Proceedings of the 6th International Conference on Civil Engineering Fundamentals and Applications (ICCEFA 2025)
Barcelona , Spain - October 27 - 29, 2025
DOI: 10.11159/iccefa25.004

Low-Damage Seismic Design: Recent Developments

Nawawi Chouw
University of Auckland Centre, New Zealand

Abstract

Seismic design philosophy, currently used worldwide, tolerates a degree of damage at locations predefined by the designer (for example, in forms of plastic hinges in beams of a structure) as long as a complete structure collapse is precluded. By tolerating plastic deformations, the maximum acceptable forces can be controlled and, more importantly, construction costs can be reduced. Major earthquakes, e.g. the Canterbury earthquakes, showed that well-designed structures behave as expected. The joints suffered plastic deformation as the designer intended, while the occupants remained alive. Repair costs, however, were often high (as high as 90% of new structure value). Costs also accrue because infrastructure is no longer fit for purpose (downtime). These costs are challenging to predict.Low-damage design, in contrast, can be achieved by activating rigid-like body movement of structural members, e.g. by allowing a partial separation at the footing and/or throughout the structure while responding to earthquake loading. Development of forces resulting from structural local deformation can then be prevented. Consequently, associated damage to structural members can be avoided. Damage-induced downtime will thus not become an issue. The recent research developments will be presented.

Keywords: recycled concrete aggregates; RCA carbonation; vaterite; calcite; interfacial transition zones