

## Los Angeles Regional Seismic Experiment (LARSE) Phase II: Auxiliary Lines Investigation of the Shallow Crustal Structure of the San Fernando Valley

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TASK D1: LARSE  
Working Group D:  
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February 1, 2001 to January 31, 2002

### **PROGRESS REPORT**

In the second phase of the Los Angeles Region Seismic Experiment (Oct. 1999, LARSE II), three auxiliary seismic profiles were recorded in the San Fernando Valley (SFV, lines 3-5, Figure 1). These profiles, 11-22 km long with 200-350 m instrument spacing, recorded 2-4 in-line shotpoints each, plus the mainline shots. These lines were designed to constrain the basin geometry and seismic velocities of the San Fernando Valley in an effort to identify areas of potentially high seismic hazard (Fuis et al., 1999; Simila et al., 2000).

Line 3, in the southern part of the SFV, strikes northwest-southeast through the Sepulveda flood control basin. Line 4, in the northern part of the SFV, strikes east-west from Hansen flood control basin to a point north of Chatsworth reservoir, crossing the Verdugo fault, the Northridge Hills blind thrust fault, and the Chatsworth reservoir fault. Line 5 extends northwestward from the east end of line 4 into the Santa Susana Mts, crossing the gravity minimum (-90 mgal) of the SFV (Simila et al., 2000). The following discussion describes the field work, data processing, and velocity modeling results.

### **DATA PROCESSING**

The LARSE II data processing included initial phase picking and velocity modeling (PROMAX, MACRAY) with Dr. Gary Fuis at the USGS in Menlo Park during summer 2000 by Kristina Thygesen, graduate student at the University of Copenhagen in Denmark. Figure 2 shows a seismic trace from line 3 (shot 2) with apparent velocities of 1.75 km/sec to 5.75 km/sec. Additional GPS field work was conducted during Spring 2000 for selected seismograph station locations.

### **RESULTS - Preliminary velocity model of the upper part of the San Fernando Valley sedimentary basin**

The tomographic inversion model for line 3 has useful ray coverage to 1.3-km depth and shows slightly different velocity structures northwest and southeast of an apparent discontinuity in the western Sepulveda flood control basin. To the northwest, velocities reach only 3.75 km/s at 1.3-km depth; whereas to the southeast, they reach 4.75 km/s. The higher velocities in the southeast may represent older (Cretaceous?) sedimentary rocks or crystalline basement rocks.

The velocity model for line 4 has adequate ray coverage to 5-km depth. Differing velocity structures are seen in the west, middle, and east parts of the model. The boundary between the structures in the west and middle parts may represent the Chatsworth reservoir fault. Also, a horst-like body in the east part appears to be bounded on its west side by the Verdugo fault. The highest velocities in the upper layer are concentrated at the ends of Line 4 and along Line 5.

In addition, these results are consistent with the gravity modeling 6-8 km east of the LARSE II main line that indicates high densities in sediments in the northern part of the San Fernando Valley. Velocities and densities could be higher in the northern part because older sediments are brought closer to the surface along thrust faults and/or because of a change in lithology from finer sediments in the south to coarse sediments in the north (Thygesen et al., 2000; Simila et al., 2001).

## PUBLICATIONS

The publications are represented by abstracts that are presented as references.

### References

- Fuis, G., T. Burdette, E. Criley, J. Murphy, J. Perron, A. Yong, M. Benthien, S. Baher, R. Clayton, P. Davis, N. Godfrey, T. Henyey, M. Kohler, J. McRaney, D. Okaya, G. **Simila**, 1999, The Los Angeles Region Seismic Experiment (LARSE): A survey to identify major faults beneath a large metropolitan area, EOS, v. 80, p.F714.
- Thygesen, K., G. S. Fuis, J. M. Murphy, and D. A. Okaya, G. Simila, and H. Thybo, 2000, Preliminary velocity modeling in the San Fernando Valley region: Results from the Los Angeles Region Seismic Experiment, Phase II (LARSE II), 2000, EOS, p. F855.
- Simila**, G., K. Thygesen, G. S. Fuis, H. Thybo, J. M. Murphy, and D. A. Okaya, 2001, Preliminary velocity model of the upper part of the San Fernando Valley sedimentary basin, GSA Cordillerean Mtg., Prgram, v. 33 no. 3, p. A62.
- Simila**, G., G. Fuis, T. Burdette, E. Criley, J. Murphy, J. Perron, A. Yong, M. Benthien, S. Baher, R. Clayton, P. Davis, N. Godfrey, T. Henyey, M. Kohler, J. McRaney, D. Okaya, 2000, The Los Angeles Region Seismic Experiment (LARSE): A survey to identify major faults beneath a large metropolitan area, AAPG Pacific Section mtg., p. A47.

