear walls (Dual Systems with Special Moment Frames) – building height changed from NL to NP in SDC D.</p> <p>(19) Intermediate reinforced masonry shear walls (Dual Systems with Intermediate Moment Frames) – building height changed from 160 ft to NP in SDC D.</p> <p>(20) Ordinary Composite Reinforced Concrete Shear Wall with steel elements (Dual Systems with Intermediate Moment Frames) – R and <math>\Omega_o</math> changed from 5-1/2 and 2-1/2 to 5 and 3, respectively.</p> <p>(21) Cantilevered Column Systems (in Inverted Pendulum System) - Added</p> |            |  |
| 5.2.2.1 Dual System  |  | 9.5.2.2.1 Dual System | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Equivalent |  |
| 5.2.2.2 Combinations |  | 9.5.2.2.2             | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Equivalent |  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                  |                                                                                                                                                                                                                           |                           |
|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| of Framing Systems<br>5.2.2.2.1 R and $\Omega_o$<br>Factors<br>5.2.2.2.2 Combination<br>Framing Detailing<br>Requirements |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Combinations of<br>Framing Systems<br>9.5.2.2.2.1 R and $\Omega_o$<br>Factors<br>9.5.2.2.2.2<br>Combination Framing<br>Detailing<br>Requirements |                                                                                                                                                                                                                           |                           |
| 5.2.2.3 Seismic Design<br>Categories B and C                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.2.3 Seismic<br>Design Categories A,<br>B and C                                                                                             | Identical except that the applicability is to SDCs A, B, C<br>instead of B and C.                                                                                                                                         | Considered<br>equivalent  |
| 5.2.2.4 Seismic Design<br>Categories D and E                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.2.4 Seismic<br>Design Categories D<br>and E                                                                                                | Identical                                                                                                                                                                                                                 | Equivalent                |
| 5.2.2.4.1 Limited<br>Building Height                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.2.4.1 Limited<br>Building Height                                                                                                           | Identical                                                                                                                                                                                                                 | Equivalent                |
| 5.2.2.4.2 Interaction<br>Effects                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.2.4.2 Interaction<br>Effects                                                                                                               | Identical                                                                                                                                                                                                                 | Equivalent                |
| 5.2.2.4.3<br>Deformational<br>Compatibility                                                                               | Every ...<br>Exception: Beams and columns and<br>their connections not designed as<br>part of the lateral-force-resisting<br>system but meeting the detailing<br>requirements for either <i>intermediate<br/>moment frames</i> or <i>special moment<br/>frames</i> are permitted to be designed<br>to be adequate for the vertical load-<br>carrying capacity and the induced<br>moments and shears resulting from<br>the deformation of the <i>building</i> under<br>the application of the design <i>seismic<br/>forces</i> . | 9.5.2.2.4.3<br>Deformational<br>Compatibility                                                                                                    | Identical except for the following changes:<br>(1) Exception changed to: Reinforced concrete frame<br>members not designed as part of the seismic force<br>resisting system shall comply with Section 21.9 of<br>ACI 318. | ASCE is more<br>stringent |
| 5.2.2.4.4 Special<br>Moment Frames                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.2.4.4 Special<br>Moment Frames                                                                                                             | Identical                                                                                                                                                                                                                 | Equivalent                |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                 |                                                                                                                                                                                                                   |                                                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 5.2.2.5 Seismic Design Category F             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.2.5 Seismic Design Category F             | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.3 Structure Configuration                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.3 Structure Configuration                 | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.3.1 Diaphragm Flexibility                 | Diaphragms constructed of untopped steel decking, wood structural panels, or similar panelized construction shall be considered flexible in <i>structures</i> having concrete or masonry <i>shear walls</i> . <i>Diaphragms</i> constructed of wood structural panels shall be considered rigid in light-frame <i>structures</i> using structural panels for lateral load resistance. <i>Diaphragms</i> of other types shall be considered flexible when the maximum lateral <i>deformation</i> of the <i>diaphragm</i> is more than two times the average story drift of the associated story. The loadings used for this calculation shall be those prescribed by Sec. 5.3. | 9.5.2.3.1 Diaphragm Flexibility                 | A diaphragm is flexible for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is more than two times the average story drift of the associated story. | ASCE gives the definition of diaphragm flexibility independent of the material of construction. ASCE is more stringent. |
| 5.2.3.2 Plan Irregularity                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.3.2 Plan Irregularity                     | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.3.3 Vertical Irregularity                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.3.3 Vertical Irregularity                 | Identical with the following change:<br>In case of Irregularity Type 4, SDCs in which it needs to be considered are B, C, D, E and F instead of D, E and F only.                                                  | ASCE is more stringent                                                                                                  |
| 5.2.4 Redundancy                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.4 Redundancy                              | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.4.1 Seismic Design Categories A, B, and C |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.4.1 Seismic Design Categories A, B, and C | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.4.2 Seismic Design Category D             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5.2.4.2 Seismic Design Category D             | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.4.3 Seismic Design Categories E and F     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5.2.4.3 Seismic Design Categories E and F       | Identical                                                                                                                                                                                                         | Equivalent                                                                                                              |
| 5.2.5 Analysis                                | A structural analysis shall be made for all                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.5 Analysis                                | Identical except for the following change:                                                                                                                                                                        | Considered                                                                                                              |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Procedures                                                                  | ... permitted for any <i>structure</i> . The limitations on the <i>base shear</i> stated in Sec. 5.4 apply to dynamic modal analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Procedures                                                                    | The limitations on the <i>base shear</i> stated in Sec. 5.4 apply to any modal analysis procedure which is force-based.                                                                 | equivalent            |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 5.2.5.1 Seismic Design Category A                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.5.1 Seismic Design Category A                                           | Identical                                                                                                                                                                               | Equivalent            |
| 5.2.5.2 Seismic Design Categories B and C                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.5.2 Seismic Design Categories B and C                                   | Identical                                                                                                                                                                               | Equivalent            |
| 5.2.5.3 Seismic Design Categories D, E, and F                               | Follow Table 5.2.5.3 to determine the analysis procedure. The Table identifies 4 cases:<br>1. <i>Structures</i> designated as regular up to 240 feet (70 m)<br>2. <i>Structures</i> that have only vertical irregularities of Type 1a, 1b, 2, or 3 in Table 5.2.3.3 or plan irregularities of Type 1a or 1b of Table 5.2.3.2 and have a height exceeding 65 feet (20 m).<br>3. All other <i>structures</i> designated as having plan or vertical irregularities.<br>4. <i>Structures</i> in areas with $S_{D1}$ of 0.2 and greater with a period greater than $T_0$ located on <i>Site Class F</i> or <i>Site Class E</i> soils | 9.5.2.5.3 Seismic Design Categories D, E, and F                               | Identical except for the following addition to requirements for Item 4 of NEHRP Table: also, the modal seismic design coefficient, $C_{sm}$ , shall not be limited per Section 9.5.4.5. | Considered equivalent |
| 5.2.5.4 Diaphragms                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.5.4 Diaphragms                                                          | Identical                                                                                                                                                                               | Equivalent            |
| 5.2.6 Design, Detailing Requirements, and Structural Component Load Effects |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.6 Design, Detailing Requirements, and Structural Component Load Effects | Identical                                                                                                                                                                               | Equivalent            |
| 5.2.6.1 Seismic Design Category A                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.6.1 Seismic Design Category A                                           | Identical                                                                                                                                                                               | Equivalent            |
| 5.2.6.1.1 Component Load Effects                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5.2.6.1.1 Component Load Effects                                            | Identical                                                                                                                                                                               | Equivalent            |
| 5.2.6.1.2 Connections                                                       | All parts of structure ... being connected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9.5.2.6.1.2                                                                   | Identical except for the following additions:                                                                                                                                           | Considered            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                   | Any smaller portion of the structure shall be tied to the remainder of the structure with elements having a strength of 0.133 times $S_{Ds}$ times the weight of the smaller portion or 5% of the portion's weight, whichever is greater.<br>A positive connection .. reaction. | Connections                                                                 | All parts .... greater. This connection force does not apply to the overall design of the lateral force resisting system. Connection design forces need not exceed the maximum forces that the structural system can deliver to the connection where the maximum system capacity is computed with a $\Omega_o$ factor of 3.<br>A positive connection .. reaction. One means to provide the strength is to use connecting elements such as slabs. | equivalent. ASCE additions are mostly clarifications. |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 5.2.6.1.3 Anchorage of Concrete and Masonry Walls |                                                                                                                                                                                                                                                                                 | 9.5.2.6.1.3 Anchorage of Concrete and Masonry Walls                         | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent                                            |
| 5.2.6.2 Seismic Design Category B                 |                                                                                                                                                                                                                                                                                 | 9.5.2.6.2 Seismic Design Category B                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| 5.2.6.2.1 Second-Order Effects                    |                                                                                                                                                                                                                                                                                 | 9.5.2.6.2.1 Component load effects<br>9.5.2.6.2.3 Direction of seismic load | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                            | Considered equivalent                                 |
| 5.2.6.2.2 Openings                                | Where openings occur in shear walls ... develop the force in the reinforcement.                                                                                                                                                                                                 | 9.5.2.6.2.2 Openings                                                        | Identical with the following addition:<br>Where openings ... reinforcement. The extension must be sufficient in length to allow dissipation or transfer of the force without exceeding the shear and tension capacity of the diaphragm or the wall.                                                                                                                                                                                              | Considered equivalent                                 |
| 5.2.6.2.3 Discontinuities in Vertical System      |                                                                                                                                                                                                                                                                                 | 9.5.2.6.2.4 Discontinuities in Vertical System                              | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent                                            |
| 5.2.6.2.4 Nonredundant Systems                    |                                                                                                                                                                                                                                                                                 | 9.5.2.6.2.5 Nonredundant Systems                                            | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent                                            |
| 5.2.6.2.5 Collector Elements                      |                                                                                                                                                                                                                                                                                 | 9.5.2.6.2.6 Collector Elements                                              | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                        | Equivalent                                            |
| 5.2.6.2.6 Diaphragms                              | The deflection ... the prescribed loads. Floor and roof diaphragms shall be designed to resist the following forces: A minimum force equal to 20 percent of the short period design spectral response                                                                           | 9.5.2.6.2.7 Diaphragms                                                      | Identical with the following changes:<br>The sentence prescribing the minimum force is deleted. The following sentence is added instead: At diaphragm discontinuities, such as openings and re-entrant corners, the design shall assure that the dissipation or transfer of edge (chord) forces combined with other                                                                                                                              | ASCE less stringent                                   |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                             | acceleration $S_D$ times the weight of the diaphragm and other elements of the structure attached thereto plus the portion of the seismic shear force at that level, $V_x$ , required to be transferred to the components of the vertical seismic-force-resisting system because of offsets or changes in stiffness of the vertical components above and below the diaphragm.<br>Diaphragms shall .. connections. |                                                               | forces in the diaphragm is within shear and tension capacity of the diaphragm. |            |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------|------------|
| 5.2.6.2.7 Bearing Walls                                     |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.2.7 Bearing Walls                                     | Identical                                                                      | Equivalent |
| 5.2.6.2.8 Inverted Pendulum-Type Structures                 |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.2.8 Inverted Pendulum-Type Structures                 | Identical                                                                      | Equivalent |
| 5.2.6.2.9 Anchorage of Nonstructural Systems                |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.2.9 Anchorage of Nonstructural Systems                | Identical                                                                      | Equivalent |
| 5.2.6.2.10 Columns Supporting Discontinuous Walls or Frames |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.2.10 Columns Supporting Discontinuous Walls or Frames | Identical                                                                      | Equivalent |
| 5.2.6.3 Seismic Design Category C                           |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.3 Seismic Design Category C                           | Identical                                                                      | Equivalent |
| 5.2.6.3.1 Plan Irregularity                                 |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.3.1 Direction of seismic load                         | Essentially identical                                                          | Equivalent |
| 5.2.6.3.2 Collector Elements                                |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.3.2 Collector Elements                                | Identical                                                                      | Equivalent |
| 5.2.6.3.3 Anchorage of Concrete or Masonry Walls            |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.3.3 Anchorage of Concrete or Masonry Walls            | Identical                                                                      | Equivalent |
| 5.2.6.4 Seismic Design Category D                           |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.4 Seismic Design Category D                           | Identical                                                                      | Equivalent |
| 5.2.6.4.1 Orthogonal Load Effects                           |                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5.2.6.4.1 Direction of seismic load                         | Essentially identical                                                          | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                     |                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                                                                   |                                                                   |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 5.2.6.4.2 Collector Elements                        |                                                                                                                                                                                                                                                                       | 9.5.2.6.4.2 Collector Elements                           | Essentially identical                                                                                                                                                             | Equivalent                                                        |
| 5.2.6.4.3 Plan or Vertical Irregularities           |                                                                                                                                                                                                                                                                       | 9.5.2.6.4.3 Plan or Vertical Irregularities              | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.2.6.4.4 Vertical Seismic Forces                   |                                                                                                                                                                                                                                                                       | 9.5.2.6.4.4 Vertical Seismic Forces                      | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.2.6.5 Seismic Design Categories E and F           |                                                                                                                                                                                                                                                                       | 9.5.2.6.5 Seismic Design Categories E and F              | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.2.6.5.1 Plan or Vertical Irregularities           |                                                                                                                                                                                                                                                                       | 9.5.2.6.5.1 Plan or Vertical Irregularities              | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.2.7 Combination of Load Effects                   | The effects on the structure and its components due to gravity loads and seismic forces shall be combined in accordance with the factored load combinations as presented in ASCE 7-95 except that the effect of seismic loads, $E$ , shall be as defined herein. .... | 9.5.2.7 Combination of Load Effects - Paragraph 1        | Refers to ASCE 7-98; essentially identical as far as the earthquake effects are concerned.                                                                                        | Considered equivalent                                             |
| 5.2.7.1 Special Combination of Loads                | When specifically required by these provisions, .... strengths.                                                                                                                                                                                                       | 9.5.2.7 Combination of Load Effects - Paragraph 2 to end | For columns supporting discontinuous lateral-force-resisting elements, the axial compression in the columns shall be computed using the special load combinations given in NEHRP. | Considered equivalent                                             |
| 5.2.8 Deflection and Drift Limits                   |                                                                                                                                                                                                                                                                       | 9.5.2.8 Deflection and Drift Limits                      | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.3 EQUIVALENT LATERAL FORCE PROCEDURE              |                                                                                                                                                                                                                                                                       | 9.5.3 Equivalent Lateral Force Procedure                 | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.3.1 General                                       |                                                                                                                                                                                                                                                                       | 9.5.3.1 General                                          |                                                                                                                                                                                   |                                                                   |
| 5.3.2 Seismic Base Shear                            |                                                                                                                                                                                                                                                                       | 9.5.3.2 Seismic Base Shear                               | Identical                                                                                                                                                                         | Equivalent                                                        |
| 5.3.2.1 Calculation of Seismic Response Coefficient | In addition to three equations to compute seismic response coefficient, $C_s$ , it is stated that $C_s$ shall not be taken less than: $C_s = 0.1 S_{D1} I$                                                                                                            | 9.5.3.2.1 Calculation of Seismic Response Coefficient    | Identical except that $C_s$ shall not be less than: $C_s = 0.044 S_{D1} I$ instead of $0.1 S_{D1} I$ in NEHRP.                                                                    | ASCE is less stringent at locations where $S_{D1} < 2.273 S_{D1}$ |
| 5.3.3 Period Determination                          |                                                                                                                                                                                                                                                                       | 9.5.3.3 Period Determination                             | Identical                                                                                                                                                                         | Equivalent                                                        |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                           |                                                                                                                                    |                                                                                                                                                                                                                                                                                                                       |                                                                                                       |
|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 5.3.3.1 Approximate Fundamental Period                                                    | 9.5.3.3.1 Approximate Fundamental Period                                                                                           | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.4 Vertical Distribution of Seismic Forces                                             | 9.5.3.4 Vertical Distribution of Seismic Forces                                                                                    | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.5 Horizontal Shear Distribution                                                       | 9.5.3.5 Horizontal Shear Distribution and Torsion<br>9.5.3.5.1 Direct shear<br>9.5.3.5.2 Torsion                                   | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.5.1 Torsion<br>5.3.5.2 Accidental Torsion<br>5.3.5.3 Dynamic Amplification of Torsion |                                                                                                                                    | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.6 Overturning                                                                         | 9.5.3.6 Overturning                                                                                                                | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.7 Drift                                                                               | 9.5.3.7 Drift                                                                                                                      | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| Determination and P-Delta Effects                                                         | Determination and P-Delta Effects                                                                                                  | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.7.1 Story Drift Determination                                                         | 9.5.3.7.1 Story Drift Determination                                                                                                | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |
| 5.3.7.2 P-Delta Effects                                                                   | 9.5.3.7.2 P-Delta Effects                                                                                                          | Identical with the following addition:<br>When P-delta effect is included in an automated analysis, Eq. 9.5.3.7.2-2 must still be satisfied, however, the value of $\theta$ computed from Eq. 9.5.3.7.2-1 using the results of the P-delta analysis may be divided by $(1 + \theta)$ before checking Eq. 9.5.3.7.2-2. | Considered equivalent                                                                                 |
| No corresponding provisions in NEHRP                                                      | 9.3.8 Simplified Analysis Procedure for Seismic Design of Buildings<br>9.3.8.1 Seismic Base Shear<br>9.3.8.2 Vertical distribution |                                                                                                                                                                                                                                                                                                                       | ASCE has incorporated procedure from 1997 UBC that is not in 1997 NEHRP. Equivalency is not affected. |
| 5.4 MODAL ANALYSIS                                                                        | 9.5.4 Modal Analysis Procedure                                                                                                     | Identical                                                                                                                                                                                                                                                                                                             | Equivalent                                                                                            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                 |                                                                                       |                                                   |  |                                                                                                                            |  |                       |
|-------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------|--|-----------------------|
| PROCEDURE                                       |                                                                                       |                                                   |  |                                                                                                                            |  |                       |
| 5.4.1 General                                   |                                                                                       | 9.5.4.1 General                                   |  |                                                                                                                            |  |                       |
| 5.4.2 Modeling                                  |                                                                                       | 9.5.4.2 Modeling                                  |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.3 Modes                                     |                                                                                       | 9.5.4.3 Modes                                     |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.4 Modal Properties                          |                                                                                       | 9.5.4.4 Periods                                   |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.5 Modal Base Shear                          |                                                                                       | 9.5.4.5 Modal Base Shear                          |  | Identical except that NEHRP Exception 1 has been deleted.                                                                  |  | Considered equivalent |
| 5.4.6 Modal Forces, Deflections, and Drifts     |                                                                                       | 9.5.4.6 Modal Forces, Deflections, and Drifts     |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.7 Modal Story Shears and Moments            |                                                                                       | 9.5.4.7 Modal Story Shears and Moments            |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.8 Design Values                             |                                                                                       | 9.5.4.8 Design Values                             |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.9 Horizontal Shear Distribution             |                                                                                       | 9.5.4.9 Horizontal Shear Distribution             |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.10 Foundation Overturning                   |                                                                                       | 9.5.4.10 Foundation Overturning                   |  | Identical                                                                                                                  |  | Equivalent            |
| 5.4.11 P-Delta Effects                          |                                                                                       | 9.5.4.11 P-Delta Effects                          |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5 SOIL-STRUCTURE INTERACTION EFFECTS          |                                                                                       | 9.5.5 Soil Structure Interaction                  |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5.1 General                                   |                                                                                       | 9.5.5.1 General                                   |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5.2 Equivalent Lateral Force Procedure        |                                                                                       | 9.5.5.2 Equivalent Lateral Force Procedure        |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5.2.1 Base Shear                              |                                                                                       | 9.5.5.2.1 Base Shear                              |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5.2.1.1 Effective Building Period             |                                                                                       | 5.5.2.1.1 Effective Building Period               |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5.2.1.2 Effective Damping                     | The effective damping .... The values of $\beta_0$ corresponding to $A_v = 0.15$ .... | 9.5.5.2.1.2 Effective Damping                     |  | Identical except that the term $A_v$ was replaced by 0.4 $S_{DS}$ , correcting an editorial error in the NEHRP Provisions. |  | Equivalent            |
| 5.5.2.2 Vertical Distribution of Seismic Forces |                                                                                       | 9.5.5.2.2 Vertical Distribution of Seismic Forces |  | Identical                                                                                                                  |  | Equivalent            |
| 5.5.2.3 Other Effects                           |                                                                                       | 9.5.5.2.3 Other Effects                           |  | Identical                                                                                                                  |  | Equivalent            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                |                                  |           |            |
|--------------------------------|----------------------------------|-----------|------------|
| 5.5.3 Modal Analysis Procedure | 9.5.5.3 Modal Analysis Procedure |           |            |
| 5.5.3.1 Modal Base Shears      | 9.5.5.3.1 Modal Base Shears      | Identical | Equivalent |
| 5.5.3.2 Other Modal Effects    | 9.5.5.3.2 Other Modal Effects    | Identical | Equivalent |
| 5.5.3.3 Design Values          | 9.5.5.3.3 Design Values          | Identical | Equivalent |
|                                |                                  |           |            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                                            |                                                                                                                                                                                                                                                                                                                                                                                     | 1998 ASCE 7                                                                 |                                                                           | Comments              |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------|
| Section                                                               | Provision                                                                                                                                                                                                                                                                                                                                                                           | Section                                                                     | Provision                                                                 |                       |
| <b>6 ARCHITECTURE, MECHANICAL, AND ELECTRICAL DESIGN REQUIREMENTS</b> |                                                                                                                                                                                                                                                                                                                                                                                     | <b>9.6 ARCHITECTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS AND SYSTEMS</b> |                                                                           |                       |
