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MULTI-OBJECTIVE OPTIMIZATION OF REINFORCED CONCRETE RESERVOIRS SUBJECTED TO DYNAMIC RESPONSE AND BLAST ANALYSIS

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ABSTRACT

Iconic and public buildings have become a universal target of bomb attacks from terrorists. Most of these buildings have been or are built without consideration for their vulnerability to such events. Planning and building control authorities have begun to recognize the risks of these events and have introduced provisions in planning guidelines for mitigation of such impact. This paper is a study of the impact of near field explosions on the structural framing system and key elements such as columns and describes the component material response. This information can be used in planning strategies to mitigate potential catastrophic and progressive collapse of the structure. Reinforced concrete framed buildings have been selected for this study. A two stage finite element modeling (FEM) and analytical technique has been used to interrogate the structural framing system and components for global stability and local residual strength capacity in the linear elastic and non-linear plastic response regimes. The first stage involved linear time history analysis carried out using SAP 2000 to verify the response of the complete framing system and its ability to restore global frame stability and to enable iterative interrogations. An explicit rigorous analysis accounting for strain rate effects of the reinforced concrete elements was carried out in stage two using LS DYNA code to investigate the non-linear response of vulnerable elements identified in the first stage. The damage mechanisms and the extent of damage have been studied using principal stress plots along with plastic strain diagrams and used to assess the residual strength capacity of key elements that can cause catastrophic failure of large sections of the building and propagate progressive collapse. Numerical analysis is based on techniques that have been established in previous research work and the models have been calibrated with similar work by others. The method used in this research work can be used for assessing vulnerability, damage and residual strength capacity of building frames and component elements subjected to near field blast events.

KEYWORDS: Artificial Bee Colony, Durability, Optimization, Reinforced Concrete Reservoirs