The behaviour Analysis of RC Frame Structure under Explosion Loading

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Summary

Terrorist attacks with explosives are, after earthquakes, the most encountered extreme loadings that can produce the collapse of a structure. More over, it was observed that in terrorist attacks most deaths were caused due to the collapse of structures and not due to the shock waves or fragments projection.

The latest of this paper in the study of reinforced concrete frame building behaviour under terrorist attack are: (i) the study of phenomena, as a whole, for terrorist attack (the detonation, the shock waves propagation, the plastic hinge occurrence, the failure of strong loaded elements, the initiation and the eventual propagation of collapse) and (ii) the approach of this item using a new numerical method – applied element method.

Keywords: explosion, collapse, progressive collapse, modeling, simulation, applied element method

1. Introduction

During their lifetime, civil engineering structures could be subjected to natural hazards (earthquakes, hurricanes, tornadoes, floods and fires) or manmade hazards (blast and impact). Structures are not usually designed for extreme loadings and when such events occur can lead to catastrophic failure. In recent times, events such as earthquakes (Northridge - 1994, Kobe - 1995, and recent earthquakes of Haiti and Chile 2010) or terrorist attacks (1995 Murrah Federal building bombing and 2001 attack on the World Trade Center) have led to structural failures and collapse resulting in related loss of life and staggering economic loss.

The particular local failure of Ronan Point building (London 1968) was called “progressive collapse” or “disproportionate collapse regarding the initial cause”.

Therefore, extreme events such as blast and impact which were considered improbable in the past are now considered to be credible events, with a finite probability of occurrence.

During last years structural design professionals have concerned about the description, definition schedule terms realisation, but they have especially tried to include in calculus this phenomenon with the many characteristics it can be.

In order to mitigate the potential of progressive collapse the structures design mode demands another treatment as the conventional one. This has to focus on these events with low probability of occurrence, like “what can be wrong/unanticipated/unhappened” and after that to imagine scenarios able to perform an appropriate design process.

The goals of this paper are represented by the study of the potential progressive collapse of a structure under blast loadings, using the applied element method. The object of study is a reinforced concrete structure with 4 bays, 2 spans and 6 floors.

https://doi.org/10.2749/222137810796024682