Fire and Tall Buildings: Basic Issues for the Future

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Tall Building Tool Box

- Compartmentation features
- Smoke management systems
- Pressurized stairs
- Water tank storage
- Fire pumps
- Standpipes
- Emergency generators
- Fire detection
- Voice and visual notification
- Mass notification systems
- Evacuation elevators
- Extra stairs / stair width
- Enhanced stair enclosures
- Fire resistive components
  - Wiring
  - Fire stopping
  - Joint systems
  - Perimeter slab edge containment
- High-bond strength fire proofing
- Low level exit signage
- Photoluminescent markings
- Fire/smoke dampers
- Special supression systems
- Fire department operations support technologies
- Refuge areas/floors
- Automatic Sprinklers

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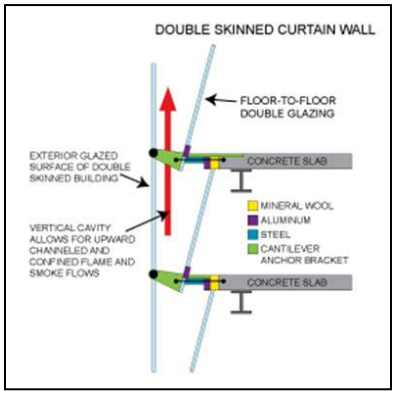
Concerns for the Future

- Exterior Facade Materials

- Ventilated & Double Skin Facades



- Automatic Sprinklers must be the highest priority

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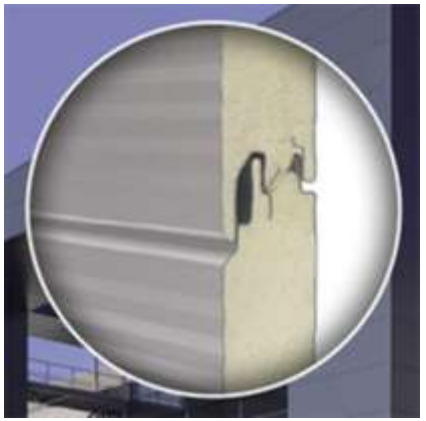
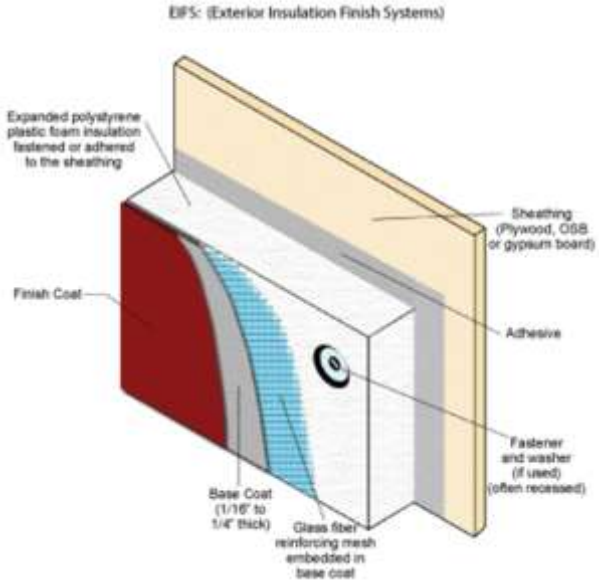
Combustible Facade Components

- Combustible Cladding Materials
  - Exterior Insulation and Finish Systems (EIFS)
  - Metal/Aluminum composite Materials (ACM, MCM)
  - Fiberglass Reinforced Plastics (FRP)
  - High Pressure Laminates (HPL)
  - Insulated foam core sandwich panels
  - Spray applied foam





Basic Assumptions NFPA 285 Test Method

- Interior Post-Flashover fire
- Glass breaks
- Flames project out
- Performance should be comparable to noncombustible wall

- Test does not address
  - Burning Fuel loads exterior to building
  - Exposure fire from adjacent property
  - Unusual wall geometry, corner scenarios
  - Man tossing water on flames

