Los Angeles Basin Seismic Hazard (LABSH) Survey

Fact Sheet

Synopsis: A program to develop more accurate and higher resolution earthquake ground motion maps to determine areas of high-risk to life and critical infrastructure in the Los Angeles Basin area (Figure 1).

Justification and Benefits: Current earthquake ground motion prediction maps are low resolution and can miss areas of high ground acceleration that pose a high risk to critical infrastructure and human safety. Accurate, high resolution ground motion maps can be used to identify areas of high risk, and derived expected ground motion information can be used to determine resiliency of existing infrastructure (building, roadways, utilities, etc.). An additional benefit will be more accurate after-event ShakeMaps for use by first responders and infrastructure operators to identify areas of high ground motion as high-priority areas for emergency response.

Project Summary: Figure 1 shows the proposed LABSH survey area that covers the LA Basin proper, an area of critical infrastructure whose resiliency is critical to the economic livelihood of all of Southern California and Western U.S.. The LABSH Survey has three phases: data collection, data analysis, and dissemination of results. The total project will take about one year to complete and has a proposed budget of $11M. The resulting ground motion maps and auxiliary data will be released at the end of the one-year period. Results will be an open-source database.

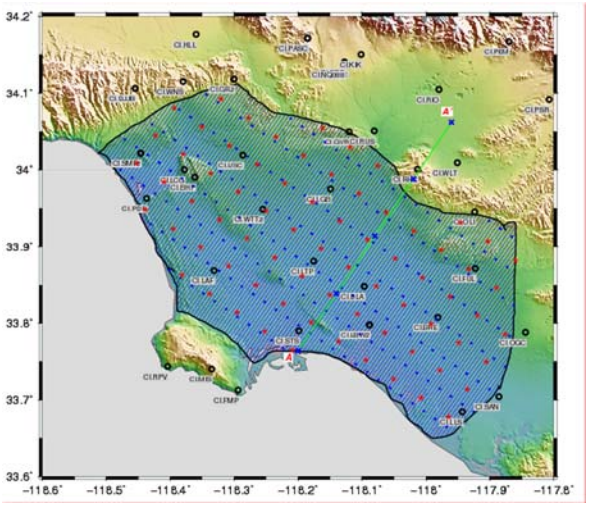

Figure 1 - Outline of LABSH Survey (black outline)

End-Users of Data: Federal (FEMA, USGS, Army Corp. of Engineers, etc.), State (Caltrans, OES, etc.), Local (Ports of Los Angeles and Long Beach; county and city roads, planning and building departments, etc.), Utilities (SCE, LA-DWP, SoCalGas, rail networks, pipelines, etc.), Academic (universities, SCEC, etc.), general public.

Project Collaborators: Rob Clayton (Caltech), Dan Hollis (Sisprobe), and Eric Campbell (LA Seismic).

