U.S. DEPARTMENT OF THE INTERIOR U.S. GEOLOGICAL SURVEY

BOREHOLE P- AND S-WAVE VELOCITY AT THIRTEEN STATIONS IN SOUTHERN CALIFORNIA

by

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BOREHOLE P- AND S-WAVE VELOCITY AT THIRTEEN SITES IN SOUTHERN CALIFORNIA

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INTRODUCTION

The U.S. Geological Survey (USGS), as part of a program to aquire seismic velocity data at locations of strong-ground motion in earthquakes (e.g. Gibbs, et al., 2000), has investigated thirteen additional sites in the Southern California region. Of the thirteen sites, twelve are in the vicinity of Whittier, California and one is located in San Bernardino, California.

Several deployments of temporary seismographs were made after the Whittier Narrows, California earthquake of 1 October 1987 (Mueller et al., 1988). A deployment, between 2 October and 9 November 1987, was the motivation for selection of six of the drill sites. Temporary portable seismographs at Hoover School (HOO), Lincoln School (LIN), Corps of Engineers Station (NAR), Olive Junior High School (OLV), Santa Anita Golf Course (SAG) and Southwestern Academy (SWA), recorded significant aftershock data. These portable sites with the exception of Santa Anita Golf Course were co-sited with strong-motion recorders.

Stations at HOO, Lincoln School Whittier (WLB), Saint Paul High School (STP), Alisos Adult School (EXC), Cerritos College Gymnasium (CGM), Cerritos College Physical Science Building (CPS), and Cerritos College Police Building (CPB) were part of an array of digital strong-motion stations deployed from "bedrock" in Whittier to near the deepest part of the Los Angeles basin in Norwalk. Although development and siting of this new array (patially installed at the time of this writing) was generally motivated by the Whittier Narrows earthquake, these new sites (with the exception of HOO) were not part of any Whittier Narrows aftershock deployments. A similar new digital strong-motion site was installed at the San Bernardino Fire Station during the same time frame.

Velocity data were obtained to depths of about 90 meters at two sites, 30 meters at seven sites, and 18 to 25 meters at four sites. Lithology data from the analysis of cuttings and samples, was obtained from the two 90-meter deep holes and from five of the shallower holes to supplement the velocity interpretation. The two 90-meter boreholes (SB1, CPB) have been instrumented with borehole seismometers for continuous monitoring of earthquake activity (Rogers, et al., 1998). No drill samples or cuttings were obtained from the other six sites but driller's logs were scanned for major changes noted there. The velocity models at those sites were interpreted using only the measured data and major changes in the driller's log as noted above.

The sites are shown in Figure 1 and listed in Table 1, which gives references to information regarding the strong-motion data. Several hundred strong-motion records of the main-shock were written by this moderate size earthquake ($M_L = 5.9$) making it important from a scientific and engineering prospective (Brady et al., 1988, Shakal et al., 1988).



Figure 1. Regional map showing the locations of boreholes (triangles) included in this report. Inset shows the locations of the Cerritos College boreholes at an expanded scale. Locations of roads and cities are approximate.

Table 1. Site names, three letter codes, and coordinates using the North American Datums of 1927 (NAD27) and 1983 (NAD83).

Station	StaCode	Lat:NAD27	Long:NAD27	Lat:NAD83	Long:NAD83
Cerritos College Gymnasium	CGM	33.88663	-118.09329	33.88664	-118.09419
Cerritos College Physical Sci. Bldg.	CPS	33.88589	-118.09698	33.88590	-118.09788
Cerritos College Police Bldg.	CPB	33.88212	-118.09680	33.88213	-118.09770
Corps of Engineers Station $*$	NAR	34.03219	-118.05225	34.03220	-118.05315
Hoover School *	HOO	33.98491	-118.02889	33.98492	-118.02979
Lincoln School *	LIN	34.09043	-118.09305	34.09044	-118.09395
Lincoln School Whittier	WLB	33.98535	-118.04061	33.98536	-118.04151
Los Alisos Adult School	EXC	33.89559	-118.08428	33.89560	-118.08518
Olive Junior High School *	OLV	34.10073	-117.97409	34.10074	-117.97499
San Bernardino Fire Station	SB1	34.10534	-117.28201	34.10535	-117.28289
Santa Anita Golf Course	SAG	34.13096	-118.03074	34.13097	-118.03164
South Western Academy $*$	SWA	34.11533	-118.13046	34.11534	-118.13136
St. Paul High School	STP	33.95158	-118.05369	33.95159	-118.05459

* Strong-motion accelerograph located near borehole (see location maps in Appendix A).

P- AND S-WAVE TRAVEL-TIME DATA

Shear waves were generated at the ground surface by an air-powered horizontal ram (Liu, *et al.*, 1988) striking an anvil at either end of an aluminum channel 2.3 meters long. The ram was driven first in one direction and then in the other to generate pulses of opposite polarity. A switch attached to the shear source triggered the recorder and established the reference for the timing of arrivals. *P*-waves were generated by striking a steel plate with a sledge hammer. The recorder was triggered by a switch attached to the handle of the sledge hammer. *P*- and *S*-wave sources were offset from the borehole (same horizontal distance but different locations) to minimize the effect of waves traveling down the grout surrounding the casing. The source offsets varied from 2 to 4 meters depending on available space and depth of the borehole. Shallow holes (30 meters or less) were offset 2 or 3 meters.

Downhole measurements were made at 2.5-meter intervals at ten locations and at 2-meter spacing at three of the shallower boreholes. The measurements were made by moving a three-component geophone to each depth and clamping it to the casing by an electrically-activated lever arm. A second three-component geophone was placed on the surface near the shear source used to verify timing of the triggered recorder. The data were recorded on diskettes using a 12-channel recording system.

VELOCITY PROFILES

The procedure for determining velocities is summarized in Figure 2. Because the orientation of the downhole geophone could not be controlled when moving from one depth to the next, the azimuth of the horizontal geophones relative to the source was unknown and changed with depth. To minimize the effects of those changes, the horizontal components were rotated to the direction that maximized the integral square amplitude within a time interval containing the shear wave (Boatwright *et al.*, 1986). *P*- and *S*-wave first-arrival times were determined from the time series displayed at each depth on a 20-inch computer screen. The *P*-wave arrival-time was obtained from the vertical trace, and the *S*-wave arrival-times were obtained from the average of the rotated horizontal traces for ram strikes in opposite directions. The arrivals were timed to the nearest millisecond, probably a realistic precision for clear arrivals uncontaminated by noise.

A trial set of layer boundaries was chosen for the S-wave model, based on the lithologic descriptions and geophysical logs at the two sites (CBP, SB1) where geologic information was available. At five sites (CGM, CPS, EXC, STP, WLB) simplified lithology, determined from drill cuttings, was used to supplement the velocity determinations. At the remaining six sites (NAR, HOO, LIN, OLV, SAG, SWA) the velocity models were determined without the benefit of lithology or electric logs. The travel-time data were fit in a least-squares sense by a model made up of constant velocity layers, taking into account refraction across the interfaces between layers. The travel times were weighted by the inverse of an assigned normalized variance. A normalized standard deviation of 1 was assigned to the clear arrivals and values up to 5 were assigned to the others. The residuals were examined, and layer boundaries were added, if necessary, to reduce large residuals or to remove systematic trends in the residuals. The *P*-wave travel time data were analyzed initially with the set of layer boundaries finally determined for the *S*-wave data. Layer boundaries were then added if needed to fit the data and deleted if not needed. Commonly, an additional layer



Figure 2. Flow-chart outlining the data processing and steps in the interpretation.

boundary corresponding to the top of the zone of water saturation was needed to fit the P-wave data.

Some of the dynamic Poisson's ratios σ , calculated with initial velocity models, resulted in ratios that were out of the accepted range of values (0.0–0.5). To obtain a value in the acceptable range we made minor adjustments to the velocities using one or more of the following procedures: repicking shallow arrivals (usually P arrivals because small changes in P travel-times have greater effect on σ), adding a shallow layer, and/or adjusting layer thickness to ensure that Poisson's ratio was in the range 0.0–0.5. In most cases the small changes were made in the P-wave velocities at shallow depths (for more details see, Gibbs, et al., 1999). Overall, the changes in velocity required to produce acceptable values of σ were small and were only in a few layers.

For example, at San Bernardino Fire Station several velocity models were tried to get Poisson's ratio into the accepted range. We were forced to average the P-wave velocity over the top 8.5 meters to get the ratio from a negative value to a value of 0.04. The preferred model in which the S-velocity follows the lithology (in general, the S-wave velocity is a better indicator of lithology than P-wave velocity) is included in Appendix A.

SUMMARY VELOCITY PROFILES

Figures 3-5 show the S-wave velocity profiles determined from the borehole measurements at the thirteen sites. The velocity profiles are plotted at the same scale for ease of comparison. Figures 6-8 show the P-wave velocity profiles for the same sites as Figures 3-5, respectively.

DESCRIPTION OF APPENDICES

Appendix A contains for each site: a location map, S- and P-wave time-series records, a time-depth plot, and tables giving arrival times and velocity values. The upper and lower bounds on the velocity plots show approximate 68 percent confidence limits. The bounds are not symmetrical because they are based on the inverse velocities in the layers. Appendix B contains tables of P- and S-wave velocity models and the Poisson's ratios obtained from those models.



Figure 3. S-wave velocity models shown on the same figure for comparison.



Figure 4. S-wave velocity models shown on the same figure for comparison.



Figure 5. S-wave velocity models shown on same figure for comparison.



Figure 6. P-wave velocity models shown on the same figure for comparison.



Figure 7. P-wave velocity models shown on the same figure for comparison.



Figure 8. P-wave velocity models shown on the same figure for comparison.

ACKNOWLEDGMENTS

We could not have completed these studies without the assistance of many individuals who helped us to gain access to the sites, assisted with utilities clearances and granted permission to conduct the studies. These people include Michael Sebak at Cerritos College; Warren Thomas at Corps of Engineers Station; Margie Leon and Ray Rodriguez at Hoover School; Jack Feldman at Lincoln School; Stephen Finkle at Lincoln School Whittier; Mr. Hengler at Los Alisos Adult School; Daniel at Olive Junior High School; Richard McGreevy at San Bernardino Fire Station; Dave Cuellar, Terry Moeller, and Tom Dittmar at Santa Anita Golf Course; Charles Craig at South Western Academy; Father Robert Gallagher at St. Paul High School. We also thank Allen Foss of the U.S. Geological Survey for his help with the P- and S-wave logging.

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APPENDIX—A Detailed Results



Figure A-1. Site location map for the borehole at Cerritos College Gymnasium.



Oct 23, 2001 F:\CGM\CGMT.DT F:\CGM\CGMT2.GRA

Figure A-2. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Oct 23, 2001 F:\CGM\CGMPWAVE.DT F:\CGM\CGMPWAVE.GRA

Figure A-3. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-4. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-1. S-wave arrival times and velocity summaries.

Location: Cerritos College Gymnasium: S Coordinates: hoffset = 2.00 travel-time file: F:\CGN\CGNS.TT

29.4	27.5	25.0	22.5	20.0	17.5	15.0	12.5	10.0	7.5	5.0	2.5	d(m) d
96.5	90.2	82.0	73.8	65.6	57.4	49.2	41.0	32.8	24.6	16.4	8.2	l(ft)
0.1173	0.1108	0.1040	0.0936	0.0835	0.0738	0.0637	0.0540	0.0420	0.0313	0.0199	0.0126	tsl(s)
0.1166	0.1108	0.1032	0.0932	0.0832	0.0731	0.0631	0.0530	0.0415	0.0300	0.0185	0.0098	tvrt(s)
252	248	242	241	240	239	238	236	241	250	270	255	vavg(m/s)
H	Ч	н	H	н	ч	ч	н	+	н	Ļ	ч	sig
0.0003	-0.0005	0.0003	-0.0001	-0.0002	0.0001	0.0000	0.0002	-0.0004	0.0002	0.0000	0.0000	rsdl(sec)

33.88663 -118.09329 Hole_Code:

296

nlayers = Ś

																	29.4	25.0	12.5	5.0	2.5	dtb (m)
																	4.4	12.5	7.5	2.5	2.5	thk (m)
	(s/m)TΔ	∇(m/s)	thk (m)	dtb(m)	rsdl (se	sig	m) from	tvrt(s)					tsl(s)	d(ft)	d(m)	Explanat	925	249	217	288	255	v(m/s)
			ш	н	č) =	ñ	5								п	ion,						v1 (
	(se	vel	thi	dep	res	Sig	COL	Ver	blo	ave	tim	ę	obs	dep	dep		320	247	215	277	249	m/s)
0.22	e text for	ocity of	.ckness of	th to bott	ndard devi idual (obs	ma, stands	uputed as a	tical trat	ws differi	rage of p:	ies used in	receiver,	served arri	th in feet	oth in mete		338	250	219	299	262	vu(m/s)
	of velocit r explanat	layer in 1	layer in	com of lay	served -	urd deviat	avg_vel =	rel time .	ng in di	icks from	the S-wa	along a :	lval time		ers		96.5	82.0	41.0	16.4	8.2	dtb(ft)
	ion of t	neters po	meters	ver in me	fitted to	ion nori	d(m)/tvr	computed	ection 1	traces	we model	slant pat	in secor				14.4	41.0	24.6	8.2	8.2	thk (ft)
	velocity	er second		eters	cks ravel tin	nalized t	rt (s)	from the	by 180 de	obtained	l, the t:	ch). Foi	nds (from				1079	816	711	943	837	v(ft/s)
	second limits)				te), in s	to the	sach nebo	model	igrees.	from ham	imes are	the arr	Source				1050	118	704	806	817	vl(ft/s)
					100S		ш,	r		mer	the	ival					1109	822	718	186	858	vu(ft/s)

vu(m/s) = upper limit of velocity in meters per secon dtb(ft) = depth to bottom of layer in feet thk(ft) = thickness of layer in feet v(ft/s) = velocity of layer in feet per second vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second

= upper limit of velocity in meters per second = depth to bottom of layer in feet

6T

TABLE A-2. P-wave arrival times and velocity summaries.

