

**Project Title: Collapse analysis of Plasco Building using OpenSEES**

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**Project Team Members: Tejeswar Yalagadda and Md Anwar Orabi**

**Project Outline:**

The aim of this project is to carry out collapse analysis of Plasco Building using the Open System for Earthquake Engineering Simulation (OpenSEES). The Plasco Building was a 17-storey tall steel framed structure in Tehran, Iran, built in the 1960s and was the tallest structure in Iran at that time. It collapsed on 19th January 2017 as a result of a major fire. The PI has been interested in investigating the behaviour of steel frame structures ever since the start of his career as an academic and has previously investigated the collapse of WTC buildings as a result of terrorist attack on September 11, 2001. So far there hasn't been a systematic investigation of the Plasco Building collapse except for some preliminary work. As collapses of steel frame structures in fire are rare, the PI feels that it essential for structural engineers working in steel construction to investigate and understand the possible failure mechanisms responsible for the collapse. The PI has noted significant similarities in between the framing systems of the twin WTC Towers and the Plasco Building and feels that his previous experience of WTC collapse simulation will be useful investigating the possible reasons of the collapse of the Plasco Building. OpenSEES will be used as it is being developed by the PI and his students to analyse large 3D framed structures subjected to realistic fires automatically. No commercial code currently offers such capability. OpenSEES will enable the project team to subject the structural model to a large range of realistic fires that conform to video evidence and simulate the collapse sequences as observed in videos and photographs. The work of the project will also involve some additional development of OpenSEES.

**Objectives:**

1. Verification of OpenSEES thermomechanical analysis capabilities by solving suitable benchmark problems (on beams, plates and shells);
2. To determine possible collapse mechanisms of the Plasco Building that are consistent with on-site video and photographic observations.

**Expected deliverables**

1. Documentation of OpenSEES developments including the verification and benchmarking studies carried out. An SCI journal article will be submitted based to report work.
2. A range of fire scenarios including horizontal and vertical spread through the building based on the video and photographic evidence.

3. OpenSEES implementation of the developed fire scenarios and simulation of the consequent thermomechanical responses of the Plasco Building structural model as-built in OpenSEES.
4. Report on the results of the analyses with details and conclusions regarding the most probable collapse mechanisms including potential lessons that could be learnt for the safety of contemporary steel framed structures in fire. Another two SCI journal articles will be submitted to disseminate this work.