

Fire Safety in Very Tall Buildings and the Revised SFPE Guide



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Original SFPE Guide: Fire Safety for Very Tall Buildings

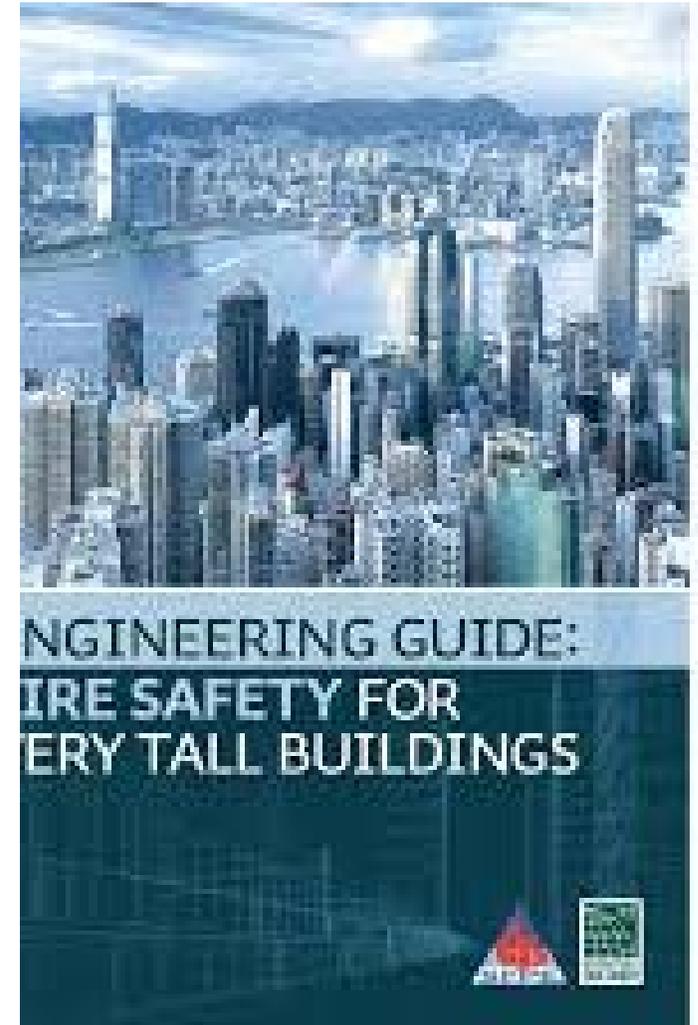
Version 1 Published in 2013

Partnership between the Society of Fire Protection Engineers (SFPE) and the International Code Council (ICC)

Followed SFPE Guide Development Process

Guide does not address what is a “very tall” building

Identifies several fire safety challenges faced by very tall buildings and provides insight as to how to address within a performance-based design context



Concept of the Guide

- Intended to be a guide, not a code
- Written to not be adoptable
- Provides items to consider, not what one must do
- Attempts to address those issues unique to tall buildings



The 2nd Edition

- Published in November 2020
- Available from Springer – Print and Electronic Format
- Purchase Individual Chapters in E-format
- Will be Part of Springer's SFPE Series
- First draft received over 250 public comments
- Over 3800 downloads

Fire Safety for Very Tall Buildings

Engineering Guide

Second Edition



Motivation to Revise Guide

ICC Not Interested in Publishing

Some Content Outdated

- History Section
- Situation Awareness
- Emergency Egress
- Fire Resistance
- Building Envelope

Need for New Content

- Special Features and Attractions
- Energy Storage Systems (ESS)
- Existing Building Considerations
- Aerial Landing Strips

History Section (New Case Studies Added)



Situation Awareness

- Occupants will make risk-based decisions about how best to provide for their own safety based on the information they receive.
- Discussion on Internet, Social Media & Smartphones
- The SFPE Guide to Human Behavior in Fire 2nd Edition contains information related to managing the movement of building occupants
- How is this connected to egress strategies:
 - Defend-in-place
 - Refuge Floors
 - Occupant Egress Elevators
- Relationship to Notification

