POSTER PRESENTATION OF THE SESI HIGH SCHOOL CAPTSONE PROJECT

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An exciting element to the multifaceted mission of EERI is the School Earthquake Safety Initiative (SESI). This initiative is a collaborative effort between EERI student and professional chapter members that promotes safer buildings for school children. The SESI Classroom Education and Outreach subcommittee aims to create an ongoing dialog about earthquake safety within the education system and among students, parents, and teachers. This grassroots approach partners various EERI student chapters with local K-12 schools to teach and promote earthquake safety through hands-on, project-based earthquake engineering curriculum. By integrating earthquake engineering curriculum in classrooms, SESI creates awareness of the dangers that would otherwise be noticed too late. Moreover, this partnership helps school teachers meet Next Generation Science Standards (NGSS) and Common Core standards. The curriculum targets two levels: 4th grade, and high school physics.

The high school version of the SESI curriculum exposes students to principles of earthquake safety through a team design competition. Specifically, teams of students are tasked to design and build a small scale balsa wood structure to be tested on an instructional shake table. A performance index guides the design competition process and encourages students to build the strongest structure while using the least amount of material possible. Their goal is to learn how buildings withstand earthquakes and to build a structure that will survive multiple earthquake tests on the instructional shake table. The objectives of this curriculum are to teach and promote earthquake safety and to meet academic standards within an exciting and enlightening learning environment for the students.

The curriculum begins with two teaching sessions that highlight the basic principles of earthquakes and how structural engineers design buildings to withstand them. These sessions also include demonstrations that utilize a small instructional shake table and enable students to visualize the concepts being taught. The students then complete a research assignment regarding specific techniques used to design buildings for earthquake forces. Having completed the first section of the curriculum, the students begin designing and constructing the balsa wood structure to include a Lateral Force Resisting System (LFRS) of either shear walls or braced frames. Following the construction of the structure, each team analyzes their structure and predicts its dynamic behavior according to a specific earthquake ground motion record. The specific parameter to be predicted is the structure’s maximum acceleration as determined from an acceleration response spectrum. The curriculum concludes with testing the structures on the instructional shake table under a maximum of three ground motion records and comparing the students’ predictions to the observed results. The team that builds a structure that survives the most amount of earthquakes and uses a minimal amount of material receives the highest performance index score and thereby wins the competition.

The SESI high school curriculum has completed one trial and is currently undergoing its second implementation in the high school physics classroom of Robert Whitney at Westview High School in San Diego, California. The first implementation took place during the Fall 2015 term through a total of 4 visits by UC San Diego students and faculty. The first two visits included teaching, demonstrations, and the introduction of the design competition. A third visit was used to check the construction process and to explain how the students would analyze their structures and predict its behavior. Finally, the structures were tested and the winning team was determined during the fourth visit. Overall, the students showed creativity and critical thinking in the design of their structures. However, some teams overlooked important design concepts and most teams used close to the maximum limit of materials. In terms of the testing results, 5 structures failed on the first ground motion, 3 structures failed on the second ground motion, and 2 structures passed all 3 tests.
Although these results are well distributed, our goal for the current pilot is to ensure that the students build with all design concepts in mind while also focusing on an efficient use of materials. Furthermore, there is room for improvement in the mathematical models that the students use to predict their structure’s behavior. As these improvements are being made, the UC San Diego team will also be making preparations to train EERI chapter members and to expand the curriculum into more local San Diego schools. This poster will provide an overview of the SESI Classroom Education and Outreach initiative and describe specific details of the high school curriculum including areas for future improvement.