

### Unusual steel structures in fire

- Steel has a great strength-to-weight ratio allowing engineers in combination with modern analysis and form-finding tools to realise architectural visions.

- However, most of our current prescriptive fire protection guidance are for 'normal' structures made of beams and columns and might therefore not be applicable for 'unusual' structures.
- Solution: Assess the effects of fire from first principles early in the design

**Buro Happold** the engineering of excellence

### ME Hotel – Aldwych London

Client: **MELIÁ** HOTELS INTERNATIONAL

Architects: **Foster + Partners**

10 storey refurbished hotel and residential building with central atrium

SOUTH SIDE ELEVATION: VIEW FROM THE AIRPORT ROAD (2010)

**Buro Happold** the engineering of excellence

### Location of the Atrium

Sprinklered everywhere but in the atrium

Simulations evacuation

Low fire load in the atrium

**Buro Happold** the engineering of excellence

### Assessment Methodology

- Hazard identification and risk assessment
  - List all possible fire scenarios
  - Undertake risk assessment and reduce risk if possible
- Structural response modelling at elevated temperature
  - Define design fire
  - Determine fire protection scheme
  - Calculate the heat transfer of the structure
  - Calculate the response of the structure at the elevated temperature
  - Assessment criteria – Global stability

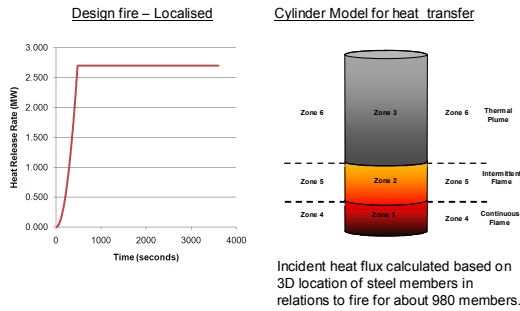
**Buro Happold** the engineering of excellence

### Design Fire Scenarios

- Risk assessment result: Unsprinklered fire at the atrium base
- 2 fire locations have been assessment

**Buro Happold** the engineering of excellence

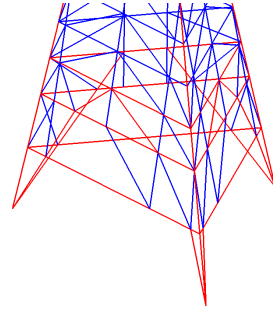
## Thermal Analysis – Fire model



Buro Happold the engineering of excellence

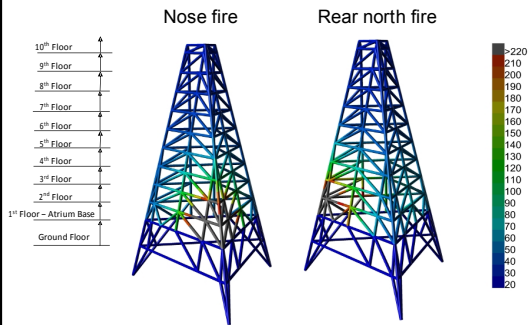
## Thermal Analysis – Fire protection

- Type of fire protection**
- Intumescent paint
- Preliminary protection**
- Basement to 1<sup>st</sup> - R120
  - 1<sup>st</sup> to 2<sup>nd</sup> - R60
  - 2<sup>nd</sup> to 10<sup>th</sup> R0 all but columns
  - 2<sup>nd</sup> to 10<sup>th</sup> R60 to columns



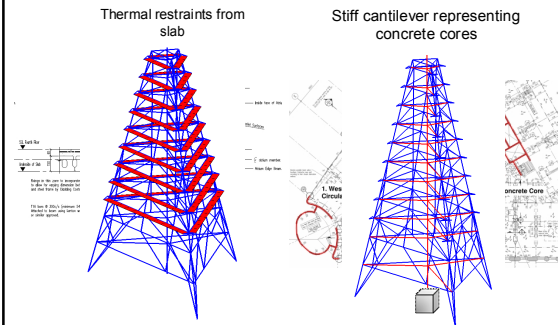
Buro Happold the engineering of excellence

## Thermal Analysis - Results



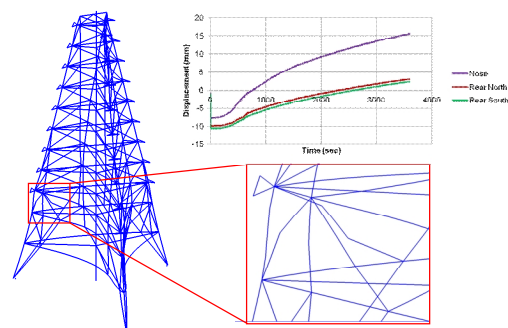
Buro Happold the engineering of excellence

## Structural Analysis using Vulcan - Restraints



Buro Happold the engineering of excellence

## Structural Analysis – Results at Rear North



Buro Happold the engineering of excellence

## Site images



Buro Happold the engineering of excellence

## Conclusion

- The ME Hotel atrium is an example for unusual steel structures.
- Structural fire engineering from first principles was used.
- The cases study demonstrated a significant reduction in fire protection, whilst still maintaining an appropriate level of safety.
- And finally – the project has been a great engineering challenge!