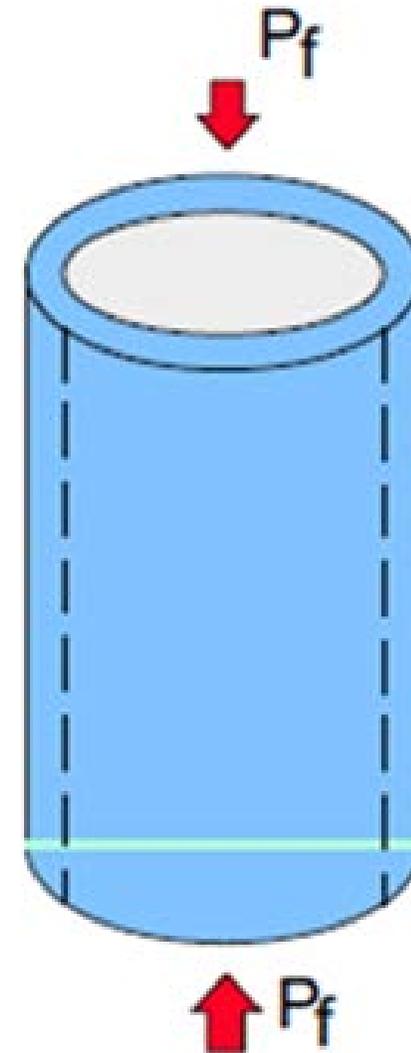
Emergency Egress

- New Content Related to
 - Understanding Evacuation Times
 - How Evacuation Models are Applied to Very Tall Buildings
 - Movement on Stairs
 - Use in Comparison in Evacuation Strategies
 - Occupant Evacuation Elevators
 - Defend-in-Place
- Updated Content Related to:
 - Evacuation Strategies
 - Emergency Planning
 - Exiting and Wayfinding



