# Should elevators be used for the evacuation of tall buildings?

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# Content

Background

Alternatives

Solutions

- Evacuation strategies
- Codes and norms
- Technical solutions
- Human aspects

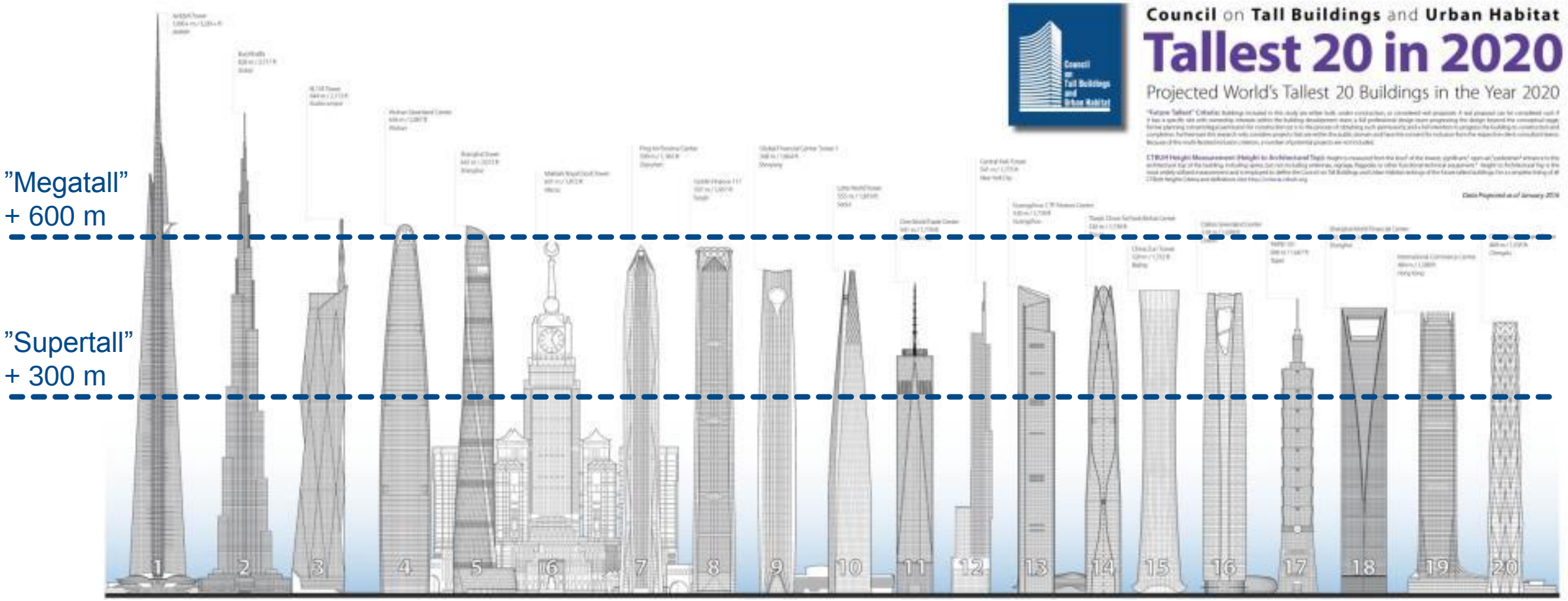
Conclusions

# Background

# Reasons for evacuation

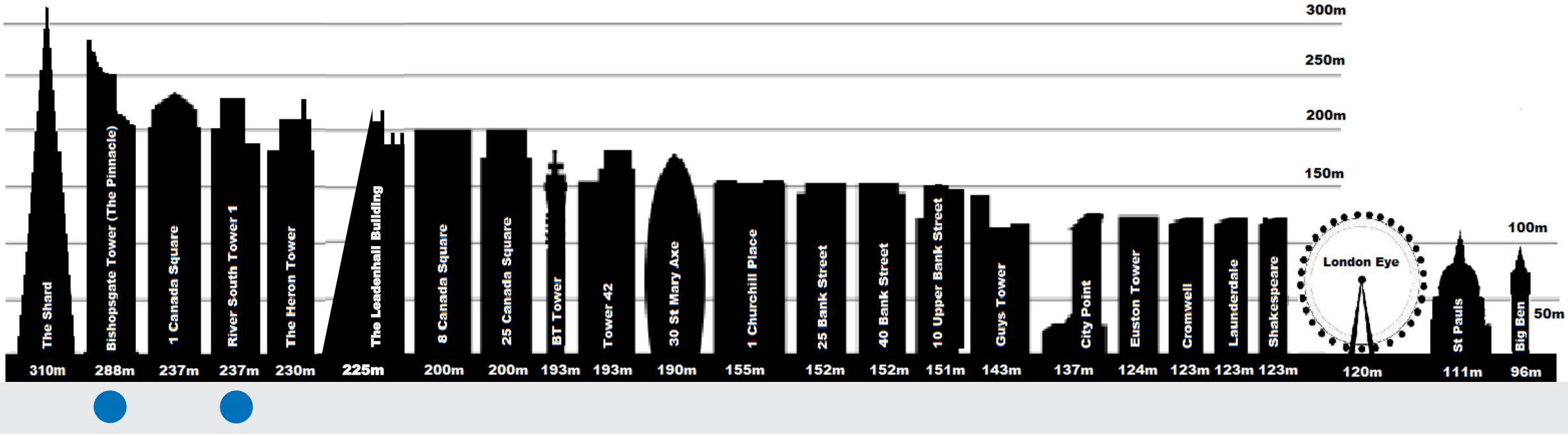

Source: CTBUH – Emergency Evacuation Elevator Systems Guideline

# All megatall buildings use elevators for evacuation



# Tallest buildings in London

- Under Construction




Source: https://en.wikipedia.org/wiki/List_of_tallest_buildings_and_structures_in_London

# Alternatives

# When and why elevators should be used for evacuation

- All buildings over 300 m high
- In buildings over 20–30 floors high, elevators are the fastest means of evacuation
- Elevators provide a method of evacuation for disabled people who cannot use stairs

