

**PROGRESSIVE COLLAPSE ASSESSMENT OF  
REINFORCED CONCRETE FRAMED BUILDING  
STRUCTURES**

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M.Eng in Structural Engineering Design

Department of Civil Engineering

University of Moratuwa  
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Engineering

Department of Civil Engineering

University of Moratuwa  
Sri Lanka

June 2014

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## DECLARATION OF THE CANDIDATE AND SUPERVISOR

“I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters thesis under my supervision.

Signature of the supervisor: ..... Date:

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## Abstract

A structure is subjected to progressive collapse when a primary structural element fails, resulting in failure of adjoining structural elements which, in their turn, cause further structural failure leading eventually to partial or total collapse. The failure of a primary vertical support might occur due to extreme loadings such as bomb explosion in a terrorist attack, gas explosion and huge impact of a vehicle in the parking area.

Different guidelines such as the General Services Administration (GSA) and the Unified Facilities Criteria (UFC) addressed the structural progressive collapse due to the sudden loss of a main vertical support. In the current study, a progressive collapse assessment according to the GSA guideline is carried out for a typical 10-story reinforced concrete framed structure designed according to BS 8110 code.

Linear elastic analysis for the structure was carried out using “Etabs” Building software. The investigated cases included the removal of a middle column in short and long side periphery of the building, corner column, and internal columns one at a time. 3 dimensional analysis with slabs panels was carried out to avoid more conservative solutions.

It was found for the case that was studied, reinforced concrete structures designed according to BS 8110 code do not meet the GSA limits and that they have a high potential for progressive collapse in flexure mode for all cases and sudden shear mode collapse at the loss of corner column. Some modifications to avoid progressive collapse that could be done in analysis, design and detailing stages are proposed in this study.



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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
BS	British Standard
DCR	Demand Capacity Ratio
GSA	General Services Administration
NA	Not Applicable
UFC	Unified Facilities Criteria