| <b>6.1 GENERAL</b>                                                    |                                                                                                                                                                                                                                                                                                                                                                                     | <b>9.6.1 GENERAL</b>                                                        | Identical                                                                 | Equivalent            |
| 6.1.1 References and Standards                                        |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.1 References Standards                                                | Identical                                                                 | Equivalent            |
| 6.1.1.1 Consensus Standards                                           |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.1.1 Consensus Standards                                               |                                                                           |                       |
| 6.1.1.2 Accepted Standards                                            |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.1.2 Accepted Standards                                                |                                                                           |                       |
| <b>6.1.2 Component Force Transfer</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                     | <b>9.6.1.2 Component Force Transfer</b>                                     | Identical                                                                 | Equivalent            |
| <b>6.1.3 Seismic Forces</b>                                           |                                                                                                                                                                                                                                                                                                                                                                                     | <b>9.6.1.3 Seismic Forces</b>                                               | Identical                                                                 | Equivalent            |
| <b>6.1.4 Seismic Relative Displacements</b>                           |                                                                                                                                                                                                                                                                                                                                                                                     | <b>9.6.1.4 Seismic Relative Displacements</b>                               | Identical                                                                 | Equivalent            |
| <b>6.1.5 Component Importance Factor</b>                              |                                                                                                                                                                                                                                                                                                                                                                                     | <b>9.6.1.5 Component Importance Factor</b>                                  | Identical                                                                 | Equivalent            |
| <b>6.1.6 Component Anchorage</b>                                      | Components shall be anchored in accordance with the following provisions.                                                                                                                                                                                                                                                                                                           | <b>9.6.1.6 Component Anchorage</b>                                          | Identical to NEHRP except for the deletion of second sentence in 6.1.6.1. | Considered equivalent |
| 6.1.6.1                                                               | 6.1.6.1: The force in the connected part shall be determined based on the prescribed forces for the component specified in Sec. 6.1.3. Where component anchorage is provided by expansion anchors, shallow chemical anchors or shallow (low deformability) cast-in-place anchors, a value of $R_p = 1.5$ shall be used in Sec. 6.1.3 to determine the forces in the connected part. | 9.6.1.6.1                                                                   |                                                                           |                       |
| 6.1.6.2                                                               |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.6.2                                                                   |                                                                           |                       |
| 6.1.6.3                                                               |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.6.3                                                                   |                                                                           |                       |
| 6.1.6.4                                                               |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.6.4                                                                   |                                                                           |                       |
| 6.1.6.5                                                               |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.6.5                                                                   |                                                                           |                       |
| 6.1.6.6                                                               |                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.1.6.6                                                                   |                                                                           |                       |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                            |                                                                                                                                                                                                                                                                                 |                                                              |           |                                                                                     |                             |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------|-----------------------------|
| 6.1.6.7                                                    | For additional requirements for anchors to steel, see Chapter 10                                                                                                                                                                                                                |                                                              |           | No specific corresponding provisions in Chapter 9.6                                 | Does not affect equivalency |
| 6.1.6.8                                                    | For additional requirements for anchors to masonry, see Chapter 11                                                                                                                                                                                                              |                                                              |           |                                                                                     |                             |
| 6.1.6.9                                                    | For additional requirements for anchors to wood, see Chapter 12                                                                                                                                                                                                                 |                                                              |           |                                                                                     |                             |
| 6.1.7 Construction Documents                               | Construction documents shall be prepared by a registered design professional in a manner consistent with the requirements of these <i>Provisions</i> , as indicated in Table 6.1.7, in sufficient detail for use by the owner, building officials, contractors, and inspectors. | 9.6.1.7 Construction Documents                               |           | Essentially identical; the word "registered professional" is not specifically used. | Equivalent                  |
| 6.2 ARCHITECTURAL COMPONENT DESIGN                         |                                                                                                                                                                                                                                                                                 | 9.6.2 Architectural Component Design                         |           |                                                                                     |                             |
| 6.2.1 General                                              |                                                                                                                                                                                                                                                                                 | 9.6.2.1 General                                              | Identical |                                                                                     | Equivalent                  |
| 6.2.2 Architectural Component Forces and Displacements     |                                                                                                                                                                                                                                                                                 | 9.6.2.2 Architectural Component Forces and Displacements     | Identical |                                                                                     | Equivalent                  |
| 6.2.3 Architectural Component Deformation                  |                                                                                                                                                                                                                                                                                 | 9.6.2.3 Architectural Component Deformation                  | Identical |                                                                                     | Equivalent                  |
| 6.2.4 Exterior Nonstructural Wall Elements and Connections |                                                                                                                                                                                                                                                                                 | 9.6.2.4 Exterior Nonstructural Wall Elements and Connections | Identical |                                                                                     | Equivalent                  |
| 6.2.5 Out-of-Plane Bending                                 |                                                                                                                                                                                                                                                                                 | 9.6.2.5 Out-of-Plane Bending                                 | Identical |                                                                                     | Equivalent                  |
| 6.2.6 Suspended Ceilings                                   |                                                                                                                                                                                                                                                                                 | 9.6.2.6 Suspended Ceilings                                   | Identical |                                                                                     | Equivalent                  |
| 6.2.6.1 Seismic Forces                                     |                                                                                                                                                                                                                                                                                 | 9.6.2.6.1 Seismic Forces                                     | Identical |                                                                                     | Equivalent                  |
| 6.2.6.2 Industry Standard Construction                     |                                                                                                                                                                                                                                                                                 | 9.6.2.6.2 Industry Standard Construction                     | Identical |                                                                                     | Equivalent                  |
| 6.2.6.2.1 Seismic Design Category C                        |                                                                                                                                                                                                                                                                                 | 9.6.2.6.2.1 Seismic Design Category C                        | Identical |                                                                                     | Equivalent                  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                    |                                                                      |                                                                                                                                                                                                                                                                          |                                             |
|--------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 6.2.6.2.2 Seismic Design Categories D, E, and F                    | 9.6.2.6.2.2 Seismic Design Categories D, E, and F                    | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.2.6.3 Integral ceiling/sprinkler construction                    | 9.6.2.6.3 Integral ceiling/sprinkler construction                    | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.2.7 Access Floors                                                | 9.6.2.7 Access Floors                                                | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.2.7.1 General                                                    | 9.6.2.7.1 General                                                    | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.2.7.2 Special Access Floors                                      | 9.6.2.7.2 Special Access Floors                                      | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.2.8 Partitions                                                   | 9.6.2.8 Partitions                                                   | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.2.9 Steel Storage Racks                                          | 9.6.2.9 Steel Storage Racks                                          | Steel storage racks supported at the base of the structure shall be designed to meet the force requirements of Section 9.14. Steel Storage Racks supported above the base of the structure shall be designed to meet the force requirements of Sections 9.6.1 and 9.6.2. | Considered equivalent                       |
| 6.3 MECHANICAL AND ELECTRICAL COMPONENT DESIGN<br>6.3.1 General    | 9.6.3 Mechanical and Electrical Component Design<br>9.6.3.1 General  | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.3.2 Mechanical and Electrical Component Forces and Displacements | 9.6.3.2 Mechanical and Electrical Component Forces and Displacements | ASCE identical to NEHRP, except for the following changes:<br>The $a_p$ and $R_p$ factors in Table 9.6.3.2 have been changed from 1.0 and 3.5 for General Electrical distribution systems (bus ducts, conduit, cable tray) to 2.5 and 5.0, respectively.                 | ASCE provisions are slightly more stringent |
| 6.3.3 Mechanical and Electrical Component Period                   | 9.6.3.3 Mechanical and Electrical Component Period                   | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.3.4 Mechanical and Electrical Component Attachments              | 9.6.3.4 Mechanical and Electrical Component Attachments              | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |
| 6.3.5 Component Supports                                           | 9.6.3.5 Component Supports                                           | Identical                                                                                                                                                                                                                                                                | Equivalent                                  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                           |                                                                                                                                                                                                                        |                              |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 6.3.6 Component Certification                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 9.6.3.6 Component Certification                           | Identical                                                                                                                                                                                                              | Equivalent                   |
| 6.3.7 Utility and Service Lines at Structure Interfaces |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 9.6.3.7 Utility and Service Lines at Structure Interfaces | Identical                                                                                                                                                                                                              | Equivalent                   |
| 6.3.8 Site-Specific Considerations                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 9.6.3.8 Site-Specific Considerations                      | Identical                                                                                                                                                                                                              | Equivalent                   |
| 6.3.9 Storage Tanks                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 9.6.3.9 Storage Tanks                                     | Identical                                                                                                                                                                                                              | Equivalent                   |
| 6.3.10 HVAC Ductwork                                    | Attachments and supports for HVAC ... of this section. In addition to their attachments and supports, ductwork systems designated as having an $I_p > 1.0$ shall be designed to meet the force and displacement requirements of Sec. 6.1.3 and 6.1.4 and the additional requirements of this section. Where HVAC ductwork runs between <i>structures</i> that could displace relative to one another and for isolated <i>structures</i> where the HVAC ductwork crosses the isolation interface, the HVAC ductwork shall be designed to accommodate the seismic relative displacements specified in Sec. 6.1.4. Seismic restraints are ... requirements of Sec. 6.1.3. Appurtenances such as dampers, louvers, and diffusers shall be positively attached with mechanical fasteners. Unbraced piping attached to in-line equipment shall be provided with adequate flexibility to accommodate differential displacements. | 9.6.3.10 HVAC Ductwork                                    | Identical, except for the following changes:<br>1. $I_p > 1.0$ has been changed to $I_p = 1.5$ in ASCE.<br>The two sentences "Where HVAC ... Sec. 6.1.4." and "Appurtenances ... displacements." Were deleted in ASCE. | ASCE slightly less stringent |
| 6.3.11 Piping Systems                                   | Attachments and supports for piping systems shall be designed to meet the force and displacement requirements of Sec. 6.1.3 and 6.1.4 and the additional requirements of this section. In addition to their attachments and supports, piping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9.6.3.11 Piping Systems                                   | Identical, except for the following changes:<br>1. $I_p > 1.0$ has been changed to $I_p = 1.5$ in ASCE.<br>2. The sentence "When piping ... Sec. 6.1.4" has been dropped in ASCE.                                      | ASCE slightly less stringent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                              |                                                                                                                                                                         |                             |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                                            | systems designated as having $I_p$ greater than 1.0 themselves shall be designed to meet the force and displacement provisions of Sec. 6.1.3 and 6.1.4 and the additional requirements of this section. When piping systems are attached to structures that could displace relative to one another and for isolated structures, including foundations, where the piping system crosses the isolation interface, the piping system shall be designed to accommodate the seismic relative displacements specified in Sec. 6.1.4. |                                              |                                                                                                                                                                         |                             |
|                                            | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9.6.3.11.1 Pressure Piping Systems           | Deemed-to-comply provision                                                                                                                                              | Does not affect equivalency |
| 6.3.11.1 Fire Protection Sprinkler Systems | Fire protection sprinkler systems designed and constructed in accordance with Ref. 6-12 shall be deemed to meet the force, displacement, and other requirements of this section provided that the seismic design force and displacement calculated in accordance with Ref. 6-12, multiplied by a factor of 1.4, is not less than that determined using these Provisions.                                                                                                                                                       | 9.6.3.11.2 Fire Protection Sprinkler Systems | "provided that ... using these Provisions." has been replaced with "except the force and displacement requirements of Sections 9.6.1.3 and 9.6.1.4 shall be satisfied." | Considered equivalent       |
| 6.3.11.2 Other Piping Systems              | The following documents have been adopted ... comparable to those determined using these Provisions.<br><b>Exception:</b> Piping systems designated as having an $I_p$ greater than 1.0 shall not be designed using the simplified analysis procedures of Ref. 6-9 (Sec. 919.4.1(a)).<br>The following requirements shall also be met for piping systems designated as having an $I_p$ greater than 1.0                                                                                                                        | 9.6.3.11.3 Other Piping Systems              | The term $I_p > 1.0$ has been replaced by $I_p = 1.5$ in ASCE. In addition, ASCE specifies more requirements for designing other piping systems.                        | ASCE is more stringent.     |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                    |                                                                                                                                                                                                           |                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                 |                              |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 6.3.11.2.1 Supports and Attachments for Other Piping               |                                                                                                                                                                                                           | 9.6.3.11.4 Supports and Attachments for Other Piping                       | Essentially identical, except for the following changes:<br>1. The term $I_p > 1.0$ has been replaced by $I_p = 1.5$ in ASCE.<br>2. The term "high deformability" of NEHRP has been replaced by "ductile" in ASCE.<br>3. In addition, ASCE specifies that seismic supports are not required for ductile piping in SDCs A, B, or C designated as having an $I_p = 1.0$ and a nominal pipe size of 6 in. or less. | Considered equivalent        |
| 6.3.12 Boilers and Pressure Vessels                                |                                                                                                                                                                                                           | 9.6.3.12 Boilers and Pressure Vessels                                      | Identical                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent                   |
| 6.3.12.1 ASME Boilers and Pressure Vessels                         |                                                                                                                                                                                                           | 9.6.3.12.1 ASME Boilers and Pressure Vessels                               | Identical                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent                   |
| 6.3.12.2 Other Boilers and Pressure Vessels                        |                                                                                                                                                                                                           | 9.6.3.12.2 Other Boilers and Pressure Vessels                              | Identical                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent                   |
| 6.3.12.3 Supports and Attachments for Boilers and Pressure Vessels |                                                                                                                                                                                                           | 9.6.3.12.3 Supports and Attachments for Other Boilers and Pressure Vessels | Identical                                                                                                                                                                                                                                                                                                                                                                                                       | Equivalent                   |
| 6.3.13 Mechanical Equipment, Attachments, and Supports             |                                                                                                                                                                                                           | 9.6.3.13 Mechanical Equipment, Attachments, and Supports                   | Identical, except that the term " $I_p > 1.0$ " of NEHRP has been replaced by " $I_p = 1.5$ " in ASCE.                                                                                                                                                                                                                                                                                                          | Equivalent                   |
| 6.3.13.1 Mechanical Equipment                                      |                                                                                                                                                                                                           | 9.6.3.13.1 Mechanical Equipment                                            | Essentially identical except that the term " $I_p > 1.0$ " of NEHRP has been replaced by " $I_p = 1.5$ " in ASCE.                                                                                                                                                                                                                                                                                               | Equivalent                   |
| 6.3.13.2 Attachments and Supports for Mechanical Equipment         |                                                                                                                                                                                                           | 9.6.3.13.2 Attachments and Supports for Mechanical Equipment               | Essentially identical, except that one more requirement is specified in ASCE as given below:<br>Drilled and grouted-in-place anchors for tensile load applications shall use either expansive cement or expansive epoxy grout.                                                                                                                                                                                  | ASCE slightly more stringent |
| 6.13.14 Electrical Equipment, Attachments, and Supports            | Attachments and supports for electrical equipment shall be designed to meet the force and displacement requirements of Sec. 6.1.3 and 6.1.4 and the additional requirements of this section. In addition, | 9.6.13.14 Electrical Equipment, Attachments, and Supports                  | Identical except for the following changes:<br>1. The term " $I_p > 1.0$ " of NEHRP has been replaced by " $I_p = 1.5$ " in ASCE.<br>2. The last sentence "When conduit, cable ... Sec. 6.1.4," of NEHRP has been deleted in                                                                                                                                                                                    | ASCE slightly more stringent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                              |                                                                                                                                                                                                                                                                                                   |                        |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                            | <p>electrical equipment designated as having <math>I_p</math> greater than 1.0 shall itself be designed to meet the force and displacement requirements of Sec. 6.1.3 and 6.1.4 and the additional requirements of this section.</p> <p>Seismic effects that shall be considered in the design of other electrical equipment include the dynamic effects of the equipment, its contents, and when appropriate its supports. The interaction between the equipment and the supporting <i>structures</i>, including other mechanical and electrical equipment, shall also be considered. When conduit, cable trays, or similar electrical distribution components are attached to <i>structures</i> that could displace relative to one another and for isolated <i>structures</i> where the conduit or cable trays cross the isolation interface, the conduit or cable trays shall be designed to accommodate the seismic relative displacements specified in Sec. 6.1.4.</p> |                                                              | ASCE.                                                                                                                                                                                                                                                                                             |                        |
| 6.3.14.1 Electrical Equipment                              | <p>Electrical equipment designated as having an <math>I_p</math> greater than 1.0 shall meet the following requirements:</p> <ul style="list-style-type: none"> <li>a. Provisions shall be made to eliminate seismic impact between the equipment and other components.</li> <li>b.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.6.3.14.1 Electrical Equipment                              | <p>Identical, except for the following changes:</p> <ol style="list-style-type: none"> <li>1. The term "<math>I_p &gt; 1.0</math>" of NEHRP has been replaced by "<math>I_p = 1.5</math>" in ASCE.</li> <li>2. The sub-section "a" of NEHRP has been replaced by two new sub-sections.</li> </ol> | ASCE is more stringent |
| 6.3.14.2 Attachments and Supports for Electrical Equipment |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9.6.3.14.2 Attachments and Supports for Electrical Equipment | Identical                                                                                                                                                                                                                                                                                         | Equivalent             |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                     |                                                                         |           |            |
|---------------------------------------------------------------------|-------------------------------------------------------------------------|-----------|------------|
| 6.3.15 Alternative Seismic Qualification Methods                    | 9.6.3.15 Alternative Seismic Qualification Methods                      | Identical | Equivalent |
| 6.3.16 Elevator Design Requirements                                 | 9.6.3.16 Elevator Design Requirements<br>9.6.3.16.1 Reference documents | Identical | Equivalent |
| 6.3.16.1 Elevators and Hoistway Structural System                   | 9.6.3.16.2 Elevators and Hoistway Structural System                     | Identical | Equivalent |
| 6.3.16.2 Elevator Machinery and Controller Supports and Attachments | 9.6.3.16.3 Elevator Machinery and Controller Supports and Attachments   | Identical | Equivalent |
| 6.3.16.3 Seismic Controls                                           | 9.6.3.16.4 Seismic Controls                                             | Identical | Equivalent |
| 6.3.16.4 Retainer Plates                                            | 9.6.3.16.5 Retainer Plates                                              | Identical | Equivalent |
|                                                                     |                                                                         |           |            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1998 ASCE 7                                                        |                                                                                                                                                                                                                                                                                                                                                                        | Comments                                                         |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Section                                    | Provision                                                                                                                                                                                                                                                                                                                                                                                                                            | Section                                                            | Provision                                                                                                                                                                                                                                                                                                                                                              |                                                                  |
| <b>7 FOUNDATION DESIGN REQUIREMENTS</b>    |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>9.7 FOUNDATION DESIGN REQUIREMENTS</b>                          |                                                                                                                                                                                                                                                                                                                                                                        |                                                                  |
| 7.1 GENERAL                                |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.1 General                                                      | Identical                                                                                                                                                                                                                                                                                                                                                              | Equivalent                                                       |
| 7.2 STRENGTH OF COMPONENTS AND FOUNDATIONS |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.3 SDC B                                                        |                                                                                                                                                                                                                                                                                                                                                                        |                                                                  |
| 7.2.1 Structural Materials                 |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.3.1 Structural Components                                      | Identical                                                                                                                                                                                                                                                                                                                                                              | Equivalent                                                       |
| 7.2.2 Soil Capacities                      |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.3.2 Soil Capacities                                            | Identical                                                                                                                                                                                                                                                                                                                                                              | Equivalent                                                       |
| 7.3 SEISMIC DESIGN CATEGORIES A AND B      | Any construction meeting the requirements of Sec. 7.1 and 7.2 is permitted to be used for <i>structures</i> assigned to <i>Seismic Design Category A</i> or <i>B</i> .                                                                                                                                                                                                                                                               | 9.7.2 Seismic Design Category A<br>9.7.3 Seismic Design Category B | There are no special requirements for the foundations of structures assigned to Category A<br>The determination of site coefficient (Section 9.4.1.2.4) shall be documented and the resisting capacities of the foundations, subjected to the prescribed seismic forces of sections 9.1 through 9.9, shall meet the following requirements (i.e., 9.7.3.1 and 9.7.3.2) | ASCE less stringent for SDC A<br>Considered equivalent for SDC B |
| 7.4 SEISMIC DESIGN CATEGORY C              |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.4 SEISMIC DESIGN CATEGORY C                                    | Identical                                                                                                                                                                                                                                                                                                                                                              | Equivalent                                                       |
| 7.4.1 Investigation                        |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.4.1 Investigation                                              | Identical                                                                                                                                                                                                                                                                                                                                                              | Equivalent                                                       |