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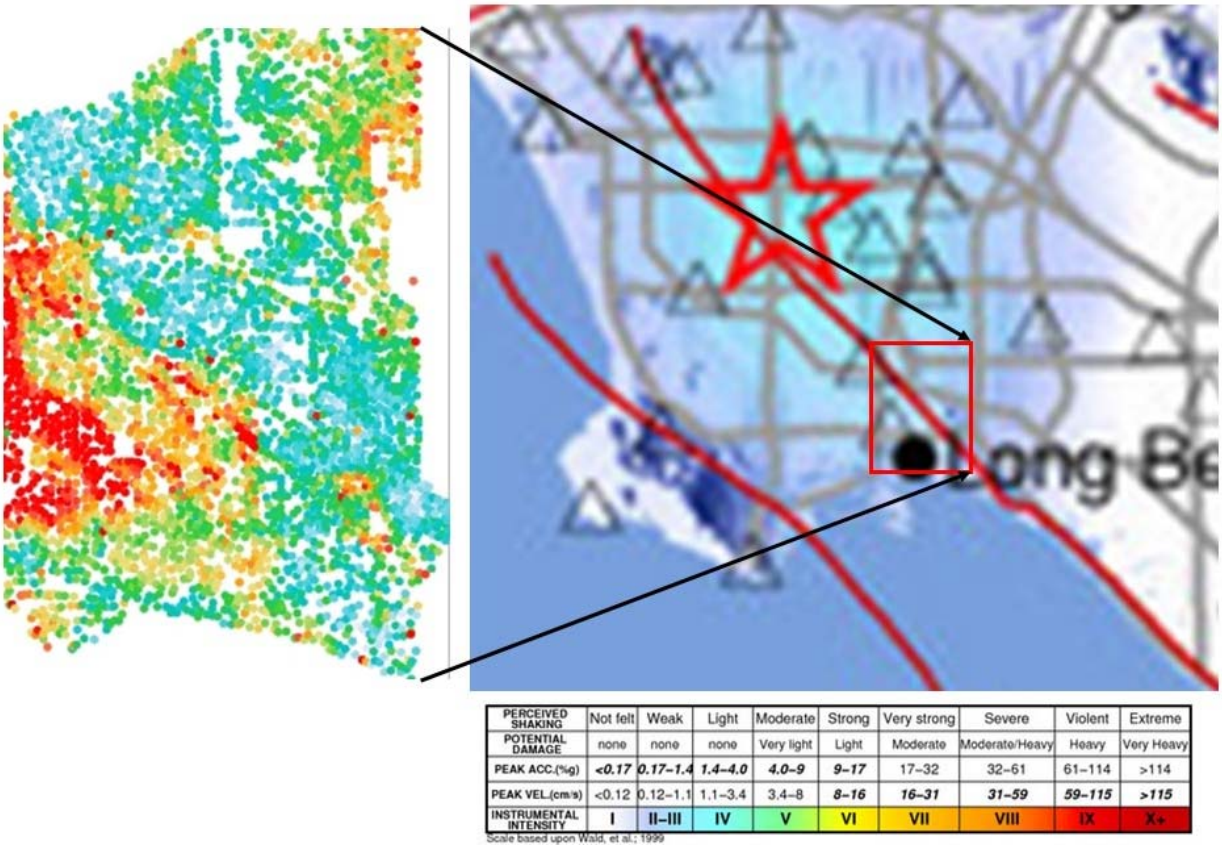
Background: Computer simulations of ground motion in the Los Angeles Basin are based on models of subsurface and near-surface rock velocities. Ground motion simulations are only as good as the velocity model used and it generally known and shown in recent studies that the current model used for these simulations may underestimated ground motion and are limited in resolution (Figures 2).



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<0.17*	*0.17–1.4*	*1.4–4.0*	*4.0–9*	*9–17*	17–32	32–61	61–114	>114
PEAK VEL.(cm/s)	<0.12	0.12–1.1	1.1–3.4	3.4–8	*8–16*	*16–31*	*31–59*	*59–115*	*>115*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

Figure 2 - Actual ground motion of 2011 M2.5 Carson (left) earthquake as measured on a temporary dense seismic array in Long Beach. Note the high variability of ground motion due subsurface and near-surface velocity variations. Right is the ShakeMap of the same earthquake showing predicted ground motion based on the current velocity model. Note the lack of detail in the predicted ground motion shown on the ShakeMap.

Generally, ground motion decreases in an amplitude with distance from an earthquake epicenter (i.e. spherical spreading). However, differences in subsurface and near surface rock velocities can amplify ground motion at great distances so that actual ground motion can be higher and more destructive than ground motion predicted by spherical spreading. During the M6.7 1994 Northridge earthquake, the I-10 Freeway overpass at La Cienega Blvd that is 16 miles from the earthquake epicenter collapsed due to amplified ground motion caused by local conditions.

Current velocities models are based on a variety of sparse data (i.e. well, industry seismic reflection data, etc.) and velocities are interpolation between point were velocities are measured. The LABSH Survey with its 200 sensors per square mile coverage will greatly increase the resolution of ground motion map (Figure 3).