Fire Resistance

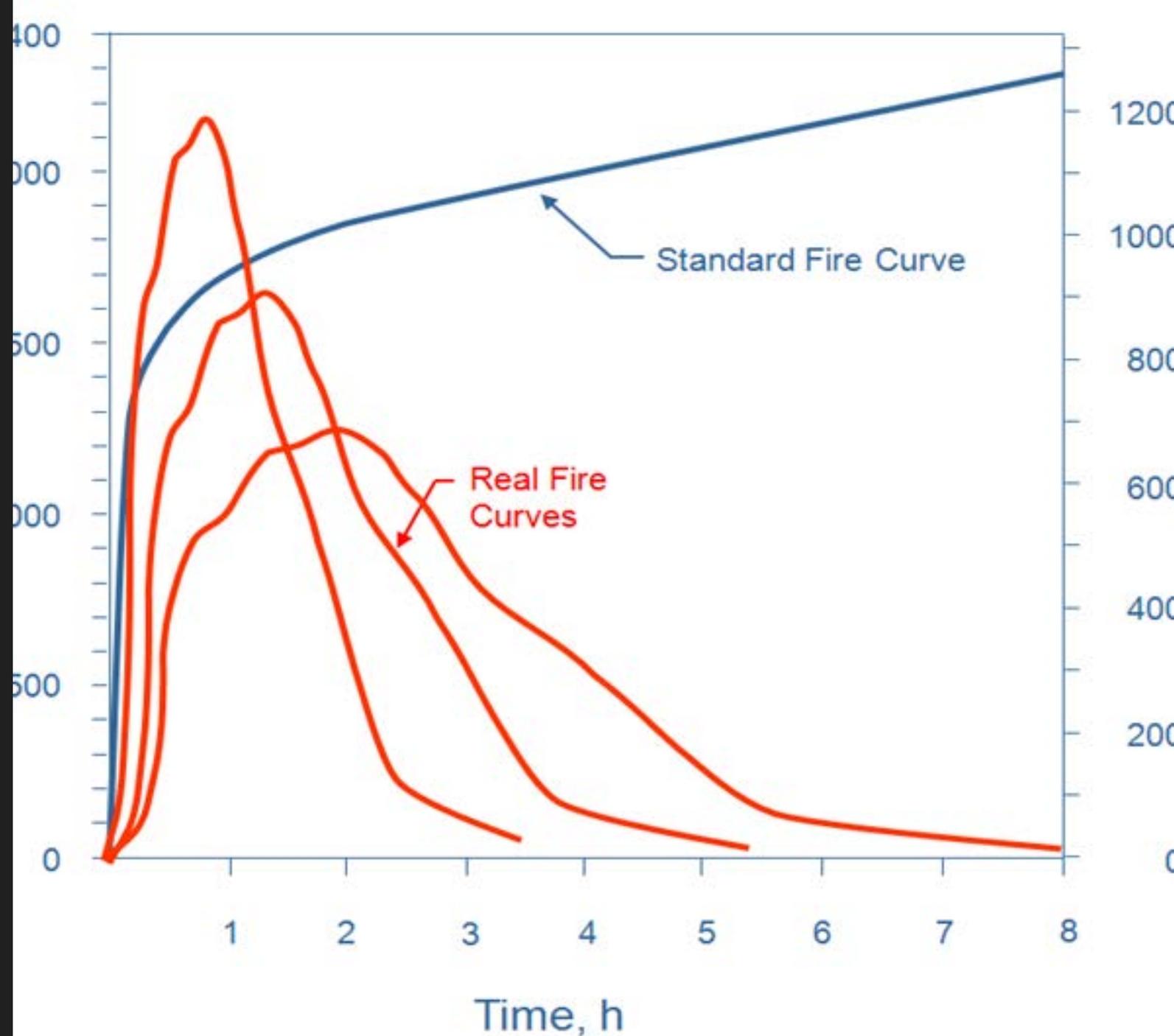
- Unique Structural Systems in Very Tall Buildings
 - Large complex atria,
 - Large open floor plates,
 - Large structural members,
 - Long structural spans,
 - Innovative and/or complex structural systems and geometries
 - Innovative use of structural materials (e.g. mass timber, very high-strength concrete)
 - Protecting Egress (Defend-in-Place, Refuge Floors, Full Evacuation)
- Performance Approach Should Be Considered in Very Tall Buildings



