

Structural fire analysis for a perimeter braced-frame structure

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INTRODUCTION

Analysis of highly complex structural forms in fire can bring value to a design framework.

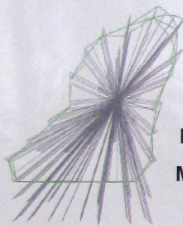
Quantifying the effect of fire on high-rise complex structural forms can lead to cost effective yet intrinsically more robust designs being formulated in the commercial domain.

A greater understanding of structural systems in fire allows for increased safety and efficiency in design.

BACKGROUND

This poster demonstrates key performance issues identified through advanced analysis, which would not have been identified if the building was protected to typical Building Codes

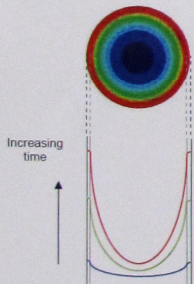
A case study is given of a proposed iconic sixty-three storey office building in the UK and its response when exposed to a severe single floor fire. The structure is a composite steel framed building with a braced external tube stability system.



Diagrid Behaviour
Diagonal bracing elements
Force transfer through structure
Megaframe & intermediate floors

Composite Columns

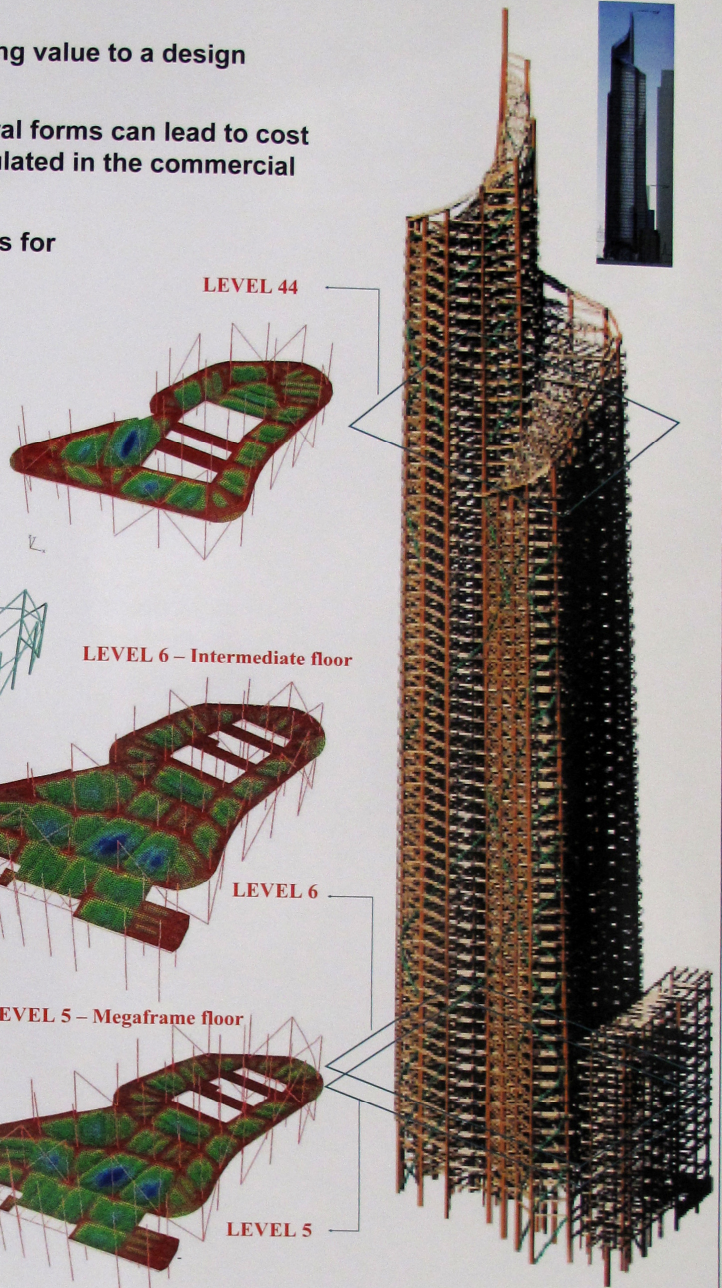
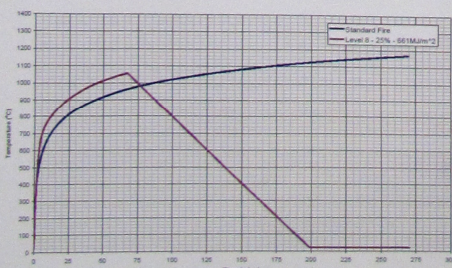
Concrete filled steel tubes
How to model? Validation?
Temperature variation over cross section



Sub Shell Model
Cellular beam behaviour – web-post buckling
Partial shear connection in fire

Design Fire

Severe full floor involvement



LEVEL 44

LEVEL 6 – Intermediate floor

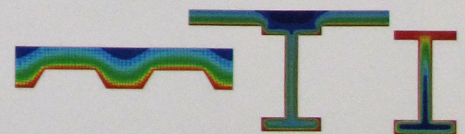
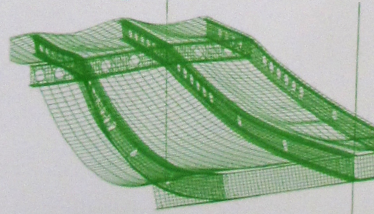
LEVEL 6

LEVEL 5 – Megaframe floor

LEVEL 5

Trapezoidal Concrete Deck

Heat transfer to top flange of steel beams
Resulting steel beam temperatures



OUTCOME & CONCLUSIONS

An understanding of the strengths and weaknesses of structural design in terms of fire for tall buildings in general and specific to this structure.

A reduction in the applied fire protection to structural systems can provide a robust and safe, yet value engineered solution.