Passive Shallow Seismic Experiments Using IRIS/PASSCAL Facilities:
Shear-Velocity Assessments at Over 300 Urban Sites

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Surveys of shallow shear velocity in the Reno, Los Angeles and Las Vegas urban areas give us information assisting in the mitigation of earthquake hazards, and in preparing for future damaging earthquakes. Three transects (16, 60, and 15 km long respectively) were completed quickly and economically using the refraction microtremor method, providing 100-m-deep shear-velocity profiles of over 300 separate sites. Shear-wave velocity averaged over 30 m depth (Vs30) is unexpectedly smooth along all three transects, exhibiting realistic fractal dimensions of 1.5 to 1.8. Expected variances climb from about 5% at 0.3 km distances between measurements, to only 18% at 1.0 km distances. Vs100 values for the three transects, averaging over the 100 m depth to which most of our measurements are valid, show trends mimicking the Vs30 trends. Across all three cities our measurements correlate poorly against available USDA soil maps and geologic mapping, and often poorly against hazard mapping when prepared from general maps. Standard maps do not predict the conditions of any individual site with accuracy sufficient for engineering application; special-purpose mapping for shear velocities provides better predictions. A detailed stratigraphic model derived from deep water-well logs in Las Vegas predicts Vs30 better than maps, but only in thoroughly sampled areas.

Shear velocity averaged to 30 m depth (Vs30) for each of >300 sites, plotted as three transects of Los Angeles (blue), Las Vegas (red), and Reno (green). (Transects are placed on the same distance scale for visual convenience only.) IRIS-PASSCAL “Texan” arrays recorded urban microtremor surface waves at each site.


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