| 7.4.2 Pole-Type Structures                 |                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.7.4.2 Pole-Type Structures                                       | Identical                                                                                                                                                                                                                                                                                                                                                              | Equivalent                                                       |
| 7.4.3 Foundation Ties                      | Individual pile caps, drilled piers, or caissons shall be interconnected by ties. All ties shall be capable of carrying, in tension or compression, a force equal to the product of the larger pile cap or column load times $S_{DS}$ divided by 4 unless it can be demonstrated that equivalent restraint can be provided by <i>reinforced concrete beams</i> within slabs on grade or <i>reinforced concrete slabs</i> on grade or | 9.7.4.3 Foundation Ties                                            | Identical, except that minimum tie strength is larger pile cap or column load times $S_{DS}/10$ , rather than $S_{DS}/4$ , as in NEHRP. Although this would appear to be less conservative, it is in fact a correction of error. $C_u/4$ of 1994 NEHRP should have translated into $S_{DS}/10$ , rather than $S_{DS}/4$ .                                              | Equivalent                                                       |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                     | confinement by competent rock, hard cohesive soils, very dense granular soils, or other approved means.                                                                                                                                                                                                                                         |                                                       |                                                                                                                                                                                                                                                                                                    |  |                       |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------|
| 7.4.4 Special Pile Requirements                     |                                                                                                                                                                                                                                                                                                                                                 | A9.7.4.4 Special Pile Requirements for Category C     | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.4.4.1 Uncased Concrete Piles                      |                                                                                                                                                                                                                                                                                                                                                 | A9.7.4.4.1 Uncased Concrete Piles                     | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.4.4.2 Metal-Cased Concrete Piles                  |                                                                                                                                                                                                                                                                                                                                                 | A9.7.4.4.2 Metal-Cased Concrete Piles                 | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.4.4.3 Concrete-Filled Pipe                        |                                                                                                                                                                                                                                                                                                                                                 | A9.7.4.4.3 Concrete-Filled Pipe                       | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.4.4.4 Precast Concrete Piles                      |                                                                                                                                                                                                                                                                                                                                                 | A9.7.4.4.4 Precast Concrete Piles                     | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.4.4.5 Precast-Prestressed Piles                   | The upper 2 ft (0.6 m) of the pile shall have No. 3 ties minimum at not over 4-in. (102 mm) spacing or equivalent spirals. The pile cap connection is permitted to be by means of dowels as required in Sec. 7.4.4.. Pile cap connection is permitted to be by means of developing pile reinforcing strand if a ductile connection is provided. | A9.7.4.4.5 Precast-Prestressed Piles                  | IBC deleted the sentence "The upper ... spirals". The ASCE requires a minimum volumetric ratio of spiral reinforcement in the ductile region.                                                                                                                                                      |  | Considered equivalent |
| 7.5 Seismic Design Categories D, E, and F           |                                                                                                                                                                                                                                                                                                                                                 | 9.7.5 Seismic Design Categories D, E, and F           | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.5.1 Investigation                                 |                                                                                                                                                                                                                                                                                                                                                 | 9.7.5.1 Investigation                                 | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.5.2 Foundation Ties                               |                                                                                                                                                                                                                                                                                                                                                 | 9.7.5.2 Foundation Ties                               | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.5.3 Liquefaction Potential and Soil Strength Loss |                                                                                                                                                                                                                                                                                                                                                 | 9.7.5.3 Liquefaction Potential and Soil Strength Loss | Identical; in addition specifies that "Where deemed appropriate by the authority having jurisdiction, a site specific geotechnical report is not required when prior evaluations of nearby sites with similar soil conditions provide sufficient direction relative to the proposed construction." |  | Considered equivalent |
| 7.5.4 Special Pile Requirements                     |                                                                                                                                                                                                                                                                                                                                                 | 9.7.5.4 Special Pile Requirements                     | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |
| 7.5.4.1 Uncased                                     |                                                                                                                                                                                                                                                                                                                                                 | A9.7.5.4.1 Uncased                                    | Identical                                                                                                                                                                                                                                                                                          |  | Equivalent            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Concrete Piles                     |                                                                                                                                                                                                                                                                                                  | Concrete Piles                        |                                                                                              |                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------|------------------------|
| 7.5.4.2 Metal-Cased Concrete Piles |                                                                                                                                                                                                                                                                                                  | A9.7.5.4.2 Metal-Cased Concrete Piles | Identical                                                                                    | Equivalent             |
| 7.5.4.3 Precast Concrete Piles     |                                                                                                                                                                                                                                                                                                  | A9.7.5.4.3 Precast Concrete Piles     | Identical                                                                                    | Equivalent             |
| 7.5.4.4 Precast-Prestressed Piles  | For the body of fully embedded foundation piling subjected to vertical loads only, or where the design bending moment does not exceed $0.20M_{nb}$ , spiral reinforcing shall be provided such that $\rho_s \geq 0.006$ .<br>Pile cap connection shall not be made by developing exposed strand. | A9.7.5.4.4 Precast-Prestressed Piles  | The provisions of NEHRP deleted. Instead, ASCE gives more elaborate and specific provisions. | ASCE is more stringent |
| 7.5.4.5 Steel Piles                |                                                                                                                                                                                                                                                                                                  | A9.7.5.4.5 Steel Piles                | Identical                                                                                    | Equivalent             |
|                                    |                                                                                                                                                                                                                                                                                                  |                                       |                                                                                              |                        |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                    |                             | 1998 ASCE 7                                                                                                                                              |                                                                                                                 | Comments                            |
|-----------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Section                                       | Provision                   | Section                                                                                                                                                  | Provision                                                                                                       |                                     |
| <b>8. STEEL STRUCTURE DESIGN REQUIREMENTS</b> |                             | <b>9.8. STEEL</b>                                                                                                                                        |                                                                                                                 |                                     |
| 8.1 REFERENCE DOCUMENTS                       |                             | 9.8.1 Reference Documents                                                                                                                                | Identical except that Supplement I dated 1999 to NEHRP Ref. 8-3 (AISC Seismic) have been adopted into the ASCE. | ASCE is more up-to-date, equivalent |
|                                               | No corresponding provisions | A.9.8.1 General<br>A.9.8.1.1 Structural Steel by Strength Design<br>A.9.8.1.2 Allowable Stress Design<br>A.9.8.1.3 Structural Steel Seismic Requirements |                                                                                                                 | Does not affect equivalency         |
| 8.2 SEISMIC REQUIREMENTS FOR STEEL STRUCTURES |                             | A.9.8.2 Seismic Requirements For Steel Structures                                                                                                        | Essentially identical                                                                                           | Equivalent                          |
| 8.3 SEISMIC DESIGN CATEGORIES A, B, and C     |                             | A.9.8.3 Seismic Design Categories A, B, And C                                                                                                            | Identical                                                                                                       | Equivalent                          |
| 8.4 SEISMIC DESIGN CATEGORIES D, E, and F     |                             | A.9.8.4 Seismic Design Categories D, E, And F                                                                                                            | Identical                                                                                                       | Equivalent                          |
| 8.5 COLD-FORMED STEEL SEISMIC REQUIREMENTS    |                             | A.9.8.5 Cold-Formed Steel Seismic Requirements                                                                                                           | Identical                                                                                                       | Equivalent                          |
| 8.5.1 Modifications to Ref. 8-4               |                             | A.9.8.5.1 Modifications To Ref. 9.8-4                                                                                                                    | Identical                                                                                                       | Equivalent                          |
| 8.5.2 Modifications Ref. 8-5                  |                             | A.9.8.5.2 Modifications Ref. 9.8-5                                                                                                                       | Identical                                                                                                       | Equivalent                          |
| 8.6 LIGHT-FRAMED WALLS                        |                             | A.9.8.6 Light-Framed Walls                                                                                                                               | Identical                                                                                                       | Equivalent                          |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                    |  |                                                        |           |            |
|----------------------------------------------------|--|--------------------------------------------------------|-----------|------------|
| 8.6.1 Boundary Members                             |  | A.9.8.6.1 Boundary Members                             | Identical | Equivalent |
| 8.6.2 Connections                                  |  | A.9.8.6.2 Connections                                  | Identical | Equivalent |
| 8.6.3 Braced Bay Members                           |  | A.9.8.6.3 Braced Bay Members                           | Identical | Equivalent |
| 8.6.4 Diagonal Braces                              |  | A.9.8.6.4 Diagonal Braces                              | Identical | Equivalent |
| 8.6.5 Shear Walls                                  |  | A.9.8.6.5 Shear Walls                                  | Identical | Equivalent |
| 8.7 SEISMIC REQUIREMENTS FOR STEEL DECK DIAPHRAGMS |  | A.9.8.7 Seismic Requirements For Steel Deck Diaphragms | Identical | Equivalent |
| 8.8 STEEL CABLES                                   |  | A.9.8.8 Steel Cables                                   | Identical | Equivalent |
|                                                    |  |                                                        |           |            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                                    |                                                                                                           | 1998 ASCE 7                                                     |                                                                                                                                                         | Comments                                 |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Section                                                       | Provision                                                                                                 | Section                                                         | Provision                                                                                                                                               |                                          |
| <b>9 CONCRETE STRUCTURE DESIGN REQUIREMENTS</b>               |                                                                                                           | <b>9.9 STRUCTURAL CONCRETE</b>                                  |                                                                                                                                                         |                                          |
| 9.1 REFERENCE DOCUMENTS                                       | ACI 318-95, excluding Appendix A, is adopted by reference, subject to modifications made in this chapter. | 9.9.1 Reference Documents                                       | ACI 318-99, excluding Appendix A, is adopted by reference, subject to modifications made in this chapter.                                               | ASCE is up-dated. Considered equivalent. |
| 9.1.1 Modifications to Ref. 9-1                               |                                                                                                           | A.9.9.1.1 Modifications to Ref. 9.9-1                           |                                                                                                                                                         |                                          |
|                                                               | No corresponding provision                                                                                | A.9.9.1.1 Modifications to ACI Sec. 8.1.2                       | Permits use of Alternate Design Method for non-seismic design of nonprestressed reinforced concrete members.                                            | Has no appreciable effect on equivalency |
| 9.1.1.1 Modifications to ACI Sec. 9.2.3                       |                                                                                                           | A.9.9.1.2 Modifications to ACI Sec. 9.2.3                       | Identical                                                                                                                                               | Equivalent                               |
| 9.1.1.2 Modifications to ACI Sec. 21.0                        |                                                                                                           | A.9.9.1.3 Modifications to ACI Sec. 21.0                        | Adds fewer notations to ACI 318-99 (as most are already part of ACI 318-99)                                                                             | Equivalent                               |
| 9.1.1.3 Modifications to ACI Sec. 21.1                        |                                                                                                           | A.9.9.1.4 Modifications to ACI Sec. 21.1                        | Essentially identical                                                                                                                                   | Equivalent                               |
| 9.1.1.4 Modifications to ACI Sec. 21.2.1.3 and 21.2.1.4       | Replace Sec. 21.2.1.3 and 21.2.1.4 with the requirements of Sec. 9.4 through 9.7.                         |                                                                 | No such modifications in ASCE. Have become unnecessary in view of changes made in ACI 318-99.                                                           | Does not affect equivalency              |
| 9.1.1.5 Additions to ACI Sec. 21.2.1.6 and 21.2.1.7           |                                                                                                           | A.9.9.1.5 Additions to ACI Sec. 21.2.1.6 and 21.2.1.7           | Essentially identical                                                                                                                                   | Equivalent                               |
| 9.1.1.6 Additions to ACI Sec. 21.2.2.5, 21.2.2.6 and 21.2.2.7 |                                                                                                           | A.9.9.1.6 Additions to ACI Sec. 21.2.2.5, 21.2.2.6 and 21.2.2.7 | Essentially identical                                                                                                                                   | Equivalent                               |
| 9.1.1.7 Modifications to ACI Sec. 21.2.5.1                    |                                                                                                           | A.9.9.1.7 Modifications to ACI Sec. 21.2.5.1                    | Essentially identical                                                                                                                                   | Equivalent                               |
| 9.1.1.8 Modifications to ACI Sec. 21.2.6.1                    | Makes modifications to splicing requirements of Section 21.2.6.1 of ACI 318-95.                           |                                                                 | Sections 21.2.6 and 21.2.7 of ACI 318-99 have new provisions for mechanical and welded splices, respectively, which make this modification unnecessary. | ASCE is more stringent                   |
| 9.1.1.9 Additions to ACI Sec. 21.2                            |                                                                                                           | A.9.9.1.8 Additions to ACI Sec. 21.2                            | Essentially identical                                                                                                                                   | Equivalent                               |
| 9.1.1.10 Additions to                                         | Makes a modification to the design axial                                                                  |                                                                 | This modification was considered and found to be                                                                                                        | Does not affect                          |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| ACI Sec. 21.4.5.3                                     | strength requirement for columns of Section 21.4.5.3 of ACI 318-95 - a modification taken from the 1997 UBC                   |                                                                          | unnecessary and unwarranted by ACI 318. So it was not included in ACI 318-99.                                                                          | equivalency                                               |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 9.1.1.11 Change in ACI Sec. 21.6.3                    | Requires use of strength design load combinations of ASCE 7-95 in seismic design of concrete structures.                      |                                                                          | Requires use of strength design load combinations of ASCE 7-98 in seismic design of concrete structures.                                               | ASCE has updated requirements, equivalent                 |
| 9.1.1.12 Modifications to ACI Sec. 21.6.4.1           | Makes modifications to diaphragm design requirements of Section 21.6.4 of ACI 318-95                                          |                                                                          | This provision is not needed since Section 21.7 of ACI 318-99 includes updated diaphragm design provisions.                                            | ASCE is more stringent                                    |
| 9.1.1.13 Modifications to ACI Sec. 21.6.6             | Design of shear walls for flexure and axial loads is changed from the procedure of ACI 318-95 to essentially that of 1997 UBC |                                                                          | Section 21.6 of ACI 318-99 has updated shearwall design provisions which make this modification unnecessary.                                           | Equivalent                                                |
| 9.1.1.14 Additions to ACI Sec. 21.6.7                 | Adds design requirements for coupling beams to ACI 318-95.                                                                    |                                                                          | Coupling beam design requirements have been added to Section 21.6 of ACI 318-99, making this modification unnecessary.                                 | Equivalent                                                |
| 9.1.1.15 Modifications to ACI Sec. 21.7.1             | Modifies the requirements of ACI 318-95 Section 21.7 for frame members assumed not to contribute to lateral resistance.       |                                                                          | The NEHRP modifications are now unnecessary, in view of changes made in Section 21.9 of ACI 318-99.                                                    | Equivalent                                                |
| 9.1.1.16 Modifications to ACI Sec. 21.8               | Change the title of Sec. 21.8 to read: "Requirements for Intermediate Moment Frames."                                         |                                                                          | Section 21.10 of ACI 318-99 is titled: "Requirements for Intermediate Moment Frames," meaning this modification unnecessary.                           | Equivalent                                                |
|                                                       | No corresponding requirement                                                                                                  | A.9.9.1.9 Additions to ACI Sec. 21.6                                     | Gives design requirements for wall piers and wall segments that are taken from UBC 1997 and are not part of ACI 318-99.                                | ASCE is more restrictive                                  |
|                                                       | No corresponding requirement                                                                                                  | A.9.9.1.10 Modifications to ACI Sec. 21.9.2.2                            | Lap splices in gravity columns are not required to be restricted to the middle half of the column height.                                              | ASCE is slightly less restrictive, but justifiably so.    |
| 9.2 BOLTS AND HEADED STUD ANCHORS IN CONCRETE         | Gives strength design provisions for headed bolts and headed stud anchors cast in concrete                                    | A.9.9.6 Bolts and Headed Stud Anchors in Concrete                        | Contains completely different provisions, based on what would have been Appendix D to ACI 318-99. These provisions are part of IBC 2000.               | Equivalency cannot be judged without comparative designs. |
| 9.3 CLASSIFICATION OF SEISMIC-FORCE-RESISTING SYSTEMS |                                                                                                                               | 1910 SEISMIC DESIGN PROVISIONS<br>1910.2 Classification of seismic force | Identical, except that Sections 9.3.1.1.1 and 9.3.1.1.2, modifying definition of ordinary moment frame, are part of 1910.3 (Seismic Design Category B) | ASCE is slightly less restrictive                         |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                  |  | resisting systems                                  |                                                                                                                                   |                             |
|--------------------------------------------------|--|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 9.3.1 Classification of Moment Frames            |  | A.9.9.3 SDC B                                      |                                                                                                                                   |                             |
| 9.3.1.1 Ordinary Moment Frames                   |  | A.9.9.3.1 Ordinary Moment Frames                   | Identical                                                                                                                         | Equivalent                  |
| 9.3.1.2 Intermediate Moment Frames               |  |                                                    | No explicit provisions, unnecessary                                                                                               | Does not affect equivalency |
| 9.3.1.2 Special Moment Frames                    |  |                                                    | No explicit provisions, unnecessary                                                                                               | Does not affect equivalency |
| 9.3.2 Classification of Shear Walls              |  | A.9.9.2 Classification of Shear Walls              |                                                                                                                                   |                             |
| 9.3.2.1 Ordinary Plain Concrete Shear Walls      |  | A.9.9.2.1 Ordinary Plain Concrete Shear Walls      | Essentially identical                                                                                                             | Equivalent                  |
| 9.3.2.2 Detailed Plain Concrete Shear Walls      |  | A.9.9.2.2 Detailed Plain Concrete Shear Walls      | Essentially identical except that the provision of maximum spacing of 4 ft. for vertical reinforcement in NEHRP has been dropped. | ASCE less stringent         |
| 9.3.2.3 Ordinary Reinforced Concrete Shear Walls |  | A.9.9.2.3 Ordinary Reinforced Concrete Shear Walls | Essentially identical                                                                                                             | Equivalent                  |
| 9.3.2.4 Special Reinforced Concrete Shear Walls  |  | A.9.9.2.4 Special Reinforced Concrete Shear Walls  | Essentially identical                                                                                                             | Equivalent                  |
| 9.4 SEISMIC DESIGN CATEGORY A                    |  |                                                    | No explicit provision for SDC A                                                                                                   | Does not affect equivalency |
| 9.5 SEISMIC DESIGN CATEGORY B                    |  | A.9.9.3 Seismic Design Category B                  | Identical                                                                                                                         | Equivalent                  |
| 9.5.1 Moment Frames                              |  |                                                    | No such provision, unnecessary                                                                                                    | Equivalent                  |
| 9.6 SEISMIC DESIGN CATEGORY C                    |  | A.9.9.4 Seismic Design Category C                  | Identical                                                                                                                         | Equivalent                  |
| 9.6.1 Seismic-Force-Resisting Systems            |  | A.9.9.4.1 Seismic-Force-Resisting Systems          | Detailed plain concrete walls are not allowed as part of seismic force resisting system, while NEHRP allows such usage.           | ASCE is more restrictive    |
| 9.6.1.1 Moment Frames                            |  |                                                    |                                                                                                                                   |                             |
| 9.6.1.2 Shear Walls                              |  |                                                    |                                                                                                                                   |                             |
| 9.6.2 Discontinuous                              |  | A.9.9.4.2                                          | Essentially identical                                                                                                             | Equivalent                  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Members                                                                                                    | Discontinuous Members                                                               |                                                                                                                                                                  |                                 |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 9.6.3 Plain Concrete                                                                                       | A9.9.4.4 Plain Concrete                                                             | Essentially identical                                                                                                                                            | Equivalent                      |
| 9.6.3.1 Walls                                                                                              | A9.9.4.4.1 Walls                                                                    | Structural plain concrete walls (which are permitted in NEHRP) are not permitted in structures assigned to SDC C, but for certain exceptions.                    | ASCE is more restrictive        |
| 9.6.3.2 Footings                                                                                           | A9.9.4.4.2 Footings                                                                 | Identical with following differences:<br>1. Addition of Exception 2 to Paragraph 2.<br>2. Addition of requirements for footing which exceeds 8 in. in thickness. | ASCE is slightly more stringent |
| 9.6.3.3 Pedestals                                                                                          | A9.9.4.4.3 Pedestals                                                                | Identical                                                                                                                                                        | Equivalent                      |
| 9.7 SEISMIC DESIGN CATEGORIES D, E, OR F                                                                   | A.9.9.5 Seismic Design Categories D, E, or F                                        | Essentially identical                                                                                                                                            | Equivalent                      |
| 9.7.1 Seismic-Force-Resisting Systems<br>9.7.1.1 Moment Frames<br>9.7.1.2 Shear Walls                      | A.9.9.5.1 Seismic-Force-Resisting Systems                                           | Essentially identical                                                                                                                                            | Equivalent                      |
| 9.7.2 Frame members Not Proportioned to Resist Forces Induced by Earthquake Motions                        | 9.7.2 Frame members Not Proportioned to Resist Forces Induced by Earthquake Motions | Essentially identical                                                                                                                                            | Equivalent                      |
| 9.7.3 Plain Concrete                                                                                       |                                                                                     | No corresponding provision, unnecessary, already part of ACI 318-99.                                                                                             | Equivalent                      |
| Appendix to Chapter 9 REINFORCED CONCRETE STRUCTURAL SYSTEMS COMPOSED FROM INTERCONNECTED PRECAST ELEMENTS |                                                                                     | The provisions of this appendix are not included in the ASCE.                                                                                                    | Equivalency cannot be judged    |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Section                                                                                                                               | 1997 NEHRP |         | 1998 ASCE 7                 |         | Comments                        |
|---------------------------------------------------------------------------------------------------------------------------------------|------------|---------|-----------------------------|---------|---------------------------------|
|                                                                                                                                       | Provision  | Section | Provision                   | Section |                                 |
| Chapter 10<br>COMPOSITE STEEL<br>AND CONCRETE<br>STRUCTURE DESIGN<br>REQUIREMENTS<br>10.1 REFERENCE<br>DOCUMENTS<br>10.2 REQUIREMENTS |            |         | No corresponding provisions |         | Equivalency cannot<br>be judged |
|                                                                                                                                       |            |         |                             |         |                                 |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                              |                                                                                                                                                                                                                                                        | 1998 ASCE 7                            |                                                                                                                                                                                                                                                                                                                                                                                     | Comments                            |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Section                                                 | Provision                                                                                                                                                                                                                                              | Section                                | Provision                                                                                                                                                                                                                                                                                                                                                                           |                                     |
| <b>11 MASONRY<br/>STRUCTURE DESIGN<br/>REQUIREMENTS</b> |                                                                                                                                                                                                                                                        | <b>9.11 MASONRY</b>                    |                                                                                                                                                                                                                                                                                                                                                                                     |                                     |