Location: Cerritos College Gymnasium: P Coordinates: hoffset = 2.00 travel-time file: F:\CGH\CGHP.TT 33.88663 -118.09329 Hole_Code: 296

	0.0007	н	781	0.0376	0.0384	96.5	29.4
	-0.0001	н	755	0.0364	0.0364	90.2	27.5
	-0.0005	н	718	0.0348	0.0344	82.0	25.0
	-0.0003	н	677	0.0332	0.0330	73.8	22.5
	-0.0004	н	632	0.0316	0.0314	65.6	20.0
	0.0002	н	583	0.0300	0.0304	57.4	17.5
	-0.0001	н	528	0.0284	0.0286	49.2	15.0
	0.0006	н	466	0.0268	0.0277	41.0	12.5
	-0.0001	н	396	0.0252	0.0256	32.8	10.0
29	-0.0047	(n	416	0.0180	0.0140	24.6	7.5
10	0.0007	н	437	0.0114	0.0130	16.4	5.0
9	-0.0009	н	437	0.0057	0.0064	8.2	2.5
dtb	rsdl(sec)	6TS	vavg(m/s)	tvrt(s)	tsl(s)	d(ft)	d(m)

nlayers = 3

thk(m) v(m/s) vl(m/s) 6.0 437 418 456 4.0 348 328 371 19.4 1563 1486 1648

dtb(ft) thk(ft) v(ft/s) v1(ft/s) v1(ft/s 19.7 19.7 1432 1372 1497 32.8 13.1 1142 1075 1219 96.5 63.6 5128 4877 5407

vu(m/s) = upper limit of velocity in meters per second dtb(ft) = upper limit of velocity in meters per second thk(ft) = depth to bottom of layer in feet v(m/s) vl(m/s) d(ft) d(m) Explanation: dth (m) thk (m) blows differing in direction by 180 degrees. tvrt(s) = vertical travel time computed from the model vavg(m/s)= average velocity from the surface to each depth, vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second v(ft/s) sig rsdl(sec)= residual (observed - fitted travel time), in secs dtb(m) = depth to bottom of layer in meters tsl(s) = observed arrival time in seconds (from source to receiver, along a slant path). For the arrival = velocity of layer in feet per second computed as avg_vel = d(m)/tvrt(s) = sigma, standard deviation normalized to the = depth in feet = depth in meters = velocity of layer in meters per second = thickness of layer in meters standard deviation of best picks times used in the S-wave model, the times are the average of picks from traces obtained from hammer



Figure A-6. Site location map for the borehole at Cerritos College Physical Science Building.



Figure A-7. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-8. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-9. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-3. S-wave arrival times and velocity summaries.

Location: Physical Sciences Building: S Coordinates: hoffset = 2.00 travel-time file: F:\CPS\CPSS.TT

29.0 95.1	27.5 90.2	25.0 82.0	22.5 73.8	20.0 65.6	17.5 57.4	TO' 10'ET	10 10 20 2	12.5 41.0	10.0 32.8 12.5 41.0	7.5 24.6 10.0 32.8 12.5 41.0	5.0 16.4 7.5 24.6 10.0 32.8 12.5 41.0	2.5 8.2 5.0 16.4 7.5 24.6 10.0 32.8 12.5 41.0
0.1267	0.1205	0.1102	0.1012	0.0912	0.0817	1	0.0711	0.0603	0.0487 0.0603 0.0711	0.0380 0.0487 0.0603 0.0711	0.0260 0.0380 0.0487 0.0603 0.0603	0.0178 0.0260 0.0380 0.0487 0.0603 0.0603
0.1262	0.1203	0.1104	0.1005	0.0906	0.0807		0.0709	0.0594	0.0479 0.0594 0.0709	0.0364 0.0479 0.0594 0.0709	0.0250 0.0364 0.0479 0.0594 0.0709	0.0135 0.0250 0.0364 0.0479 0.0594 0.0594
230	229	226	224	221	217		212	212 212	209 212	206 210 212	200 209 210 212	185 206 209 210 212
ч	ч	ч	Ч	H	н	1	-	чч	ччч		4444	
0.0002	-0.0001	-0.0005	0.0003	0.0001	0.0004	0.0001	-0 0004	-0.0002	-0.0002	-0.0003 -0.0002 -0.0002	-0.0009 -0.0003 -0.0002 -0.0002	0.0005 -0.0009 -0.0002 0.0002

33.88589 -118.09700 Hole_Code: 297

nlayers = 3

	dtb (m) 2.5 15.0 29.0
	thk(m) 2.5 12.5 14.0
Explanat d(m) d(ft) tsl(s) tvrt(s) vavg(m) sig sig trsdl(se dtb(m) thk(m) v(m/s) vl(m/s) vl(ft/s) vu(ft/s)	v(m/s) 185 218 253
1.0n.: (5)	N 1 (R
uppeecost to be to	1/s) 181 216 251
h in mete h in feet rved arri eceiver, s used ir s differi s differi s differi s differi dual trav age veloc uted as s a, standa dard deri dual (obs to bott h to bott h to bott city of j r limit of r limit of r limit of r limit of	vu(≞/s) 189 220 255
rs along a along a along a cks from avg_vel = ard deviat avg_vel = ard deviat com of lant layer in layer in	dtb(ft) 8.2 49.2 95.1
in secon slant pat traces of traces of traction l rection l the surj d(m)/twr d(m)/twr d(m)/twr d(m)/twr the surj d(m)/twr fitted tr fitted tr fit	thk(ft) 8.2 41.0 45.9
tro, the front the front from the from the from the from the from the from the from the from the from the from the from the from the from the from the from the from the from	v(ft/s) 607 715 830
m source r the arr from ham egrees. e model each dept to the to the me), in s me), in s second limits) second econd	vl(ft/s) 594 710 823
ival the b, ecs	vu(ft/s) 620 721 836

97

ABLE A-4. P-wave arrival times and velocity summaries.

Location: Physical Sciences Building: P Coordinates: hoffset = 2.00 travel-time file: F:\CPS\CPSP.TT

d(m) d(ft) 0.0400 0.0416 0.0430 0.0094 0.0114 0.0214 0.0214 0.0254 0.0310 0.0346 0.0366 0.0380 tsl(s) 0.0071 0.0119 0.0168 0.0216 tvrt(s) 0.0264 0.0313 0.0334 0.0355 0.0377 0.0398 0.0398 0.0419 0.0432 vavg(m/s) 5544453 4453 4453 4453 4453 4453 5524 4523 524 524 525 524 525 525 527 571 sig rsdl(sec 0.0003 0.0014 0.0014 0.0016 0.0016 0.0016 0.0005 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0004 0.0003 0.0003 0.0003 0.0003 0.0003 0.0003 0.0003 0.0003 0.0003 0.0003 0.0014 0.0003 0.0003 0.0014 0.0003 0.0014 0.0003 0.0014 0.0003 0.0014 0.0003 0.0004 0.0004 0.0004 0.0005

33.88589 -118.09700 Hole_Code:

297

nlayers = 3

 dtb(m)
 thk(m)
 v(m/s)
 v1(m/s)

 2.5
 2.5
 353
 322
 390

 15.0
 12.5
 517
 495
 540

 29.0
 14.0
 1172
 1076
 1287
dtb (ft) 8.2 49.2 95.1 5) thk(ft) v(ft/s) v1(ft/s) · 2 8.2 1158 1057 2 41.0 1695 1626 1 45.9 3845 3530) vu(ft/s) 1280 1771 4223

Explanation:

d(ft) d(m)

tsl(s) = depth in meters = depth in feet = observed arrival time in seconds (from source to receiver, along a slant path). For the arrival to receiver, along a slant path). blows differing in direction by 180 degrees. times used in the S-wave model, the times are the average of picks from traces obtained from hammer

tvrt(s) = vertical travel time computed from the model

sig standard deviation of best picks

dtb (m) thk (m) v(m/s) rsdl(sec) = residual (observed - fitted travel time), in secs = thickness of layer in meters = depth to bottom of layer in meters

= velocity of layer in meters per second

vl(m/s) = lower limit of velocity in meters per second

(see text for explanation of velocity limits) = upper limit of velocity in meters per second

vu(m/s) dtb(ft) thk(ft)

= depth to bottom of layer in feet

= thickness of layer in feet

v(ft/s) = velocity of layer in feet per second

vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second



Figure A-11. Site location map for the borehole at Cerritos College Police Building.



Cerritos College Police Station

Figure A-12. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Cerritos College Police Station

Figure A-13. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-14. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-5. S-wave arrival times and velocity summaries.

Location: Cerritos Police Building: S Coordinates: hoffset = 4.00 travel-time file: F:\CPB\CPBS.TT 33.88212 -118.09680 Hole_Code: 283

	SECOTION SECOTION	and her a	01 TT 10	of Autour	OT TIMES	dan _ /	e for the			0.0001	ł	005	0. 1.01	0.0101	111.0	04.0
	econd	at per s		of verocr	er timit		V1/10/2			0.0004	• •	000	0.200	0.2010	101	007.0
		NTIOTES	Tad Dar	rever The	octoy of .		1 1 1 1 1 1 1			0.0000	- +	0 00	0.0014	0.2000	0.00	0 0 0 0 1 0
			foot tox	Taket Th						0.0007	- ,	0 C 0 C 0 C	0.000	0.2040	010	
			foot	laver in	obmass of	= + -	+ >> / f+)			0 0002	-	305	D 2230	0 2548	270 7	202 7
		feet	yer in f	tom of la	th to bott	= dep	dtb (ft)			-0.0002	F	322	0.2483	0.2484	262.5	80.0
	second	eters per	ty in me	of veloci	er limit (= upp	Vu(m/s)			-0.0001	۲	319	0.2427	0.2428	254.3	77.5
	limits)	velocity	tion of	r explana	e text for	(se				-0.0002	ч	317	0.2367	0.2368	246.1	75.0
	second	sters per	ty in me	of veloci	er limit (= 1ow	vl(m/s)			0.0006	ч	314	0.2307	0.2316	237.9	72.5
	đ	er secon	meters F	layer in	ocity of :	= vel	$\nabla(m/s)$			0.0004	н	311	0.2247	0.2254	229.7	70.0
			meters	layer in	ckness of	= thi	thk (m)			-0.0001	ч	309	0.2187	0.2190	221.5	67.5
		ueters	yer in m	com of la	th to bott	= dep	dtb(m)			-0.0011	ч	306	0.2128	0.2120	213.3	65.0
secs	me), in	ravel ti	fitted t	served -	idual (obs	c)= res	rsdl(se			-0.0002	ч	302	0.2068	0.2070	205.1	62.5
		icks	best pi	istion of	ndard devi	sta				-0.0004	ч	299	0.2008	0.2008	196.9	60.0
	to the	malized	tion nor	ard devia	ma, stands	= sig	sig			0.0007	ч	295	0.1948	0.1960	188.6	57.5
		rt (s)	- d(m)/tv	avg_vel =	puted as a	COM				0.0003	ч	291	0.1888	0.1896	180.4	55.0
νth,	each dep	face to	the sur	rity from	rage veloc	s)= ave	vavg(m/			0.0002	ч	287	0.1829	0.1836	172.2	52.5
	e model	from th	computed	vel time	tical trav	= ver	tvrt(s)			-0.0004	ч	283	0.1769	0.1770	164.0	50.0
	legrees.	by 180 d	rection	ing in di	ws differi	p10				0.0003	ч	278	0.1709	0.1718	155.8	47.5
unmer	from ha	obtained	traces	icks from	rage of p:	ave				-0.0007	ч	274	0.1644	0.1644	147.6	45.0
y the	imes are	il, the t	ave mode	n the S-w	es used in	tim				0.0004	P	270	0.1572	0.1584	139.4	42.5
rrival	r the ar	ath). Fo	slant pa	along a	receiver,	đ				0.0001	ч	267	0.1501	0.1509	131.2	40.0
5	m source	inds (fro.	in seco	ival time	erved arri	= obs	tsl(s)			0.0009	ч	262	0.1429	0.1446	123.0	37.5
					th in feet	= dep	d(ft)			-0.0010	ч	258	0.1357	0.1356	114.8	35.0
				ers	th in mete	= dep	d(m)			0.0001	F	253	0.1285	0.1296	106.6	32.5
						ion:	Explanat			-0.0006	L	249	0.1203	0.1208	98.4	30.0
										0.0010	ч	246	0.1118	0.1140	90.2	27.5
										0.0003	ч	242	0.1033	0.1050	82.0	25.0
										-0.0001	ч	238	0.0946	0.0960	73.8	22.5
										-0.0003	ч	235	0.0850	0.0864	65.6	20.0
) 1505	1450	1477	38.7	294.6	459	442	450	11.8	89.8	-0.0003	ч	232	0.0753	0.0770	57.4	17.5
5 1380	1365	1372	105.0	255.9	420	416	418	32.0	78.0	-0.0004	ч	228	0.0657	0.0676	49.2	15.0
1156	1131	1143	45.9	150.9	352	345	348	14.0	46.0	0.0002	ч	223	0.0560	0.0590	41.0	12.5
. 982	951	966	29.5	105.0	299	290	295	9.0	32.0	-0.0003	ч	216	0.0464	0.0496	32.8	10.0
858	841	849	45.9	75.5	262	256	259	14.0	23.0	0.0006	н	213	0.0352	0.0404	24.6	7.5
3 680	658	669	19.7	29.5	207	201	204	6.0	9.0	0.0001	ч	218	0.0229	0.0294	16.4	5.0
5 770	735	752	9.8	9.8	235	224	229	з. 0	3.0	-0.0002	ч	229	0.0109	0.0204	8.2	2.5
) vu(ft/s)	vl(ft/s	v(ft/s)	thk (ft)	dtb(ft)	vu(m/s)	vl(m/s)	∿(m/s)	thk (m)	dtb (m)	rsdl(sec)	sig	vavg(m/s)	tvrt (s)	tsl(s)	d(ft)	d(m)
							2.2	N 11	nlayer							
ABLE A-6. P-wave arrival times and velocity summaries.