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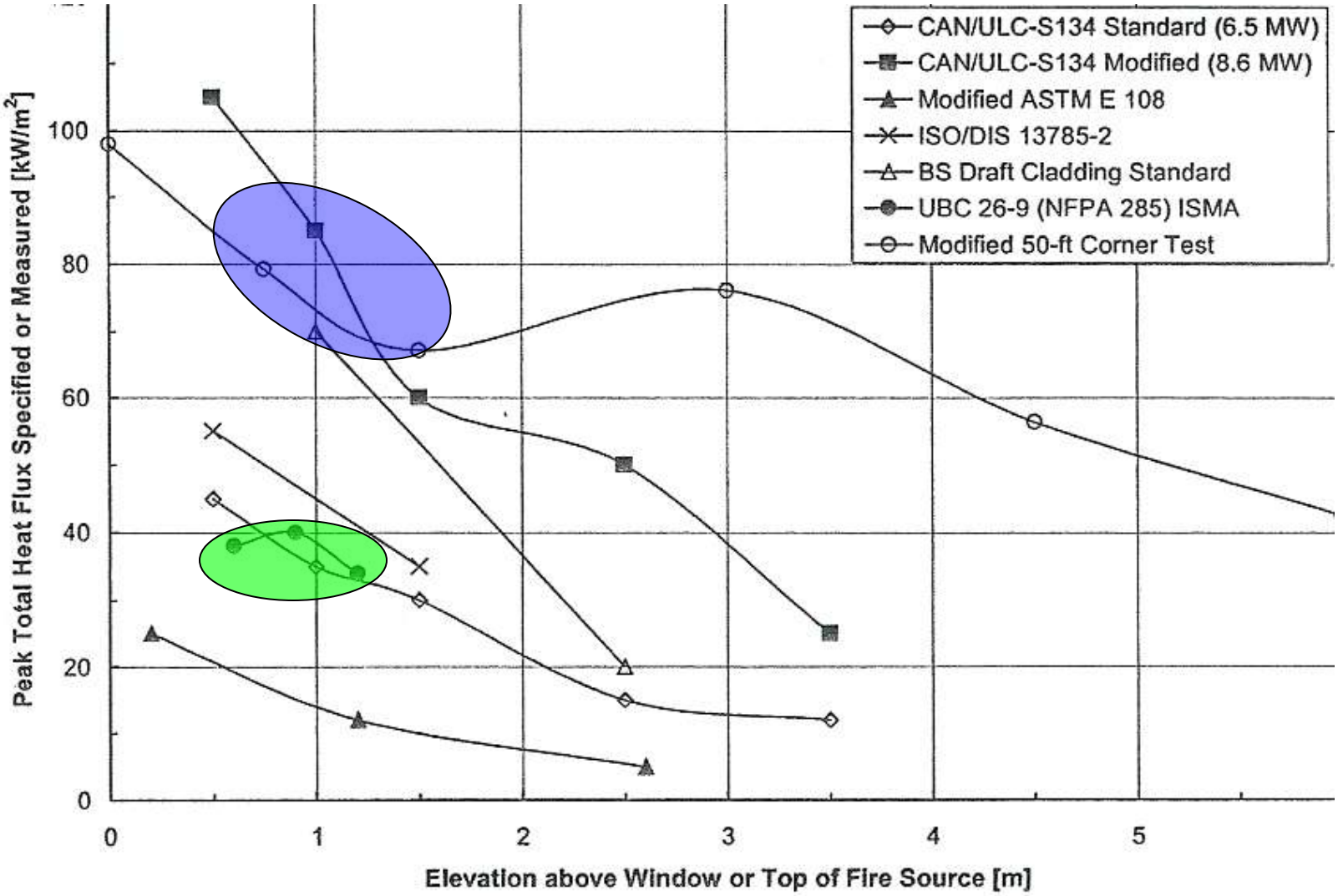
Heat Flux Comparisons