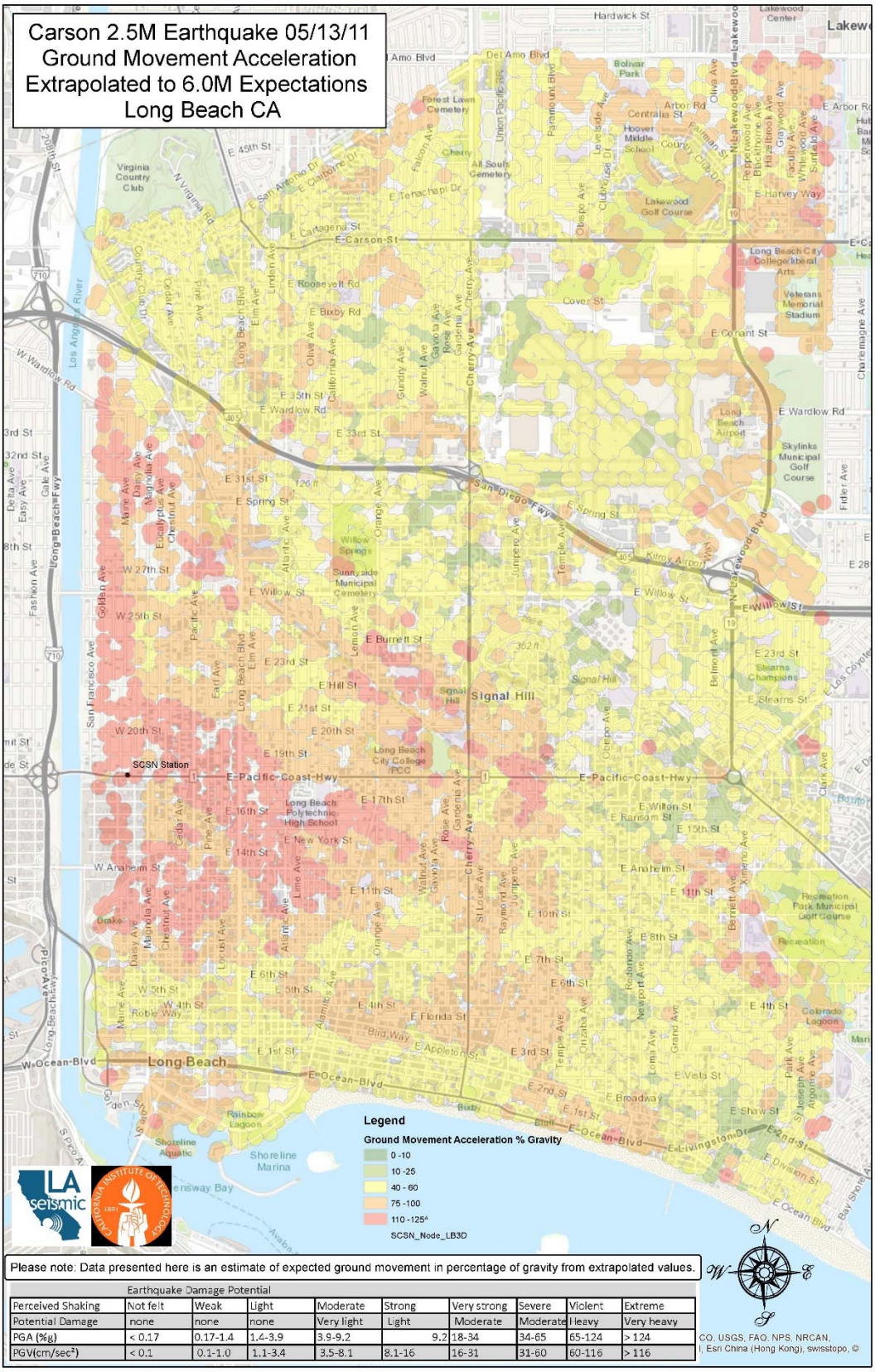


Figure 3 - High resolution map of predicted ground motion based on actual ground motion measured from the M2.5 2011 Carson earthquake. High risk areas are areas with high ground acceleration as shown in pink and orange. Infrastructure, like water and gas lines, in the pink and oranges area have a higher risk of damage and failure.