										0.0005	чч	1199 1209	0.0730	0.0735 0.0744	287.1 294.6	87.5 89.8
										0.0004	ч ч	1177 1188	0.0701	0.0705	270.7	82.5 85.0
	er second	feet p	ty in	of veloci	limit	= upper	vu(ft/s)			0.0003	H	1165	0.0687	0.0690	262.5	80.0
	er second	feet p	ty in	of veloci	limit	= lower	vl(ft/s)			0.0002	н	1153	0.0672	0.0675	254.3	77.5
	ond	er secu	feet p	layer in	ity of	= veloc	v(ft/s)			-0.0004	ч	1140	0.0658	0.0654	246.1	75.0
			1 feet	layer in	mess of	= thick	thk(ft)			-0.0005	ч	1127	0.0643	0.0639	237.9	72.5
		feet	wer in	tom of 1s	to bot	= depth	dtb(ft)			-0.0006	H	1113	0.0629	0.0624	229.7	70.0
ĭd	per secon	meters	ty in	of veloci	limit	= upper	vu(m/s)			0.0000	ч	1098	0.0615	0.0615	221.5	67.5
(S;	city limit	f velou	tion o	r explana	text fo	(see				-0.0001	ч	1083	0.0600	0.0600	213.3	65.0
ы	per secon	meters	ty in	of veloci	limit	= lower	vl(m/s)			-0.0002	H	1067	0.0586	0.0585	205.1	62.5
	econd	per s	meters	layer in	ity of	= veloc	$\nabla(m/s)$			-0.0002	۲	1050	0.0572	0.0570	196.9	60.0
		U	meter:	layer in	mess of	= thick	thk (m)			0.0003	ч	1032	0.0557	0.0561	188.6	57.5
	V	meters	wer in	tom of 1s	to bot	= depth	dtb(m)			0.0002	ч	1013	0.0543	0.0546	180.4	55.0
in secs	l time), i	travel	fitted	served -	tual (ob	:)= resid	rsdl (sec			-0.0004	ч	994	0.0528	0.0525	172.2	52.5
		picks	best	istion of	lard dev	stand				-0.0005	-	973	0.0514	0.0510	164.0	50.0
	zed to the	ormaliz	tion n	ard devis	, stand	= sigms	sig			0.0000	ч	951	0.0500	0.0501	155.8	47.5
		tvrt(s)	= d(m)/1	avg_vel :	uted as	compu				0.0000	H	927	0.0485	0.0486	147.6	45.0
depth,	to each u	urface	the s	city from	ige velo	s)= avers	vavg(m/s			0.0002	ч	903	0.0471	0.0474	139.4	42.5
1ª	m the mode	ed from	compute	vel time	cal tra	= verti	tvrt(s)			0.0001	ч	876	0.0457	0.0459	131.2	40.0
	80 degrees	1 by 1:	rection	ing in di	differ	blows				0.0006	ц ц	848	0.0442	0.0450	123.0	37.5
hammer	ined from	s obtai	trace:	icks from	uge of p	avers				0.0000	ч	818	0.0428	0.0429	114.8	35.0
are the	he times s	del, th	JAVE MO	n the S-w	used i	times				-0.0001	ч	786	0.0413	0.0414	106.6	32.5
arrival	For the	path).	slant	along a	eceiver,	to re				-0.0003	L	752	0.0399	0.0398	98.4	30.0
0 B	(from sour	conds	in se	ival time	ved arr	= obser	tsl(s)			0.0009	÷	715	0.0385	0.0396	90.Z	27.5
				đ	in fee	= depth	d(ft)			0.0008	H	549	0.0370	0.0381	82.0	25.0
				ers	in met	= depth	d(m)			0.0001	H	632	0.0356	0.0360	73.8	22.5
						OP.	Explanati			-0.0006	ч	586	0.0342	0.0339	65.6	20.0
										-0.0002	H	535	0.0327	0.0330	57.4	17.5
										0.0001	ч	480	0.0313	0.0321	49.2	15.0
										-0.0002	ч	419	0.0298	0.0309	41.0	12.5
										-0.0004	ч	378	0.0264	0.0279	32.8	10.0
571 5738	705 56	ω σ	253.1	294.6	1749	1729	1739	77.3	89.8	-0.0006	ч	359	0.0209	0.0231	24.6	7.5
247 2598	410 22	ся N	11.	41.0	792	685	734	3.5	12.5	0.0002	ч	359	0.0139	0.0180	16.4	5.0
164 1193	179 11	5	29.	29.5	364	355	359	9.0	9.0	0.0013	ч	929	0.0070	0.0144	8.2	2.5
/s) vu(ft/s)	t/s) vl(ft	b) v(ft	thk (f	dtb(ft)	7u(m/s)	vl(m/s) v	V(m/s) 1	thk (m)	dtb (m)	rsdl(sec)	sig	vavg(m/s)	tvrt (s)	tsl(s)	d(ft)	d(m)
								 Π ω	nlayers							
					283	ole_Code:)9680 Ho	-118.0	33.88212	pBP.TT	CPB\C	lding: P file: F:	lice Bui vel-time	itos Po 10 tra	n: Cerr = 4.0	Locatio hoffset

 $\frac{1}{2}$



Figure A-16. Site location map for the borehole at Corps of Engineers Station. The accelerograph is located approximately 45 meters from the borehole.



Figure A-17. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-18. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-19. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-7. S-wave arrival times and velocity summaries.

Location: Corps of Engineers Station: S Coordinates: hoffset = 2.00 travel-time file: F:\WAR\WARS.TT

2.0 4.0 8.0 10.0 12.0 14.0 14.0 14.0 14.0 14.0 20.0 22.0 d(m) d(ft) 6.6 19.7 26.2 32.8 32.8 32.8 32.8 32.8 32.8 32.8 52.5 52.5 52.5 52.5 52.5 52.5 0.0123 0.0181 0.0270 0.0343 0.0343 0.0433 0.0433 0.0539 0.0539 0.0588 0.0588 0.0598 0.0749 tsl(s) tvrt(s) 0.0083 0.0166 0.0249 0.0343 0.0438 0.0532 0.0584 0.0637 0.0689 0.0689 0.0742 0.0794 sig rsdl(sec -0.0006 -0.0010 -0.0010 -0.0010 -0.0000 0.0000 -0.0005 -0.0005

34.03219 -118.05225 Hole_Code:

298

nlayers = 3

 dtb(m)
 thk(m)
 v(m/s)
 v1(m/s)

 6.0
 6.0
 241
 237
 246

 12.0
 6.0
 212
 207
 217

 22.0
 10.0
 381
 370
 394
 dtb (ft) 19.7 39.4 72.2
 thk(ft)
 v(ft/s)
 vl(ft/s)
 vu(ft/s)

 19.7
 792
 778
 808

 19.7
 695
 678
 714

 32.8
 1252
 1214
 1292

Explanation:

d(ft) d(m) = depth in meters

tsl(s)

0.0788

tvrt(s) = vertical travel time computed from the model = depth in feet
= observed arrival time in seconds (from source
to receiver, along a slant path). For the arrival
to receiver, along a slant path. blows differing in direction by 180 degrees. average of picks from traces obtained from hammer times used in the S-wave model, the times are the

sig standard deviation of best picks

dth (m) thk (m) V(m/s) rsdl(sec) = residual (observed - fitted travel time), in secs = thickness of layer in meters = depth to bottom of layer in meters

= velocity of layer in meters per second

vl(m/s) = lower limit of velocity in meters per second

(see text for explanation of velocity limits) = upper limit of velocity in meters per second

vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second

vu(m/s) dtb(ft) thk(ft) = thickness of layer in feet = depth to bottom of layer in feet

v(ft/s) = velocity of layer in feet per second

ABLE A-8. P-wave arrival times and velocity summaries.

Location: Corps of Engineers Station: P Coordinates: hoffset = 2.00 travel-time file: F:\NAR\NARP.TT

2.0 4.0 8.0 10.0 12.0 14.0 14.0 14.0 14.0 14.0 20.0 22.0 d(m) d(ft) 6.6 19.7 26.2 32.8 32.8 32.8 32.8 32.8 32.8 32.8 52.5 52.5 52.5 52.5 52.5 52.5 0.0091 0.0116 0.0182 0.0198 0.02198 0.02242 0.02242 0.02254 0.02254 0.02254 0.02254 0.0294 tsl(s) 0.0055 0.0110 0.0191 0.0216 0.0216 0.0241 0.0255 0.0269 0.0269 0.0298 0.0298 tvrt(s) vavg(m/s) 362 362 362 362 362 362 362 443 4453 549 549 534 453 534 6735 5705 sig rsdl(sec н н ω 0.0012 0.0007 0.0002 0.0002 0.0002 0.0004 0.0005 0.0004 0.0005

0.0318

34.03219 -118.05225 Hole_Code: 298

nlayers = 3

 dtb(m)
 thk(m)
 v(m/s)
 v1(m/s)

 6.0
 6.0
 362
 349
 376

 12.0
 6.0
 798
 724
 889

 22.0
 10.0
 1409
 1294
 1545
 dtb (ft) 19.7 39.4 72.2 chk(ft) v(ft/s) vl(ft/s) -19.7 1188 1146 19.7 2618 2375 2 32.8 4622 4246) vu(ft/s) 1233 2915 5070

Explanation:

d(ft) d(m)

tsl(s) = depth in meters = depth in feet = observed arrival time in seconds (from source to receiver, along a slant path). For the arrival to receiver, along a slant path.

tvrt(s) = vertical travel time computed from the model blows differing in direction by 180 degrees. times used in the S-wave model, the times are the average of picks from traces obtained from hammer

sig standard deviation of best picks

dtb (m) thk (m) v(m/s) rsdl(sec) = residual (observed - fitted travel time), in secs = thickness of layer in meters = depth to bottom of layer in meters

= velocity of layer in meters per second

= lower limit of velocity in meters per second

vl(m/s)

(see text for explanation of velocity limits) = upper limit of velocity in meters per second

vu(m/s) dtb(ft) thk(ft)

= depth to bottom of layer in feet

= thickness of layer in feet

v(ft/s) = velocity of layer in feet per second

vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second



Figure A-21. Site location map for the borehole at Hoover School. The accelerograph is located approximately 30 meters from the borehole.



Figure A-22. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-23. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-24. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-9. S-wave arrival times and velocity summaries.