- Load resisted by steel
- Load resisted by concrete

Fire Resistance

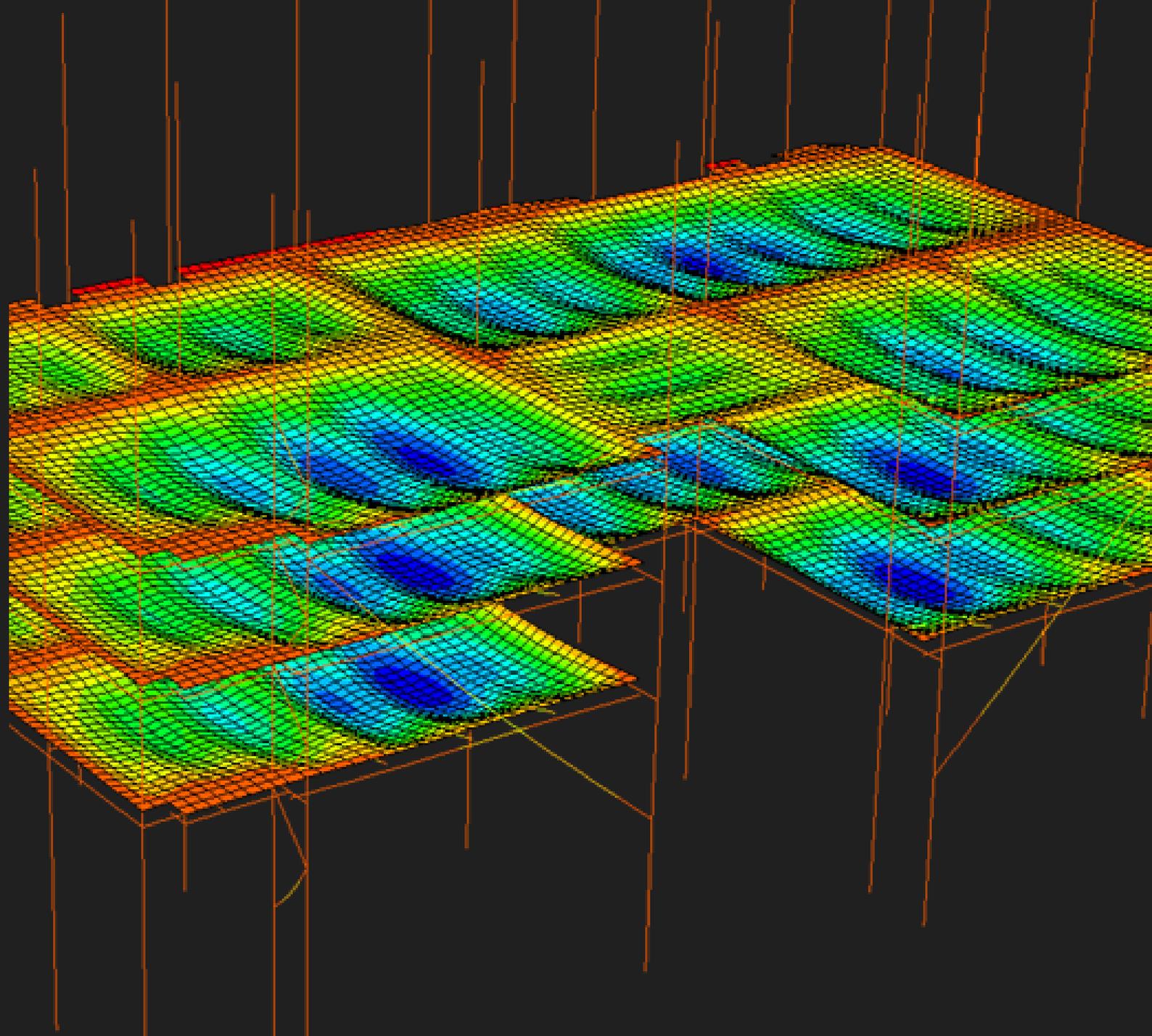
- Compares Prescriptive Approach to Performance-Based Approach
- Describes Limitations of Prescriptive Approach in Very Tall Building Design
- Systems for Reducing Drift and Accelerations Due to Wind
- Mass Timber
- Spalling
- Resilience and robustness