| 11.1 GENERAL                                            |                                                                                                                                                                                                                                                        |                                        |                                                                                                                                                                                                                                                                                                                                                                                     |                                     |
| 11.1.1 Scope                                            |                                                                                                                                                                                                                                                        | 9.11.1 Reference Documents             | Essentially similar                                                                                                                                                                                                                                                                                                                                                                 | Considered equivalent               |
| 11.1.2 Reference Documents                              | ACI 530-95 and ACI 530.1-95 are the primary reference documents.                                                                                                                                                                                       | 9.11.1 Reference Documents             | Primary reference documents updated to ACI 530-99, ACI 530.1-99.                                                                                                                                                                                                                                                                                                                    | Equivalent. ASCE is more up-to-date |
| 11.1.3 Definitions                                      |                                                                                                                                                                                                                                                        | *1.6 Definitions                       | Essentially similar                                                                                                                                                                                                                                                                                                                                                                 | Considered equivalent               |
| 11.1.4 Notations                                        |                                                                                                                                                                                                                                                        | *1.5 Definitions                       | Essentially similar                                                                                                                                                                                                                                                                                                                                                                 | Considered equivalent               |
| <b>11.2 CONSTRUCTION<br/>REQUIREMENTS</b>               |                                                                                                                                                                                                                                                        |                                        |                                                                                                                                                                                                                                                                                                                                                                                     |                                     |
| 11.2.1 General                                          | Per the requirements of ACI 530.1-95.                                                                                                                                                                                                                  |                                        | Per the requirements of ACI 530.1-99.                                                                                                                                                                                                                                                                                                                                               | Considered equivalent               |
| 11.2.2 Quality Assurance                                |                                                                                                                                                                                                                                                        | *1.14 Quality Assurance                | Essentially similar; ASCE is more detailed.                                                                                                                                                                                                                                                                                                                                         | Considered equivalent               |
| <b>11.3 GENERAL<br/>REQUIREMENTS</b>                    |                                                                                                                                                                                                                                                        | *1.1 Scope                             |                                                                                                                                                                                                                                                                                                                                                                                     |                                     |
| 11.3.1 Scope                                            | Masonry structures and components shall comply with requirements of reinforced masonry design, plain (unreinforced) masonry design, empirical design, design for architectural components of masonry, design of glass unit masonry and masonry veneer. | *1.1 Scope<br>*1.1.3                   | Masonry structures and their component members shall be designed in ... this Chapter and one of the following:<br>(a) Allowable stress design<br>(b) Limit states design (under development)<br>(c) Prestressed masonry design<br>(d) Empirical design method<br>(e) Veneers<br>(f) Glass unit masonry<br>Limit states design and prestressed masonry design are not part of NEHRP. | Equivalency cannot be judged.       |
| 11.3.2 Empirical Masonry Design                         | The requirements of Chapter 9 of ACI 530-95 shall apply to the empirical design of masonry.                                                                                                                                                            | *Chapter 5 Empirical Design of Masonry | Identical                                                                                                                                                                                                                                                                                                                                                                           | Equivalent                          |
| * indicates the Section No. in ACI 530-99               |                                                                                                                                                                                                                                                        |                                        |                                                                                                                                                                                                                                                                                                                                                                                     |                                     |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                            |                                                                                                                                                                                                                                                          |                                                                                      |                                                                                                                                                                                                     |                                |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 11.3.3 Plain (Unreinforced) Masonry Design |                                                                                                                                                                                                                                                          | *2.2 Unreinforced masonry                                                            | Contains detailed provisions that are not in NEHRP.                                                                                                                                                 | Equivalency difficult to judge |
| 11.3.4 Reinforced Masonry Design           |                                                                                                                                                                                                                                                          | *2.3 Reinforced Masonry                                                              | Essentially similar                                                                                                                                                                                 | Considered equivalent          |
| 11.3.5 Seismic Design Category A           |                                                                                                                                                                                                                                                          | *1.13.3 Seismic Design Category A                                                    | Same requirements as in NEHRP; Prestressed masonry design is additionally allowed.                                                                                                                  | ASCE less stringent            |
| 11.3.6 Seismic Design Category B           | Lateral-force-resisting system shall comply with Sec. 11.3.3 (plain masonry design) or Sec. 11.3.4 (reinforced masonry design)                                                                                                                           | *1.13.4 Seismic Design Category B                                                    | Prestressed masonry design is additionally allowed.                                                                                                                                                 | ASCE less stringent            |
| 11.3.7 Seismic Design Category C           |                                                                                                                                                                                                                                                          | *1.13.5 Seismic Design Category C                                                    | Prestressed masonry design is allowed.                                                                                                                                                              | ASCE less stringent            |
| 11.3.7.1 Material Requirements             | Structural clay load-bearing wall tile shall not be used as part of the basic structural system.                                                                                                                                                         |                                                                                      | No corresponding provision                                                                                                                                                                          | ASCE less stringent            |
|                                            | No corresponding provision                                                                                                                                                                                                                               | *1.13.5.2 Design of Elements that are not part of the Lateral Force-Resisting System |                                                                                                                                                                                                     | ASCE is more stringent         |
|                                            | No corresponding provision                                                                                                                                                                                                                               | *1.13.5.3 Design of Elements that are Part of the Lateral Force-Resisting System     |                                                                                                                                                                                                     | ASCE more stringent            |
|                                            | No corresponding provision                                                                                                                                                                                                                               | *1.13.5.3.1 Connections to Masonry Shear Walls                                       |                                                                                                                                                                                                     | ASCE is more stringent         |
| 11.3.7.2 Masonry Shear Walls               | Masonry shear walls shall comply with the requirements for <i>detailed plain masonry shear walls</i> (Sec. 11.11.2), <i>intermediate reinforced masonry shear walls</i> (Sec. 11.11.4), or <i>special reinforced masonry shear walls</i> (Sec. 11.11.5). |                                                                                      | The corresponding requirements are mentioned in different sections in ASCE.                                                                                                                         | Does not affect equivalency    |
| 11.3.7.3 Minimum Wall Reinforcement        | Vertical reinforcement of at least 0.20 in. <sup>2</sup> (129 mm <sup>2</sup> ) in cross-sectional area shall be provided continuously from support to                                                                                                   | *1.13.5.3.3 Minimum Reinforcement Requirements for                                   | Vertical reinforcement of at least 0.20 in. <sup>2</sup> (129 mm <sup>2</sup> ) in cross-sectional area shall be provided at corners, within 16 in. (406 mm) of each side of openings, within 8 in. | ASCE is less stringent         |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                           | support at each corner, at each side of each opening, at the ends of walls and at a maximum spacing of 4 feet (1219 mm) apart horizontally throughout the walls. Horizontal reinforcement not less than 0.20 in. <sup>2</sup> (129 mm <sup>2</sup> ) in cross section shall be provided as follows:<br>a. At the bottom and top of wall openings extending not less than 24 in. (610 mm) nor less than 40 bar diameters past the opening, continuously at structurally connected roof and floor levels and at the top of walls.<br>c. At the bottom of load-bearing walls or in the top of foundations when doweled to the wall.<br>d. At maximum spacing of 120 in. (3048 mm) unless uniformly distributed joint reinforcement is provided.<br>Reinforcement at the top and bottom of openings, when used in determining the maximum spacing specified in Item d above, shall be continuous in the wall. | Masonry Shear Walls                        | (203 mm) of each side of movement joints, within 8 in. (203 mm) of the ends of walls, and at a maximum spacing of 10 ft (3048 mm).<br>Horizontal joint reinforcement shall consist of at least two wires of W1.7 spaced not more than 16 in. (406 mm); or bond beam reinforcement shall be provided of at least 0.2 in. <sup>2</sup> (129 mm <sup>2</sup> ) in cross-sectional area spaced not more than 10 ft (3048 mm). Horizontal reinforcement shall also be provided at the bottom and top of the wall openings and shall exceed not less than 24 in. (610 mm) nor less than 40 bar diameters past the openings; continuously at structurally connected roof and floor levels; within 16 in. (406 mm) of the top of the walls.<br>The big difference is 10 ft maximum spacing of vertical reinforcement in the ASCE versus 4 ft maximum spacing in NEHRP. |                              |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.3.7.4 Stack Bond Construction                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalency cannot be judged |
| 11.3.7.5 Multiple Wythe Walls Not Acting Compositely      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalency cannot be judged |
| 11.3.7.6 Walls Separated from the Basic Structural System |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Equivalency cannot be judged |
| 11.3.7.7 Connections to Masonry Columns                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | *1.13.5.3.2 Connections to Masonry Columns | Identical, except ASCE invokes Sec. 2.1.6 of ACI 530.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Equivalent                   |
| 11.3.8 Seismic Design                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | *1.13.6 Seismic                            | Prestressed masonry design is allowed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ASCE is less                 |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Category D                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Design Category D                                              |                                                                                                                                                                                                                                                              |                                       |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 11.3.8.1 Material Requirements      | Prohibits use of Type N mortar and masonry cement in lateral-force-resisting system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | *1.13.6.6 Material Requirements                                | Prohibits use of Type N mortar and masonry cement in lateral-force-resisting system                                                                                                                                                                          | stringent<br>ASCE is less restrictive |
| 11.3.8.2 Masonry Shear Walls        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                | The corresponding requirements are mentioned in different sections in ASCE.                                                                                                                                                                                  | Does not affect equivalency           |
| 11.3.8.3 Minimum Wall Reinforcement | All walls ..... 48 in. (1219 mm). Except for joint reinforcement, the bar size shall not be less than a No. 3 (10-mm diameter). Reinforcement shall be continuous around wall corners and through intersections, unless the intersecting walls are separated. Only horizontal reinforcement that is continuous in the wall or element shall be included in computing the area of horizontal reinforcement. Reinforcement spliced in accordance with Sec. 11.4.5.6 shall be considered as continuous reinforcement. Architectural components of masonry shall be exempt from this reinforcement requirement. | *1.13.6.3 Minimum Reinforcement Requirements for Masonry Walls | The NEHRP text reproduced is not part of ASCE.                                                                                                                                                                                                               | ASCE is less stringent                |
| 11.3.8.4 Stack Bond Construction    | Where masonry is laid in stack bond, the minimum amount of horizontal reinforcement shall be 0.0015 times the gross cross-sectional area of the wall. If open-end units are used and grouted solid, the minimum amount of horizontal reinforcement shall be 0.0007 times the gross cross-sectional area of the wall. The maximum spacing of horizontal reinforcement shall not exceed 24 in. (610 mm). Architectural components of masonry shall be exempt from these requirements.                                                                                                                         | *1.13.6.3 Minimum Reinforcement Requirements for Masonry Walls | Wythes of stack bond masonry shall be constructed of fully grouted hollow open-end units, fully grouted hollow units laid with full head joints or solid units. Maximum spacing of reinforcement for walls with stack bond masonry shall be 24 in. (610 mm). | ASCE is less stringent                |
| 11.3.8.5 Minimum Wall Thickness     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                | No corresponding provision                                                                                                                                                                                                                                   | Equivalency cannot be judged          |
| 11.3.8.6 Minimum                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | *1.13.6.5 Minimum                                              | Essentially identical                                                                                                                                                                                                                                        | Equivalent                            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Column Reinforcement                                |                                                                                                                                                                                                                                                                               | Reinforcement for Masonry Columns                                                                                                                                        |                                                                                                                                                                          |                              |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.3.8.7 Minimum Column Dimension                   |                                                                                                                                                                                                                                                                               |                                                                                                                                                                          | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.8.8 Separation Joints                          |                                                                                                                                                                                                                                                                               |                                                                                                                                                                          | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.9 Seismic Design Categories E and F            |                                                                                                                                                                                                                                                                               | *1.13.7 Seismic Design Category E and F                                                                                                                                  | Prestressed masonry design is allowed.                                                                                                                                   | ASCE is less restrictive     |
| 11.3.9.1 Material Requirements                      |                                                                                                                                                                                                                                                                               |                                                                                                                                                                          | No corresponding provision                                                                                                                                               | Equivalency cannot be judged |
| 11.3.9.2 Masonry Shear Walls                        |                                                                                                                                                                                                                                                                               |                                                                                                                                                                          | The corresponding requirements are mentioned in different sections in ASCE.                                                                                              | Does not affect equivalency  |
| 11.3.9.3 Stack Bond Construction                    | 11.3.9.3.1<br>11.3.9.3.2 Reinforced hollow unit construction shall be grouted solid and all head joints shall be made solid by the use of open end units.                                                                                                                     | *1.13.7.2 Design of Elements that are not Part of the Lateral Force-Resisting System<br>*1.13.7.3 Design of Elements that are Part of the Lateral Force-Resisting System | Essentially the text of NEHRP Sec. 11.3.9.3.1, plus: These elements shall be solidly grouted and shall be constructed of hollow open units or two wythes of solid units. | Equivalent                   |
| 11.3.10 Properties of Materials                     |                                                                                                                                                                                                                                                                               | *1.8 Material properties                                                                                                                                                 |                                                                                                                                                                          |                              |
| 11.3.10.1 Steel Reinforcement Modulus of Elasticity |                                                                                                                                                                                                                                                                               | *1.8.2.1 Elastic Modulus of steel reinforcement                                                                                                                          | Identical                                                                                                                                                                | Equivalent                   |
| 11.3.10.2 Masonry Modulus of Elasticity             | The modulus of elasticity of masonry ( $E_m$ ) shall be determined in accordance with Eq. 11.3.10.2 or shall be based on the modulus of elasticity determined by prism test and taken between 0.05 and 0.33 times the masonry prism strength:<br>$E_m = 750 f_m'$ (11.3.10.2) | *1.8.2.2 Elastic Modulus of Clay and concrete masonry                                                                                                                    | The Eqn. 11.3.10.2 has been modified as follows:<br>$E_m = 700 f_m'$ for clay masonry<br>$E_m = 900 f_m'$ for concrete masonry                                           | Considered equivalent        |
| 11.3.10.3 Modulus of Rigidity of Masonry            |                                                                                                                                                                                                                                                                               | *1.8.2.2.2                                                                                                                                                               | Identical                                                                                                                                                                | Equivalent                   |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                          |                                                                                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                             |                              |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 11.3.10.4 Masonry Compressive Strength   |                                                                                                                                                 |                                                                 | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                  | ASCE is less stringent       |
| 11.3.10.5 Modulus of Rupture             |                                                                                                                                                 | *2.2.3.2                                                        | Allowable stress due to flexure is specified in Table instead of modulus of rupture specified in Table of NEHRP. The values of allowable tension stress are taken as half the values of MOR (with one exception).                                                                                                                                                                           | Equivalent                   |
| 11.3.10.5.1 Out-of-Plane Bending         |                                                                                                                                                 |                                                                 | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                  | Equivalency cannot be judged |
| 11.3.10.5.2 In-Plane Bending             |                                                                                                                                                 |                                                                 | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                  | Equivalency cannot be judged |
| 11.3.10.6 Reinforcement strength         |                                                                                                                                                 |                                                                 | No corresponding provision                                                                                                                                                                                                                                                                                                                                                                  | Equivalency cannot be judged |
| 11.3.11 Section Properties               |                                                                                                                                                 | *1.9                                                            | Essentially identical                                                                                                                                                                                                                                                                                                                                                                       | Considered equivalent        |
| 11.3.11.1                                |                                                                                                                                                 | *1.9.1                                                          |                                                                                                                                                                                                                                                                                                                                                                                             |                              |
| 11.3.11.2                                |                                                                                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                             |                              |
| 11.3.12 Headed and Bent-Bar Anchor Bolts | All bolts shall be grouted in place with at least 1-inch grout between the bolt and masonry, except that ...                                    | *2.1.2.2 Plate, Headed, and bent-bar anchor bolts<br>*2.1.2.2.1 | The minimum effective embedment length shall be 4 bolt diameters, but not less than 2 in.                                                                                                                                                                                                                                                                                                   | ASCE more stringent          |
| 11.3.12.1                                | The design axial strength for headed anchor bolts...                                                                                            | *2.1.2.2.2                                                      | The allowable load in tension shall be lesser of that given by Eq. (2-1) or Eq. (2-2).<br>$B_a = 0.5 A_p f_m^{10.5}$ (2-1) { = $2.0 A_p f_m^{10.5}$ in NEHRP }<br>$B_a = 0.2 A_b f_y$ (2-2) { = $0.9 A_p f_y$ in NEHRP }<br>Other requirements are essentially similar<br>ASCE is based on allowable compared to strength design in NEHRP.                                                  | Considered equivalent        |
| 11.3.12.2                                | The design axial strength for bent-up anchor bolts ....<br>In addition to the equations for headed anchor bolts, another equation is specified. | *2.1.2.2.2                                                      | The allowable load in tension shall be lesser of that given by Eq. (2-1) or Eq. (2-2).<br>$B_a = 0.5 A_p \sqrt{f_m}$ (2-1) { = $2.0 A_p \sqrt{f_m}$ in NEHRP }<br>$B_a = 0.2 A_b f_y$ (2-2) { = $0.9 A_p f_y$ in NEHRP }<br>The third equation of NEHRP dropped in ASCE.<br>Other requirements are essentially similar.<br>ASCE is based on allowable compared to strength design in NEHRP. | Considered equivalent        |
| 11.3.12.3                                | The design shear strength is given by                                                                                                           | *2.1.2.2.3                                                      | Modified in ASCE as:                                                                                                                                                                                                                                                                                                                                                                        | Considered                   |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                            |                                                                                                                                                                                                                                          |                        |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                           | lesser of the following equations:<br>$B_v = 875 \sqrt{f_m A_b}$ (11.3.12.3-1)<br>$B_v = 0.54 A_{pv} f_y$ (11.3.12.3-2)                                                                                                                                                                                                                                                                                                                                                    |                                            | $B_v = 350 \sqrt{f_m A_b}$ (2-5)<br>$B_v = 0.12 A_{pv} f_y$ (2-6)<br>ASCE is based on allowable compared to strength design in NEHRP.                                                                                                    | equivalent             |
| 11.3.12.4                                 | Anchor bolts subjected to combined shear and tension shall be designed ..                                                                                                                                                                                                                                                                                                                                                                                                  | *2.1.2.2.4                                 | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4 DETAILS OF REINFORCEMENT             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12 Details of Reinforcement             |                                                                                                                                                                                                                                          |                        |
| 11.4.1 General                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.1 Scope                              | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4.2 Size of Reinforcement              | 11.4.2.1 Reinforcing bars used in masonry shall not be larger than a No. 9 bar (29 mm diameter). The bar diameter shall not exceed one-eighth of the nominal wall thickness and shall not exceed one-quarter of the least clear dimension of the cell, course, or collar joint in which it is placed. The area of reinforcing bars placed in a cell, or in a course, of hollow unit construction shall not exceed 4 percent of the cell area.<br>11.4.2.2 Longitudinal ... | *1.12.2 Size of Reinforcement              | 1.12.2.1 The maximum size of reinforcement used in masonry shall be No. 11.<br>1.12.2.2 The diameter of reinforcement shall not exceed one-half the least clear dimension of the cell, bond beam, or collar joint in which it is placed. | ASCE is less stringent |
| 11.4.3 Placement Limits for Reinforcement |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.3 Placement Limits for Reinforcement | 1.12.2.3 Identical to 11.4.2.2 of NEHRP                                                                                                                                                                                                  | Equivalent             |
| 11.4.3.1                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.3.1                                  | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4.3.2                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.3.2                                  | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4.3.3                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.3.3                                  | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4.3.4                                  | Reinforcing bars shall not be bundled.                                                                                                                                                                                                                                                                                                                                                                                                                                     | *1.12.3.4                                  | Groups of parallel reinforcing bars bundled in contact to act as a unit shall be limited to two in any of the bundle. Individual bars.                                                                                                   | ASCE less stringent    |
| 11.4.4 Cover for reinforcement            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.4 Protection for reinforcement       |                                                                                                                                                                                                                                          |                        |