7.5 12.5 27.5 25.0 25.0	d(B) 5.0	Location hoffset
8 7 5 4 4 3 4 2 3 5 7 9 1 2 4 2 3 5 7 9 1 0 8 6 0 8 6 4 0 0 8 6	d(ft) 8.2 16.4	1: Hoov = 3.0
0.0210000.022100.0000000000000000000000	tsl(s) 0.0087 0.0122	er Scho O tra
0.0191 0.0223 0.0225 0.0234 0.0341 0.0341 0.0381	tvrt(s) 0.0106	ol: S Wel-time
665555 6622 6429 6429 6544 6544 6544 6544 6544 6544 6544 654	vavg(m/s) 470 470	file: F:)
	s Tu Tu	Coot \HOO\HC
-0.0001 0.0000 0.000000	rsdl(sec) 0.0004 -0.0002	rdinates:)0S2.TT
	dtb (m) 7.5 25.0	33.9849. nlayer
	thk(m) 7.5 17.5	I -118. s = 2
Explana d(m) d(ft) tsl(s) tsl(s) tvrt(s) vavg(m sig rsdl(s) dtb(m) thk(m) vl(m/s) vl(m/s) vl(ft/s) vu(ft/s)	v(m/s) 470 790	02890
<pre>tion: dep = dep = dep = obs to tim sta ec) = tes = sig = sta ec) = tes = thi = thi =</pre>	vl(m/s) 464 777	Hole_Cod
th in met th in met th in fee erved ar receiver, es used : rage of] wage velo trical fer trical fer trace velo puted as rage velo ndard der indard der indard der indard der th to bot th to bot	vru(m∕s) 476 804	e: 299
ers et along a along a along a avel time ority from ority from of veloci of veloci	dtb(ft) 24.6 82.0	
in second slant part rection l computed to traces the sur titted to fitted to fitted to the sur the sur the su	thk(ft) 24.6 57.4	
ids (from th). For obtained from the tics) de face to e tc(s) tc(s	v(ft/s) 1542 2593	
the source the arr from ham agrees. ach dept ach dept to the to the second limits) second cond	vl(ft/s) 1521 2549	
ecs	vu(ft/s) 1563 2639	

2₽

ABLE A-10. P-wave arrival times and velocity summaries.

			27.5 57.4 0.0172 0.000 20.0 65.6 0.0207 0.020 22.5 73.8 0.0228 0.022 25.0 82.0 0.0249 0.024	7.5 24.6 0.0114 0.011 10.0 32.8 0.0129 0.013 12.5 41.0 0.0133 0.014 13.6 49.0 0.0177 0.016	d(m) d(ft) tsl(s) tvrt(s 2.5 8.2 0.0066 0.003 5.0 16.4 0.0090 0.007	Location: Hoover School: P hoffset = 3.00 travel-tim
			17 1013	00000000000000000000000000000000000000	:) vavg(m/s) si(87 680 .	Cc e file: F:\HOO\
			1 -0.0001 1 -0.0003	1 -0.0005 1 -0.0006 1 0.0006	g rsdl(sec) 1 0.0009 1 0.0004	bordinates: HOOP2.TT
					dtb(m) 7.5 25.0	33.98491 nlayers
			Þ	đ	thk (m) 7.5 17.5	-118.00 = 2
vl(m/s) vu(m/s) dtb(ft) thk(ft) v(ft/s) vl(ft/s)	vavg(m/ sig rsdl(se dtb(m) tbk(m)	tvrt (s)	xpianac d(m) d(ft) tsl(s)		v(m/s) 680 1283	H 0682
<pre>> = lowe = uppe = dept = thicl > = lowe</pre>	s) = aver = comp = sigm c) = resi = dept = thic	to r sver blow	= dept = dept = obse		vl(m/s) 664 1241	ole_Code:
r limit of text for r limit of h to botto h to botto kness of l city of ls city of ls r limit of	age veloci uted as av a, standar dard devia dard devia dual (obse dual (obse h to botto h to botto	eceiver, s s used in age of pic s differin ical trave	h in meter h in feet rved arriv		vu(m/s) 697 1328	299
velocit explanat velocit m of lay ayer in yer in velocit	g_vel = d deviat tion of rved - m of lay aver in	llong a ; the S-ws Mas from g in din l time ;	s al time		dtb(ft) 24.6 82.0	
y in met ion of , y in met feet feet feet feet feet feet	the suri d(m)/tvr ion norm best pi(fitted t) fer in m meters	slant pat we model traces rection 1 computed	in secor		thk(ft) 24.6 57.4	
ters per velocity set second it per se	face to e tt(s) ualized t tks tks tavel tim sters	th). For , the ti obtained oy 180 de from the	ıds (from		v(ft/s) 2231 4211	
second limits) second	ach dept .o the .e), in s	the arr mes are from ham grees. model	source		vl(ft/s) 2179 4072	
	ie cy	ival the mer			vu(ft/s) 2286 4359	

81⁄2



Figure A-26. Site location map for the borehole at Lincoln School. The accelerograph is located approximately 91 meters from the borehole.



Figure A-27. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-28. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-29. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-11. S-wave arrival times and velocity summaries.

17.5 20.0 25.0 29.7 29.7	12.5	7.5	5.0	Location hoffset d(m)
57 5 90 2 91 2 92 2 93 4 94 2 95 4 97 4 97 4 97 4 97 4 97 4 97 4 97 4 97	41.0	24.6	8.2 16.4	h: Line = 3.0 d(ft)
0.0414 0.0414 0.0536 0.06600 0.0696 0.0696 5.0696 5.0696	0.0353	0.0250	0.0144	oln Sch O tra tsl(s)
0.0468 0.0529 0.0588 0.0641 0.0694 0.0694 0.0694	0.0347	0.0226	0.0098	ool: S vel-time tvrt(s)
409000 1409000 14090000 1400000000000000	360	332	256 302	file: F: vavg(m/s)
			чч	Coo \LIN\LJ sig
0.0007 0.0007 0.0007 0.0007	-0.0004	0.0008	-0.0008 0.0006	rdinates: [NS2.TT rsdl(sec)
		29.7	3.0 22.0	34.09043 nlayers dtb(m)
		7.7	3.0 19.0) -118. ; = () thk(m)
Explanat d(ft) d(ft) tsl(s) tvrt(s) vavg(m sig rsdl(s) dtb(m) thk(m) v(m/s) vl(m/s) vu(ft/s) vu(ft/s)		470	256 413	09300 3 V(m/s)
<pre>i.ion:</pre>		452	249 408	Hole_Code vl(m/s)
th in mete erved arri- erved arri- rage used in rage of p- rage veloc puted as ; mas, stand mas, stand mas, stand that devi- idual (obs idual (obs chness of chness of er limit o er limit to bott th to bott th to bott chness of er limit o er limit of chness of er limit of er limit of chness of		490	264 418	e: 300 vu(m/s)
ars shong a shong a the from icks from ral time o ral time o ral time o rat y from served o served o layer in layer in		97.4	9.8 72.2	dtb (ft)
in second lin second traces traces traces the sur- the su		25.3	9.8 62.3	thk (ft)
nds (from th). from the for the for the for the for the for the for face to a face to a face to a face to a face to a the face the ravel the ters per ters per second at per sa		1544	841 1354	v(ft/s)
<pre>t source f the arr from ham agrees. a model ach dept second the second limits) second icond icond</pre>		1484	818 1338	vl(ft/s)
ival the mer		1609	865 1371	vu(ft/s)

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ABLE A-12. P-wave arrival times and velocity summaries.

112.5 22.5 25.5 29.7	7.5	d(m) 2.5	Locatio hoffset
41.0 97.2 97.2 97.4 97.4 97.4 97.4 97.4 97.4 97.4 97.4	16.4 24.6	d(ft) 8.2	n: Line = 3.0
0.02260 0.02060 0.0000000000	0.0126	tsl(s) 0.0110	oln Sch O tra
0.0222 0.0222 0.0223 0.0233 0.0433 0.04433 0.04434 0.04436 0.04436	0.0111	tvrt(s) 0.0068	ool: P wel-time
5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	506 506	vavg(m/s) 368	file: F:
	- u u	sig gits	Coo \LIN\L
-0.0004 -0.0004 0.0004 0.0004 0.0004 0.0005 0.0004 0.0005	0.0002	rsdl(sec) 0.0004	rdinates: [NP.TT
	22.0 29.7	dtb (m) 3.0	34.09044 nlayers
	19.0 7.7	thk(m) 3.0	-118. 3
Explana d(ft) d(ft) tsl(s) tsl(s) tvrt(s vavg(m sig rsdl(s dtb(m) thk(m) vl(m/s) vl(ft/s vu(ft/s	675 753	v(m/s) 368	09306
<pre>tion: tion: dept dept dept dept dec)= rest dec)= rest dec)= rest dec)= rest dept dept dept dept dept dept dept dep</pre>	666 722	vl(m/s) 358	Hole_Code
th in met th in fee erved arr rage of p rage velo trage velo that dev that dev that dev that dev thes of thes of thes of thes of the bot the bot the bot the bot the bot the bot the bot the bot the bot the bot	684 787	vu(m/s) 378	:: 300
ers tral time along a n the S-w icks from ing in di ren time city from avg_vel = served = taver in laver in	72.2 97.4	dtb(ft) 9.8	
in secon slant para rection 1 traces traces the sur tion norn fitted to fitted to meters meters meters feet ty in met ty in met ty in feet ty in feet	62.3 25.3	thk(ft) 9.8	
th). (from th). For b). For b) alled face to e face to e tr(s) travel to ravel tim ravel tim ret per set set per set per second	2213 2470	v(ft/s) 1207	
source the arr from ham grees. ach dept ach dept the the second limits) second limits	2184 2367	vl(ft/s) 1175	
ecs	2243 2582	vu(ft/s) 1241	

gg







Figure A-32. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-33. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-34. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).





ABLE A-13. S-wave arrival times and velocity summaries.

hoffset = 2.00Location: Lincoln School - Whittier: S Coordinates: hoffset = 2.00 travel-time file: F:\WLB\WLBS.TT 1.0 3.0 7.0 9.0 11.0 13.0 15.0 15.0 18.5 d(m) d(ft) 0.0155 0.0181 0.0225 0.0279 0.0279 0.0335 0.0382 0.0382 0.0438 0.0438 0.0558 0.0598 tsl(s) 0.0072 0.0151 0.0209 0.0266 0.0324 0.0324 0.0382 0.0382 0.0439 0.0439 0.0439 0.0555 tvrt(s) sig rsdl(sec) 1 -0.0006 1 0.0003 1 0.0003 1 0.0003 1 -0.0004 1 -0.0005 1 -0.0005 1 0.0007 1 0.0007 1 0.0007 -0.0002 33.98535 -118.04060 Hole_Code:
 dtb(m)
 thk(m)
 v(m/s)
 v1(m/s)

 1.5
 1.5
 139
 135
 142

 18.5
 17.0
 347
 344
 351
 nlayers = 2 dtb (m) thk (m) v (m/s) sig Explanation: d(ft) d(m) rsdl(sec) = residual (observed - fitted travel time), in secs tvrt(s) = vertical travel time computed from the model vl(m/s) = lower limit of velocity in meters per second tsl(s) = depth in meters = depth in feet = observed arrival time in seconds (from source to receiver, along a slant path). For the arrival to receiver, along a slant path). For the arrival = sigma, standard deviation normalized to the = velocity of layer in meters per second = thickness of layer in meters = depth to bottom of layer in meters standard deviation of best picks (see text for explanation of velocity limits) blows differing in direction by 180 degrees. times used in the S-wave model, the times are the average of picks from traces obtained from hammer 301 dtb(ft) thk(ft) v(ft/s) vl(ft/s) vu(ft/s) 4.9 60.7 4.9 55.8 455 1140 1130 444

466 1150

vu(m/s) dtb(ft) thk(ft) vl(ft/s) = lower limit of velocity in feet per second v(ft/s) vu(ft/s) = upper limit of velocity in feet per second = velocity of layer in feet per second = thickness of layer in feet = upper limit of velocity in meters per second = depth to bottom of layer in feet

summaries.	
velocity	
and	
times	
arrival	
S-wave	
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ABLE	

ation:	Lincoln	School	Whittier:	P Coordinates:	33.98535
= \$	2.00	travel	-time file:	: F:\WLB\WLBVERT.TT	

	22									th
	vl(m/s)	212	1217	501					ion:	= dep
	V(m/s)	224	1382	517					Explanat	d(m)
ຕ ແ	thk (m)	1.5	6.0	11.0						
nlayers	dtb(m)	1.5	7.5	18.5						
	rsdl(sec)	-0.0004	0.0006	0.0004	0.0007	-0.0003	-0.0006	-0.0004	-0.0007	0.0002
	sig		-	-	-	-	-1	ч	-	-
	vavg(m/s)	224	386	542	656	646	618	600	587	578
	tvrt (s)	0.0045	0.0078	0.0092	0.0107	0.0139	0.0178	0.0217	0.0255	0.0294
	tsl(s)	0.0096	0.0090	0.0100	0.0116	0.0138	0.0174	0.0214	0.0250	0.0298
	d(ft)	3.3	9.8	16.4	23.0	29.5	36.1	42.7	49.2	55.8
	d(m)	1.0	3.0	5.0	7.0	9.0	11.0	13.0	15.0	17.0