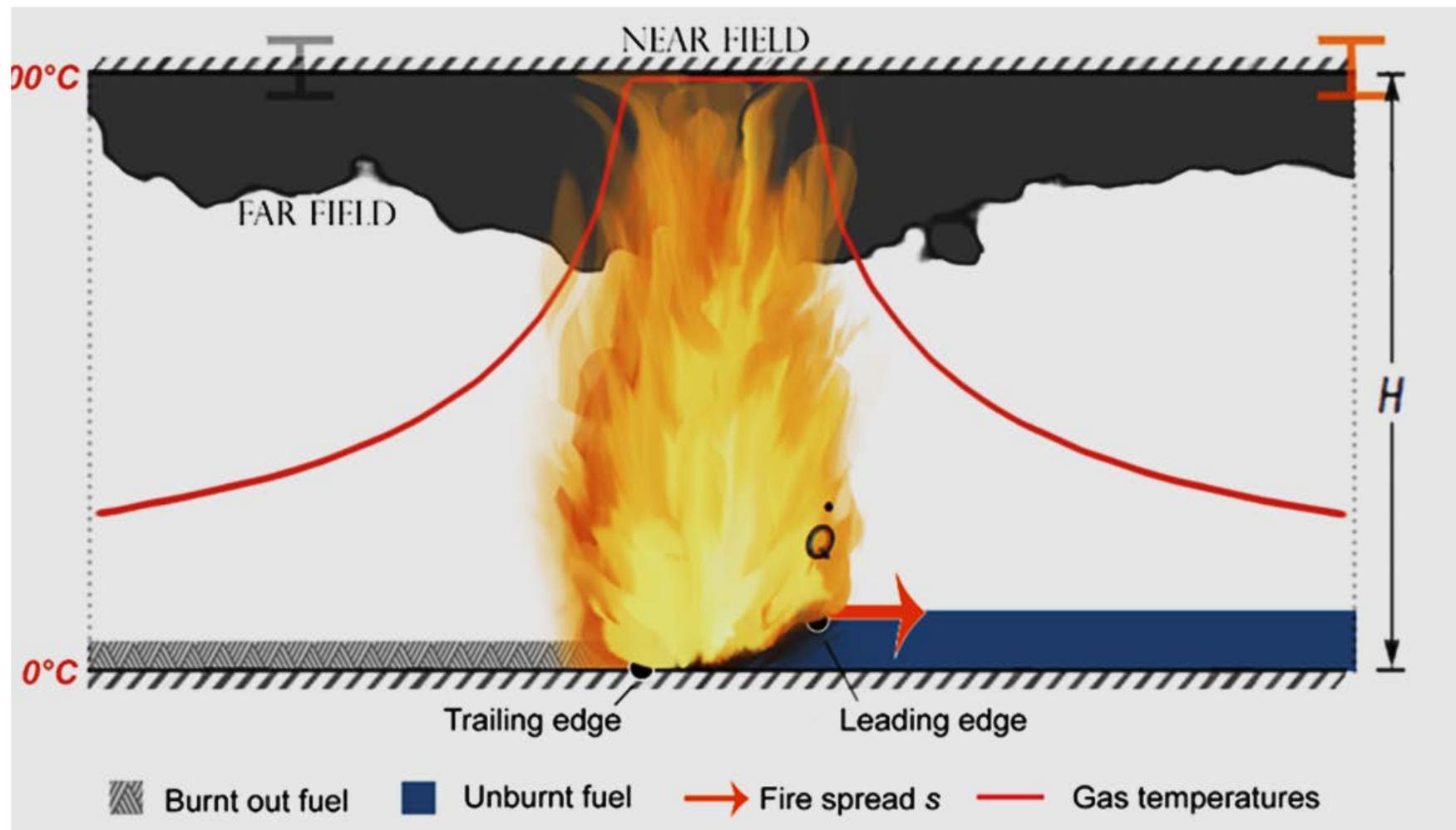
Fire Resistance

Performance Approach

- Types of Analysis (single element vs advanced methods)
- Discussion on Fire Scenarios
- Cooling phase (decay)
- Coupling of gravity and lateral load resisting systems