| 11.4.4.1                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.4.1                                  | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4.4.2                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | *1.12.3.5                                  | Identical                                                                                                                                                                                                                                | Equivalent             |
| 11.4.4.3                                  | Longitudinal wires of joint reinforcement shall be fully embedded in mortar or grout                                                                                                                                                                                                                                                                                                                                                                                       | *1.12.4.2                                  | The minimum cover for corresponding exposures in ASCE are changed to 5/8 in. and 1/2 in., respectively.                                                                                                                                  | ASCE more stringent    |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                       |                                                                                                                                                                    |                                                                           |                                                                                                                                                                                                                                                                                                                                                                       |                               |  |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--|
|                                                                                       | with a minimum cover of 1/2 in. (13 mm) when exposed to earth or weather and 3/8 in. (10 mm) when not exposed to earth or weather.                                 |                                                                           |                                                                                                                                                                                                                                                                                                                                                                       |                               |  |
| 11.4.4.4                                                                              |                                                                                                                                                                    | *1.12.4.3                                                                 | Identical                                                                                                                                                                                                                                                                                                                                                             | Equivalent                    |  |
| 11.4.5 Development of Reinforcement<br>11.4.5.1 General                               |                                                                                                                                                                    | *2.1.8 Development of reinforcement embedded in grout<br>*2.1.8.1 General | Essentially identical                                                                                                                                                                                                                                                                                                                                                 | Equivalent                    |  |
| 11.4.5.2 Embedment of Reinforcing Bars and Wires in Tension                           |                                                                                                                                                                    | *2.1.8.2 Embedment of Bars and Wires in Tension                           | Different equation to calculate development length.                                                                                                                                                                                                                                                                                                                   | Equivalency cannot be judged. |  |
| 11.4.5.3 Standard Hooks                                                               |                                                                                                                                                                    | *1.12.5 Standard hooks<br>*2.1.8.4 Hooks                                  | Essentially identical, except for the following changes:<br>1. The option of 135-degree turn plus 6 bar diameter is dropped in ASCE.<br>2. For stirrup and tie anchorage only, the provision of 180-degree turn has been replaced by 90-degree turn.<br>3. The equivalent embedment length in tension has been changed from $13d_b$ in NEHRP to $11.225 d_b$ in ASCE. | ASCE less stringent           |  |
| 11.4.5.4 Minimum Bend Diameter for Reinforcing Bars                                   |                                                                                                                                                                    | *1.12.6 Minimum bend diameter for reinforcing bars                        | Identical                                                                                                                                                                                                                                                                                                                                                             | Equivalent                    |  |
| 11.4.5.5 Development of Shear Reinforcement<br>11.4.5.5.1<br>11.4.5.5.2<br>11.4.5.5.3 | Except at wall intersections, the end of a reinforcing bar ...                                                                                                     | *2.1.8.5 Development of shear reinforcement                               | Essentially identical.                                                                                                                                                                                                                                                                                                                                                | Equivalent                    |  |
| 11.4.5.6 Splices of Reinforcement                                                     |                                                                                                                                                                    | *2.1.8.6 Splices of reinforcement                                         | No corresponding provisions                                                                                                                                                                                                                                                                                                                                           | ASCE is less stringent        |  |
| 11.4.5.6.1 Lap Splices                                                                | Lap splices shall not be used in plastic hinge zones. The length of the plastic hinge zone shall be taken as at least 0.15 times the distance between the point of |                                                                           | No corresponding provision                                                                                                                                                                                                                                                                                                                                            | ASCE is less stringent        |  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                            | zero moment and the point of maximum moment.                                                                                                                                                                                                   |                                   |                                                                                                                                           |                                       |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 11.4.5.6.1.1                               | The minimum length of lap, $l_{d\ell}$ for bars in tension or compression shall be equal to the development length, $l_{d\ell}$ as determined by Eq. 11.4.5.2 but shall not be less than 12 in. (305 mm) for bars and 6 in. (152 mm) for wire. | *2.1.8.6.1.1                      | Identical except that the equation for development length has been changed.                                                               | Equivalency cannot be judged          |
| 11.4.5.6.1.2                               |                                                                                                                                                                                                                                                | *2.1.8.6.1.2                      | Identical                                                                                                                                 | Equivalent                            |
| 11.4.5.6.2 Welded Splices                  |                                                                                                                                                                                                                                                | *2.1.8.6.2 Welded splices         | Identical                                                                                                                                 | Equivalent                            |
| 11.4.5.6.3 Mechanical Connections          |                                                                                                                                                                                                                                                | *2.1.8.6.3 Mechanical Connections | Identical                                                                                                                                 | Equivalent                            |
| 11.4.5.6.4 End Bearing Splices             |                                                                                                                                                                                                                                                | *2.1.8.6.4 End-Bearing Splices    | Identical                                                                                                                                 | Equivalent                            |
| 11.5 STRENGTH AND DEFORMATION REQUIREMENTS |                                                                                                                                                                                                                                                | *2.1.1.2 Design strength          |                                                                                                                                           |                                       |
| 11.5.1 General                             |                                                                                                                                                                                                                                                | *2.1.1.2.3 Strength requirements  | Essentially similar                                                                                                                       | Considered equivalent                 |
| 11.5.2 Required strength                   |                                                                                                                                                                                                                                                | *2.1.1.2.3.1 Required strength    | Essentially similar                                                                                                                       | Considered equivalent                 |
| 11.5.3 Design Strength                     |                                                                                                                                                                                                                                                | *2.1.1.2.3.3 Design strength      | Different strength reduction factors, mainly because ASCE gives allowable stress design whereas NEHRP provisions are for strength design. | Equivalency cannot be judged          |
| 11.5.4 Deformation Requirements            | Masonry structures shall be designed so the design story drift does not exceed the allowable story drift given in Table 5.2.8 (The table shows drift 0.007 to 0.013 story height depending on SUGs and lateral resisting systems)              | *1.13.2.2                         | The calculated story drift ... shall not exceed 0.007 times the story height.                                                             | ASCE is equivalent to more stringent. |
| 11.6 FLEXURE AND AXIAL LOADS               |                                                                                                                                                                                                                                                |                                   |                                                                                                                                           |                                       |
| 11.6.1 Scope                               |                                                                                                                                                                                                                                                |                                   |                                                                                                                                           |                                       |
| 11.6.2 Design Requirements for             |                                                                                                                                                                                                                                                | *2.3 Reinforced masonry           |                                                                                                                                           |                                       |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Reinforced Masonry Members                            |                                    |  |                                                                                          |                                                                                                                                                                                                                                                                                                                                 |                                   |
|-------------------------------------------------------|------------------------------------|--|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 11.6.2.1                                              |                                    |  |                                                                                          | No corresponding provisions                                                                                                                                                                                                                                                                                                     | Does not affect equivalency       |
| 11.6.2.2                                              |                                    |  | A.9.11.4 Maximum Reinforcement Percentages<br>A.9.11.4.1 Method A<br>A.9.11.4.2 Method B | Method A of ASCE is essentially identical to NEHRP provisions except for the following change:<br>It is applicable when the story drift $\leq 0.1h_{sx}$ and when extreme compressive fiber strains are below certain specific values. In addition, Method B has been added for the case when the story drift $\leq 0.13h_{sx}$ | ASCE is somewhat more restrictive |
| 11.6.2.3                                              |                                    |  | *2.1.1.2.3.1 Required strength                                                           | Essentially similar                                                                                                                                                                                                                                                                                                             | Considered equivalent             |
| 11.6.3 Design of Plain (Unreinforced) Masonry Members |                                    |  | *2.2 Unreinforced Masonry                                                                |                                                                                                                                                                                                                                                                                                                                 |                                   |
| 11.6.3.1                                              |                                    |  |                                                                                          | No corresponding provisions                                                                                                                                                                                                                                                                                                     | Does not affect equivalency       |
| 11.6.3.2                                              |                                    |  |                                                                                          |                                                                                                                                                                                                                                                                                                                                 |                                   |
| 11.6.3.3                                              |                                    |  |                                                                                          |                                                                                                                                                                                                                                                                                                                                 |                                   |
| 11.6.3.4                                              |                                    |  |                                                                                          |                                                                                                                                                                                                                                                                                                                                 |                                   |
| 11.6.3.5                                              | Design axial strength shall be ... |  | *2.2.3 Axial compression and flexure                                                     | Identical, except $\phi$ is different, as noted earlier.                                                                                                                                                                                                                                                                        | Equivalency difficult to judge    |
| 11.7 SHEAR                                            | Uses strength design method        |  | *2.2.5 Shear (Unreinforced masonry)<br>*2.3.5 Shear (reinforced masonry)                 | Uses allowable stress design method                                                                                                                                                                                                                                                                                             | Equivalency cannot be judged      |
| 11.8 SPECIAL REQUIREMENTS FOR BEAMS                   |                                    |  | *2.3.3.4 Beams                                                                           |                                                                                                                                                                                                                                                                                                                                 |                                   |
| 11.8.1                                                |                                    |  | *2.3.3.4.4                                                                               | Essentially identical                                                                                                                                                                                                                                                                                                           | Equivalent                        |
| 11.8.2                                                |                                    |  |                                                                                          | No corresponding provisions                                                                                                                                                                                                                                                                                                     | Equivalency cannot be judged      |
| 11.8.3                                                |                                    |  |                                                                                          | No corresponding provisions                                                                                                                                                                                                                                                                                                     | Equivalency cannot be judged      |
| 11.8.4 Deep Flexural Members                          |                                    |  |                                                                                          | No corresponding provision                                                                                                                                                                                                                                                                                                      | Equivalency cannot be judged      |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 11.9 SPECIAL REQUIREMENTS FOR COLUMNS               |                                                                                                                                                                  | *2.1.4 Columns                                                                                      |                                                                                                                                                   |                                                          |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 11.9.1                                              | Area of longitudinal reinforcement for <i>columns</i> shall be not less than 0.005 nor more than 0.04 times cross-sectional area of the <i>column</i> .          | *2.1.4.4                                                                                            | Identical, except that the lower limit on reinforcement ratio has been changed from 0.005 to 0.0025 times the cross-sectional area of the column. | ASCE is less stringent                                   |
| 11.9.2                                              | There shall be a minimum of four longitudinal bars in <i>columns</i> .                                                                                           | *2.1.4.4                                                                                            | Identical                                                                                                                                         | Equivalent                                               |
| 11.9.3                                              | Lateral ties shall be provided to resist shear and shall comply with the following:<br>...                                                                       | *2.1.4.6 Lateral ties                                                                               | Identical                                                                                                                                         | Equivalent                                               |
| 11.10 SPECIAL REQUIREMENTS FOR WALLS                | The nominal flexural strength of the <i>wall</i> for out-of-plane flexure shall be at least equal to 1.3 times the cracking moment strength of the <i>wall</i> . |                                                                                                     | ASCE has no corresponding provision.                                                                                                              | ASCE is less stringent                                   |
| 11.10.1                                             |                                                                                                                                                                  |                                                                                                     |                                                                                                                                                   |                                                          |
| 11.11 SPECIAL REQUIREMENTS FOR SHEAR WALLS          |                                                                                                                                                                  |                                                                                                     |                                                                                                                                                   |                                                          |
| 11.11.1 Ordinary Plain masonry Shear Walls          | To be designed per Sections 11.3.2 or 11.3.3.                                                                                                                    | *Chapter 5 Empirical Design of Masonry<br>*2.2 Unreinforced masonry                                 | Identical<br>Not the same                                                                                                                         | Equivalent<br>Equivalency difficult to judge             |
| 11.11.2 Detailed Plain Masonry Shear Walls          | To be designed per Sections 11.3.3. Reinforcement details per Sections 11.3.7.3 and 11.3.7.4.                                                                    | *2.2 Unreinforced masonry<br>*1.13.5.3.3 Minimum Reinforcement Requirements for Masonry Shear Walls | Not the same<br>Similar with some differences explained earlier                                                                                   | Equivalency difficult to judge<br>ASCE is less stringent |
| 11.11.3 Ordinary Reinforced Masonry Shear Walls     | To be designed per Sections 11.3.4.                                                                                                                              | *2.3 Reinforced Masonry                                                                             | Essentially similar                                                                                                                               | Considered equivalent                                    |
| 11.11.4 Intermediate Reinforced Masonry Shear Walls | To be designed per Sections 11.3.3. Reinforcement details per Sections 11.3.7.3 and 11.3.7.4.                                                                    | *2.2 Unreinforced masonry<br>*1.13.5.3.3 Minimum Reinforcement Requirements for                     | Not the same<br>Similar, with some differences explained earlier                                                                                  | Equivalency difficult to judge<br>ASCE is less stringent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                 |                                                                                                                                                        | Masonry Shear Walls                                                                                 |                                                                      |                                                          |  |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------|--|
| 11.11.5 Special Reinforced Masonry Shear Walls  | To be designed per Sections 11.3.3. Reinforcement details per Sections 11.3.7.3 and 11.3.7.4. In addition, there are more requirements as given below: | *2.2 Unreinforced masonry<br>*1.13.5.3.3 Minimum Reinforcement Requirements for Masonry Shear Walls | Not the same<br><br>Similar, with some differences explained earlier | Equivalency difficult to judge<br>ASCE is less stringent |  |
| 11.11.5.1 Vertical Reinforcement                |                                                                                                                                                        | *1.13.6.4 Shear wall reinforcement requirements                                                     | Essentially identical                                                | Equivalent                                               |  |
| 11.11.5.2 Horizontal Reinforcement              |                                                                                                                                                        |                                                                                                     |                                                                      |                                                          |  |
| 11.11.5.3 Shear Keys                            |                                                                                                                                                        |                                                                                                     | No corresponding provisions                                          | Equivalency cannot be judged                             |  |
| 11.11.6 Flanged Shear Walls                     |                                                                                                                                                        |                                                                                                     | No corresponding provisions                                          | Equivalency cannot be judged                             |  |
| 11.11.7 Coupled Shear Walls                     |                                                                                                                                                        |                                                                                                     | No corresponding provision                                           | Equivalency cannot be judged                             |  |
| 11.11.7.1 Design of Coupled Shear Walls         |                                                                                                                                                        |                                                                                                     |                                                                      |                                                          |  |
| 11.11.7.2 Shear Strength of Coupling Beams      |                                                                                                                                                        |                                                                                                     | No corresponding provision                                           | Equivalency cannot be judged                             |  |
| 11.12 SPECIAL MOMENT FRAMES OF MASONRY          |                                                                                                                                                        |                                                                                                     | No corresponding provision                                           | Equivalency cannot be judged                             |  |
| 11.13 GLASS-UNIT MASONRY AND MASONRY VENEER     |                                                                                                                                                        |                                                                                                     |                                                                      |                                                          |  |
| 11.13.1 Design Lateral Forces and Displacements |                                                                                                                                                        |                                                                                                     | No corresponding provision                                           | Does not affect equivalency                              |  |
| 11.13.2 Glass-Unit Masonry Design               | Refers to Chapter 11 of ACI 530-95.                                                                                                                    | *CHAPTER 7 GLASS UNIT MASONRY                                                                       | Essentially similar provisions                                       | Considered equivalent                                    |  |
| 11.13.3 Masonry Veneer Design                   | Refers to Chapter 12 of ACI 530-95.                                                                                                                    | *CHAPTER 6 VENEERS                                                                                  | Basically the same, refers to Chapter 6 of ACI 530-99.               | Considered equivalent                                    |  |
| Appendix to Chapter 11 ALTERNATIVE              |                                                                                                                                                        | A.9.11 SUPPLEMENTARY                                                                                | Essentially similar                                                  | Considered equivalent                                    |  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| PROVISIONS FOR<br>THE DESIGN OF<br>MASONRY<br>STRUCTURES |  | PROVISIONS FOR<br>MASONRY |  |  |
|----------------------------------------------------------|--|---------------------------|--|--|
|                                                          |  |                           |  |  |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                           |                                                                                                                     | 1998 ASCE 7                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                | Comments                                  |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Section                                              | Provision                                                                                                           | Section                                                                                            | Provision                                                                                                                                                                                                                                                                                                                                                                                      |                                           |
| <b>Chapter 12 WOOD STRUCTURE DESIGN REQUIREMENTS</b> |                                                                                                                     | <b>9.12 WOOD</b>                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                |                                           |
| 12.1 General                                         | Limited to seismic design only.                                                                                     | 9.12.1 Reference Documents                                                                         | Essentially similar                                                                                                                                                                                                                                                                                                                                                                            | Considered equivalent                     |
| 12.1.1 Scope                                         |                                                                                                                     | 9.12.1 Reference Documents                                                                         | Essentially similar                                                                                                                                                                                                                                                                                                                                                                            | Considered equivalent                     |
| 12.1.2 Reference Documents                           |                                                                                                                     |                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                |                                           |
| 12.1.2.1 Engineered Wood Construction                |                                                                                                                     |                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                |                                           |
| 12.1.2.1 Conventional Light-Frame Construction       |                                                                                                                     |                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                |                                           |
| 12.1.2.3 Materials Standards                         |                                                                                                                     |                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                |                                           |
| 12.1.3 Notations                                     |                                                                                                                     |                                                                                                    | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                    | Equivalency is not affected               |
| 12.2 DESIGN METHODS                                  | LRFD and Conventional Construction only.                                                                            |                                                                                                    | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                    | Equivalency is not affected               |
| 12.3 ENGINEERED WOOD CONSTRUCTION                    |                                                                                                                     |                                                                                                    | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                    | Equivalency difficult to judge            |
| 12.4 DIAPHRAGMS AND SHEAR WALLS                      |                                                                                                                     |                                                                                                    | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                                    | Equivalency difficult to judge            |
| 12.5 CONVENTIONAL LIGHT-FRAME CONSTRUCTION           |                                                                                                                     |                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                |                                           |
