CERIS : Civil Engineering Research and Innovation for Sustainability

Resiliency and progressive collapse design of framed RC structures against extreme abnormal events

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Summary

Due to the growing occurrence of abnormal or man-made extreme events (such as explosion, landslide, vehicle impact, terrorist attack, etc.), progressive collapse resistance design of structures has become an increasingly important requirement of public and private buildings, especially those of high importance classes.

The main objective of this research is to develop a cost-effective strengthening system to improve resiliency by increasing robustness (progressive collapse resistance) of critical infrastructures against extreme weather events and man-made hazards, to maintain aftershock operation up to repair so as to save lives and reduce economical losses.

The focus of the study is on framed reinforced concrete structures. The innovation relies on the development of a quasi-passive set of prestressing cables to be embedded at the beam's level. These will be activated by large displacements resulting from a column collapse, taking advantage from the cables catenary behaviour. The work-plan comprises three major stages: i) system conception; ii) experimental testing and numerical simulation; and iii) guideline proposal for system design and practical implementation by contractors.

Main results comprise: (i) a novel technique for progressive collapse design; (ii) numerical models for retrofitted structures; and (iii) design guidelines.

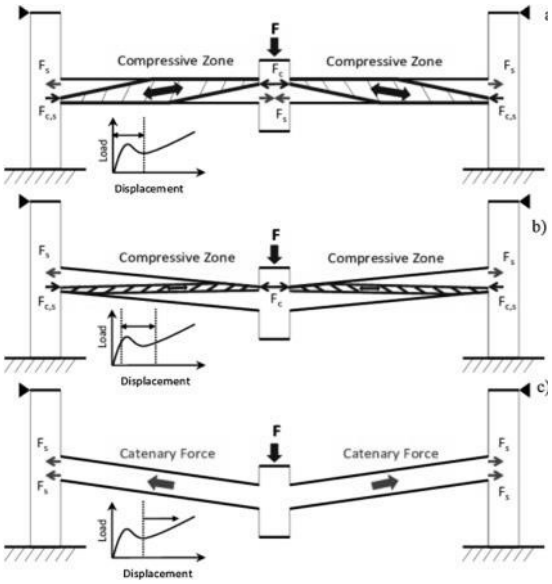
Keywords

Resiliency, progressive collapse, reinforced concrete, strengthening, pre-stress, extreme events.

I) Flexural action

II) Compressive arch action

III) Catenary action



Stability mechanisms of structures