

EFFECT OF THE BUILDING HEIGHT ON PROGRESSIVE COLLAPSE

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ABSTRACT

Progressive collapse is defined as extension of initial collapse, from a part of structure to another one that may result in destruction of structure. Possible risks and abnormal loads that cause progressive collapse are as follows: aircraft collision, design or construction error, firing, gas explosion, random overload, vehicles contusion, bomb blast and etc. such phenomenon are not considered in designing typical structure, since possibility of occurring these risks is very low. However, they should be regarded in very important or special structures.

In this research, effect of the building height on progressive collapse is studied. For this purpose, steel moment resisting structures designed for high seismicity zone areas, with four, eight and twelve- stories are considered and their progressive collapse are studied and compared.

Results indicate that the potential of progressive collapse decreases by increasing building height. The main reason is increasing structure indeterminate degree, and catenary action of members.

INTRODUCTION

Increasing catastrophic events in recent years showed that the prevention or mitigation of progressive collapse must be included as a requirement in design and analysis of important buildings. Many methods have been proposed to mitigate progressive collapse and several building codes, standards, and design guidelines have discussed this issue. General Services Administration (GSA, 2013) and Department of Defence (DoD, 2005) have been used more than the others for designing and analysing of progressive collapse. The alternate path method (APM) is a threat independent approach that is commonly used for analysis of progressive collapse. This approach is based on removing a load-bearing element and evaluating stability of the remaining structure and also its ability to bridge over the removed element.

There are different analysis procedures for the APM that have been suggested in guidelines. These procedures are linear static, linear dynamic, nonlinear static and nonlinear dynamic. In recent decades, many studies have been performed to evaluate the potential of progressive collapse of buildings by computer modelling and also to evaluate the advantages and disadvantages of each four progressive collapse analysis procedures some of these studies have been performed by Marjanishvili (2004); Powell (2005); Marjanishvili and Agnew (2006); McKay (2008). A more complex nonlinear analysis is required to obtain more realistic results but it is better that the static and the dynamic analysis properly be incorporated so that the best results can be achieved for analysis of progressive collapse. Kim and An (2009) investigated the effect of catenary action on the progressive collapse potential of steel structures. Khandelwal et al. (2009) applied a macro analysis model to investigate the resistance to progressive collapse of seismically designed steel braced frames.

In this research, effect of the building height on progressive collapse is studied. For this purpose, steel