

WP 9: Shake table dynamic tests on a full-scale steel silo filled with wheat

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Keywords

Full-scale silo, seismic isolation, dynamic testing, shake table testing.

Figure



Figure 1. Full-scale silo structure tested in as-built and seismic isolated configurations

Main Results

The transnational access (TA) framework of the SERA project gave European and worldwide researchers the opportunity to target an extremely wide range of crucial aspects in earthquake engineering and seismology fields, through the access to the largest collection of high-class European Research Infrastructures. The EUCENTRE experience, in addition to the coordination of the TA framework, resulted in relevant contributions to earthquake engineering fields in which experimental data on full-scale structures and non-structural components is very limited.

EUCENTRE TA activities encompass real time dynamic testing of innovative optimized variable-friction seismic isolation devices, silo structures and industrial facilities with respect to early warning and protection from dangerous leakage and both structural and non-structural damage.

In Figure 1, a real full-scale silo tested on the EUCENTRE shake table is pictured. The structural design of steel flat-bottom ground-supported silos containing granular material represents a challenging issue. They differ from many other civil structures since the weight of the silo structure is sensibly lower than the one of the ensiled particulate material and, in case of earthquake ground motion, the particle-structure interaction plays a fundamental role on the global dynamic response. The complex mechanism through which the ensiled material interacts with the silo wall has been studied since the XIX century. Nonetheless, several issues are still to be addressed regarding “grain-silo systems” and structural failures still occur, with potential loss and spread of huge amount of the ensiled content. To this end, an extensive experimental campaign with several parametric shake table test runs has been

carried out. A wide spectrum of related aspects has been targeted, such as the dynamic characterization (frequency, damping ratio, amplification, etc.) of such complex silo-grain system, the experimental assessment of the static pressure (during and at the end of the filling phase), and the seismic dynamic over-pressures exerted by the ensiled material on the silo wall. Furthermore, the assessment of the benefits obtained introducing a seismic isolation system based on curved surface sliders at the base of the silo has been carried out.

In order to fully exploit the potential of this testing campaign, a fruitful collaboration between EUCENTRE and worldwide researchers as well as a deeply analyzed specific selection of a variety of shake table input signals were successfully carried out within the testing campaign preliminary phases.

List of Publications

- Journal and conference publications are currently either under review or in preparation.
- The SERA Deliverable D9.1 submitted on M24 of the project include detailed information on the above described experimental activity.

Access to Data and Services

All data will be included in the SERA DB.

Liability claim

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