Summary of Proposed Project

SCEC should develop a project to increase the number of people that can correctly distinguish between:

(a) earthquake magnitude
(b) site-oriented seismic intensity

This project should use SCEC ground motion software to calculate ground motions after significant California earthquakes, then create different types of animations to explain the two concepts.

(a) Regional Earthquake Animations (earthquake magnitude)
(b) Site-oriented Animations (seismic intensity)
Motivation

In California, seismologists often avoid discussing seismic intensity values in order to avoid confusing the public.

If there is an earthquake, and Seismologists report that Pasadena experienced Intensity Level 7 shaking, the public may think that there was a Magnitude 7 earthquake in Pasadena.
Importance of These Concepts In Public Safety Education

The USGS is developing an Earthquake Early Warning system for the West Coast of the United States.

The ShakeAlert user display reports an estimated Earthquake Magnitude.

It also reports an estimated Seismic Intensity for a specific location.
Use SCEC Simulation Software To Illustrate these Concepts

Project would monitor California earthquake activity, and after significant events, we use SCEC software to run realistic earthquake simulations that produce ground motion time series (e.g. BBP, AWP, Hercules …) so we have ground motions across the region. Then, using simulated ground motion data (or observations) we create different style animations to explain the two concepts.

- Regional earthquake animations (improve on ShakeMovie):
- Site-oriented ground motion intensity animations (for a list of populated sites with significant ground motions after each earthquake):
Regional Earthquake Animations:

This animation shows ground motions from a M7.8 San Andreas earthquake propagating north towards Los Angeles. (Image Credit: Kim Olsen, Amit Chourasia, Yifeng Cui (SDSC))
Site-oriented Animations:

Site oriented animations show the intensity of the earthquake shaking at a particular site. Viewers can see that seismic intensities are site-based, and that different sites can experience different intensities for the same earthquake.
Ground motion time series can be used for multiple animations

Once ground motion simulations are produced, and site-oriented ground motions are calculated, they can be used in a variety of ways, from the same data set.

1. Regional ground motion animations (ShakeMovies..)
2. Standardized site response animations (e.g. common objects)
3. Locally-defined site response (e.g. based on building inventory)
4. User specific site inventory site response (e.g. combine ground motions with users personal inventory)
Site-Specific Intensity Reports

Site-oriented Intensity Animations: This animation shows the response of every day objects to ground motions for a site in Pacoima, CA. (Image Credit: Philip Maechling (SCEC))

Intensity Seven (VII) Shaking in Pacoima California located 12km (7mi) from M6.7 Northridge Earthquake on Monday January 17, 1994 at 04:30:55 AM PST
SCEC’s Site-oriented Intensity Movie Concepts

Using SCEC’s physics-based simulation software, we can accurately model the ground motions at any sites near the earthquake: Building on this capability in the following way:

1. Users take a video of their home or office interior using their phone cameras
2. Videos are used to create 3D model of the room and its contents:
3. Earthquake simulation performed and ground motions for site are determined
4. Simulated ground motions are input to physics-based 3D models of room.
5. Animation showing response of their room is created and delivered to users
Technical Challenges In This Project

Project would require integration of multiple technologies including:

- Linking real-time eq monitoring and HPC computer resources
- Workflows that perform ground motion simulation and seismological processing of simulation results
- Physics-based game engines or simulators
- Workflows that automate generation of animations
- Animation rendering pipelines and workflows
- Public information distribution
Potential Benefits of This Project

1. Motivated by clear public information need for science information
2. Consistent with SCEC Mission and Goals
3. Leverages existing SCEC Capabilities
4. Collaborative with SCEC Science, SCEC CEO, SCEC software, workflow groups, ground motion groups, visualization groups
5. Builds new capabilities by integrating existing capabilities
6. Limited current similar work by others
7. Could increase visibility of SCEC brand
8. Meets strong demand for digital content after earthquake
9. Could contribute to public understanding of seismic intensity