| 12.5.1 Scope                                         | In addition to other requirements and exceptions the Tables in Reference 12-5 have been modified to Table 12.5.1-1. | A.9.12. Supplementary provisions for wood (modifications in conventional light-frame construction) | Table A.9.12.10.1-1a is essentially the same as Table 12.5.1-1 of NEHRP except for the following changes:<br>Braced wall requirements in SDC C are the same as in SDC B for detached one- and two-family dwellings. It is specifically mentioned that a cripple wall which exceeds 14 in. in height is considered to be above grade.<br>Table A.9.12.10.1-1b of ASCE is essentially similar to | Considered equivalent<br><br>ASCE is less |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                          |  |  |  | Table 12.5.2-1 of NEHRP. However, ASCE allows conventional construction where $S_{DS} \geq 1.0$ , while NEHRP does not. | stringent                    |
|------------------------------------------|--|--|--|-------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 12.5.2 Braced Walls                      |  |  |  | No corresponding provisions                                                                                             | Equivalency cannot be judged |
| 12.5.3 Detailing Requirements            |  |  |  | No corresponding provisions                                                                                             | Equivalency cannot be judged |
| 12.6 SEISMIC DESIGN CATEGORY A           |  |  |  | No corresponding provisions                                                                                             | Equivalency cannot be judged |
| 12.7 SEISMIC DESIGN CATEGORY B, C, AND D |  |  |  | No corresponding provisions                                                                                             | Equivalency cannot be judged |
| 12.8 SEISMIC DESIGN CATEGORY E AND F     |  |  |  | No corresponding provisions                                                                                             | Equivalency cannot be judged |
|                                          |  |  |  |                                                                                                                         |                              |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                |           | 1998 ASCE 7                                                             |                       | Comments   |
|-------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------|-----------------------|------------|
| Section                                                                                   | Provision | Section                                                                 | Provision             |            |
| <b>CHAPTER 13<br/>SEISMICALLY<br/>ISOLATED<br/>STRUCTURES<br/>DESIGN<br/>REQUIREMENTS</b> |           | <b>9. 13 PROVISIONS<br/>FOR SEISMICALLY<br/>ISOLATED<br/>STRUCTURES</b> |                       |            |
| 13.1 General                                                                              |           | 9.13.1 General                                                          | Identical             | Equivalent |
| 13.2 CRITERIA<br>SELECTION                                                                |           | 9.13.2 Criteria<br>Selection                                            |                       |            |
| 13.2.1 Basis for<br>Design                                                                |           | 9.13.2.1 Basis for<br>Design                                            | Identical             | Equivalent |
| 13.2.2 Stability of the<br>Isolation System                                               |           | 9.13.2.2 Stability of the<br>Isolation System                           | Identical             | Equivalent |
| 13.2.3 Seismic Use<br>Group                                                               |           | 9.13.2.3 Seismic Use<br>Group                                           | Identical             | Equivalent |
| 13.2.4 Configuration<br>Requirements                                                      |           | 9.13.2.4 Configuration<br>Requirements                                  | Identical             | Equivalent |
| 13.2.5 Selection of<br>Lateral Response<br>Procedure                                      |           | 9.13.2.5 Selection of<br>Lateral Response<br>Procedure                  | Identical             | Equivalent |
| 13.2.5.1 General                                                                          |           | 9.13.2.5.1 General                                                      |                       |            |
| 13.2.5.2 Equivalent<br>Lateral Force<br>Procedure                                         |           | 9.13.2.5.2 Equivalent<br>Lateral Force<br>Procedure                     | Identical             | Equivalent |
| 13.2.5.3 Dynamic<br>Analysis                                                              |           | 9.13.2.5.3 Dynamic<br>Analysis                                          | Essentially identical | Equivalent |
| 13.2.5.3.1 Response-<br>Spectrum Analysis                                                 |           | 9.13.2.5.3.1<br>Response-Spectrum<br>Analysis                           | Identical             | Equivalent |
| 13.2.5.3.2 Time-<br>History Analysis                                                      |           | 9.13.2.5.3.2 Time-<br>History Analysis                                  | Identical             | Equivalent |
| 13.2.5.3.3 Site-Specific<br>Design Spectra                                                |           | 9.13.2.5.3.3 Site-<br>Specific Design<br>Spectra                        | Identical             | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                    |  |                                                                                      |           |            |
|------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------|-----------|------------|
| 13.3 EQUIVALENT LATERAL FORCE PROCEDURE                                            |  | 9.13.3 Equivalent Lateral Force Procedure                                            | Identical | Equivalent |
| 13.3.1 General                                                                     |  | 9.13.3.1 General                                                                     |           |            |
| 13.3.2 Deformation Characteristics of the Isolation System                         |  | 9.13.3.2 Deformation Characteristics of the Isolation System                         | Identical | Equivalent |
| 13.3.3 Minimum Lateral Displacements                                               |  | 9.13.3.3 Minimum Lateral Displacements                                               |           |            |
| 13.3.3.1 Design Displacement                                                       |  | 9.13.3.3.1 Design Displacement                                                       | Identical | Equivalent |
| 13.3.3.2 Effective Period                                                          |  | 9.13.3.3.2 Effective Period at Design Displacement                                   | Identical | Equivalent |
| 13.3.3.3 Maximum Displacement                                                      |  | 9.13.3.3.3 Maximum Displacement                                                      | Identical | Equivalent |
| 13.3.3.4 Effective Period at maximum Displacement                                  |  | 9.13.3.3.4 Effective Period at maximum Displacement                                  | Identical | Equivalent |
| 13.3.3.5 Total Displacement                                                        |  | 9.13.3.3.5 Total Lateral Displacement                                                | Identical | Equivalent |
| 13.3.4 Minimum Lateral Forces                                                      |  | 9.13.3.4 Minimum Lateral Forces                                                      |           |            |
| 13.3.4.1 Isolation System and Structural Elements At or Below the Isolation System |  | 9.13.3.4.1 Isolation System and Structural Elements At or Below the Isolation System | Identical | Equivalent |
| 13.3.4.2 Structural Elements Above the Isolation System                            |  | 9.13.3.4.2 Structural Elements Above the Isolation System                            | Identical | Equivalent |
| 13.3.4.3 Limits on $V_s$                                                           |  | 9.13.3.4.3 Limits on $V_s$                                                           | Identical | Equivalent |
| 13.3.5 Vertical Distribution of Force                                              |  | 9.13.3.5 Vertical Distribution of Force                                              | Identical | Equivalent |
| 13.3.6 Drift Limits                                                                |  | 9.13.3.6 Drift Limits                                                                | Identical | Equivalent |
| 13.4 DYNAMIC LATERAL RESPONSE                                                      |  | 9.13.4 Dynamic Lateral Response                                                      | Identical | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| PROCEDURE                                                                             |  | Procedure                                                                    |                     |
|---------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------|---------------------|
| 13.4.1 General                                                                        |  | 9.13.4.1 General                                                             |                     |
| 13.4.2 Isolation System and Structural Elements Below the Isolation System            |  | 9.13.4.2 Isolation System and Structural Elements Below the Isolation System | Identical           |
| 13.4.3 Structural Elements Above the Isolation System                                 |  | 9.13.4.3 Structural Elements Above the Isolation System                      | Identical           |
| 13.4.4 Ground Motion                                                                  |  | 9.13.4.4 Ground Motion                                                       |                     |
| 13.4.4.1 Design Spectra                                                               |  | 9.13.4.4.1 Design Spectra                                                    | Identical           |
| 13.4.4.2 Time Histories                                                               |  | 9.13.4.4.2 Time Histories                                                    | Identical           |
| 13.4.5 Mathematical Model                                                             |  | 9.13.4.5 Mathematical Model                                                  | Identical           |
| 13.4.5.1 General                                                                      |  | 9.13.4.5.1 General                                                           |                     |
| 13.4.5.2 Isolation System                                                             |  | 9.13.4.5.2 Isolation System                                                  | Identical           |
| 13.4.5.3 Isolated Building                                                            |  | 9.13.4.5.3 Isolated Building                                                 |                     |
| 13.4.5.3.1 Displacement                                                               |  | 9.13.4.5.3.1 Displacement                                                    | Identical           |
| 13.4.5.3.2 Forces and Displacements in Elements of the Lateral-Force-Resisting System |  | 9.13.4.5.3.2 Forces and Displacements in Key Elements                        | Essentially similar |
| 13.4.6 Description of Analysis Procedures                                             |  | 9.13.4.6 Description of Analysis Procedures                                  | Identical           |
| 13.4.6.1 General                                                                      |  | 9.13.4.6.1 General                                                           |                     |
| 13.4.6.2 Input Earthquake                                                             |  | 9.13.4.6.2 Input Earthquake                                                  | Identical           |
| 13.4.6.3 Response-Spectrum Analysis                                                   |  | 9.13.4.6.3 Response-Spectrum Analysis                                        | Essentially similar |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                                 |  |                                                                                                   |           |            |
|-------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------|-----------|------------|
| 13.4.6.4 Time-History Analysis                                                                  |  | 9.13.4.6.4 Time-History Analysis                                                                  | Identical | Equivalent |
| 13.4.7 Design Lateral Force                                                                     |  | 9.13.4.7 Design Lateral Force                                                                     | Identical | Equivalent |
| 13.4.7.1 Isolation System and Structural Elements At or Below the Isolation System              |  | 9.13.4.7.1 Isolation System and Structural Elements At or Below the Isolation System              | Identical | Equivalent |
| 13.4.7.2 Structural Elements Above the Isolation System                                         |  | 9.13.4.7.2 Structural Elements Above the Isolation System                                         | Identical | Equivalent |
| 13.4.7.3 Scaling of Results                                                                     |  | 9.13.4.7.3 Scaling of Results                                                                     | Identical | Equivalent |
| 13.4.7.4 Drift Limits                                                                           |  | 9.13.4.7.4 Drift Limits                                                                           | Identical | Equivalent |
| 13.5 LATERAL LOAD ON ELEMENTS OF STRUCTURES AND NONSTRUCTURAL COMPONENTS SUPPORTED BY BUILDINGS |  | 9.13.5 Lateral Load On Elements Of Structures And Nonstructural Components Supported By Buildings | Identical | Equivalent |
| 13.5.1 General                                                                                  |  | 9.13.5.1 General                                                                                  |           |            |
| 13.5.2 Forces and Displacements                                                                 |  | 9.13.5.2 Forces and Displacements                                                                 |           |            |
| 13.5.2.1 Components At or Above the Isolation Interface                                         |  | 9.13.5.2.1 Components At or Above the Isolation Interface                                         | Identical | Equivalent |
| 13.5.2.2 Components Crossing the Isolation Interface                                            |  | 9.13.5.2.2 Components Crossing the Isolation Interface                                            | Identical | Equivalent |
| 13.5.2.3 Components Below the Isolation Interface                                               |  | 9.13.5.2.3 Components Below the Isolation Interface                                               | Identical | Equivalent |
| 13.6 DETAILED SYSTEM REQUIREMENTS                                                               |  | 9.13.6 Detailed System Requirements                                                               | Identical | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                           |  |                                             |                                                                  |                        |
|-------------------------------------------|--|---------------------------------------------|------------------------------------------------------------------|------------------------|
| 13.6.1 General                            |  |                                             |                                                                  |                        |
| 13.6.2 Isolation System                   |  | 9.13.6.2 Isolation System                   |                                                                  |                        |
| 13.6.2.1 Environmental Conditions         |  | 9.13.6.2.1 Environmental Conditions         | Identical                                                        | Equivalent             |
| 13.6.2.2 Wind Forces                      |  | 9.13.6.2.2 Wind Forces                      | Identical                                                        | Equivalent             |
| 13.6.2.3 Fire Resistance                  |  | 9.13.6.2.3 Fire Resistance                  | Identical                                                        | Equivalent             |
| 13.6.2.4 Lateral-Restoring Force          |  | 9.13.6.2.4 Lateral-Restoring Force          | Identical                                                        | Equivalent             |
| 13.6.2.5 Displacement Restraint           |  | 9.13.6.2.5 Displacement Restraint           | Identical                                                        | Equivalent             |
| 13.6.2.6 Vertical-Load Stability          |  | 9.13.6.2.6 Vertical-Load Stability          | The load combinations in ASCE are different from those in NEHRP. | ASCE is less stringent |
| 13.6.2.7 Overturning                      |  | 9.13.6.2.7 Overturning                      | Identical                                                        | Equivalent             |
| 13.6.2.8 Inspection and Replacement       |  | 9.13.6.2.8 Inspection and Replacement       | Identical                                                        | Equivalent             |
| 13.6.2.9 Quality Control                  |  | 9.13.6.2.9 Quality Control                  | Identical                                                        | Equivalent             |
| 13.6.3 Structural System                  |  | 9.13.6.3 Structural System                  |                                                                  |                        |
| 13.6.3.1 Horizontal Distribution of Force |  | 9.13.6.3.1 Horizontal Distribution of Force | Identical                                                        | Equivalent             |
| 13.6.3.2 Building Separations             |  | 9.13.6.3.2 Building Separations             | Identical                                                        | Equivalent             |
| 13.6.3.3 Nonbuilding Structures           |  | 9.13.6.3.3 Nonbuilding Structures           | Identical                                                        | Equivalent             |
| 13.7 FOUNDATIONS                          |  | 9.13.7 Foundations                          | Identical                                                        | Equivalent             |
| 13.8 DESIGN AND CONSTRUCTION REVIEW       |  | 9.13.8 Design And Construction Review       | Identical                                                        | Equivalent             |
| 13.8.1 General                            |  | 9.13.8.1 General                            |                                                                  |                        |
| 13.8.2 Isolation                          |  | 9.13.8.2 Isolation System                   |                                                                  |                        |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| System                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9 Required Tests Of The Isolation System | Identical                                                                                                                                 | Equivalent                   |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 13.9 REQUIRED TESTS OF THE ISOLATION SYSTEM |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.1 General                              | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2 Prototype Tests                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2 Prototype Tests                      | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2.1 General                            |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.1 General                            | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2.2 Record                             |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.2 Record                             | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2.3 Sequence and Cycles:               | The following sequence of tests shall be performed for the prescribed number of cycles at a vertical load equal to the average <i>dead load</i> plus one-half the effects due to <i>live load</i> on all <i>isolator units</i> of a common type and size:<br>1.<br>2.<br>3. and<br>4. $30S_{D1}B_D/S_{DS}$ , but not less than ten, fully reversed cycles of loading at 1 <i>total design displacement</i> , $1.0D_{TP}$ |  | 9.13.9.2.3 Sequence and Cycles:               | ASCE identical to NEHRP except for the following change:<br>Item 4 of NEHRP was changed from $30S_{D1}B_D/S_{DS}$ to $15S_{D1}B_D/S_{DS}$ | ASCE slightly less stringent |
| 13.9.2.4 Units Dependent on Loading Rates   |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.4 Units Dependent on Loading Rates   | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2.5 Units Dependent on Bilateral Load  |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.5 Units Dependent on Bilateral Load  | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2.6 Maximum and Minimum Vertical Load  |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.6 Maximum and Minimum Vertical Load  | The load combinations in ASCE are different from NEHRP.                                                                                   | ASCE is less stringent       |
| 13.9.2.7 Sacrificial-Wind-Restraint Systems |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.7 Sacrificial-Wind-Restraint Systems | Identical                                                                                                                                 | Equivalent                   |
| 13.9.2.8 Testing Similar Units              |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.2.8 Testing Similar Units              | Identical                                                                                                                                 | Equivalent                   |
| 13.9.3 Determination                        |                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 9.13.9.3 Determination                        | Identical                                                                                                                                 | Equivalent                   |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| of Force-Deflection<br>Characteristics                             |  | of Force-Deflection<br>Characteristics                   |                             |                                 |
|--------------------------------------------------------------------|--|----------------------------------------------------------|-----------------------------|---------------------------------|
| 13.9.4 Test Specimen<br>Adequacy                                   |  | 9.13.9.4 Test<br>Specimen Adequacy                       | Identical                   | Equivalent                      |
| 13.9.5 Design<br>Properties of the<br>Isolation System             |  | 9.13.9.5 Design<br>Properties of the<br>Isolation System |                             |                                 |
| 13.9.5.1 Maximum and<br>Minimum Effective<br>Stiffness             |  | 9.13.9.5.1 Maximum<br>and Minimum Effective<br>Stiffness | Identical                   | Equivalent                      |
| 13.9.5.2 Effective<br>Damping                                      |  | 9.13.9.5.2 Effective<br>Damping                          | Identical                   | Equivalent                      |
| Appendix to Chapter<br>13 PASSIVE ENERGY<br>DISSIPATION<br>SYSTEMS |  |                                                          | No corresponding provisions | Equivalency cannot<br>be judged |
|                                                                    |  |                                                          |                             |                                 |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| 1997 NEHRP                                                                                |                                                                                                                                                  | 1998 ASCE 7                                                   |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Section                                                                                   | Provision                                                                                                                                        | Section                                                       | Provision                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Chapter 14</b><br><b>NONBUILDING</b><br><b>STRUCTURE DESIGN</b><br><b>REQUIREMENTS</b> |                                                                                                                                                  | <b>Section 9.14</b><br><b>NONBUILDING</b><br><b>STRUCTURE</b> | Essentially identical                                                                                                                                                                                                                                                                                                                                                                |
| 14.1 GENERAL                                                                              |                                                                                                                                                  | 9.14.1 General                                                |                                                                                                                                                                                                                                                                                                                                                                                      |
| 14.1.1 Scope                                                                              |                                                                                                                                                  | 9.14.1.1                                                      |                                                                                                                                                                                                                                                                                                                                                                                      |
| 14.1.2 Nonbuilding Structures Supported by Other Structures                               |                                                                                                                                                  | 9.14.1.2                                                      | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                          |
| 14.1.3 Architectural, Mechanical, and Electrical Components                               |                                                                                                                                                  | 9.14.1.3                                                      | Identical                                                                                                                                                                                                                                                                                                                                                                            |
| 14.1.4 Loads                                                                              |                                                                                                                                                  | 9.14.1.4                                                      | Identical                                                                                                                                                                                                                                                                                                                                                                            |
| 14.1.5 Fundamental Period                                                                 |                                                                                                                                                  | 9.14.1.5                                                      | Identical                                                                                                                                                                                                                                                                                                                                                                            |
| 14.1.6 Drift Limitations                                                                  |                                                                                                                                                  | 9.14.1.6                                                      | Identical                                                                                                                                                                                                                                                                                                                                                                            |
| 14.1.7 Materials Requirements                                                             | The requirements regarding specific materials in Chapters 8, 9, 10, 11, and 12 shall be applicable unless specifically exempted in this chapter. |                                                               | No corresponding provisions                                                                                                                                                                                                                                                                                                                                                          |
| 14.2 STRUCTURAL DESIGN REQUIREMENTS                                                       | <i>Nonbuilding structures</i> ..... with the following additions and exceptions:                                                                 | 9.14.2 Nonbuilding Structures Similar to Building             | Essentially identical with the following exception:<br>Intermediate moment frames of reinforced concrete shall not be used at sites where the seismic coefficient $S_{DS}$ is greater than or equal to 0.50 unless that both of the following conditions are met:<br>1. The nonbuilding structure is less than 50 feet (15 240 mm) in height.<br>2. $R \leq 3.0$ is used for design. |
| 14.2.1 Design Basis                                                                       |                                                                                                                                                  | 9.14.2.1 Design Basis                                         | Seems like there are printing errors such as: (1) 9.14.2 should probably be titled structural design requirements, (2) 9.14.2.1.1 is missing, (3) It may be noted that 9.14.2 has similar heading as 9.14.3.                                                                                                                                                                         |
| 14.2.1.1 Seismic Factors                                                                  |                                                                                                                                                  |                                                               |                                                                                                                                                                                                                                                                                                                                                                                      |
| 14.2.1.2 Importance Factors and Seismic                                                   |                                                                                                                                                  | 9.14.2.1.2                                                    | Identical                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                           |                                                                                                                                                  |                                                               | Equivalent                                                                                                                                                                                                                                                                                                                                                                           |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

| Use Group Classifications                         |  |                                                     |                       |            |
|---------------------------------------------------|--|-----------------------------------------------------|-----------------------|------------|
| 14.2.2 Rigid Nonbuilding Structures               |  | 9.14.2.2 Rigid Nonbuilding Structures               | Identical             | Equivalent |
| 14.2.3 Deflection Limits and Structure Separation |  | 9.14.2.3 Deflection Limits and Structure Separation | Identical             | Equivalent |
| 14.2 NONBUILDING STRUCTURES SIMILAR TO BUILDINGS  |  | 9.14.3 Nonbuilding Structures Similar To Buildings  | Identical             | Equivalent |
| 14.3.1 General                                    |  | 9.14.3.1                                            |                       |            |
| 14.3.2 Pipe Racks                                 |  | 9.14.3.2 Pipe Racks                                 | Identical             | Equivalent |
| 14.3.2.1 Design Basis                             |  | 9.14.3.2.1 Design Basis                             |                       |            |
| 14.3.3 Steel Storage Racks                        |  | 9.14.3.3 Steel Storage Racks                        | Essentially identical | Equivalent |
| 14.3.3.1 General Requirements                     |  | 9.14.3.3.1 General Requirements                     | Essentially identical | Equivalent |
| 14.3.3.2 Operating Weight                         |  | 9.14.3.3.2 Operating Weight                         | Identical             | Equivalent |
| 14.3.3.3 Vertical Distribution of Seismic Forces  |  | 9.14.3.3.3 Vertical Distribution of Seismic Forces  | Identical             | Equivalent |
| 14.3.3.4 Seismic Displacements                    |  | 9.14.3.3.4 Seismic Displacements                    | Essentially identical | Equivalent |
| 14.3.4 Electrical Power Generating Facilities     |  | 9.14.3.4 Electrical Power Generating Facilities     | Identical             | Equivalent |
| 14.3.4.1 General                                  |  | 9.14.3.4.1 General                                  |                       |            |
| 14.3.4.2 Design Basis                             |  | 9.14.3.4.2 Design Basis                             |                       |            |
| 14.3.5 Structural Towers for Tanks and Vessels    |  | 9.14.3.5 Structural Towers for Tanks and Vessels    | Identical             | Equivalent |
| 14.3.5.1 General                                  |  | 9.14.3.5.1 General                                  |                       |            |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                                                                                                                                          |  |                                                                                                                                                                                                                        |           |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|
| 14.3.6 Piers and Wharves<br>14.3.6.1 General<br>14.3.6.2 Design Basis                                                                                                                                    |  | 9.14.3.6 Piers and Wharves<br>9.14.3.6.1 General<br>9.14.3.6.2 Design Basis                                                                                                                                            | Identical | Equivalent |
| 14.4 NONBUILDING STRUCTURES NOT SIMILAR TO BUILDINGS<br>14.4.1 General<br>14.4.2 Earth Retaining Structures<br>14.4.2.1 General<br>14.4.3 Tanks and Vessels<br>14.4.3.1 General<br>14.4.3.2 Design Basis |  | 9.14.4 Nonbuilding Structures Not Similar To Buildings<br>9.14.4.1 General<br>9.14.4.2 Earth Retaining Structures<br>9.14.4.2.1 General<br>9.14.4.3 Tanks and Vessels<br>9.14.4.3.1 General<br>9.14.4.3.2 Design Basis | Identical | Equivalent |
| 14.4.3.3 Additional Requirements                                                                                                                                                                         |  | 9.14.4.3.3 Additional Requirements                                                                                                                                                                                     | Identical | Equivalent |
| 14.4.4 Electrical Transmission, Substation, and Distribution Structures<br>14.4.4.1 General<br>14.4.4.2 Design Basis                                                                                     |  | 9.14.4.4 Electrical Transmission, Substation, and Distribution Structures<br>9.14.4.4.1 General<br>9.14.4.4.2 Design Basis                                                                                             | Identical | Equivalent |
| 14.4.5 Telecommunication Towers<br>14.4.5.1 General<br>14.4.5.2 Design Basis                                                                                                                             |  | 9.14.4.5 Telecommunication Towers<br>9.14.4.5.1 General<br>9.14.4.5.2 Design Basis                                                                                                                                     | Identical | Equivalent |
| 14.4.6 Stacks and Chimneys<br>14.4.6.1 General<br>14.4.6.2 Design Basis                                                                                                                                  |  | 9.14.4.6 Stacks and Chimneys<br>9.14.4.6.1 General<br>9.14.4.6.2 Design Basis                                                                                                                                          | Identical | Equivalent |

**Table 2. Detailed Comparison of Structural Provisions of 1998 ASCE 7 to 1997 NEHRP (continued)**

|                                                                                  |                                                                                         |                             |                             |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------|-----------------------------|
| 14.4.7 Amusement Structures<br>14.4.7.1 General<br>14.4.7.2 Design Basis         | Basis<br>9.14.4.7 Amusement Structures<br>9.14.4.7.1 General<br>9.14.4.7.2 Design Basis | Identical                   | Equivalent                  |
| 14.4.8 Special Hydraulic Structures<br>14.4.8.1 General<br>14.4.8.2 Design Basis | 9.14.4.8 Special Hydraulic Structures<br>9.14.4.8.1 General<br>9.14.4.8.2 Design Basis  | Identical                   | Equivalent                  |
| 14.4.9 Buried Structures<br>14.4.9.1 General<br>14.4.9.2 Design Basis            | 9.14.4.9 Buried Structures<br>9.14.4.9.1 General<br>9.14.4.9.2 Design Basis             | Identical                   | Equivalent                  |
| 14.4.10 Inverted Pendulums                                                       | 9.14.4.10 Inverted Pendulums                                                            | Identical                   | Equivalent                  |
| Appendix to Chapter 14                                                           |                                                                                         | No corresponding provisions | Does not affect equivalency |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

| 2000 IRC                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                  | 1997 NEHRP                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Comments             |
|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Section                                                                                                                  | Provision                                                                                                                                                                                                                                                                                                                                                                        | Section                                         | Provision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
| CHAPTER 3<br>BUILDING PLANNING<br>R301 DESIGN<br>CRITERIA                                                                |                                                                                                                                                                                                                                                                                                                                                                                  | Chapter 1<br>GENERAL<br>PROVISIONS              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |
