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The growth in mega-tall buildings is a challenge to firefighters

While on leave traveling through Asia and the Middle East, I couldn't help noticing the number of tall buildings being constructed and the challenges firefighters now face.

To put this into perspective, high-rise buildings are categorized based on their height:

- **Tall buildings:** Typically, these are structures over 50m but under 300m. They are the most common type of high-rise building.
- **Super-tall buildings:** These are skyscrapers that reach between 300m and 600m. Examples include iconic structures like the Empire State Building.
- **Mega-tall buildings:** These are exceptionally tall skyscrapers exceeding 600m, such as the Burj Khalifa, which currently holds the title of the world's tallest building.

Let me expand on the challenges of firefighters in super-tall buildings and above.

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Evacuation complexity

In super tall buildings, evacuation procedures are more complex due to the sheer height and number of occupants. Stairwells, often the primary means of evacuation, can quickly become overcrowded. Additionally, fatigue and physical limitations may hinder the speed at which people can descend from high floors. Modern strategies include refuge areas on intermediate floors and phased evacuation plans to manage the flow of people more effectively.

Fire spread

The stack effect, where air moves vertically through a building due to temperature differences, can significantly exacerbate fire spread. In tall buildings, the stack effect can draw smoke and flames upwards, making it difficult to contain a fire to one floor. This effect is particularly strong during colder months or in buildings with extensive atriums, necessitating advanced fire compartmentalization and pressure systems to manage air movement.

Access for firefighters

Reaching the upper floors of super-tall buildings is a major challenge for firefighters. Traditional fire-engine ladders are inadequate for extreme heights, and reliance on interior stairwells or elevators – if operational – slows response times. Fire departments require specialized equipment, such as high-pressure hoses and aerial platforms, along with advanced training in vertical firefighting techniques. Pre-installed firefighting systems like sprinklers and fire lifts are critical but they must be robust and reliable.

Material and structural integrity

The materials used in constructing super-tall buildings are often lightweight to reduce overall mass but this can also mean they are more combustible. Additionally, the structural integrity of these materials under high heat is crucial. In the event of a fire, high temperatures can weaken steel and other structural components, potentially leading to catastrophic failure. Fire-resistant materials and designs that ensure structural stability during and after a fire are essential.

Smoke management

Effective smoke management systems are crucial in super tall buildings to prevent smoke from compromising escape routes and accumulating in occupied areas. Smoke control systems include mechanical ventilation, smoke curtains and pressurized stairwells, all designed to keep escape routes clear and prevent smoke from spreading. These systems must be carefully designed and tested to ensure they function correctly during a fire, as smoke inhalation is often the leading cause of fire-related fatalities.

These challenges necessitate a combination of advanced engineering, stringent building codes and proactive safety measures to ensure the safety of occupants in super-tall buildings.

Several mega-tall buildings are currently under construction in Asia, showcasing the region's rapid urban development and architectural ambitions. Notable projects include:

- **Wuhan Greenland Centre** (Wuhan, China) – Expected to reach a height of 475.6m with 97 floors. It is designed to house hotels, serviced apartments and office spaces.
- **Chushang Building** (Wuhan, China) – This building is projected to stand at 475m with 111 floors, primarily serving as an office tower. Completion is anticipated around 2025.
- **Fuyuan Zhongshan 108 IFC** (Zhongshan, China) – With a planned height of 498m and 108 floors, this building is set to be one of the tallest in China.
- **Greenland Centre** (Xi'an, China) – Expected to reach a height of 498m with 101 floors. The building will combine hotel and office spaces, with completion targeted for 2024.

Upon completion Merdeka 118 will be the tallest building in Southeast Asia.

- **Suzhou Centre North Tower** (Suzhou, China) – This tower is under construction with a planned height of 470m, primarily designed for office use.
- **Merdeka 118** (Kuala Lumpur, Malaysia) – This tower is 644m with 118 floors. Upon completion, it will be the tallest building in Southeast Asia.
- **Jeddah Towers** (Jeddah, Saudi Arabia) – Anticipated to be over 1,000m with 167 floors. Expected to be the world's first building to reach a kilometre in height.

These projects highlight ongoing developments in regions outside China, particularly in Malaysia and Saudi Arabia, where architectural and engineering achievements are being pushed to new limits.

Why am I pointing out what should be blindingly obvious? This is no longer a maybe, it is happening all around us now. The fire service should be at the first-sketch stage all the way through to the final occupancy. Because it's firefighters that deal with the problems when something goes wrong. ●

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