

WP 8: Experimental study of a two-storey flat slab building under seismic and gravity loads

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Keywords

Earthquake engineering, flat slab, large-scale tests, pseudodynamic testing, retrofit.

Figure



Figure 1. Test specimen: a two-storey flat slab structure

Main Results

Flat slab buildings for commercial, office, and residential use are built in many countries. Yet, their performance under seismic and gravity actions is still not very well understood. Many studies have been carried out in North America and Asia, but European research is lagging behind and Eurocode 8 does not fully cover the design of buildings with flat slab frames used as primary seismic elements.

The SlabSTRESS Transnational Access project at the ELSA Reaction Wall of the Joint Research Centre studied the response of flat slab reinforced concrete buildings under earthquake and gravity loads. The objective of the project was twofold: to study the ultimate capacity and failure modes of flat slab

structures with different layouts of reinforcement and to verify the effectiveness of steel studs for the repair of damaged slab-column connections.

The test specimen was a full-scale two-storey flat slab structure with plan dimensions 9×14 m. Punching shear reinforcement was placed only in the slab of the second storey. In addition, uniformly distributed horizontal reinforcement was placed in half of the slab at each floor, while, in the other half, the same amount of horizontal reinforcement was mostly concentrated close to the columns.

The testing programme included two pseudodynamic tests (hybrid simulation of the physical specimen and numerical shear walls) with input corresponding to the Serviceability and Ultimate Limit States and three quasi-static tests under imposed cyclic displacement with increasing amplitude (three slab-column joints were strengthened after the first cyclic test).

The project provided new knowledge on the response of flat-slab structures with different detailing rules that could not be captured in previous tests on column-slab sub-assemblies. The results will help calibrate models, verify the Eurocode and Model Code models for punching shear, and develop new rules for the deformation-based design and detailing of flat-slab structures subjected to earthquake and gravity loads, as well as to improve the design of flat-slab frames as primary seismic structures.

The results of the project are being exploited by the 14 Users of the SlabSTRESS project and by 19 research groups from 13 countries, who participate in an ongoing blind prediction competition.

More information: www.slabstress.org, www.researchgate.net/project/SlabSTRESS

List of Publications

Lamperti, M., Tornaghi, G., Tsionis, P., Pegon, P., Molina, J., Peroni, M., Coronelli, D., Pinho Ramos, A., Pascu, R. Experimental study of a two-storey flat slab building under seismic and gravity loads. 17th World Conference on Earthquake Engineering, 2020 (accepted abstract).

Access to Data and Services

All experimental and documentation data will be made available through the SERIES Data Access Portal after the completion of the blind prediction competition.

Liability claim

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