Travelling Fires for the Structural Design of Modern Buildings

Egle Rackauskaite, Guillermo Rein
Imperial College London, Department of Mechanical Engineering
**TRAVELLING FIRES?**

- Current Design Codes

AIM of this research

**Develop tools to design structures to resist travelling fires**

Limitations:
- Floor areas $< 500 \text{ m}^2$
- Heights $< 4 \text{ m}$

Only 8% of volume within limitations

- Large open-plan compartments - ?
TRAVELLING FIRES METHODOLOGY

- Developed by Stern-Gottfried, Law and Rein

**Near-Field**
Flames → short and hot

\[ T_{nf} = 1200^\circ C \]

**Far-Field**
Smoke → long and cool

\[ T_{ff}(x,t) = T_\infty + \frac{5.38}{H} \left( \frac{L L^*_t W \dot{Q}^*}{x + 0.5 L L^*_t - \dot{x}_t} \right)^{2/3} \]

Distance (m)

0  7  14  21  28  35  42

Gas Temperature (°C)

0  400  800  1200

Burnt out fuel ↓

Flame spreads

\( T_{nf} \) Near field

\( T_{ff} \) Far field

\( H \)
TRAVELLING FIRES METHODOLOGY

Short and hot ~1200°C for 20 min

Near field

Initial Far Field Heating

Posterior Far Field Heating

Long and cold ~100-600°C for hours

Time
RESEARCH OBJECTIVES

WORK DONE
• Continuous analytical correlation
• Flame flapping region

FUTURE
• More realistic near field temperature
• To investigate different fire paths in complex geometries
• Application of TFM to timber, concrete and steel members
• Analysis of simple frames

Thank You!