1 0.0007

572

18.5 60.7 0.0332 0.0323

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-118.04060 Hole_Code: 301

v(m/s) vl	(m/s	s) M	(m/s)	đ	cb(ft)	thk (ft)	v(ft/s)	vl(ft/s)	vu(ft/s)
224	212	01	238		4.9	4.9	736	695	782
1382	1217	~	1599		24.6	19.7	4535	3994	5245
517	501	2	533		60.7	36.1	1695	1644	1749
Explanation	ä								
d(m)	= de	epth	in me	ters					
d(ft)	= de	epth	in fe	et					
tsl(s)	40 =	OServ	ed ar	rival	. time	in secor	ids (from	. source	
	ŭ	o rec	ceiver,	, al	ong a	slant pat	th). For	the arri	Lval
	5	imes	used	in tl	ne S-w	ave model	, the t:	mes are	che
	at	rerag	re of	picks	s from	traces	obtained	from ham	ler
	q	Lows	diffe.	ring	in di	rection]	oy 180 do	sgrees.	
tvrt (s)	= 76	ertic	al tr	avel	time	computed	from the	model	
vavg(m/s)	= 81	verag	re vel	ocity	r from	the sur!	ace to	sach depth	1,
c J	Ŭ	omput	ed as	avg	vel =	d(m)/tvr	t (s)		
sig	II II	Igma,	stan	dard	devia	tion norn	alized t	to the	
	ţ	canda	urd de	viati	on of	best pic	sks		
rsdl(sec)	r.	esidu	al (o	bsert	- per	fitted to	ravel tin	e), in s	sce
dtb(m)	= q	epth	to bo	ttom	of la	yer in me	eters		
thk (m)	= t	nickn	less o	f la	yer in	meters			
(s/m)∧	= 76	eloci	ty of	laye	er in	meters po	er second		
vl(m/s)	= 10	DWer	Limit	of	veloci	ty in met	cers per	second	
	-	see t	cext f	or e:	xp1anat	cion of	relocity	limits)	
vu(m/s)	In =	oper	limit	of	veloci	ty in met	cers per	second	
dtb(ft)	= q	epth	to bo	ttom	of la	yer in fo	et		
thk (ft)	= t	hickn	less o	f la	ver in	feet			
v(ft/s)	= 76	eloci	ty of	laye	er in	feet per	second		
vl(ft/s)	۲ ۲	DWer	limit	of	veloci	ty in fee	st per s	scond	
vu(ft/s)	1n =	per	limit	of	veloci	ty in fee	et per s	econd	



Figure A-36. Site location map for the borehole at Los Alisos Adult School.



Figure A-37. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-38. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-39. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-15. S-wave arrival times and velocity summaries.

22.5 27.5 5 5	Locatio hoffset d(m) 2.5 10.0 12.5 12.5 12.5 12.5 12.5
90.2 90.2	n: Los = 2.0 d(ft) 8.2 16.4 24.6 32.8 32.8 41.0 41.0 457.4
0.0936 0.1132	0 trg 0 trg 0.0163 0.0253 0.0253 0.0345 0.0449 0.0554 0.0554 0.0648 0.0648
0.0929 0.11024 0.11119	s vel-time tvrt(s) 0.0235 0.0235 0.0235 0.0235 0.0235 0.0235 0.0235 0.0235 0.0235 0.0235 0.0235 0.0542 0.0542 0.0542 0.0542
2 2 2 4 4 4 6 4 2	file: F: vavg(m/s) 194 215 224 231 231 234 237 240
	Coot Sig : 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
0.0003 0.0003	CS.TT (CS.TT -0.0002 0.0003 -0.0003 0.0001 0.0005 0.0005 0.0000 0.0000
	33.89560 nlayer: dtb(m) 2.5 14.0 27.5
) -118. 8 = 3 thk(m) 2.5 11.5 13.5
d(m) tsl(s) tsl(s) tvrt(s vavg(m sig rsdl(s) dtb(m) thk(m) vl(m/s) vl(m/s) vu(ft/ vu(ft/	08427 v (m/s) 194 242 262 Explanat
<pre>s) = thin s) = thin s</pre>	Hole_Cod vl(m/s) 188 239 259 259
th in meta th in ference receiver, receiver, es used in rage of po was differ thick to puted as puted as puted as puted as that dev that do that do that do that do that fo conty of e text fo th to both that to both th to both that to choess of the to both that to choess of the to both that to the to both the the to both the to both the to both the to both the to both the the to both the the to both the the to both the the the the the the the the the the	₂: 302 vu(m/s) 265 265
ers ival time along a n the S-w ind in dii ng in dii ng in dii try from inty from inty from try from avg_vel = com of la layer in layer in	dtb(ft) 45.9 90.2
in second slant pa ave mode traces rection computed the sur d(m)/tw in best pi hest pi hest pi ver in me yer in me yer in f feet per feet per	thk (ft) 8.2 37.7 44.3
nds (from th). Fo th). Fo by 180 d from th face to face to ravel to eters eters eters eters per ters per ters per second et per s	v(ft/s) 636 794 859
<pre>h source r the arr imes are from ham egrees. egrees. egrees. to the to the to the to the second limits) second econd</pre>	vl(ft/s) 7618 849
ival the h, her	vu(tt/s) 656 804 870

89

ABLE A-16. P-wave arrival times and velocity summaries.

		17.5 20.0 27.5 27.5	d (۲) 2.5 12.5 12.5	Location hoffset
		90.2	d(ft) 8.2 16.4 32.8 41.0 49 2	1: Los = 2.0
		0.0306 0.0320 0.0358 0.0358 0.0358 0.0358	tsl(s) 0.0093 0.0116 0.0222 0.0222 0.0222	Alisos: O tra
		0.0303 0.0321 0.0356 0.0391 0.0426	tvrt(s) 0.0069 0.0118 0.0167 0.0217 0.0217 0.02266	p vel-time
		6,6,6,6,5,5 4,2,3,2,7,1 5,9,0,2,8,0 5,9,0,2,8,0	vavg(m/s) 361 422 462 470 528	file: F:\
		4 N N W W	ی بند 1923 ۵ 4 ۵ ۵ ۵	Coor EXC\EX
		-0.0002 0.0001 0.0001	rsdl(sec) 0.0005 0.0001 0.0009 0.0001 0.0001	CP.TT
			dtb(m) 2.5 12.5 20.0 27.5	33.89560 nlayers
			thk(m) 2.5 10.0 7.5 7.5	s = 118.1
<pre>dtb(m) dtb(m) thk(m) v(m/s) v1(m/s) vu(m/s) dtb(ft thk(ft thk(ft v1(ft/s) v1(ft/s)</pre>	tvrt (s vavg(m sig	Explanat d(m) d(ft) tsl(s)	マ(加/s) 361 509 1358 711	08427
s)))))))))))))))))))	tu (/s) = blo sts sts	ton: = den tobs	vl(m/s) 344 491 1185 650	Hole_Cod
th to both ckness of locity of ee text fo ee text fo ber limit - th to both tokness of locity of locity of	arage of p arage of p nows differi- rtical tran- trage velo- anguted as - anguted as - andard dev-	oth in meto oth in feet served arr; receiver,	vru (m/s) 380 527 1590 785	le: 302
som of lay layer in n layer in n explanat of velocit of velocit som of lay layer in 1 layer in 1 layer in 1	n the s-wa icks from ing in dir yel time o sity from avg_vel = avg_vel = istion of	ers C ival time along a s	dtb(ft) 8.2 41.0 65.6 90.2	
er in m meters p ieters p y in me y in me y in me feet in f feet per	traces traces ection computed the sur d(m)/tv ion nor best pi	in seco	thk(ft) 8.2 32.8 24.6 24.6	
eters er second ters per velocity ters per ters per eet eet second et per su	L, the t obtained by 180 d from the face to (face to (rt(s) rt(s) rt(s)	nds (from	v(ft/s) 1186 1669 4456 2334	
t second limits) second	imes are from hau egrees. e model each dept so the	source the arr	vl(ft/s) 1129 1611 3889 2133	
j	h, er	ival	vu(ft/s) 1248 1730 5218 2575	


Figure A-41. Site location map for the borehole at Olive Junior High School. The accelerograph is located approximately 46 meters from the borehole.



Figure A-42. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-43. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-44. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-17. S-wave arrival times and velocity summaries.

	16.8	15.0	13.0	11.0	9.0	7.0	5.0	3.0	1.0	d(m)		Location hoffset
	55.1	49.2	42.7	36.1	29.5	23.0	16.4	9.8	3.3 3	d(ft)		n: 01iv = 3.0
	0.0348	0.0320	0.0291	0.0253	0.0226	0.0196	0.0158	0.0138	0.0142	tsl(s)		e Jr. H O tra
	0.0343	0.0315	0.0283	0.0252	0.0214	0.0176	0.0138	0.0100	0.0048	tvrt(s)		igh Scho vel-time
	489	476	459	436	420	397	362	299	209	vavg(m/s		ol: S file: G:
	۲	ч	ч	ч	ч	ч	+	ч	N	sig		Coo:
	0.0000	0.0000	0.0001	-0.0008	0.0001	0.0006	0.0001	0.0007	-0.0009	rsdl(sec)		rdinates: JVS.TT
							16.8	11.0	1.5	dtb (m)	nlayer	34.1007
							5.8	9.5	1.5	thk (m)	и 11	3 -117.
tsl(s)	d(#)	Explans					636	527	209	v(m/s)		97409
	1 1 2 0	tion:					597	512	200	vl (m/s		Hole_Co
served ar	pth in me						189	543	219) vu(m/s)		de: 303
rival time	ters t						55.1	36.1	4.9	dtb (ft)		
e in seco							19.0	31.2	4.9	thk (ft)		
nds (from							2087	1728	589	v(ft/s)		
E SOURCE							1957	1679	529	vl(ft/s)		
ival							2235	1781	718	vu(ft/s)		

Explanation: d(m) = depth in meters d(ft) = depth in feet tsl(s) = observed arrival time in seconds (from source tsl(s) = observed arrival time in seconds (from source tsl(s) = observed arrival time seconds (the times are the average of picks from traces obtained from hammer blows differing in direction by 180 degrees. tvrt(s) = vertical travel time computed from the model vavg(m/s) = average velocity from the sufface to each depth, computed as avg_vel = d(m)/tvrt(s) sig = sigma, standard deviation normalized to the rsdl(sec) = residual (observed - fitted travel time), in secs thb(m) = depth to bottom of layer in meters v(m/s) = thickness of layer in meters per second vl(m/s) = lower limit of velocity in meters per second dtb(tt) = depth to bottom of layer in feet v(ft/s) = velocity of layer in feet v(ft/s) = velocity of layer in feet v(ft/s) = velocity of layer in feet v(ft/s) = lower limit of velocity in feet v(ft/s) = lower limit of velocity in feet v(ft/s) = lower limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vl(ft/s) = upper limit of velocity in feet per second vl(ft/s) = upper limit of velocity in feet per second vl(ft/s) = upper limit of velocity in feet per second vl(ft/s) = upper limit of velocity in feet per second

ABLE A-18. P-wave arrival times and velocity summaries.

	15.0 16.8	11.0 13.0	9.0	7.0	5.0	3.0	1.0	d(m)		Location hoffset
	49.2 55.1	36.1 42.7	29.5	23.0	16.4	9.8	3.3	d(ft)		1: 011v = 3.0
	0.0218	0.0174	0.0150	0.0130	0.0106	0.0091	0.0101	tsl(s)		e Jr. H O tra
	0.0210	0.0169	0.0144	0.0119	0.0093	0.0068	0.0032	tvrt(s)		ligh Schow wel-time
	714 736	649 685	625	165	537	444	309	vavg(m/s)		file: G:
	чч	цч	ч.	ч	-	H	ч	giz		Coo Coo
	0.0004 -0.0002	-0.0001 -0.0002	-0.0001	0.0002	0.0000	0.0002	-0.0001	rsdl(sec)		rdinates: LVP.TT
					16.8	11.0	1.5	dtb (m)	nlayer:	34.10073
					5.8	9.5	1.5	thk (m)		8 -117.
d(ft) tsl(s)	Explana d(m)				886	786	309) v(m/s)	ω	.97409
Lattore Lattore	tion: = de				937	772	302	vl (m/s		Hole_Co
pth in f served a receiven mes used erage of erage of	pth in m				1032	800	316) vu(m/s)		de: 303
eet rrival ti , along in the S picks fr picks fr	eters				55.	36	4.) dtb (ft		
ne in sec a slant p -wave mode om traces direction					1 19.0	1 31.2	9 4.9	;) thk (ft)		
onds (fro ath). Fo al, the t obtained by 180 d					3223	2579	1013	v(ft/s)		
m source r the arr imes are from ham egrees.					3075	2534	066	vl(ft/s)		
ival the mer					3386	2625	1038	vu(ft/s)		

Explanation: d(m) = depth in meters d(ft) = depth in feet tsl(s) = observed arrival time in seconds (from source tsl(s) = observed arrival time in seconds (from source tsl(s) = creativer, along a slant path). For the arrival times used in the S-wave model, the times are the average of picks from traces obtained from hammer hlows differing in direction by 180 degrees. tvrt(s) = vertical travel time computed from the model varg(m/s) = average velocity from the surface to each depth, sig = sigma, standard deviation normalized to the standard deviation of best picks rsdl(sec) = residual (observed - fitted travel time), in secs dtb(m) = depth to bottom of layer in meters v(m/s) = lower limit of velocity in meters per second vl(m/s) = upper limit of velocity in meters per second dtb(tt) = depth to bottom of layer in meters per second dtb(tt) = depth to bottom of layer in feet v(ft/s) = upper limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet v(ft/s) = lower limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vl(ft/s) = upper limit of velocity in feet per second vl(ft/s) = upper limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second



Figure A-46. Site location map for the borehole at San Bernardino Main Fire Station.