Traveling Fire Methodology



Building Envelope

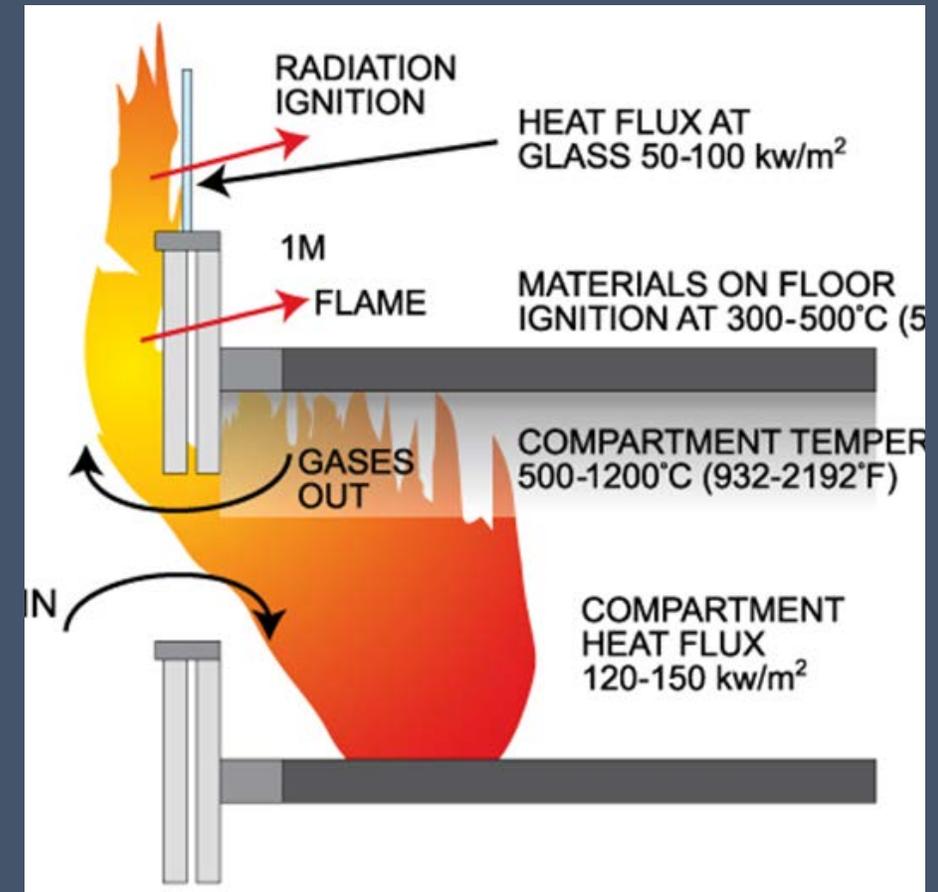
- Changed Name of Chapter (from Facades)
- Many of the Fires Since First Edition Related to Building Envelope (See Revised History Chapter)
- Broader Discussion on Risk Assessment Methods including EFFECT, (Exterior Façade Fire Evaluation and Comparison Tool, www.nfpaeffect.com)
- Now Includes discussion about:
 - LED display screens
 - Photovoltaic (PV) Systems
 - Vegetative walls



Building Envelope (Fire Dynamics)

Mechanisms of Fire Spread

- Fire Initiating events
 - Interior Fire
 - Exterior Fire
 - Fire Starts in Cavity
- After initiating event
 - Fire spread to the interior of floor above via openings
 - Fire spread via combustible materials found on exterior balconies
 - Flame spread over the external surface of the wall
 - Flame spread within an interval vertical cavity /air gap
 - Heat flux impacts cause degradation/separation of non-combustible external skin
 - Secondary external fires initiated at lower (ground) floors arising from falling burning debris.
 - Secondary external fires initiated on adjacent property arising from falling burning debris.



Building Envelope (Fire Testing)

