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# TITLE: COLLABORATIVE RESEARCH WITH CALTECH AND HARVARD UNIVERSITY: 3D VELOCITY-DENSITY MODELING AND STRONG GROUND MOTION PREDICTION IN THE LOS ANGELES BASIN

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**ABSTRACT**We present a new three-dimensional density model of the greater Los Angeles basin, California, that is based on hundreds of formerly proprietary bulk density and density porosity logs. The density model was constructed to augment a detailed velocity ($v_p$) model of the Los Angeles basin developed in a previous NEHRP funded effort (Suss & Shaw, 2003). Both of the models provide new, observationally constrained, detailed representations of subsurface structure in southern California that can be used for numerical simulations of seismic wave propagation to predict hazardous groundshaking. These simulations can consider various rupture scenarios and provide a basis for probabilistic maps of ground shaking hazards. Thus, the prediction and characterization of strong ground motions based on this new velocity and density information should contribute to reduce earthquake damage and loss.

The density model was constructed using the statistical interpolation method kriging, in the 3D modeling program GOCAD. The well data were used to interpolate density values in the sedimentary volume of the Los Angeles basin, defined by the topography as the top surface and the sediment/basement interface as the bottom surface; both of these surfaces are those used in constructing the velocity model. The resultant density model is characterized by a heterogeneous, spatially varying density gradient with a range in densities from about 1.5 to 3.0 g/cm$^3$ in the sedimentary section.

To explore the relationships between density and velocity, we compared the observations from wells with overlapping density and velocity logs. Although the relationship between density and velocity is complex and variable, many wells showed a statistically significant correlation between the properties. We generate relations that describe these correlations, which could be used in subsequent iterations of the models to can be used to predict missing properties in areas where either density or velocity data exists, but not both.

Note: Only the Harvard portion of this collaborative proposal was funded. Thus, the supported research focussed on the development and building of 3D velocity and density models at Harvard, and no numerical simulations of seismic wave propagation were supported at Caltech. The models will be provided to the eathquake science community, however, to support such numerical modeling.