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THE EVALUATION OF PROGRESSIVE COLLAPSE IN TALL STEEL STRUCTURES WITH TUBULAR SYSTEM UNDER THE IMPACT OF EARTHQUAKE LOAD

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INTRODUCTION

Progressive collapse occurs when a major member of a structure or key member of the structure is failed and this failure is transmitted to the adjacent members in a chain, eventually leading to a complete or large fracture of the structure. Various factors, such as earthquake and misplaced design lead to progressive collapse in the structure. In this research, the evaluation of tubular systems in high-rise steel structures against progressive collapse is discussed.

RESEARCH METHOD

First, a 45-story high residential building (each story is 3-meter high) with a tubular system in the ETABS program is designed by using issues 6 and 10 of the National Building Regulations and 2800-4 bylaw, and a dynamic linear analysis of spectral type under the earthquake records, and then one or some key members of the structure are removed and uses the OpenSees software and non-linear dynamic incremental analysis (IDA) under a progressive collapse analysis. According to UFC and GSA documents, perimeter columns include corner columns, mid-columns, or near to mid-range and internal columns with maximum internal force are critical members, and the key structures. Finally, we will discuss surrounding this issue using the OpenSees software and the UFC and GSA regulations.

It is worth mentioning that soil type 3 is used for this thesis. Moreover, Tabas, Cape Mendocino and Chi-Chi earthquake records are used in this project. The magnitudes of these 3 earthquakes are 7.4, 7.01 and 7.62. (Figure 1)

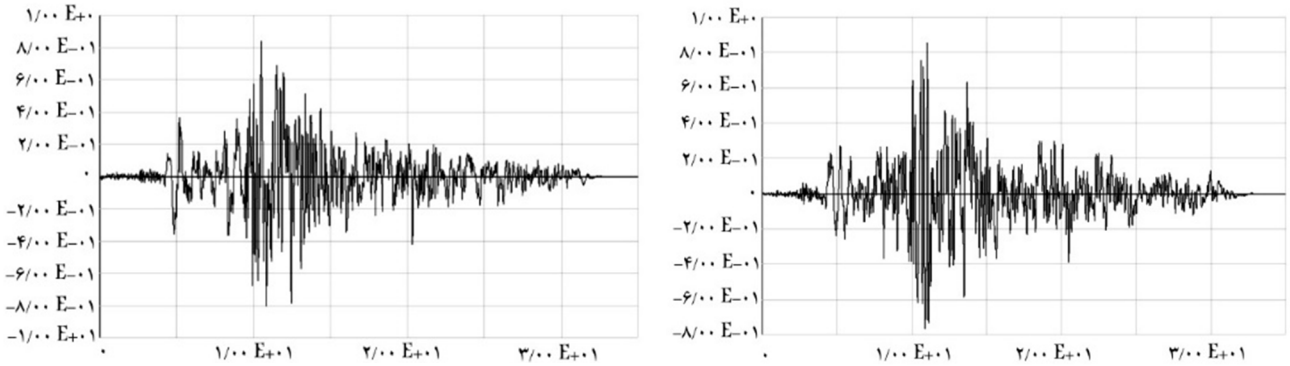

Figure 1. Tabas Earthquake.

Furthermore, ST37 and C21 are the materials which are used in this thesis. Also, B50×100×4.5×3.5 and B45×100×4.2×2.5 (I profile) are used for beams and square columns including 60×60, 70×70, 80×80, 90×90 and 100×100 are used. In this paper, the alternative load path method is used. Finally, the intriguing factor of the progressive collapse in this structure is earthquake.

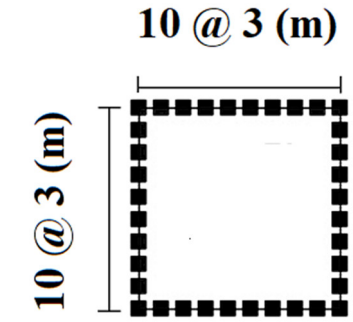

Figure 2. Plan of the 45-story structure.

The purpose of this research is to familiarize with the operation of tubular systems in the event of the removal of one or more elements of the structure under the earthquake loads.

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