CCTV & Mandarin Oriental Hotel

Violation of Law, Extreme Ignition Source, Combustibles in a Flue Space

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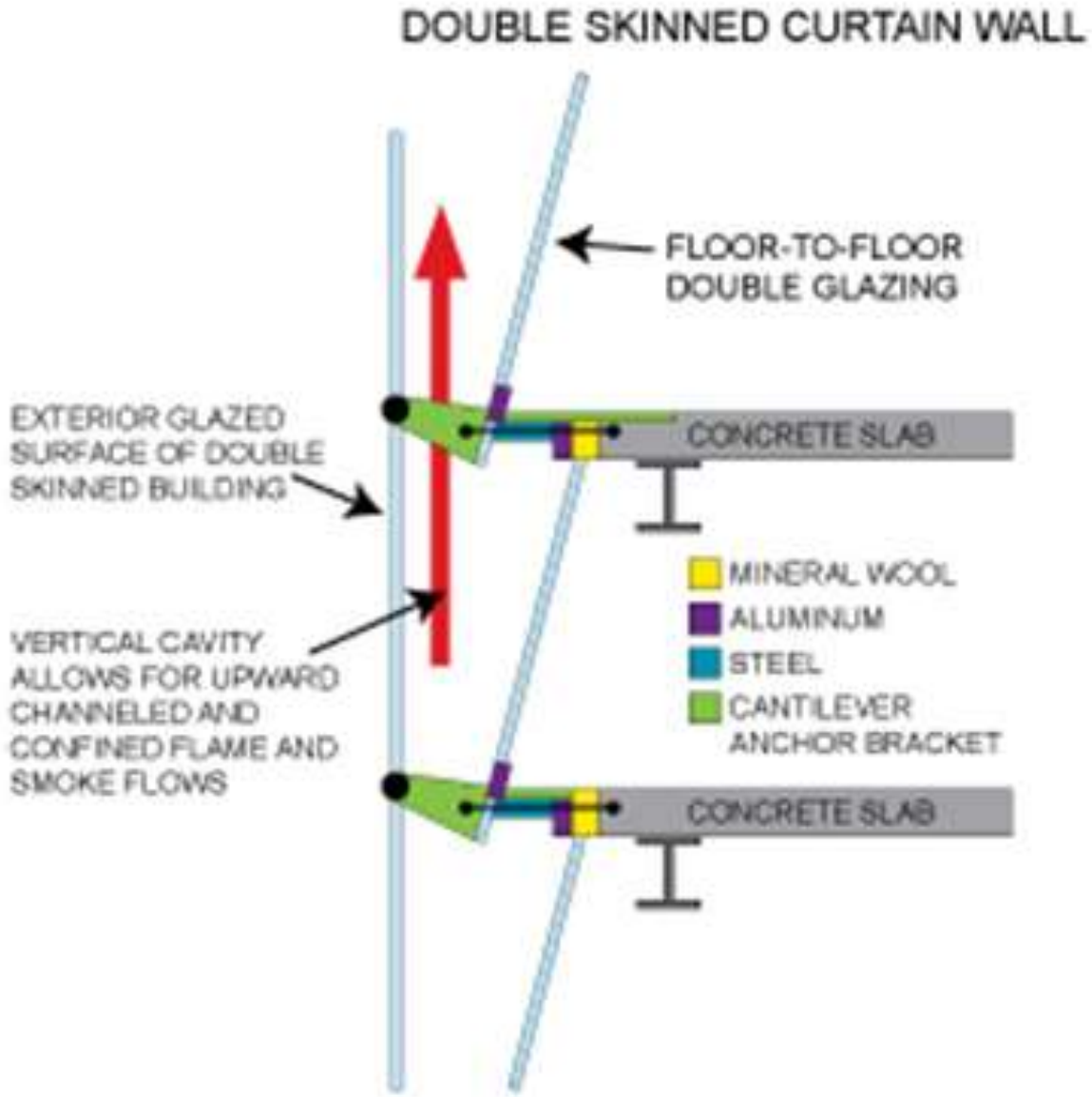
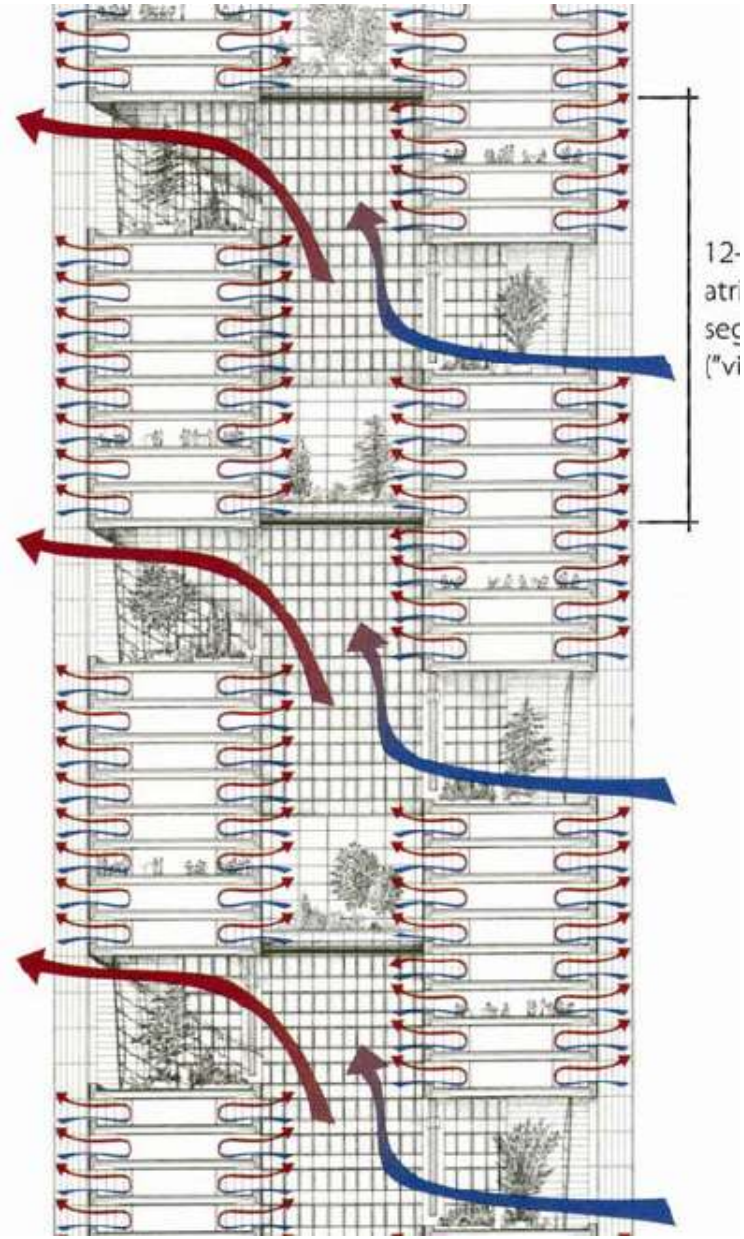
Russian Republic of Chechnya