| R301.2.2 Seismic Provisions                                                                                              | The seismic provisions of this code shall apply to buildings constructed in SDCs C, D <sub>1</sub> , and D <sub>2</sub><br>Exception: Detached one and two family dwellings in SDC C (i.e., where $S_{DS} \leq 0.50g$ )                                                                                                                                                          | 1.2.1 Scope                                     | These Provisions ... these Provisions.<br>Exception: Detached one- and two-family dwellings located where $S_{DS}$ is less than 0.4g are exempt from all requirements of these Provisions. Thus, it covers only part of the dwellings exempted by IRC                                                                                                                                                                                                                                                                                                                                                                                                             | IRC less stringent   |
| R301.2.2.1 Determination of Seismic Design Category<br>R301.2.2.1.1 Alternative determination of Seismic Design Category | The Seismic Design Categories and corresponding Short Period Design Spectral Response Accelerations, $S_{DS}$ shown in Fig. R301.1(1) are based on soil Site Class D. For other soil conditions, $S_{DS}$ can be determined as per IBC, and SDC can be assigned according to Table R301.2(3).<br>IBC SDC D has been split into SDC D <sub>1</sub> and D <sub>2</sub> in the IRC. | 4.2.1 Determination of Seismic Design Category: | All structures shall be assigned to a Seismic Design Category based on their Seismic Use Group and the design spectral response acceleration coefficients, $S_{DS}$ and $S_{D1}$ , determined in accordance with Sec. 4.1.2.5. Each building and structure shall be assigned to the most severe Seismic Design Category in accordance with Table 4.2.1a or 4.2.1b, irrespective of the fundamental period of vibration of the structure, $T$ .                                                                                                                                                                                                                    | Basically equivalent |
| R301.2.2.1.2 Alternative determination of Seismic Design Category E                                                      | Buildings located in SDC E in accordance with Table 301.2(3) are permitted to be reclassified as being in SDC D <sub>2</sub> provided one of the conditions is met.                                                                                                                                                                                                              | 5.2.5.3 Seismic Design Categories D, E, and F   | This section contains a provision that is much more clearly stated in the IBC. For regular structures five stories or fewer in height having a period of 0.5 sec. Or less, the design spectral response accelerations, $S_{DS}$ and $S_{D1}$ , need not exceed the values calculated using values of $S_s$ and $S_1$ , respectively, of 1.5g and 0.6g. A cap of 0.6g on $S_1$ would amount to a reclassification of SDC E structures into D. However, NEHRP Section 5.2.5.3 is part of Section 5.2.5, Analysis Procedures. Its applicability for the purposes of determination of SDC is not clear. In view of that, IRC still must be considered less stringent. | IRC less stringent   |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                         |                                                                                                                                                                                                                                             |                                                                                                                          |                                                                                                                                                                                                                                                                                                    |                                                      |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| R301.2.2.2<br>Determination of seismic design category: | The default site class is taken to be D. For other soil conditions, $S_{DS}$ can be determined as per IBC, and SDC can be assigned according to Fig. R301.2(2). Essentially similar to Section R301.2.2.1                                   | 4.2.1 Determination of Seismic Design Category:                                                                          | All structures shall be assigned to a <i>Seismic Design Category</i> based on their <i>Seismic Use Group</i> and the design spectral response acceleration ..... vibration of the structure, $T$ .                                                                                                 | Basically equivalent                                 |
| Table R301.2(3)                                         | SEISMIC DESIGN CATEGORY DETERMINATION based on $S_{DS}$                                                                                                                                                                                     | Table 4.2.1a<br>Table 4.2.1b                                                                                             | Determination of SDC based on $S_{DS}$ and Seismic Use Group<br>Determination of SDC based on $S_{D1}$ and Seismic Use Group                                                                                                                                                                       | NEHRP is broader in scope. Basically equivalent      |
| R301.2.2.3 Anchored stone and masonry veneer            | In SDC C, shall be limited to the first story above grade and shall not exceed 5 in. in thickness.                                                                                                                                          | 11.13.3 Masonry Veneer Design<br>11.13.3.1:<br>11.13.3.2:<br>12.5.1: Exceptions to Conventional Light-frame Construction | No restriction<br><br>Masonry veneer is acceptable for the first story above grade, or the first two stories above grade when the lower story has concrete or masonry walls, of SDC B and C structures.                                                                                            | IRC more stringent                                   |
| R301.2.2.4 Weights of materials                         |                                                                                                                                                                                                                                             | 12.5 CONVENTIONAL LIGHT-FRAME CONSTRUCTION<br>12.5.1 Scope                                                               | Identical for light-frame wood walls.<br>Weights for other materials not specifically mentioned.                                                                                                                                                                                                   | Equivalent<br>IRC more stringent                     |
| R301.2.2.5 Masonry construction in SDC C                | Masonry construction in SDC C shall comply with the requirements of Sec. R606.11.2                                                                                                                                                          | 11.3.7 SDC C                                                                                                             |                                                                                                                                                                                                                                                                                                    | R606.11.2 and 11.3.7 are compared later              |
| R301.2.2.6 Height Limitations in SDCs $D_1$ and $D_2$   | IRC permits wood framed buildings up to 3 stories above grade in SDC $D_1$ and up to 2 stories above grade in SDC $D_2$<br>Cold-formed steel framed buildings are restricted by the IRC to two stories above grade.                         | 12.5.1 Scope<br>Table 12.5.1-1<br><br>8.5 COLD-FORMED STEEL SEISMIC REQUIREMENTS                                         | NEHRP restricts conventional wood frame construction to 1 story above grade in SDC D.<br><br>NEHRP does not have such an explicit limitation.                                                                                                                                                      | IRC is less stringent<br><br>IRC is more restrictive |
| R301.2.2.7 Irregular Buildings                          | Conventional light-frame construction shall not be used in irregular portions of structures in SDC C, $D_1$ and $D_2$ . Only such irregular portions of structures shall be designed in accordance with accepted engineering practice ..... | 12 WOOD STRUCTURE DESIGN REQUIREMENTS<br>12.5 CONVENTIONAL LIGHT-FRAME                                                   | Irregular structures in <i>Seismic Design Categories C and D</i> of conventional light-frame construction shall have an engineered <i>late-rail-force-resisting system</i> designed to resist the forces specified in Chapter 2 in accordance with Sec. 12.2.1. A structure shall be considered to | Essentially equivalent                               |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                                               | A portion of a building is considered to be irregular if one or more of the following conditions occur:                                                                   | CONSTRUCTION<br>12.5.1.1 Irregular Structures:                                                                                                                                                                     | have an irregularity when one or more of the conditions described in Sec. 12.5.1.1.1 to 12.5.1.1.7 are present.<br>The conditions are essentially identical. |                                            |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| R301.2.2.8 Concrete construction                                                              | Buildings with above-grade concrete walls in SDC D <sub>1</sub> and D <sub>2</sub> shall be designed in accordance with accepted engineering practice.                    | 9.1 REFERENCE DOCUMENTS                                                                                                                                                                                            | The same thing is required through adoption of ACI 318 by reference although no formal statement as with IRC is included.                                    | Essentially equivalent                     |
| R301.2.2.9 Irregular buildings in Seismic Design Categories D <sub>1</sub> and D <sub>2</sub> | In Seismic Design Categories C, D <sub>1</sub> and D <sub>2</sub> , Irregular buildings shall have an engineered lateral-force-resisting-system designed as per IBC.      | 5.2.3.2 Plan Irregularity<br>5.2.3.3 Vertical Irregularity<br>5.2.6.3.1 Plan Irregularity (SDC C)<br>5.2.6.4.3 Plan or Vertical Irregularities (SDC D)<br>5.2.6.5.1 Plan or Vertical Irregularities (SDCs E and F) | IRC requirements are more specific to the type of structures it covers.                                                                                      | Equivalent in principle                    |
| R301.2.3 Snow loads                                                                           | Limits applicability of IRC to ground snow load $\leq 70$ psf                                                                                                             |                                                                                                                                                                                                                    |                                                                                                                                                              | N/A                                        |
| R301.2.4 Floodplain construction                                                              | Requires conformance with R327                                                                                                                                            | 5.2.7 Combination of Load Effects                                                                                                                                                                                  | Requires conformance with Section 5.3 of ASCE 7-95                                                                                                           | Basically equivalent                       |
| R301.3 Dead load                                                                              | The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.<br>Table R301.4 | 2.1 GLOSSARY                                                                                                                                                                                                       | Similar definition of dead load                                                                                                                              | Considered equivalent                      |
| R301.4 Live load                                                                              |                                                                                                                                                                           | 5.2.7                                                                                                                                                                                                              | Refers to ASCE 7-95.<br>Table 4-1 specifies basically the same loads for residential constructions.                                                          | Equivalent                                 |
| R301.5 Roof load                                                                              | Table R301.5                                                                                                                                                              | 5.2.7                                                                                                                                                                                                              | Refers to ASCE 7-95. Section 4.9.1 specifies the same roof live loads.<br>The snow load of Table 301.2(1) cannot be compared with ASCE 7 requirements.       | Equivalent<br>Equivalency cannot be judged |
| CHAPTER 4                                                                                     |                                                                                                                                                                           | Chapter 7                                                                                                                                                                                                          |                                                                                                                                                              |                                            |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

| FOUNDATIONS                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | FOUNDATION DESIGN REQUIREMENTS                      |                                                                                                                                                                                                                                               |                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| R401.1 Application                                                                                                                | The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for all buildings. Wood foundations shall be designed and installed in accordance with AF&PA Report No.7.<br>Wood foundations in SDCs D <sub>1</sub> and D <sub>2</sub> shall be designed in accordance with accepted engineering practice.                                                                                               | No such provisions in Chapter 7 or Chapter 12.      |                                                                                                                                                                                                                                               | IRC more stringent                                       |
| R403 FOOTINGS<br>R403.1 General<br>R403.1.1 Minimum size<br>R403.1.2 Continuous footings in SDC D <sub>1</sub> and D <sub>2</sub> | The braced wall panels at exterior walls of all buildings located in SDC D <sub>1</sub> and D <sub>2</sub> shall be supported by continuous footings. All required interior braced wall panels in buildings with plan dimensions greater than 50 feet shall also be supported by continuous footings.<br>Concrete footings located in SDCs D <sub>1</sub> and D <sub>2</sub> shall have min. reinforcement. The term "Minimum reinforcement" is not clear. | 12.5.3.5 Foundation Supporting Braced Wall Panels:  | In conventional Light-Frame Construction in SDCs B and above, exterior braced wall panels must be supported on foundations for plan dimensions not over 50 ft and all braced wall panels must be so supported for plan dimensions over 50 ft. | Considered equivalent                                    |
| R403.1.3 Seismic reinforcing                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 9.7 SDCs D, E, or F<br>9.7.3 Plain Concrete         |                                                                                                                                                                                                                                               | IRC is equivalent to more stringent                      |
| R403.1.4 Minimum depth                                                                                                            | In SDCs D <sub>1</sub> and D <sub>2</sub> , interior footings supporting bearing or bracing walls and cast monolithically with a slab on grade shall extend to a depth of not less than 18 in. below the top of slab.                                                                                                                                                                                                                                      | No such provisions                                  |                                                                                                                                                                                                                                               | IRC more stringent                                       |
| R403.1.6 Foundation anchorage                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 12.5.3.1 Wall Anchorage:                            |                                                                                                                                                                                                                                               | Equivalency cannot be judged without comparative designs |
| R404 FOUNDATION WALLS<br>R404.1.1 Masonry foundation walls                                                                        | .... In SDCs D <sub>1</sub> and D <sub>2</sub> , concrete masonry and clay masonry foundation walls shall comply with Section R404.1.4                                                                                                                                                                                                                                                                                                                     | 11.3.8 SDC D<br>11.3.8.3 Minimum wall reinforcement |                                                                                                                                                                                                                                               | IRC is more detailed. See also R404.1.4                  |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                                                                      |                                                                                                                                                                                                                                 | 11.3.8.5 Minimum wall thickness                      |                                          |                       |
|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------|-----------------------|
| R404.1.2 Concrete foundation walls                                                                                   | .... In SDCs D1 and D2, concrete foundation walls shall comply with Section R404.1.4                                                                                                                                            | 9.7 SDCs D, E or F<br>9.7.3 Plain concrete<br>Item 3 |                                          | See R404.1.4          |
| R404.1.4 Seismic Design Categories D1 and D2                                                                         | In addition to ... in SDCs D1 and D2 shall comply with the following:                                                                                                                                                           | 9.7.3 (3)<br>11.3.8.3                                | Partially equivalent. IRC more detailed. | IRC more stringent    |
| R404.1.8 Rubble stone masonry                                                                                        | Rubble stone masonry .... Pressure greater than 30 psf and shall not be constructed in SDCs D1 and D2 ...                                                                                                                       | 11.3.8.3 Minimum wall reinforcement                  | Is also prohibited                       | Equivalent            |
| R404.4 Insulating concrete from foundation walls<br>R404.4.1 Applicability limits                                    | The provisions .... high. Foundation walls shall be limited to buildings subjected to a maximum ground snow load of 70 psf and located in SDC A, B or C.                                                                        | No such provisions                                   |                                          | IRC more stringent    |
| R407 COLUMNS<br>R407.3 Structural requirements                                                                       | The columns shall be restrained to prevent lateral displacement at the bottom end.<br>Wood columns .... equivalent.<br>Exception: In SDCs A, B and C columns no more than 48 inches in height on a pier or footing ...          | No similar provisions                                |                                          | IRC more stringent    |
| CHAPTER 5 FLOORS                                                                                                     |                                                                                                                                                                                                                                 |                                                      |                                          |                       |
| R502 WOOD FLOOR<br>FRAMING R502.7<br>Lateral restraint at supports                                                   | Joists shall be supported laterally at the ends by full depth solid blocking not less than 2 in. nominal thickness ....<br>Exception: In SDCs D1 and D2, lateral restraint shall also be provided at each intermediate support. | No similar provisions                                |                                          | IRC more stringent    |
| R505 STEEL FLOOR<br>FRAMING<br>R505.3 Floor construction<br>R505.3.1 Floor to foundation or bearing wall connections |                                                                                                                                                                                                                                 | No similar provisions                                |                                          | IRC is more stringent |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                                                                                            |                                                                                                                                                                                                                                                                              |                                                                                                                                   |                                                                                                                                             |                                                  |  |
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| Table R505.3.1(1)<br>Floor to foundation or<br>bearing wall<br>connection<br>requirements                                                  |                                                                                                                                                                                                                                                                              |                                                                                                                                   |                                                                                                                                             |                                                  |  |
| CHAPTER 6 WALL<br>CONSTRUCTION                                                                                                             |                                                                                                                                                                                                                                                                              |                                                                                                                                   |                                                                                                                                             |                                                  |  |
| R602 WOOD WALL<br>FRAMING<br>R602.3 Design and<br>construction                                                                             |                                                                                                                                                                                                                                                                              |                                                                                                                                   |                                                                                                                                             |                                                  |  |
| R602.3.2 Top plate                                                                                                                         | Wood stud walls ...partitions. End joints in<br>top plates shall be offset at least 24<br>inches.<br>Exception: .....                                                                                                                                                        | 12.5.3.2 Top Plates:                                                                                                              | Stud walls shall be capped ... intersections. End<br>joints in double-top plates shall be offset at least<br>4 feet. Single top ... plates. | IRC is more<br>stringent.                        |  |
| R602.3.3 Bearing<br>studs                                                                                                                  | Where joists, trusses or rafters are spaced<br>more than 16 in. on center and the bearing<br>studs below are spaced 24 in. on center,<br>such members shall bear within 5 in. of the<br>studs beneath.<br>Exceptions: ...                                                    | No such provisions                                                                                                                |                                                                                                                                             | IRC more<br>stringent                            |  |
| R602.3.5 Bottom (sole)<br>plate                                                                                                            | Identical                                                                                                                                                                                                                                                                    | 12.5.3.3 Bottom Plates                                                                                                            |                                                                                                                                             | Equivalent                                       |  |
| R602.9 Cripple walls                                                                                                                       | Foundation cripple walls shall be framed of<br>studs not less in size than the studding<br>above. When exceeding 4 feet in height,<br>such walls shall be framed of studs having<br>the size required for an additional story.<br>Cripple walls ....<br>IRC is more detailed | 12.5.2.2 Braced Wall<br>Line Sheathing<br>Requirements                                                                            | Cripple walls shall be braced as required for<br>braced wall lines and shall be considered an<br>additional story.                          | IRC is more<br>detailed but no<br>more stringent |  |
| R602.10 Wall bracing<br>R602.10.1 Braced wall<br>lines<br>R602.10.2 Cripple wall<br>bracing<br>R602.10.3 Braced wall<br>panel construction |                                                                                                                                                                                                                                                                              | 12.5.2 Braced Walls<br>12.5.2.1 Spacing<br>Between Braced Wall<br>Lines<br>12.5.2.2 Braced Wall<br>Line Sheathing<br>Requirements |                                                                                                                                             | IRC is more<br>detailed and more<br>stringent.   |  |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                  |                                                                                                                              |                                                                                                                                                  |                                                 |
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| methods<br>R602.10.4 Length of<br>braced panels<br>R602.10.5 Continuous<br>structural panel<br>sheathing<br>R602.10.6 Alternate<br>braced wall panels<br>R602.10.7 Panel joints<br>R602.10.8<br>Connections<br>R602.10.9 Interior<br>braced wall support<br>R602.10.10 Design of<br>structural elements<br>R602.10.11 Bracing in<br>SDCs D <sub>1</sub> and D <sub>2</sub><br>Table R602.10.3 |                                                                                                                                                                                  | Cripple Wall Bracing<br>12.5.2.3 Attachment<br>12.5.3.4 Braced Wall<br>Panel Connections<br>Table 12.5.1-1<br>Table 12.5.2-1 | The length of braced panels (per section<br>R602.10.4 of IRC) is less than those prescribed<br>in NEHRP (Table 12.5.2-1) for SDC C and<br>above. | IRC is less<br>stringent                        |
| R602.11 Framing and<br>connections for SDCs<br>D1 and D2                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                  |                                                                                                                              |                                                                                                                                                  |                                                 |
| R602.11.1 Wall<br>anchorage                                                                                                                                                                                                                                                                                                                                                                   | .... Plate washers, a minimum of ¼ in. by<br>2 in. by 2 in. (1/4 in.x 3 in. x 3 in. in<br>NEHRP) in size, shall be provided<br>between the foundation sill plate and the<br>nut. | 12.5.3.1 Wall<br>Anchorage                                                                                                   | Similar provisions; IRC is somewhat less<br>stringent; however, this may not result in any<br>effective difference in performance.               | IRC is less<br>stringent                        |
| R602.11.2 Interior<br>braced wall panel<br>connections                                                                                                                                                                                                                                                                                                                                        | Basically equivalent; but more detailed<br>with Table R602.3(1).                                                                                                                 | 12.5.3.4 Braced Wall<br>Panel Connections                                                                                    |                                                                                                                                                  | Considered<br>equivalent. IRC<br>more detailed. |
| R602.11.3 Stepped<br>foundations                                                                                                                                                                                                                                                                                                                                                              | Detailed construction requirements are<br>given.                                                                                                                                 | 12.5.3.6 Stepped<br>Footings                                                                                                 | Essentially similar with minor changes in Item 2<br>(Item b in NEHRP)                                                                            | Considered<br>equivalent                        |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                   |                                                                            |                                                                                                                                                                                                     |                                                                                                                                |
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| R603 STEEL WALL FRAMING<br>R603.1.1 Applicability limits<br>R603.1.1.1 Additional limits in high wind and high seismic regions<br>R603.1.2 In-line framing<br>R603.2 Structural framing<br>R603.3 Wall construction<br>R603.3.1 Wall to foundation or floor connections<br>R603.3.2 Load-bearing walls<br>R603.3.3 Stud bracing<br>R603.6 Headers | IRC is more detailed and elaborate.                                                               | 8.6 LIGHT-FRAMED WALLS                                                     | Refers to AISC Specification for the Design of Cold-Formed Steel Structural members, 1996, and ASCE Specification for the Design of Cold-Formed Stainless Steel Structural Members, ANSI/ASCE 8-90. | IRC requirements are more detailed and equivalency cannot be established without detailed reference to AISI and ASCE standards |
| R603.7 Structural sheathing                                                                                                                                                                                                                                                                                                                       | Prescriptive requirements.<br>IRC appears to require slightly less sheathing percentage on walls. | 12.4.3.1 Structural-Use panel Sheathing                                    | Different prescriptive requirements.                                                                                                                                                                | Equivalency difficult to judge                                                                                                 |
| R603.8 Braced walls and diaphragms in high seismic and high wind regions<br>R603.8.1 General<br>R603.8.2 Seismic Design Categories D1 and D2                                                                                                                                                                                                      |                                                                                                   | 12.4 DIAPHRAGMS and SHEAR WALLS<br>12.4.3.1 Structural-Use Panel Sheathing | IRC allows Gypsum, etc. as sheathing; NEHRP only allows wood structural-use panel sheathing.                                                                                                        | IRC less stringent with respect to sheathing material allowed. Otherwise, equivalency difficult to judge                       |
| R606 GENERAL MASONRY CONSTRUCTION                                                                                                                                                                                                                                                                                                                 |                                                                                                   |                                                                            |                                                                                                                                                                                                     |                                                                                                                                |
| R606.2 Thickness of                                                                                                                                                                                                                                                                                                                               | Essentially identical                                                                             | Ref. 11.1: Chapter 9                                                       | Applicable to lateral force-resisting systems for                                                                                                                                                   | IRC more                                                                                                                       |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

| masonry                                                                                                                                                |                                                                                                                                                                                                                                                                                                                  | EMPIRICAL DESIGN OF MASONRY                                                                                                               | structures in SDC A only and parts of buildings in SDCs A, B and C.                                                   | restrictive                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| R606.2.1 Minimum thickness<br>R606.2.2 Rubble stone masonry wall<br>R606.2.3 Change in thickness<br>R606.2.4 parapet walls<br>R606.3 Corbelled masonry |                                                                                                                                                                                                                                                                                                                  | 9.6 Thickness of masonry<br>9.6.2.1 Minimum thickness<br>9.6.2.2 Rubble stone walls<br>9.6.2.3 Change in thickness<br>9.6.4 Parapet walls |                                                                                                                       |                                  |