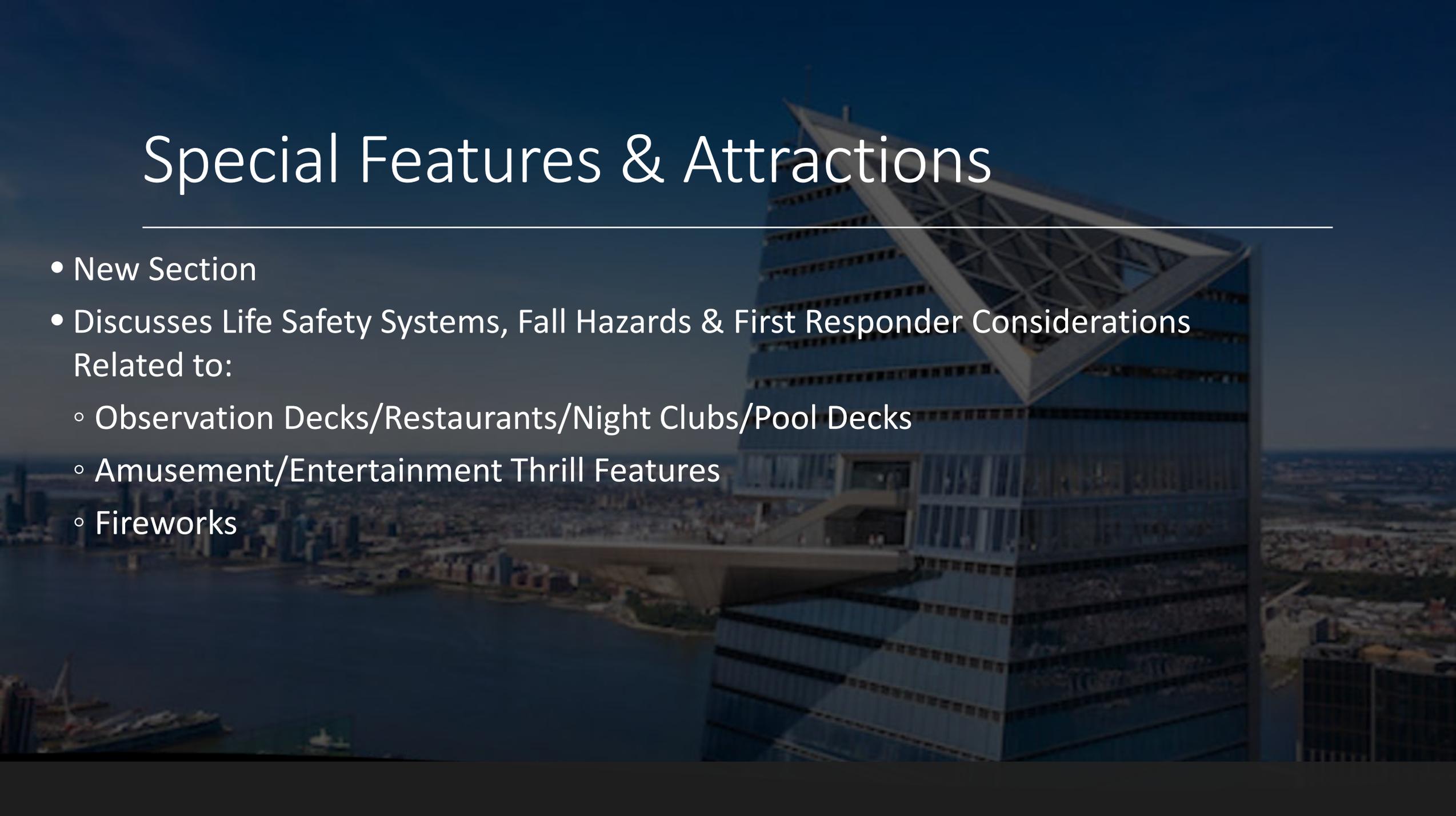
Now Includes Expanded Discussion on
Fire Testing of Building Envelope
Systems:

- Reaction to fire tests of the constituent materials of the building envelope.
- Fire resistance testing of perimeter fire barrier systems with or without fire rated spandrels or the entire glazing system if the façade is to be fire rated.
- Large scale fire testing of the façade system.
- Large scale testing of the roofing system.



Special Features & Attractions

- New Section
- Discusses Life Safety Systems, Fall Hazards & First Responder Considerations Related to:
 - Observation Decks/Restaurants/Night Clubs/Pool Decks
 - Amusement/Entertainment Thrill Features
 - Fireworks





ESS

- Part of Green Movement to Conserve Energy
- Codes & Standards Not Fully Developed in this Area
- Description of Technology & Hazards
- Fire Safety Considerations

Existing Building Considerations

- Many tall buildings constructed before technological advancements over the past 30 years
- Cities have enacted regulations to improve fire safety in these existing buildings.
 - Projects can be complicated
 - Include asbestos abatement
 - Historic preservation issues
- Reasonable fire safety should include:
 - A means to detect the presence of a fire;
 - A means to notify the occupants and emergency forces of the fire;
 - Protected pathways for occupants to exit the building or reach an area of rescue assistance; and,
 - A means to control the spread of the fire.
- Scoring systems
- Adaptive Reuse & Change of Occupancy

Aerial Landing Strips

- Many very tall buildings have some form of landing strip
- Discussion on Egress
- Firefighting Considerations
- Fire Suppression



SFPE Task Group on Fire Safety in Very Tall Buildings

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Special Thanks



Thanks!

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