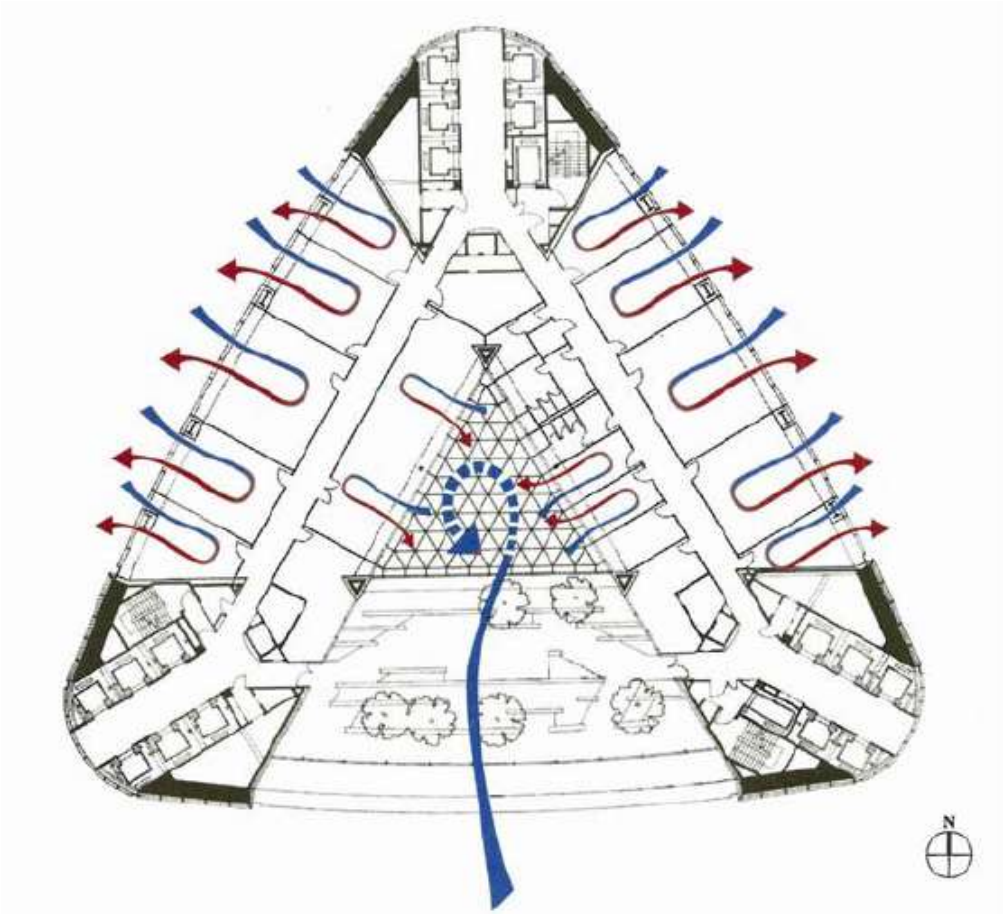
- 40 story apartment
- No deaths /injuries
- 100 firefighters
- 16 engines

