SOCRAT BENCHMARK

Seismic simulation of Overhead CRAne on shaking Table

First announcement

This is the announcement concerning the launching of SOCRAT Benchmark: international benchmark regarding the seismic behavior of overhead crane bridges organized by IRSN and EDF under the umbrella of the OECD/NEA.

General presentation and objective

Crane bridges are handling devices used to lift and transfer heavy loads, widely used in the industry, especially the nuclear industry. Assessing the dynamic behavior of crane bridges may constitute an important issue for nuclear safety: within the context of seismic Level 1 Probabilistic Safety Assessment (PSA) studies, these devices have been identified as significant contributors in the probability of core meltdown.

Moreover, modelling the mechanical behavior of such a device under seismic load is a challenging scientific and engineering exercise, due to the importance of contact dissipative phenomena such as friction, sliding and impacts in determining their dynamic response. The behavior of the anchoring seems to be the primary cause of failure of this equipment when loading is supposed beyond design conditions. Consequently, it is necessary to enhance the knowledge on the mechanical behavior of this equipment in order to fully understand its response to earthquakes and, in particular, to assess the efforts transmitted to the anchorages.

The objective of the SOCRAT international benchmark is (i) to identify best modeling practices of crane bridge devices and (ii) to identify relevant failure criteria. In addition, a more midterm objective is to improve knowledge of crane bridge modeling practices to assess the associated seismic fragility with a high confidence level. Within the framework of the SOCRAT benchmark, works focus on the identification of best modeling practices; seismic fragility will not be included in its scope. However, issues related to the definition of seismic fragilities may be considered in a future activity.

An experimental campaign on a scaled model of an overhead crane bridge was carried out in 2015 on the shaking table of French Sustainable Energies and Atomic Energy Commission (CEA) and has produced a large experimental database. These data will be used to characterize and calibrate the models, and to assess the predictive capacity in case of high intensity earthquakes.

The mock-up

The mock-up is a 1/5 scaled model of a 22.5 m long overhead crane bridge:

© CEA – Saclay, France
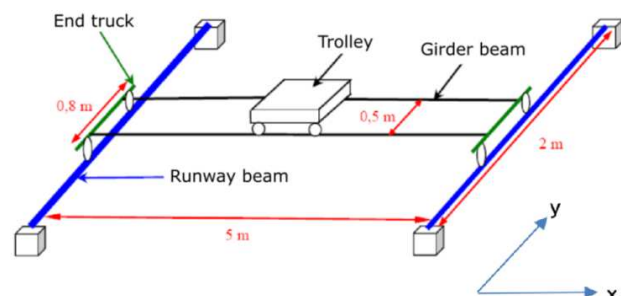
SOCRAT BENCHMARK

Seismic simulation of Overhead CRAne on shaking Table

Tasks

The different tasks of the Benchmark are the following:

- Stage #1: Modelling, characterization and calibration of the participants' models
    Description of the participants' modelling assumptions
    Calibration, for low seismic intensities, of the participants' models and its components
    Calibration, for significant seismic intensities, of the participants' models

- Stage #2: Assessment of the predictive capabilities of the participants' models
    Blind non-linear simulations at high seismic intensities

- International Workshop

For the first stage, the necessary data are provided to participants to build their own numerical model, before providing them with reference data to allow for calibration of the models.

The stage #2 lies in performing blind predictive computation for high intensity seismic loadings in order to assess the predictive capabilities.

The benchmark will be concluded by a restitution workshop in which the different participants will be gathered to exchange and discuss their models and results they have obtained in order to identify the best modelling practices. The workshop will provide a synthesis of lessons learnt and recommendations based on findings of the benchmark analysis.

Schedule

Participation

Each Participating Institution is requested to express its intention to take part in the Benchmark by filling in the registration form on the following website:

www.socrat-benchmark.org

Input data and experimental data will also be provided on this website.