Figure 1. Location of the main LARSE line (north-south) and the cross-lines (#3,4,5).

Figure 2. Seismic record section on Line 3 from shot 2(66-9260).

Figure 3. Tomographic model for Line 3. 3a) shows the misfit between observed and calculated travel times, 3b) shows the difference in observed first arrivals (green dots) and calculated first arrivals (red dots) for each shot point, and 3c) the tomographic inversion model has relatively good coverage down to a depth of about 1.5 km where the velocities reach 5.5 km/s. In the top 200m, the velocities are 1.75 to 2.0 km/s which define the shallow basin.

Figure 4. Tomographic model for Line 4. 4a) shows the misfit between observed and calculated travel times, 4b) shows the difference in observed first arrivals (green dots) and calculated first arrivals (red dots) for each shot point, and 4c) the tomographic inversion model has relatively good coverage down to a depth of about 5 km where the velocities range from 2.0 to 5.5 km/s. Line 4 shows a distinct basin in the center of the profile.

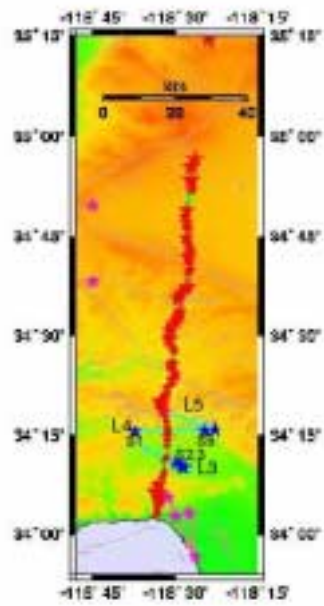


Fig. 1

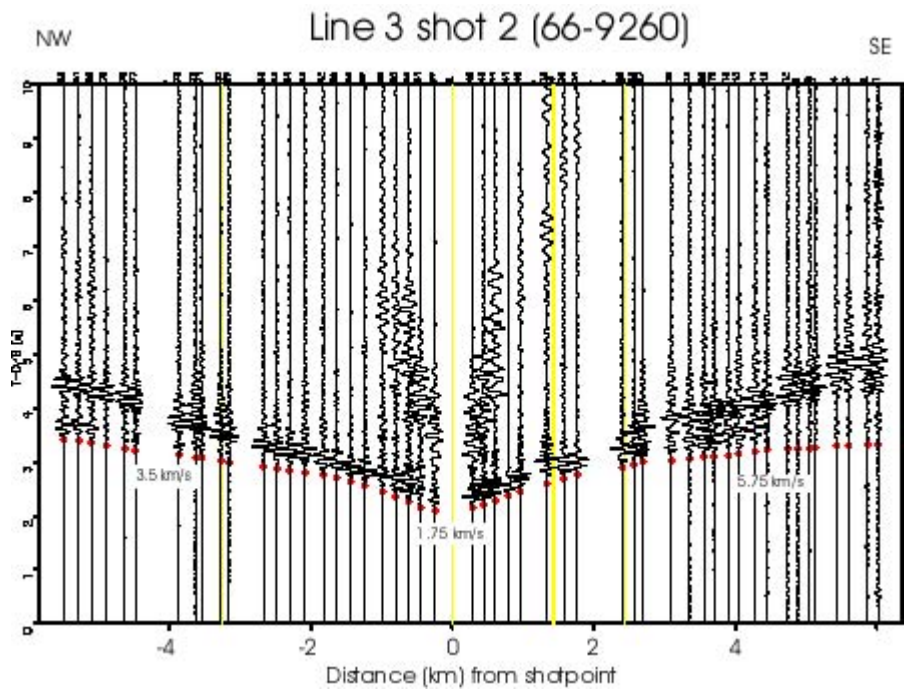


Fig. 2

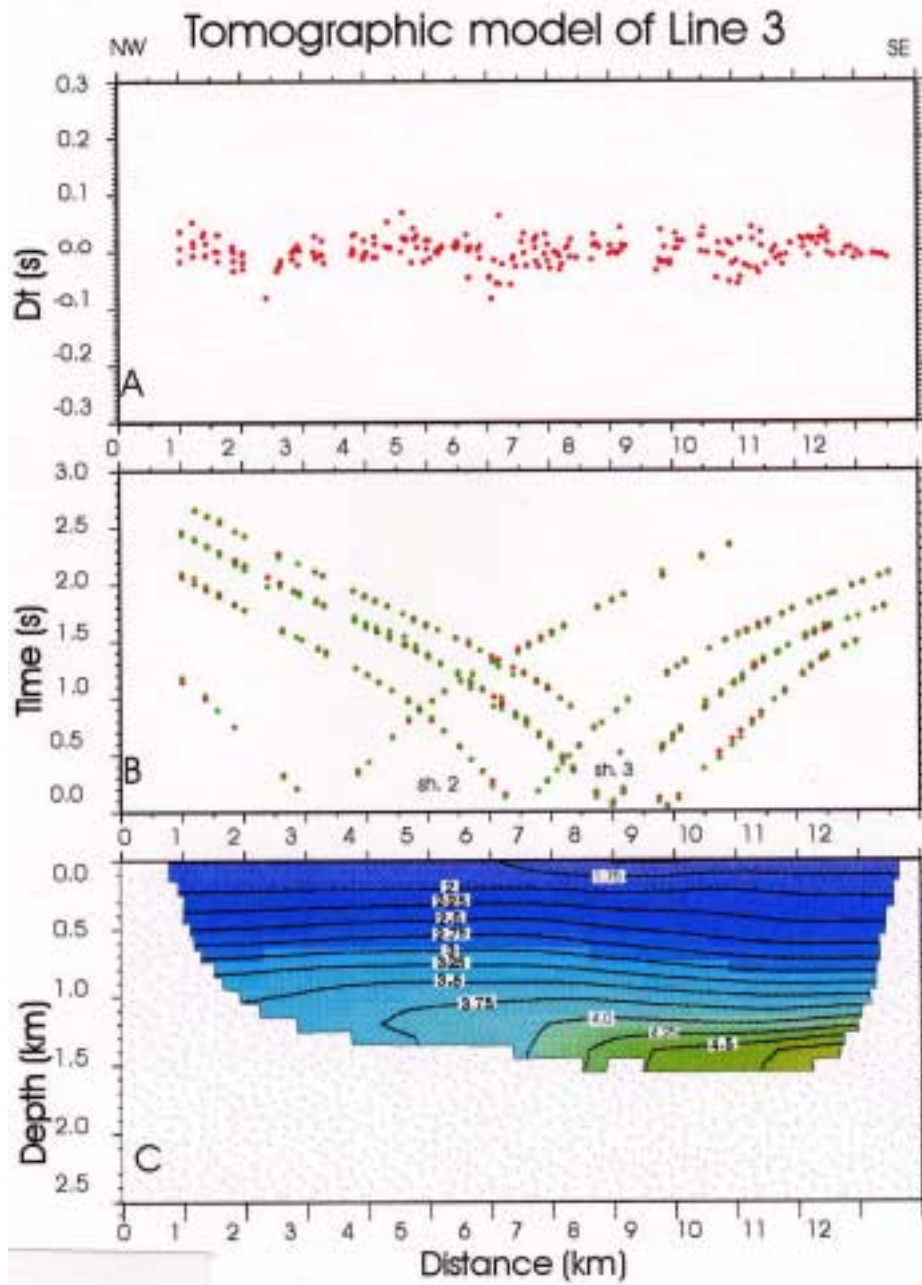


Fig. 3