San Bernardino Main Fire Station

Figure A-47. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-48. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



- d_obs
- d obs

Figure A-49. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A-19. S-wave arrival times and velocity summaries.

Location: San Bernardino Fire Station: S Coordinates:

34.10534 -117.28201 Hole_Code:

305

hoffset = 4.0090.00 90 d(m) d(ft) 0.0600 0.0790 0.0790 0.0790 0.0930 0.1070 0.1192 0.1270 0.1270 0.1270 0.1270 0.1270 0.1270 0.1284 0.1284 0.1584 0.2582 0.2084 0.22520.0230 0.0304 0.0356 0.0428 0.0496 0.0140 tsl(s) travel-time file: F:\SB1\SB1S.TT 0.0168 0.0252 0.0252 0.0419 0.0503 0.0578 0.0578 0.0578 0.0578 0.0715 0.0784 0.0715 0.0784 0.07852 0.09852 0.09852 0.1058 0.1126 tvrt(s) 0.0084 0.1850 0.1904 0.1959 0.2013 0.2067 0.2267 0.2114 0.2114 0.2159 0.2229 0.1259 0.1321 0.1382 0.1443 0.1443 0.1443 0.1505 0.1505 0.1566 0.1567 0.1627 0.1627 0.1687 0.1627 51g rsdl(sec -0.0019 dtb(m) 3.7 16.2 41.2 59.5 78.0 90.0 nlayers = thk(m) 3.7 12.5 18.3 18.3 18.5 12.0 n,) ⊽(11/s) 297 265 365 460 556 $\nabla(m/s) = 0$ $\nabla l(m/s) = 0$ vu(m/s) dtb(ft) thk(ft) Explanation: dtb (m) thk (m) sig d(ft) d(m) v(ft/s) vavg(m/s)= average velocity from the surface to each depth, computed as avg_vel = d(m)/tvrt(s) tvrt(s) = vertical travel time computed from the model vl(ft/s) = lower limit of velocity in feet per second standard deviation of best picks
rsdl(sec)= residual (observed - fitted travel time), in secs tsl(s)) v1(m/s) 284 360 401 450 520 = depth in meters = depth in feet = observed arrival = upper limit of velocity in meters per second = depth to bottom of layer in feet = velocity of layer in feet per second = sigma, standard deviation normalized to the = thickness of layer in feet = velocity of layer in meters per second = thickness of layer in meters = depth to bottom of layer in meters observed arrival time in seconds (from source to receiver, along a slant path). For the arrival lower limit of velocity in meters per second average of picks from traces obtained from hammer times used in the S-wave model, the times are the (see text for explanation of velocity limits) vu(∭/s) 312 306 416 472 597 dtb (ft) 12.1 53.1 135.2 195.2 255.9 295.3 thk(ft) 12.1 41.0 60.0 60.7 39.4 v(ft/s) 976 1197 1197 1339 1511 1824 vl(ft/s) 932 962 1182 1314 1314 1475 1475 vu(ft/s) 1024 1004 1213 1365 1548 1960

0.0002

vu(ft/s) = upper limit of velocity in feet per second

ABLE A-20. P-wave arrival times and velocity summaries.

Location: hoffset	= San E	'ernardi trav	no Fire el-time	Station:] file: F:\\$	P Coo	ordinates: BIP.TT	34.10534	-117.	10282	iole_Code:	305					
							nlayers	11 14								
ц(щ)	d(ft)	tsl(s)	tvrt (s)	vavg(m/s)	51g	rsdl(sec)	dtb (m)	thk (m)	v(m/s)	v1(m/s)	vu(m/s)	dtb(ft)	thk (ft)	v(ft/s)	vl(ft/s)	vu(ft/s)
2.5	8.2	0.0091	0.0058	430	ч	-0.0019	8.5	8.5	430	421	441	27.9	27.9	1412	1381	1445
5.0	16.4	0.0165	0.0116	430	н	0.0016	16.2	7.7	936	876	1006	53.1	25.3	3072	2873	3301
7.5	24.6	0.0201	0.0174	430	ч	0.0003	70.0	53.8	1647	1614	1680	229.7	176.5	5402	5295	5513
10.0	32.8	0.0231	0.0214	468	H	0.0002	90.0	20.0	2094	1870	2378	295.3	65.6	6870	6136	7803
12.5	41.0	0.0240	0.0240	520	÷	-0.0010										
15.0	49.2	0.0255	0.0267	562	ч	-0.0020										
17.5	57.4	0.0285	0.0288	809	H	-0.0008										
20.0	65.6	0.0309	0.0303	660	ч	0.0002										
22.5	73.8	0.0336	0.0318	707	÷	0.0015			Explanat	ion:						
25.0	82.0	0.0345	0.0333	750	ч	0.0009			d(m)	= dept	h in mete	K S				
27.5	90.2	0.0354	0.0349	789	ч	0.0003			d(ft)	= dept	h in feet					
30.0	98.4	0.0366	0.0364	825	ч	0.0000			tsl(s)	= obse	rved arri	val time	in secon	ds (from	source	
32.5	106.6	0.0381	0.0379	858	÷	0.0000				to r	eceiver,	along a s	ant pat	h). For	the arri	val
35.0	114.8	0.0405	0.0394	888	Ч	0.0009				time	s used in	the S-wa	we model	, the ti	mes are t	the
37.5	123.0	0.0414	0.0409	916	, н	0.0004				aver	age of pi	.cks from	traces o	btained	from hamm	ler
40. T	100.4	0.0430	0.0424	740	- 0	0.0003				MOTO	S UTTTELT	TTN TTT FUT	ACCTON N	an not A	grees.	
45.0	147 6	0.0111	0.0110	000	- +	0.0000			10/10/0/	al - vero	trat tolog	ito from	the cove		and donth	1
47.5	155.8	0.0465	0.0470	1011	ωι	-0.0006				COMD	uted as a	wq vel =	d(m)/tvr	C(S)		
50.0	164.0	0.0485	0.0485	1031	4	-0.0001			sig	= sigm	a, standa	rd deviat	ion norm	alized t	o the	
52.5	172.2	0.0505	0.0500	1049	ω	0.0003			10000	stan	dard devi	ation of	best pic	ks		
55.0	180.4	0.0510	0.0516	1067	ч	-0.0006			rsdl (se	c)= resi	dual (obs	erved - :	fitted tr	avel tim	e), in se	SOS
57.5	188.6	0.0525	0.0531	1083	N	-0.0006			dtb (m)	= dept	h to bott	om of lay	ver in me	ters		
60.0	196.9	0.0546	0.0546	6601	ω	0.0000			thk (m)	= thic	kness of	layer in	meters			
62.5	205.1	0.0565	0.0561	1114	N	0.0003			v(m/s)	= velo	city of 1	ayer in I	aters pe	r second		
65.0	213.3	0.0575	0.0576	1128	N	-0.0002			vl(m/s)	= lowe	r limit o	of velocit	y in met	ers per	second	
67.5	221.5	0.0588	0.0591	1141	N	-0.0004				(see	text for	explanat	ion of v	relocity	limits)	
70.0	229.7	0.0600	0.0607	1154	N	-0.0007			vu (m/s)	= uppe	r limit o	of velocit	y in met	ers per	second	
72.5	237.9	0.0618	0.0619	1172	N	-0.0001			dtb(ft)	= dept	h to bott	on of lay	ver in fe	ęt		
75.0	246.1	0.0625	0.0630	1190	N	-0.0006			thk(ft)	= thic	kness of	layer in	feet			
77.5	254.3	0.0640	0.0642	1206	N	-0.0003			v(ft/s)	= velo	city of 1	ayer in	feet per	second		
80.0	262.5	0.0655	0.0654	1223	N	0.0000			vl(ft/s	<pre>> = lowe</pre>	r limit o	f velocit	y in fee	t per se	cond	
82.5	270.7	0.0665	0.0666	1238	2	-0.0002			vu(ft/s) = uppe	r limit c	f velocit	y in fee	t per se	cond	
85.0	278.9	0.0680	0.0678	1253	N	0.0001										
87.5	287.1	0.0692	0.0690	1268	N	0.0001										
90.0	295.3	0.0708	0.0702	1282	ω	0.0005										



Figure A-51. Site location map for the borehole at Santa Anita Golf Course.



Figure A-52. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-53. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-54. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).





ABLE A-21. S-wave arrival times and velocity summaries.

Location: Santa Anita Golf Course: S Coordinates: hoffset = 3.00 travel-time file: F:\SAG\SAGS_RE.TT nlayers = 4

29.6	27.5	25.0	22.5	20.0	17.5	15.0	12.5	10.0	7.5	5.0	2.5	d(m)
97.1	90.2	82.0	73.8	65.6	57.4	49.2	41.0	32.8	24.6	16.4	8.2	d(ft)
0.0813	0.0775	0.0730	0.0676	0.0618	0.0573	0.0485	0.0417	0.0343	0.0285	0.0217	0.0140	tsl(s)
0.0809	0.0771	0.0726	0.0669	0.0612	0.0555	0.0483	0.0410	0.0337	0.0264	0.0176	0.0088	tvrt(s)
366	357	344	336	327	315	311	305	297	284	284	284	vavg(m/s)
ч	ч	ч	Ч	H	н	÷	F	н	-	F	н	sig
0.0000	0.0000	-0.0001	0.0001	-0.0001	0.0010	-0.0007	-0.0004	-0.0009	0.0000	0.0012	0.0002	rsdl (sec)

34.13096 -118.03070 Hole_Code: 304

		29.6	25.0	17.4	7.5	dtb (m)
		4.6	7.6	9.9	7.5	thk (m)
	Explanat d(m) d(ft) tsl(s)	553	439	343	284	v(m/s)
tim ave	cion: = depi = depi = obs	500	420	335	279	vl(m/s)
receiver, es used : rage of]	th in met th in fea erved arg	619	460	352	288	vu(m/s)
along a in the S-v picks from	cers et rival time	97.1	82.0	57.1	24.6	dtb(ft)
slant pa ave mode traces	in seco	15.1	24.9	32.5	24.6	thk (ft)
th). For 1, the t obtained	nds (fro	1814	1441	1126	931	v(ft/s)
r the arr imes are from ham	source	1640	1377	1099	917	vl(ft/s)
ival the mer		2031	1510	1154	946	vu(ft/s)

standard deviation of best picks
rsdl(sec)= residual (observed - fitted travel time), in secs
dtb(m) = depth to bottom of layer in meters
thk(m) = thickness of layer in meters
v(m/s) = velocity of layer in meters per second
vl(m/s) = lower limit of velocity in meters per second
(see text for explanation of velocity limits) sig vavg(m/s)= average velocity from the surface to each depth, computed as avg_vel = d(m)/tvrt(s) tvrt(s) = vertical travel time computed from the model = sigma, standard deviation normalized to the

vu(m/s) = upper limit of velocity in meters per secon dtb(ft) = depth to bottom of layer in feet thk(ft) = thickness of layer in feet v(ft/s) = velocity of layer in feet per second vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second

= upper limit of velocity in meters per second = depth to bottom of layer in feet

ABLE A22. P-wave arrival times and velocity summaries.

Location: Santa Anita Golf Course: P Coordinates: hoffset = 3.00 travel-time file: F:\SAG\SAGP.TT

d(m) d(ft) 16.4 24.6 32.8 57.4 57.6 82.0 90.2 97.1 0.0450 0.0466 0.0492 0.0086 0.0156 0.0225 0.0225 0.0271 0.0271 0.0312 0.0312 0.0350 0.0388 0.0388 tsl(s) b tvrt(s)
b 0.0446 vavg(m/s)
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 411< sig rsdl(sec) 1 -0.0009 1 -0.0001 1 -0.0001 1 -0.0000 1 -0.0001 1 -0.0001 1 -0.0001 1 -0.0001 1 -0.0001 1 -0.0005 1 0.0003

0.0468

34.13096 -118.03075 Hole_Code:

304

nlayers = 4

7.5 17.4 25.0	1000 1000 1000	411 609 752	401 696	421 637 817	24.6 82.0	- 24	- 00 00 00	6 1348 5 1999 2466 3727
7.5 17.4 25.0	 	411 609 752	584 696	421 637 817	24. 82.	· O H O	6 24.6 24.9	6 24.6 1348 1 32.5 1999 0 24.9 2466
25.0	7.6	752	969	817	82.0		24.9	24.9 2466
29.6	4.6	1136	930	1459	97.	-	1 15.1	1 15.1 3727

V(m/s) Explanation: dtb (m) thk (m) sig d(ft) d(m) blows differing in direction by 180 degrees.
tvrt(s) = vertical travel time computed from the model vl(m/s) standard deviation of best picks
rsdl(sec)= residual (observed - fitted travel time), in secs tsl(s) = velocity of layer in meters per second = lower limit of velocity in meters per second (see text for explanation of velocity limits) = depth in meters = depth in feet = observed arrival time in seconds (from source to receiver, along a slant path). For the arrival = sigma, standard deviation normalized to the = thickness of layer in meters = depth to bottom of layer in meters average of picks from traces obtained from hammer times used in the S-wave model, the times are the

vu(m/s) dtb(ft) thk(ft)

= upper limit of velocity in meters per second = depth to bottom of layer in feet

v(ft/s)

vl(ft/s) = lower limit of velocity in feet per second

= velocity of layer in feet per second

= thickness of layer in feet

vu(ft/s) = upper limit of velocity in feet per second



Figure A-56. Site location map for the borehole at South Western Academy. The accelerograph is located approximately 10 meters from the borehole.