|                                                                                                                                                        | Solid masonry units shall be used for corbelling. The maximum ... wall. Adds another requirements on Support conditions (R606.3.1)                                                                                                                                                                               | Ref. 11.1: Chapter 9<br>9.9.4 Corbelling                                                                                                  | Applicable to lateral force-resisting systems for structures in SDC A only and parts of buildings in SDCs A, B and C. | IRC more stringent               |
| R606.4 Allowable stresses                                                                                                                              | Table R606.4 is identical to Table 9.4.2 of Ref. 11.1 in NEHRP.<br>Adds another requirement in R606.4.1<br>Combined units: The net thickness of any facing unit that is used to resist stress shall not be less than 1.5 in.                                                                                     | Ref. 11.1: Chapter 9<br>EMPIRICAL DESIGN OF MASONRY<br>9.4 Compressive stress requirements<br>9.4.2                                       | Applicable to lateral force-resisting systems for structures in SDC A only and parts of buildings in SDCs A, B and C. | IRC less stringent               |
| R606.5 Piers                                                                                                                                           | The unsupported height of masonry piers shall not exceed 10 times their least dimension. ....<br>IRC is more detailed; included NEHRP provisions.                                                                                                                                                                | 9.5 Lateral support<br>9.5.1.1.                                                                                                           | NEHRP restriction is more stringent, but IRC makes it generally applicable.                                           | Equivalency cannot be judged     |
| R606.6 Chases                                                                                                                                          |                                                                                                                                                                                                                                                                                                                  | Ref. 11.1: Chapter 9<br>9.9.1 Chases and recesses                                                                                         | Applicable to lateral force-resisting systems for structures in SDC A only and parts of buildings in SDCs A, B and C. | IRC more stringent               |
| R606.7 Stack bond                                                                                                                                      | In unreinforced masonry where masonry units are laid in stack bond, longitudinal reinforcement consisting of not less than two continuous wires each with a minimum aggregate cross-sectional area of 0.017 sq. in. shall be provided in horizontal bed joints spaced not more than 16 in. on center vertically. | 11.3.7.4 Stack bond construction (SDC C)<br>11.3.8.4 Stack bond construction (SDC D)                                                      |                                                                                                                       | IRC is more stringent in spacing |
| R606.8 Lateral support                                                                                                                                 | Masonry walls shall be laterally supported                                                                                                                                                                                                                                                                       | Ref. 11.1: Chapter 9                                                                                                                      | Applicable to lateral force-resisting systems for                                                                     | IRC more                         |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                   | in either the horizontal or the vertical direction. ... Table R606.8 (which is identical to Table 9.5.1 of Ref. 11-1)                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 9.5 – Lateral support<br>9.5.1<br>9.5.2                               | structures in SDC A only and parts of buildings in SDCs A, B and C.                                                                                                                                      | stringent                                          |
|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| R606.8.1 Horizontal lateral support<br>R606.8.1.1 Bonding pattern | Fifty percent of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than 3 in. on the unit below.<br>Interior nonload-bearing walls shall be anchored ... hardware cloth.<br>Adds another requirements for intersecting masonry walls, other than nonload-bearing walls.                                                                                                                                                                                                           | Ref. 11.1: Chapter 9<br>9.8 Anchorage<br>9.8.2.1                      | Applicable to lateral force-resisting systems for structures in SDC A only and parts of buildings in SDCs A, B and C.<br><br>NEHRP gives one more choice for anchorage.                                  | IRC slightly more stringent                        |
| R606.8.1.2 Metal reinforcement                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9.8.2.4<br>9.8.2.3<br>9.8.2.5                                         |                                                                                                                                                                                                          |                                                    |
| R606.8.2 Vertical lateral support                                 | Vertical lateral support of masonry walls in SDCs A, B or C shall be provided in accordance with one of the methods in Section R606.8.2.1 or R606.8.2.2.<br>Masonry walls ... 6 feet. Anchors shall be embedded at least 16 in. (15 in. in NEHRP) into the masonry, or be hooked or welded to bond beam reinforcement (0.20 sq. in. of bond beam reinforcement in NEHRP) placed not less than 6 in. from the top of the wall.<br>Masonry walls shall be ... ½ in. bolts spaced at intervals not to exceed 6 feet ... NEHRP provisions have no mention of bolt-dimension. | Ref. 11.1: Chapter 9<br>9.8.3 Floor and roof anchorage<br><br>9.8.3.3 | Applicable to lateral force-resisting systems for structures in SDC A only and parts of buildings in SDCs A, B and C.<br><br>NEHRP restriction is more stringent, but IRC makes it generally applicable. | Equivalency cannot be judged                       |
| R606.8.2.1 Roof structures                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                       |                                                                                                                                                                                                          |                                                    |
| R606.8.2.2 Floor diaphragms                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9.8.3.1                                                               |                                                                                                                                                                                                          | IRC more stringent                                 |
| R606.10 Anchorage                                                 | Gives the detailing in Figures. Not identical instructions in NEHRP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ref. 11.1: Chapter 9<br>9.8 Anchorage                                 | Applicable to lateral force-resisting systems for structures in SDC A only and parts of buildings in SDCs A, B and C.                                                                                    | IRC more detailed. Equivalency difficult to judge. |
| R606.11 Seismic Requirements<br>R606.11.1 General                 | The seismic requirements of this section shall apply to the design of masonry and the construction of masonry building                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                       | NEHRP provisions, although not detailed, explains the provisions to be applicable to different SDCs.                                                                                                     |                                                    |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                           |                                                                                                                                                                                                                    |                                         |  |                                                                                                                                                                                                                                                                                                   |                                                        |
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|                                                                           | elements located in SDCs C, D1 or D2. These requirements shall not apply to glass unit masonry or masonry veneer.                                                                                                  |                                         |  |                                                                                                                                                                                                                                                                                                   |                                                        |
| R606.11.2 SDC C                                                           |                                                                                                                                                                                                                    | 11.3.7 Seismic Design Category C        |  |                                                                                                                                                                                                                                                                                                   |                                                        |
| R606.11.2.2 Design of Elements part of the Lateral Force-Resisting System |                                                                                                                                                                                                                    |                                         |  |                                                                                                                                                                                                                                                                                                   |                                                        |
| R606.11.2.2.1 Connections to masonry shear walls                          | ... Connections shall be designed to transfer horizontal design forces acting either perpendicular or parallel to the wall, but not less than 200 lb per linear foot of wall.                                      | 5.2.6.3.3                               |  | Different provisions. No minimum requirements.                                                                                                                                                                                                                                                    | IRC more stringent                                     |
| R606.11.2.2.2 Connections to masonry column                               | ... There shall be a minimum of two #4 lateral ties provided in the top 5 in. of the column.                                                                                                                       | 11.3.7.7 Connections to Masonry Columns |  | Essentially identical. IRC more detailed.                                                                                                                                                                                                                                                         | Essentially equivalent                                 |
| R606.11.2.2.3 Minimum reinforcement requirements for masonry shear walls  | Vertical reinforcement of at least one #4 bar shall be provided ... and at a maximum spacing of 10 feet.<br><br>Horizontal joint reinforcement .... or ... at least one #4 bar spaced not more than 10 feet.       | 11.3.7.3 Minimum Wall Reinforcement     |  | Vertical reinforcement of at least 0.20 sq. in. in cross-sectional area shall be provided ..., at the ends of walls and at a maximum spacing of 4 feet apart ...<br>Horizontal reinforcement not less than 0.20 sq. in. in cross section shall be provided ... at maximum spacing of 120 in. .... | IRC less stringent<br><br>Essentially equivalent       |
| R606.11.3 SDC D <sub>1</sub>                                              | ... Masonry structures in SDC D <sub>1</sub> shall be limited in height to one story and 9 feet between lateral supports.                                                                                          | 11.3.8 Seismic Design Category D        |  | No similar restrictions.                                                                                                                                                                                                                                                                          | IRC more stringent                                     |
| R606.11.3.1 Design requirements                                           | Masonry elements other than those covered by Section R606.11.2.1.2 shall be designed in accordance with the requirements of Chapter 7 of ACI 530/ASCE 5/ TMS 402                                                   |                                         |  |                                                                                                                                                                                                                                                                                                   |                                                        |
| R606.11.3.2 Minimum reinforcement requirements for masonry walls          | ... The sum of ... at least 0.002 times the gross cross-sectional area of the wall, and the min. ... 0.0007 times the gross .... Table R606.11.3.2 provides the minimum reinforcing bar sizes required for varying | 11.3.8.3 Minimum Wall Reinforcement     |  | ... The sum of the areas of horizontal and vertical reinforcement shall be at least 0.002 times the gross cross-sectional area of the wall and the min. area .... not less than 0.0007 times the gross cross-sectional area of the wall. The                                                      | Essentially equivalent. IRC is slightly more stringent |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                               | thicknesses of masonry walls. The max. spacing ... 48 inches provided ...                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                       | spacing ... shall not exceed 48 in. Except for joint reinforcement, the bar size shall not be less than a No. 3. ....                                                                                                                                                                                                                                                                                                                                                      |                        |
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| R606.11.3.2.1 Shear wall reinforcement requirements                           | The max. spacing of vertical and horizontal reinforcement shall be the smaller of 1/3 <sup>rd</sup> the length of shear wall, 1/3 <sup>rd</sup> the height of the shear wall, or 48 in. The min. cross-sectional area of vertical reinforcement shall be 1/3 <sup>rd</sup> of the required shear reinforcement. Shear reinforcement shall be anchored around vertical reinforcing bars with a standard hook. | 11.11 SPECIAL REQUIREMENTS FOR SHEARWALLS<br>11.11.5 Special Reinforced Masonry Shear Walls<br>11.11.5.1 Vertical Reinforcement<br>11.11.5.2 Horizontal Reinforcement | Essentially identical with the following differences:<br>The maximum spacing of horizontal reinforcement shall be smaller of:<br>a. one-third the length of the wall<br>b. one-third the height of the wall<br>c. 48 in.<br>d. 24 in. for stack bond masonry<br>The item (d) in NEHRP is not included in IRC. IRC adds the following restriction for vertical reinforcement: The min. cross-sectional area shall be 1/3 <sup>rd</sup> of the required shear reinforcement. | Essentially equivalent |
| R606.11.3.3 Minimum reinforcement for masonry columns                         | Lateral ties in masonry columns shall be spaced not more than 8 in. on center and shall be at least 3/8 in. diameter. Lateral ties shall be embedded in grout.                                                                                                                                                                                                                                               | 11.3.8.6 Minimum Column Reinforcement                                                                                                                                 | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Equivalent             |
| R606.11.3.4 Material restrictions                                             | Type N mortar or masonry cement shall not be used as part of the lateral-force-resisting system.                                                                                                                                                                                                                                                                                                             | 11.3.8.1 Material Requirements                                                                                                                                        | Identical                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Equivalent             |
| R606.11.3.5 Lateral tie anchorage                                             | Standard hooks for lateral tie anchorage shall be either a 135-degree standard hook or a 180-degree standard hook.                                                                                                                                                                                                                                                                                           | 11.4.5.3 Standard Hooks                                                                                                                                               | Different types of standard hooks are defined including those of IRC. However, no specific mention about SDCs is given                                                                                                                                                                                                                                                                                                                                                     | IRC more stringent     |
| R606.11.4 SDC D <sub>2</sub>                                                  | Structures in SDC D <sub>2</sub> shall comply with the requirements of SDC D <sub>1</sub> and to the additional requirements of this section.                                                                                                                                                                                                                                                                | 11.3.9 Seismic Design Categories E and F                                                                                                                              | Structures assigned to SDCs E and F shall conform to the requirements of SDC D and to the additional requirements and limitations of this section.                                                                                                                                                                                                                                                                                                                         | IRC more stringent     |
| R606.11.4.1 Design of elements not part of the lateral force-resisting system | Stack bond masonry that is not part of the lateral-force-resisting system shall have a horizontal reinforcement of at least 0.0015 times the gross cross-sectional area of masonry. The max. spacing of horizontal reinforcement shall be 24 in. ...                                                                                                                                                         | 11.3.9.3 Stack Bond Construction<br>11.3.9.3.1 Sentence 1                                                                                                             | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Equivalent             |
| R606.11.4.2 Design of                                                         | Stack bond masonry that is not part of the                                                                                                                                                                                                                                                                                                                                                                   | 11.3.9.3 Stack Bond                                                                                                                                                   | Essentially identical                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Equivalent             |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

| elements part of the lateral force-resisting system        | lateral-force-resisting system shall have a horizontal reinforcement of at least 0.0025 times the gross cross-sectional area of masonry. The max. spacing of horizontal reinforcement shall be 16 in. ... | Construction<br>11.3.9.3.1 Sentence 2 |                         |                        |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------|------------------------|
| R607 UNIT MASONRY                                          |                                                                                                                                                                                                           |                                       |                         |                        |
| R607.1 Mortar                                              |                                                                                                                                                                                                           |                                       |                         |                        |
| R607.1.1 Foundation walls                                  |                                                                                                                                                                                                           |                                       |                         |                        |
| R607.1.2 Masonry in SDCs A, B and C                        | Mortar for masonry serving as the lateral-force-resisting system in SDCs A, B and C shall be Type M, S or N mortar.                                                                                       | Ref. 11-1<br>9.6.3.1                  | Essentially identical   | Equivalent             |
| R607.1.3 Masonry in SDCs D <sub>1</sub> and D <sub>2</sub> | Mortar for masonry serving as the lateral-force-resisting system in SDCs D <sub>1</sub> and D <sub>2</sub> shall be Type M or S mortar.                                                                   | 11.3.8.1 Material Requirements        |                         |                        |
| R608 MULTIPLE WYTHE MASONRY                                |                                                                                                                                                                                                           | Ref. 11-1<br>9.7 Bond                 |                         | Essentially equivalent |
| R608.1.1.1 Solid units                                     |                                                                                                                                                                                                           | 9.7.2.1                               | Identical               |                        |
| R608.1.1.2 Hollow units                                    |                                                                                                                                                                                                           | 9.7.2.2                               | Identical               |                        |
| R608.1.2.1 Bonding with wall ties                          |                                                                                                                                                                                                           | 9.7.3.1                               | Essentially identical   |                        |
| R608.1.2.2 Bonding with adjustable wall ties               |                                                                                                                                                                                                           | 5.8.3.2                               | Slightly less stringent |                        |
| R608.1.2.3 Bonding with prefabricated joint reinforcement  |                                                                                                                                                                                                           | 9.7.3.2                               | Identical               |                        |
| R608.1.3.1 Ashler masonry                                  |                                                                                                                                                                                                           | 9.7.4.1                               | Identical               |                        |
| R608.1.3.2 Rubble stone masonry                            |                                                                                                                                                                                                           | 9.7.4.2                               | Identical               |                        |
| R608.2 Masonry bonding pattern                             |                                                                                                                                                                                                           |                                       | Identical               | Equivalent             |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                       |                                                                                  |                                                                                                                                                                                                                                                                                                                                                 |                       |
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| R608.2.1 Masonry laid in running bond                                                                                                 | In each wythe of masonry ... offset shall not be less than 1/4 <sup>th</sup> the unit length, ...., the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 in. apart, shall be 0.0007 times the vertical cross-sectional area of the wall. | 11.1.3 Definition of running bond                                                | Identical                                                                                                                                                                                                                                                                                                                                       |                       |
| R608.2.2 Masonry laid in stack bond                                                                                                   |                                                                                                                                                                                                                                                                                                       | 11.3.7.4 Stack Bond Construction                                                 | Identical                                                                                                                                                                                                                                                                                                                                       |                       |
| R610 GLASS UNIT MASONRY                                                                                                               | Essentially identical with the requirements of 11.13.2 of Ref. 11-1, following additions:<br>R610.2 Materials<br>R610.5.2 Lateral support<br>Exceptions<br>R610.5.2.1 Panel anchor restraints<br>R610.5.2.2 Channel-type restraints<br>R610.6 Sills<br>R610.8 Mortar: sentence 2<br>R610.10 Placement | 11.13 GLASS-UNIT MASONRY AND MASONRY VENEER<br>11.13.2 Glass-Unit Masonry Design | The requirements of Chapter 11 of Ref. 11-1 shall apply to the design of glass unit masonry. The out-of-plane seismic strength shall be considered as the same as the strength to resist wind pressure as specified in Sec. 11.3 of Ref. 11-1.<br>Ref. 11-1: Building Code Requirements for Masonry Structures, ACI 530-95/ASCE 5-95/TMS 402-95 | Considered equivalent |
| R611 INSULATING CONCRETE FORM WALL CONSTRUCTION<br>R611.1 General                                                                     |                                                                                                                                                                                                                                                                                                       |                                                                                  |                                                                                                                                                                                                                                                                                                                                                 |                       |
| R611.2 Applicability limits                                                                                                           | ... Walls constructed in accordance with the provisions of this section shall be limited to buildings subjected to a maximum design wind speed of 130 mph, a maximum ground snow load of 70 psf, and SDCs A, B and C.                                                                                 | No such provisions in NEHRP                                                      |                                                                                                                                                                                                                                                                                                                                                 | IRC more stringent    |
| R611.7 Wall construction<br>R611.7.1 Reinforcement<br>R611.7.1.1 Location<br>R611.7.1.2 Vertical steel<br>R611.7.1.3 Horizontal steel |                                                                                                                                                                                                                                                                                                       | No such provisions in NEHRP                                                      |                                                                                                                                                                                                                                                                                                                                                 | IRC more stringent    |
| R611.7.2 Wall                                                                                                                         |                                                                                                                                                                                                                                                                                                       | No such provisions in                                                            |                                                                                                                                                                                                                                                                                                                                                 | IRC more              |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

| Openings                                           |  | NEHRP                                   |                                                                                                                                                           | stringent             |
|----------------------------------------------------|--|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| R611.7.3 Lintels                                   |  | No such provisions in NEHRP             |                                                                                                                                                           | IRC more stringent    |
| R611.7.4 Minimum length of wall without openings   |  | No such provisions in NEHRP             |                                                                                                                                                           | IRC more stringent    |
| R611.8 ICF wall to floor connections               |  | No such provisions in NEHRP             |                                                                                                                                                           | IRC more stringent    |
| CHAPTER 7                                          |  |                                         |                                                                                                                                                           |                       |
| WALL COVERING                                      |  |                                         |                                                                                                                                                           |                       |
| R703 EXTERIOR COVERING                             |  |                                         |                                                                                                                                                           |                       |
| R703.7 Stone and masonry veneer                    |  | 11.13.3 Masonry Veneer Design 11.13.3.1 | The requirements of Chapter 12 of Ref. 11-1 shall apply.<br>Ref. 11-1: Building Code Requirements for Masonry Structures, ACI 530-95/ASCE 5-95/TMS 402-95 |                       |
| R703.7 Stone and masonry veneer, general           |  | Ref. 11-1                               | Essentially identical                                                                                                                                     | Equivalent            |
| Exceptions:                                        |  | 12.5.1.2<br>12.5.1.3                    |                                                                                                                                                           |                       |
| R703.7.2 Exterior veneer support                   |  | Ref. 11-1<br>12.5.1.4                   | Essentially identical                                                                                                                                     | Equivalent            |
| R703.7.4 Anchorage                                 |  | Ref. 11-1:<br>12.8.3<br>12.9.4          | Essentially identical                                                                                                                                     | Equivalent            |
| R703.7.4.1 Size and spacing                        |  | Ref. 11-1:<br>12.7                      | Essentially similar, but in more details.                                                                                                                 | Considered equivalent |
| R703.7.4.1.1 Veneer ties around wall openings      |  | Ref. 11-1<br>12.7.6.4                   | Essentially identical                                                                                                                                     | Equivalent            |
| R703.7.4.1.2 SDC D <sub>1</sub> and D <sub>2</sub> |  | Ref. 11-1<br>12.12.2.4                  |                                                                                                                                                           | IRC more stringent    |
| CHAPTER 8 ROOF-                                    |  | No such prescriptive                    | The IRC prescriptive provisions are based on the                                                                                                          | Considered            |

**Table 3. Detailed Comparison of Structural Provisions of IRC 2000 and 1997 NEHRP (Continued)**

| CEILING<br>CONSTRUCTION                      |  | provisions in NEHRP                         | engineered construction requirements of 1997<br>NEHRP Chapter 12. | equivalent               |
|----------------------------------------------|--|---------------------------------------------|-------------------------------------------------------------------|--------------------------|
| R801 GENERAL                                 |  |                                             |                                                                   |                          |
| R802 WOOD ROOF<br>FRAMING                    |  | No such prescriptive<br>provisions in NEHRP |                                                                   | Considered<br>equivalent |
| R803 ROOF<br>SHEATHING                       |  | No such prescriptive<br>provisions in NEHRP |                                                                   | Considered<br>equivalent |
| R803.1 Lumber<br>sheathing                   |  | No such prescriptive<br>provisions in NEHRP |                                                                   | Considered<br>equivalent |
| R803.2 Wood<br>structural panel<br>sheathing |  | No such prescriptive<br>provisions in NEHRP |                                                                   | Considered<br>equivalent |
| R804 METAL                                   |  | No such prescriptive<br>provisions in NEHRP |                                                                   | Considered<br>equivalent |
|                                              |  |                                             |                                                                   |                          |
| CHAPTER 10<br>CHIMNEYS AND<br>FIREPLACES     |  | No such provisions in<br>NEHRP              |                                                                   | IRC more<br>stringent    |
| R1001 MASONRY<br>CHIMNEYS                    |  |                                             |                                                                   |                          |
| R1001.1 General                              |  |                                             |                                                                   |                          |
| R1002 FACTORY-<br>BUILT CHIMNEYS             |  |                                             |                                                                   |                          |
| R1003 MASONRY<br>FIREPLACES                  |  |                                             |                                                                   |                          |
| R1003.1 General                              |  |                                             |                                                                   |                          |
| R1003.2 Footings and<br>foundation           |  |                                             |                                                                   |                          |
| R1003.3 Seismic<br>reinforcing               |  |                                             |                                                                   |                          |
| R1003.4 Seismic<br>anchorage                 |  |                                             |                                                                   |                          |

