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Analysis of Blast Effect on Nonlinear Behavior of Steel Flexural Frames Using Abaqus Software

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ABSTRACT

In a situation where terrorist attacks on civilian places and facilities are on the rise, the safe design of buildings against the impact loads caused by explosions is very important. Steel structures are very sensitive to heat, and the pair of explosions and fire can cause progressive failure in such structures. Since explosion is usually associated with fire structures, in this study, the effect of the explosion on steel flexural frames under fire conditions was investigated. This study investigates two five-span frames of the same steel bending frame with differences in their height, one three and the other five-story, which explode under the TNT material at a distance of 10 meters from the frame. The results of numerical calculations for the maximum impact pressure caused by the explosion, the duration of the positive phase of the explosion, and the duration of the negative phase of the explosion equal to 0.1 kgf/〖cm〗^2 , 3.89 s, and 0.0139 s, respectively, were entered into the odeling of Abaqus software. Three- and five-story frames were modeled on Abaqus software and subjected to the force of the explosive explosion outside the frame. To compare the explosion behavior of the two frames, stress analysis, displacement, roof floor acceleration, rotation, and work performed on the frame were performed. The minimum stress in a three-story frame (9.07 kgf/cm2) is approximately 2 times less than in a five-story frame (17.25 kgf/cm2), and equivalent compressive loading has created less force in the three-story frame. The results of the analysis show that the more malleable the structure, the better the explosion behavior.

Keywords: **Explosion loading, Nonlinear behavior, Steel bending frame, Abaqus**

1. INTRODUCTION

Terrorist attacks such as the bombing of the US Embassy in Nairobi-Kenya, Dar es Salaam-Tanzania (1998), the Ronan Point building in the United Kingdom (1968), the towers of the Al-Khobar military sanatorium in Dhahran-Saudi Arabia (1996), the Mora Federal Building in Oklahoma (1995) and the center World Trade In New York (1993), the need to study the behavior of structures requires explosive loads. Since a blast accompanies a sudden release of a great amount of energy in the form of a shock wave with the sound of an explosion, most infrastructure subjected to a blast or explosion will undergo serious damage to its structural members. In particular, considering the latest terror attacks that have been concentrated on infrastructures, additional concern must be given to major public facilities as military installations to preserve the strength of structures and to