Project Summary

Seismic Behaviour of Existing Reinforced Concrete Buildings with Thin Walls

The seismic assessment of an existing structure calls for an in-depth understanding of the type of failure mechanisms that can influence the behaviour of the building. The research project addresses the seismic behaviour of reinforced concrete wall buildings that were constructed 1950-1970 in Switzerland. A number of these buildings belong to the Swiss cultural heritage. For such structures seismic retrofit interventions need often be kept to an absolute minimum. The project aims therefore at understanding the performance of these structures in their original state through large-scale testing and at exploring advanced computer simulation procedures to predict their seismic response.

Although before 1970 seismic loads were not considered when designing buildings in Switzerland , the study showed that RC wall buildings constructed 1950-1970 have some characteristics that are in their favour. Amongst others are the often large number of walls and reasonable longitudinal *and* transverse reinforcement contents, as well as the flanges that help stabilizing the wall and reduce the detrimental effect of compressive strains. Other characteristics that were initially considered unfavourable, such as the placement of the transverse bars on the inside of the longitudinal bars, did not show a significant effect on the wall behaviour in the large-scale tests that were performed within the scope of this project. On the other hand, a clear shortcoming of these walls is the relatively short lap splices at the wall base. The lap splice significantly reduced the wall displacement capacity by up to 50%, which should be taken into account during the seismic evaluation (namely in the modelling phase). Despite these shortcomings, the walls that were tested within this project reached their full force capacity and developed some inelastic deformations before failure, which indicates that the resulting deformation capacity might be often sufficient for regions of low seismicity. Based on the experimental and numerical results of this project, seismic assessment guidelines for such buildings were formulated and an outlook on further research needs given. The latter should address in particular the development and validation of regularisation techniques for beam and shell elements as well as the effect of bidirectional loading on the performance of RC walls.

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Publications:

Almeida J, Tarquini, D, Beyer K (2014). Modelling approaches for inelastic behaviour of RC walls: Multi-level assessment and dependability of results. Submitted to Archives of Computational Methods in Engineering.

Further publications are in preparation. All publications will be published on the laboratory's webpage (eesd.epfl.ch)