EVALUATION OF NONLINEAR STATIC PROGRESSIVE COLLAPSE IN IRREGULAR CONCRETE STRUCTURES

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ABSTRACT

Progressive collapse is a structural catastrophic phenomenon, which can cause by natural disasters or human negligence where local failure of a member causes significant deformations that leads to destruction of structure. In this study, evaluation of the progressive collapse in concrete structures with intermediate moment frame in irregular state in plan according to GSA(2003) & DOD(2009) and using APM on "Open Sees" software with nonlinear static analysis in 3D structures 3, 6 and 10 stories has been carried out. The obtained results indicate that in creating this phenomenon the location of the removed column and the height of the structure has the most effect.

INTRODUCTION

Structural engineering science has always tried to predict events which in the lifetime of the structures has significant influence on the efficiency and strength of the structure. Progressive collapse is a kind of those events that if they will not be predicted they can bring about much financial and human losses. In general, buildings have not been designed with loading conditions such as gas explosions, bomb explosions, vehicles collision, plane collision, terrorist attacks and, etc... when these structures have been encountered with such loads they may suffer great damages. This phenomenon can also create problems for structures during severe earthquake, which leads to destruction of the structure. Initially after the destruction of the Ronan Point in London in 1968 engineers' attention were paid to this phenomenon. The collapse of the World Trade Centre on 11 September 2001 attracted vast attention and several standardization committes such as the United States Department of Defence (DOD) or UFC and United States General Services Administration (GSA)[1] start designing of structures against such progressive collapses. Two general methods have been created to decrease the progressive collapse in regulations:

1) indirect method, which prevents the progressive collapse by determining minimum essentials in strength, continuity and adequate development for alternative loading path among structural elements.
2) direct method, which prevents progressive collapse by being able to compensate the damages as part of the design and it consists of two sub categories A) Alternative load Path Method(APM) and B) Specific Local Resistance Method (SLRM).

Elingwood&Leyendeker are one of the first people who performed researches on progressive collapse in 1978 and discussed about the design methods against this phenomenon.[7] Kapil Khandelwal & Sherif El-Tawil in 2009 evaluated the progressive collapse in EBF and CBF and their results showed that because of more ductility EBF than CBF, this frame is more resistant against progressive collapse.[8] Taewan Kim & Jinkoo Kim in 2009 studied the progressive collapse of the steel frames with three types of seismic connection and conclusion indicated that the designed structures with high seismicity are more resistant