SEISMIC RESPONSE CHALLENGE

1. BACKGROUND

The field of structural engineering has seen significant developments over the past half-century. Among these developments are established approaches and best practices for structural designs to minimize the probability or prevent loss of life and collapse under extreme events. Many of these approaches involve novel structural systems and innovative seismic protection systems. Protection systems are typically categorized into supplemental damping and isolation systems. The former consumes part of the seismic energy induced in the structure by providing supplemental damping, while the latter reduces the seismic energy induced in the structure by lengthening its period, typically by introducing a low lateral stiffness between the foundation and superstructure.

2. OBJECTIVE

Your team has been invited to develop and implement a passive seismic protection design solution for reducing the seismic response of a three-story building. Due to the historic importance of the building and architectural considerations there are restrictions on altering the building appearances and main structural system. Thus, the seismic protection system is restricted to be installed on the roof of the building with additional restrictions on its volume and weight. Furthermore, the retrofitted structure is expected to remain essentially elastic for the design ground motions. Considering the above, the selected seismic protection system is based on the simple principle of adding mass within a container on the roof, with the objective of altering the dynamic characteristics of the structure and reducing its seismic response

3. ELIGIBILITY

Each university may have one (1) team consisting of three (3) members.

4. PROCEDURE

Prior to the competition, teams are tasked to design and make the material inserts and detailing (internal partitions if any, etc.) to be installed inside the roof container.

4.1 RESTRICTIONS

a. Teams cannot exceed the container volume. In other words, nothing exceeding top surface of container.

b. You cannot exceed the maximum allowable container weight.

c. You may use any type of material, solid or fluid. The material can be raw/unprocessed material (sand, gravel, etc.) or it can be processed material (metal or plastic balls/spheres, etc.).

d. You are allowed to create internal compartments of partitions. However, you cannot use any type of mechanical devices, passive or active, in the form of springs, dashpots, etc.

4.2 DESIGN GUIDELINES

Teams will be provided with:

a. The structural building model details along with its dynamic characteristics (weight, height, eigenmodes/eigenfrequencies, etc.).

b. The time-histories of two ground motions, representing earthquakes with different returning periods and spectral characteristics.

c. The response of the base structure when subjected to the two provided ground motions, in terms of story drifts and accelerations.

d. The container external dimensions (volume) and maximum allowable weight (including the weight of your retrofitted material insert).

Design Guidelines will be released in Mailer 2.

The model along with the container installed on top will be provided by the competition organizers. At the time of the competition, each team should provide with the material insert/detailing that will be installed inside the container on top of the test model. The base model will be retrofitted with your material insert and detailing. Then, the retrofitted model will be subjected to the two provided ground motions. The response of the retrofitted model, in terms of story drifts and accelerations, will be measured during the shaking.

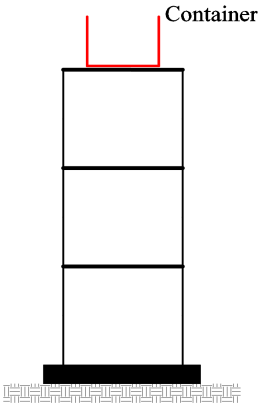
Each team will have 10 minutes to install their designed insert and 10 minutes for testing the model under the two selected ground motions and collecting the structural response time-histories (story drifts and floor accelerations).

5. JUDGING

The performance and effectiveness of your design will be judged based on the reduction of the structural response of your retrofitted design when compared to the response of the base structure. Teams will be ranked based on their reduction for both ground motions. The team with the highest reduction will receive first place and all other teams will be ranked accordingly.

5. QUESTIONS

Direct any questions to conference organizers.
Answers will be posted on the Q&A page.



STRUCTURAL BUILDING MODEL