Ventilated and Double-Skin Facades



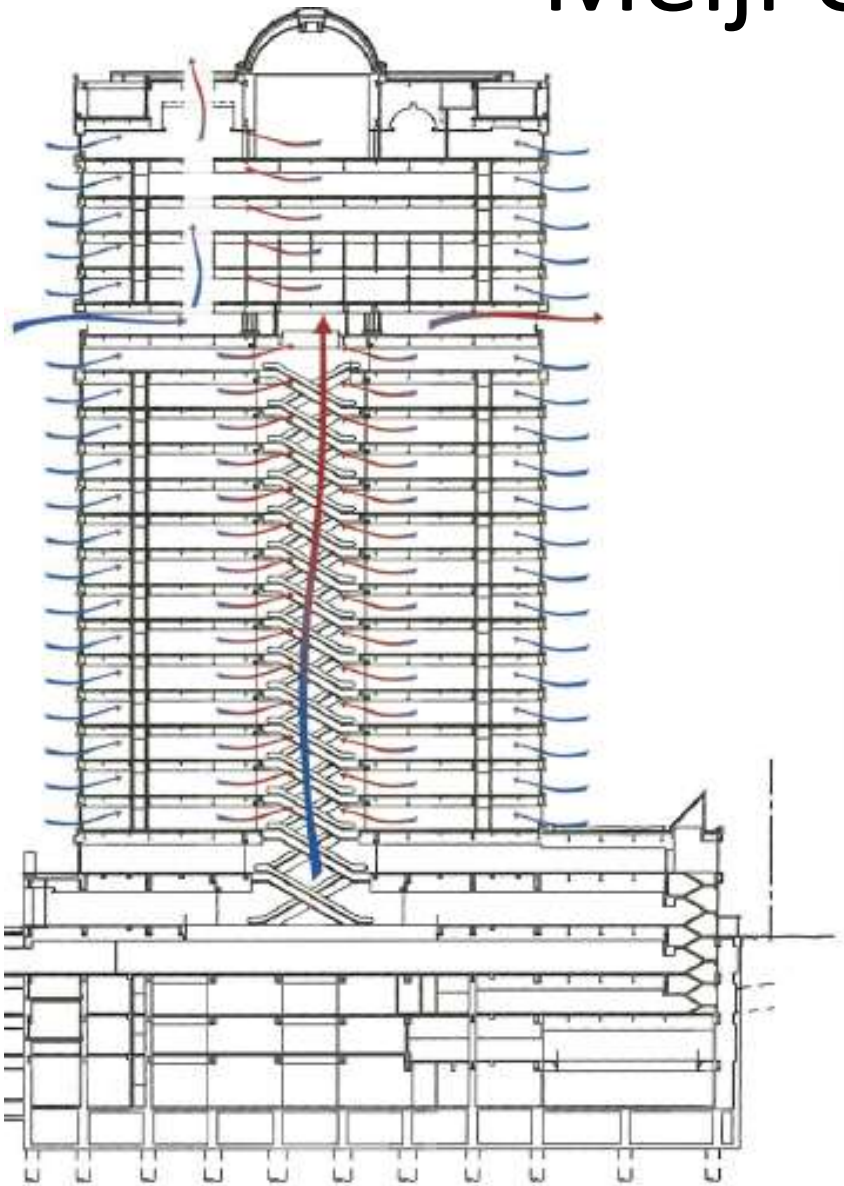
56-storyCommerzbank Frankfurt, Germany

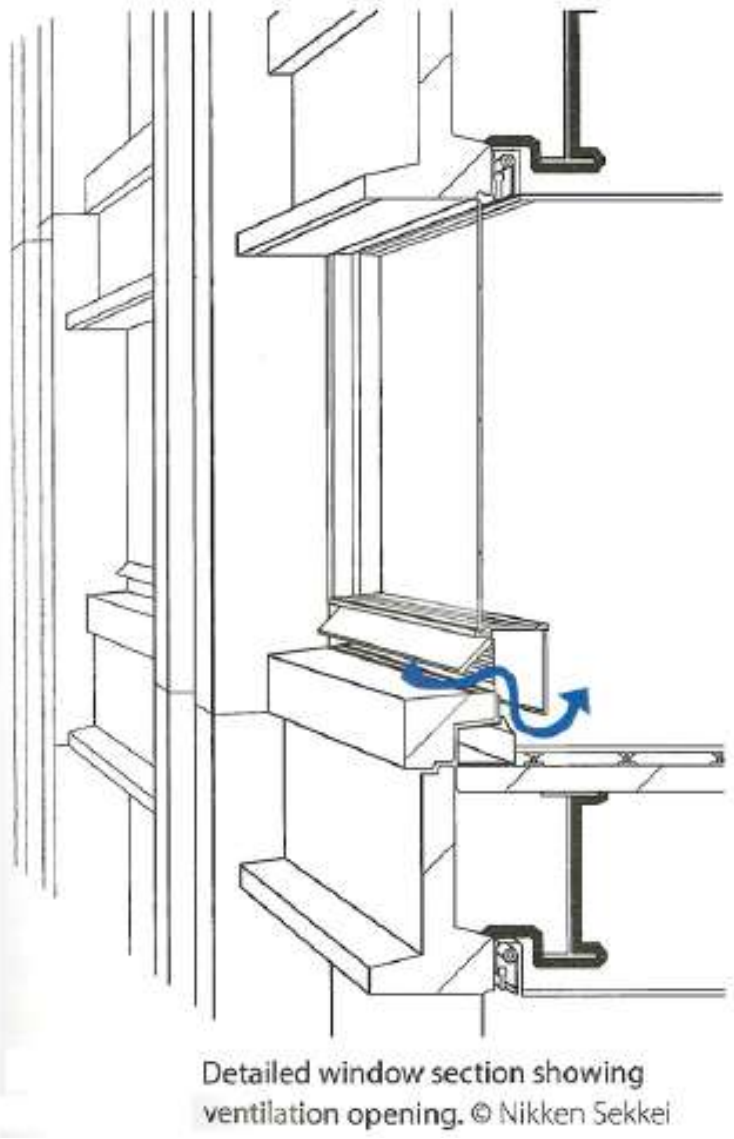




Figures courtesy CTBUH, 2013

Meiji University, Tokyo





Detailed window section showing ventilation opening. © Nikken Sekkei

Figures courtesy CTBUH, 2013

Extreme Fire Department Response

- First Interstate Bank
  - 3½ hours burned out of control; nearly abandoned
  - 64 fire companies, 383 fire fighters
- One Meridian Plaza
  - Burned 18 hours through 8 floors
  - 3 FF deaths, 24 injured
  - 51 engine companies, 15 ladder companies, over 300 firefighters
  - After 11 hours FF effort abandoned due to structural risks

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Parque Central – Caracas, Venezuela

- Venezuela's tallest, built 1970, fire 2004
- Burned 17 hours
- FF efforts abandoned after 11 hours due to structural fears

- Fully sprinklered
- On/off sprinklers leaked
- Systems shut off

Automatic Sprinklers

- Developing Urban areas worldwide
  - Limited fire department resources
  - Common view outside US - Systems maintenance costs money and is avoided
  - Fundamental lack of understanding of sprinklers value

- Worldwide Need for
  - Education of building owners
  - Training for building maintenance /engineering staff
  - Review – are systems getting too complex
  - Reliability – what features make a difference
  - Strong ordinances, rules for systems out-of service
  - Fire Service play a major role: survey and enforcement

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Concerns for the Future

- Exterior Facade Materials
  - Need to evaluate materials for range of conditions – heat flux, geometry, establish criteria for use
  - Sprinklers are mitigation against internal spread
- Ventilated & Double Skin Facades
  - Pros, cons, many design concepts,
  - sprinklers key to safe use
- Automatic Sprinklers must be the highest priority
  - Urban areas cannot tolerate large scale events
  - Fires must be kept small