Figure A-57. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-58. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-59. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



ABLE A23. S-wave arrival times and velocity summaries.

Location: South Western Academy: S Coordinates: hoffset = 3.00 travel-time file: F:\SWA\SWAS_RE.TT

27.5	25.0	22.5	20.0	17.5	15.0	12.5	10.0	7.5	5.0	2.5	d(m)
90.2	82.0	73.8	65.6	57.4	49.2	41.0	32.8	24.6	16.4	8.2	d(ft)
0.0745	0.0700	0.0655	0.0613	0.0555	0.0508	0.0430	0.0378	0.0302	0.0238	0.0159	tsl(s)
0.0743	0.0696	0.0648	0.0601	0.0553	0.0506	0.0430	0.0354	0.0278	0.0202	0.0107	tvrt(s)
370	359	347	333	316	296	291	282	270	247	233	vavg(m/s)
H	н	Ļ	H	2	-	ω	н	-	ч	н	sig
-0.0002	0.0000	0.0001	0.0006	-0.0006	-0.0008	-0.0012	0.0009	0.0003	0.0003	-0.0009	rsdl(sec)

34.11533 -118.13050 Hole_Code: 306

nlayers = 3

 dtb(m)
 thk(m)
 v(m/s)
 v1(m/s)

 4.0
 4.0
 233
 227
 238

 15.0
 11.0
 329
 323
 336

 29.5
 14.5
 527
 511
 543
 dtb (ft) 13.1 49.2 96.8 thk(ft) v(ft/s) v1(ft/s) vu(ft/s) 13.1 763 746 781 36.1 1080 1059 1102 47.6 1728 1678 1781

Explanation: d(m)

d(ft) = depth in meters

tsl(s) = depth in feet
= observed arrival time in seconds (from source
to receiver, slong a slant path). For the arrival
to receiver, slong a slant path. times used in the S-wave model, the times are the average of picks from traces obtained from hammer

blows differing in direction by 180 degrees. tvrt(s) = vertical travel time computed from the model vavg(m/s)= average velocity from the surface to each depth, computed as avg_vel = d(m)/tvrt(s) sig = sigma, standard deviation normalized to the

standard deviation of best picks

dtb (m) thk (m) v(m/s) rsdl(sec)= residual (observed - fitted travel time), in secs
dtb(m) = depth to bottom of layer in meters

= thickness of layer in meters = velocity of layer in meters per second

v(ft/s) = velocity of layer in feet per second

vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second

ABLE A-24. P-wave arrival times and velocity summaries.

2.5	d(m)		hoffset	Location	
8.2	d(ft)		= 3.00	1: South	
0.0094	tsl(s)) tran	n Wester	
0.0057	tvrt(s)		vel-time	m Acade	
437	vavg(m/s		file: F:	му: Р	
F	sig r		:\SWA\SW.	Coor	
0.0005	sdl(sec)		AP. TT	dinates:	
4.0	dtb (m)	nlayers		34.11533	
4.0	thk (m)	ι 		-118.	
437	v(m/s)			13050	
423	vl(m/s)		1925	Hole_Code	
451	vu(m/s)			306	
13	dtb (

J(m/s)	sig	rsdl(sec)	dtb (m)	thk (m)	v(m/s)	vl(m/s)	vu(m/s)	dtb(ft)	thk (ft)	v(ft/s)	v1 (ft/s)
437	н	0.0005	4.0	4.0	437	423	451	13.1	13.1		1432	1432 1388
467	н	0.0002	15.0	11.0	641	623	660	49.2	36.1		2102	2102 2042
513	÷	-0.0003	29.5	14.5	849	823	876	96.8	47.6		2785	2785 2701
540	н	-0.0009										
558	N	0.0006										
570	N	-0.0004										
598	H	0.0007										
621	H	0.0000			Explanat	ion:						
640	Ļ	-0.0001			d(m)	= dept	th in met	PRS				
656	ч	0.0000			d(ft)	= depi	th in fee	ă				
670	н	0.0001			tsl(s)	= obs	erved ari	ival time	in secor	ds	(froi	(from source
089	ч	-0.0002				đ	receiver,	along a	slant pat	Ë	Fo	For the arr

0.0126 0.0154 0.0236 0.0264 0.0304 0.0326 0.0326 0.0326 0.0354 0.0354 0.0354 0.0354

0.0107 0.0146 0.0185

0.0224 0.0263 0.0293 0.0322 0.0351 0.0381 0.0410 0.0410

d(ft) = depth in feet
tsl(s) = observed arrival time in seconds (from source
to receiver, along a slant path). For the arrival tvrt(s) = vertical travel time computed from the model vavg(m/s)= average velocity from the surface to each depth, computed as avg_vel = d(m)/tvrt(s) = sigma, standard deviation normalized to the blows differing in direction by 180 degrees. times used in the S-wave model, the times are the average of picks from traces obtained from hammer

sig rsdl(sec)= residual (observed - fitted travel time), in secs dtb(m) = depth to bottom of layer in meters standard deviation of best picks

dtb (m) thk (m) v(m/s)

thk(m) = thickness of layer in meters v(m/s) = velocity of layer in meters per second v(m/s) = lower limit of velocity in meters per second

(see text for explanation of velocity limits) vu(m/s) = upper limit of velocity in meters per second dtb(ft) = depth to hottom of layer in feet thb(ft) = thickness of layer in feet

v(ft/s) = velocity of layer in feet per second

vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second



Figure A-61. Site location map for the borehole at St. Paul High School.



Figure A-62. Horizontal component record section (from impacts in opposite directions) superimposed for identification of S-wave onset. Approximate S-wave time picks are indicated by the hatch marks.



Figure A-63. Vertical component record section. Approximate P-wave arrivals are indicated by the dots.



Figure A-64. Time-depth graph of P-wave and S-wave picks. Line segments are straightline interpolations of model predictions at the observation depths. The times for zero depth, not shown, are given by hoffset divided by the velocity in the uppermost layer (see accompanying tables of velocities for specific values).



Figure A-65. S- and P-wave velocity profiles with dashed lines representing one stan-dard deviation. Lithology is shown for correlation with velocities.

summaries.
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		m(ft/s)	766	1230	1674									ral	5e	X			265				5											
		vl(ft/s)	723	1203	1546								i source	the arriv	imes are t	from hamme	agrees.	a model	each depth,		to the		ie), in se				second	limits)	second				econd	econd
		v(ft/s)	744	1216	1608								ids (from	h). For	, the ti	obtained	oy 180 de	from the	ace to e	t (s)	alized t	iks	avel tim	eters		er second	cers per	relocity	cers per	eet		second	et per se	et per se
		thk (ft)	8.2	57.4	24.6								in secon	slant pat	we model	traces o	fection }	computed	the surf	d(m)/tvr	ion norm	best pic	fitted tr	rer in me	meters	meters pe	y in met	ion of v	y in met	rer in fe	feet	feet per	y in fee	y in fee
		dtb(ft)	8.2	65.6	90.2						S		val time	along a s	the S-ws	cks from	ni dir	al time o	ity from	vg_vel =	d deviat	ation of	erved - 1	om of lay	layer in	ayer in 1	f velocit	explanat	f velocit	om of lay	layer in	ayer in 1	f velocit	f velocit
307		vu(m/s)	233	375	510						n in meter	n in feet	rved arri	eceiver,	s used in	age of pi	s differir	ical trave	age veloc:	uted as a	a, standan	dard devia	dual (obs	h to bott	aness of	city of L	r limit o	text for	r limit o	n to bott	kness of	city of L	r limit o	r limit o
ole_Code:		vl(m/s)	221	367	471					ion:	= dept1	= dept1	= obse	to r	time	aver	blow:	= vert:	s)= aver:	combi	= sign	stan	c)= resi	= dept1	= thic	= velo	= lowe:	(see	= uppe:	= dept1	= thid	= velo) = love:) = uppe
05369 H		v(m/s)	227	371	490					Explanat:	(m) p	d(ft)	tsl(s)					tvrt (s)	Vavg (m/		sig		rsdl(se	dtb(m)	thk (m)	(s/m)∧	vl(m/s)		Vu(m/s)	dtb(ft)	thk (ft)	v(ft/s)	vl(ft/s	vu(ft/s
-118.	11	thk (m)	2.5	17.5	7.5																													
33.95158	nlayers	dtb(m)	2.5	20.0	27.5																													
Coordinates: \STPS.TT		ig rsdl(sec)	1 0.0000	1 0.0001	1 0.0007	1 -0.0001	1 -0.0007	1 -0.0008	1 0.0003	1 0.0000	1 0.0008	1 0.0001	1 -0.0003																					
: S (file: F:\STP		vavg(m/s) si	227	282	306	320	329	336	340	344	356	366	374																					
gh School rel-time		tvrt (s)	0.0110	0.0178	0.0245	0.0312	0.0380	0.0447	0.0514	0.0582	0.0633	0.0684	0.0735																					
Paul Hig O trav		tsl(s)	0.0141	0.0192	0.0260	0.0317	0.0378	0.0443	0.0521	0.0585	0.0644	0.0687	0.0734																					
n: St. = 2.C		d(ft)	8.2	16.4	24.6	32.8	41.0	49.2	57.4	65.6	73.8	82.0	90.2																					
Location hoffset		d (m)	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5																					

ABLE A-26. P-wave arrival times and velocity summaries.

Location: St. Paul High School: P Coordinates: hoffset = 2.00 travel-time file: F:\STP\STPP.TT 2.5 5.0 12.5 12.5 12.5 22.5 22.5 22.5 27.5 d(m) d(ft) 8.2 24.6 32.8 41.0 41.0 57.4 49.2 73.8 82.0 82.0 82.0 0.0074 0.0114 0.0158 0.0184 0.0240 0.0250 0.0250 0.0250 0.0256 0.0276 0.0276 0.0296 0.0316 tsl(s) 0.0059 0.0102 0.0144 0.0187 tvrt(s) 0.0230 0.0248 0.0261 0.0273 0.0273 0.0286 0.0298 0.0298 **vavg(m/s)** 425 520 535 544 535 604 604 671 671 671 671 671 673 838 838 sig rsdl(sec) 1 -0.0001 2 0.0009 3 -0.0007 2 0.0007 2 0.0007 1 -0.0000 1 -0.0002 1 -0.0002 1 -0.0003 1 -0.0003 1 -0.0003 33.95158 -118.05369 Hole_Code:
 dtb(m)
 thk(m)
 v(m/s)
 v1(m/s)

 2.5
 2.5
 425
 408
 442

 13.0
 10.5
 585
 574
 597

 27.5
 14.5
 1994
 1890
 2111
 nlayers = ω Explanation: dtb (m) thk (m) v(m/s) sig d(ft) d(m) rsdl(sec)= residual (observed - fitted travel time), in secs dtb(m) = depth to bottom of layer in meters tvrt(s) tsl(s) = depth in meters = depth in feet = observed arrival time in seconds (from source to receiver, along a slant path). For the arrival to receiver, along a slant path. = vertical travel time computed from the model = thickness of layer in meters = velocity of layer in meters per second standard deviation of best picks blows differing in direction by 180 degrees. times used in the S-wave model, the times are the average of picks from traces obtained from hammer 307 dtb (ft) 8.2 42.7 90.2 thk(ft) v(ft/s) vl(ft/s) 8.2 34.4 47.6 1394 1919 6543 1340 1882 6200) vu(ft/s) 1452 1958 6927

vu(m/s) dtb(ft) thk(ft)

vl(m/s)

= lower limit of velocity in meters per second

(see text for explanation of velocity limits) = upper limit of velocity in meters per second

v(ft/s)

vl(ft/s) = lower limit of velocity in feet per second vu(ft/s) = upper limit of velocity in feet per second

= velocity of layer in feet per second

= depth to hottom of layer in feet = thickness of layer in feet **₽**01

APPENDIX—B Poisson's Ratios
Table B-1. Poisson's ratio calculated from P- and S-wave velocity models fo: the Cerritos College Gymnasium site.

P wave - d2bot, pvel, for file: CGMP.VEL 6.00000 437.000 10.0000 348.000 29.4000 1563.00

S wave - d2bot, svel, for file: CGMS.VEL 2.50000 255.000 5.00000 288.000 12.5000 217.000 25.0000 249.000 29.4000 329.000

pssnrat	svel	pvel	thick	d2bot	d2bot_s	d2bot_p
0.24	2.550E+02	4.370E+02	2.500E+00	2.500E+00	2.500E+00	6.000E+00
0.12	2.880E+02	4.370E+02	2.500E+00	5.000E+00	5.000E+00	6.000E+00
0.34	2.170E+02	4.370E+02	1.000E+00	6.000E+00	1.250E+01	6.000E+00
0.18	2.170E+02	3.480E+02	4.000E+00	1.000E+01	1.250E+01	1.000E+01
0.49	2.170E+02	1.563E+03	2.500E+00	1.250E+01	1.250E+01	2.940E+01
0.49	2.490E+02	1.563E+03	1.250E+01	2.500E+01	2.500E+01	2.940E+01
0.48	3.290E+02	1.563E+03	4.400E+00	2.940E+01	2.940E+01	2.940E+01

Table B-2. Poisson's ratio calculated from P- and S-wave velocity models for the Cerritos College Physical Sciences Building site.

terneeq 15.0 8₽.0	2.5306+02 2.5306+02 2.5306+02	1,1728+03 5,1708+02 3,5308+02 pvel	Хоі́дЭ 2.5008+2 1.2008-2 2.4008+01	±042b 2.9008+01 2.9008+01 2.9008+01	a_todSb 2.9008+01 2.9008+01 2.9008+01	q_JodSb 10+3002.S 10+3002.S 20+3002.S
			CPSS. VEL	000 100 100 101 101 100	.522 .812 .281 .1972 ,70d2	23°0000 72°0000 2°20000 p – 90000
			CPSP. VEL	for file: 000 000	ZLTT .S22 .S25 .S20	P wave – d 2.50000 2.50000

Table B-3. Poisson's ratio calculated from P- and S-wave velocity models for the Cerritos College Police Building site.

В9.8000 7739.00 JZ.5000 329.000 9.00000 329.000 В маке - dSbot, pvel, for file: CPBP.VEL

9₽.0	4.500E+02	т.7396+03	т. твов+от	. 980Е+О1	8 TO+3086	.8 10+3089.8
۷₽.0	4.180E+O2	J.7.739E+03	3'SOOE+0J	.800E+01	800E+0J 1	8.980E+01 7.
8₽.0	3.480E+OZ	J'136E+03	I.400E+01	.600E+01	₽ T0+3009	8.980E+01 4.
6₽.0	Z0+30S6.S	J.7.739E+03	9.000E+00	.ZOOE+O1	SOOE+0J 3	8.980E+01 3.
64.0	Z.590E+02	J.7.739E+03	1.050E+01	.300E+01	300E+0J S	8.980E+01 2.
6.43	Z.590E+02	7.340E+02	3'200E+00	.SZOE+OJ	300E+0J J	T.ZSOE+O1 Z.
9Z.O	Z.040E+02	3.590E+02	6.000E+00	.000E+000	000E+00 6	.000E+00 9.
9T'O	Z.290E+02	3.590E+02	3.000E+00	.000E+000	000E+00 3	9.000E+00 3.
perneed	Teva	Tevq	хэтчэ	dSbot	a_todSb	d_todSb
				0	00.02₽	0008.68
				0	00.814	0000.87
				0	348'00	0000.04
				0	00'S6Z	0000.SE
				0	00'6SZ	23.0000
				0	00.40S	00000.6
				0	00.922	3,00000
			CBBS AEF	or file:	t, svel, f	odSb - evew 2

Table B-4. Poisson's ratio calculated from the P- and S-wave velocity model: for the Corps of Engineer's site.

Z.ZOOE+O1 Z.ZOOE+O1 1.000E+O1 1.409E+O3 3.810E+O2

6.000E+00

6.000E+00

дріск

97.0

97.0

0.10

avel pssnrat

S. IZOE+OZ

S.410E+O2

7.980E+02

3' 920E+05

DAGT

		000	1.512. 1.122	00000.3 12.0000	
ИАКЗ. УЕГ	:⊖liī	TOT	'Teva	Wave - dSbot,	S
		00.	60ÐT	22.0000	
		000	362.1	00000.9	
NYKP.VEL	∶⊖liī	Tot	'Tevq	,todSb - evew	đ

387,000

T.ZOOE+OL

6.000E+00

a_todSb

T.ZOOE+OL

6.000E+00

dZbot

Z.ZOOE+O1

T.200E+01 6.000E+00

q_todSb

0000.SS

80T

1.283E+03 7.900E+02 6T'O 2.500E+01 2.500E+01 2.500E+01 1.750E+01 ₽0.04 6.800E+02 4.700E+02 7.500E+00 7.500E+00 7.500E+00 7.500E+00 avel pssnrat pvel дртск d2bot s_todSb q_todSb 000.007 0000.2S 000.07₽ 00005.7 S wave - dSbot, svel, for file: HOOSS.VEL 1283.00 0000.2S P wave - dSbot, pvel, for file: HOOP2.VEL

Table B-5. Poisson's ratio calculated from P- and S-wave velocity models

for the Hoover School site.

Table B-6. Poisson's ratio calculated from P- and S-wave velocity models for the Lincoln School site.

P wave - d2bot, pvel, for file: LINP.VEL 3.00000 368.000 22.0000 675.000 29.7000 753.000 S wave - d2bot, svel, for file: LINS2.VEL 3.00000 256.000 22.0000 413.000 29.7000 470.000 d2bot thick d2bot p d2bot s pvel svel pssnrat 3.000E+00 3.000E+00 3.000E+00 3.000E+00 3.680E+02 2.560E+02 0.03 2.200E+01 2.200E+01 2.200E+01 1.900E+01 6.750E+02 0.20 4.130E+02 2.970E+01 2.970E+01 2.970E+01 7.700E+00 7.530E+02 4.700E+02 0.18

Table B-7. Poisson's ratio calculated from P- and S-wave velocity models for the Lincoln School Whittier site.

60.0 S. 170E+02 3.470E+02 T.850E+01 T.100E+01 1.850E+01 1.850E+01 7.500E+00 6.000E+00 79.0 1.382E+03 3.470E+02 1.850E+01 7.500E+00 6T'O J' 200E+00 J. 500E+00 Z.240E+02 1.390E+02 J.SOOE+00 1.SOOE+00 svel pssnrat pvel дртск d2bot a2bot_s d_todSb 347.000 000S'8T 1.50000 139.000 s wave - dSbot, svel, for file: WLBS.VEL 000'475 000S'8T

1382.00

1.50000 224.000 2.24.000

00005.7

Table B-8. Poisson's ratio calculated from P- and S-wave velocity models for the Los Alisos Adult School site.

Jernazq 84.0 84.0 25.0 24.0 24.0	Svel 2.620E+02 2.420E+02 2.420E+02 2.420E+02 2.620E+02	7.110E+02 1.358E+03 5.090E+03 3.610E+02 pvel	49144 2.5008+00 1.5008+00 1.5008+00 2.0008+00 3.5008+00	· 750E+01 • 000E+01 • 250E+01 • 400E+01 • 750E+00 • 750E+00	\20E+0J S \20E+0J S 400E+0J J 400E+0J J 200E+00 S qSpof ≈	S'.\20E+07 S' S'000E+07 S' S'000E+07 T' T'S20E+07 T' gSp0E+07 S' qSp0F b
			EXCS. VEL	ום ום סג בּזָן: נ	7, 29V2 ,7 292,00 242,00 262,00	s wave - d2bo 2.50000 27.50000
			664.100		00'TTZ 0'85ET 00'605 00'T9E	57.5000 20.0000 25.5000 25.5000
			EXCD ABL	· • [+ + + + • •	a lova t	odch - evew g

Table B-9. Poisson's ratio calculated from P- and S-wave velocity models for the Olive Junior High School site.

P wave - d2bot, pvel, for file: OLVP.VEL 1.50000 309.000 11.0000 786.000 16.8000 983.000 S wave - d2bot, svel, for file: OLVS.VEL 1.50000 209.000 11.0000 527.000 16.8000 636.000 d2bot thick d2bot p d2bot s pvel svel pssnrat 3.090E+02 2.090E+02 1.500E+00 1.500E+00 1.500E+00 1.500E+00 0.08 1.100E+01 1.100E+01 1.100E+01 9.500E+00 7.860E+02 5.270E+02 0.09 1.680E+01 1.680E+01 1.680E+01 5.800E+00 9.830E+02 6.360E+02 0.14

Table B-10. Poisson's ratio calculated from P- and S-wave velocity models for the San Bernardino Fire Station site.

97.0 97.0 97.0 27.0 27.0 27.0 20.0 97.0 97.0 97.0 97.0 97.0 97.0 97.0 9	S.560E+02 4.600E+02 4.600E+02 3.650E+02 2.990E+02 2.990E+02 2.990E+02 2.990E+02 2.990E+02 2.990E+02	S'004E+03 S'064E+03 T'04E+03 T'04LE+03 T'04LE+03 4'300E+05 4'300E+05 bA⊖T bA⊖T	Τ·ΣΟΟΕ+ΟΤ 8·000Ε+Ο Τ·020Ε+Ο Σ·200Ε+Ο 4·800Ε+Ο 4·200Ε+00 3·200Ε+00 4·200Ε+00	008+0T 008+0T 008+0T 208+0T 508+0T 508+00 008+00 208+00 2090	10.6 18.7 10.7 56.5 71.4 29.7 15.8 12.5 12.5	08+07 08+07 08+07 08+07 08+07 08+07 08+07 08+07 08+07 8007 8	3.00.0 7.800 7.800 7.800 4.120 4.120 7.620 7.620 7.620 7.620 7.620 7.600	000E+0J 000E+0J 000E+0J 000E+0J 900E+0J 200E+0J 200E+00 200E+00 200E+00 200E+00	.6 .7 .7 .8 .8
			SB1S.VEL	:91i]	000 000 000 000 000 100 £01	.922 .09₽ .80₽ .292 .662 .7972 .7972	, 1 0451	оооо. 90,0000 41,2000 41,2000 41,2000 41,2000 41,2000 41,2000 41,2000 41,200000 41,200000 41,2000000000000000000000000000000000000	S
			лау.чія	:⊖liī	101 100 100 100 100	₽60Z 2₽9T 986 98₽ 108₽ 47₽лd	,≠odSI	0000.000 70.0000 16.2000 0002.8 00002.8 00002.8 00002.8 00002.8	ā

Table B-11. Poisson's ratio calculated from the P- and S-wave velocity model for the Santa Anita Golf Course site.

P	wave – d 7.50000 17.4000 25.0000 29.6000	2bot,	pvel, 411. 609. 752. 1136	for 000 000 000 000	file:	SAGP.	VEL				
S	wave – d 7.50000 17.4000 25.0000 29.6000	2bot,	svel, 284. 343. 439. 553.	for 000 000 000 000	file:	SAGS_	_RE.VEL				
7 1 2 2	d2bot_p .500E+00 .740E+01 .500E+01 .960E+01	d21 7.500 1.740 2.500 2.960	oot_s DE+00 DE+01 DE+01 DE+01 DE+01	7.50 1.74 2.50 2.96	d2bot)0E+00 40E+01)0E+01 50E+01	7.50 9.90 7.60 4.60	thick)0E+00)0E+00)0E+00)0E+00	pve 4.110E+0 6.090E+0 7.520E+0 1.136E+0)2 2.)2 3.)2 3.)2 4.)3 5.	svel 840E+02 430E+02 390E+02 530E+02	pssnrat 0.04 0.27 0.24 0.34

Table B-12. Poisson's ratio calculated from P- and S-wave velocity models for the South Western Academy site.

P Wave - dZbot, pvel, for file: SWAP.VEL 4.00000 437.000 15.0000 641.000 29.5000 849.000 29.5000 849.000 15.0000 329.000

527.000

0005.92

Z.950E+01 1.450E+01 6T'O 8.490E+02 S.270E+02 Z.950E+01 Z.950E+01 28.0 6.410E+02 3.290E+02 T.SOOE+01 I.TOOE+01 T.SOOE+01 1.SOOE+01 0:30 4.000E+00 4.000E+00 4.000E+00 4.000E+00 4.370E+02 2.330E+02 terret pssnrat Dvel тріск d2bot s_todSb q_todSb

Table B-13. Poisson's ratio calculated from P- and S-wave velocity models for the St. Paul High School site.

terneeq 05.0 8₽.0 7₽.0	4.9006+02 3.7106+02 3.7106+02 2.2706+02	Т'864E+03 Т'864E+03 2'820E+05 4'520E+05 5∧67	א⊃דָעָב 2.5008+00 1.0508+00 2.0508+00 2.5008+00 2.5008+00	S.750€+01 2.000€+01 1.300€+01 2.500€+00 d2bot	z.750E+01 Z.000E+01 Z.000E+01 Z.500E+01	Z.750E+01 Z.750E+01 Z.500E+01 Z.500E+00 d.750E+00 d.750E+00
			JAV.S4TS	000 000 Lot Lile:	.064 222. 222.	8 wave – d 2.50000 27.50000 27.5000
			STPP. VEL	.00 000 000 Lok Lile:	₽66T 'S8S 'S2₽ 'T∋vq 'Jod2	P wave - d 2.50000 2.50000