# Solutions

# Benefits of and barriers to evacuation elevators

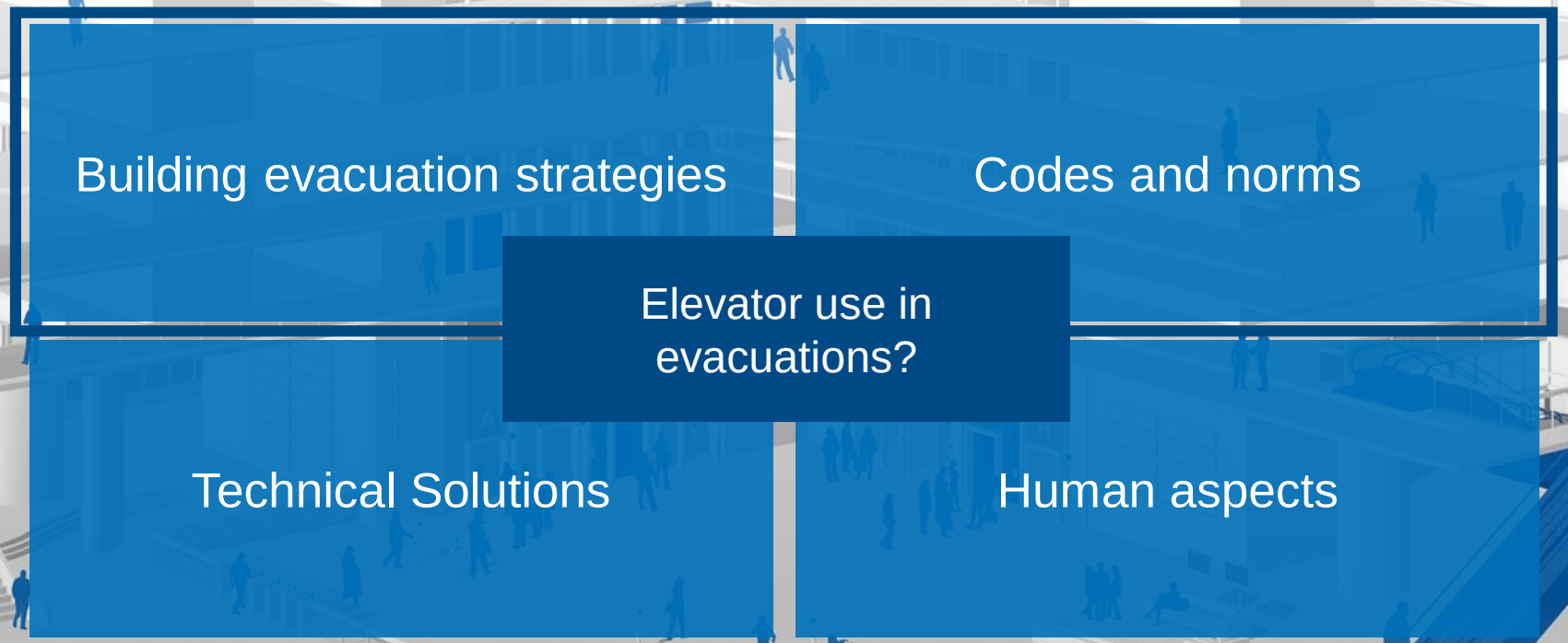
## Benefits

- Creates trust – easier to attract tenants to tall buildings
- Improved evacuation capabilities
- People can make their own choice – elevator or stairs

## Barriers

- Money, Capex, and incentives
- Alternative means exists (stairs)
- Local codes and regulations

# Elevator use in evacuation of tall buildings

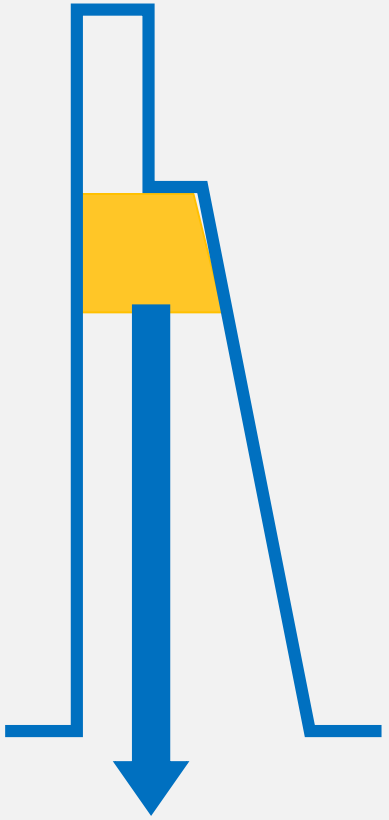


# Building evacuation strategies using elevators

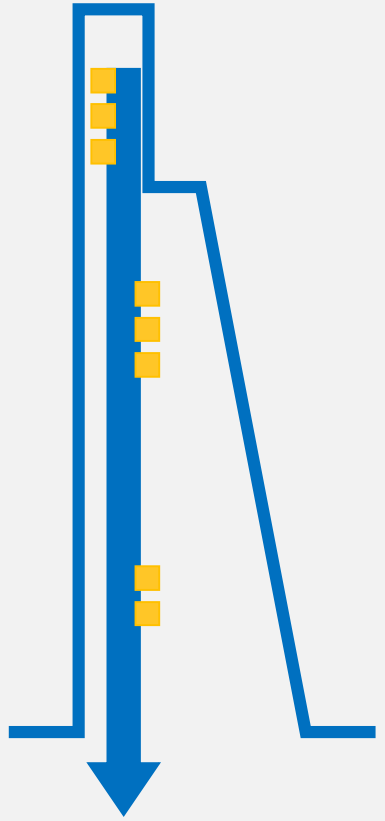
## DIFFERENT DESIGNS FOR DIFFERENT CAPACITY NEEDS

### Total

### Staged



### Fractional



Source: CTBUH emergency evacuation elevator systems guideline

# Codes and norms – EN

## EVACUATION OF DISABLED PERSONS AND USING LIFTS FIRE FIGHTERS LIFTS

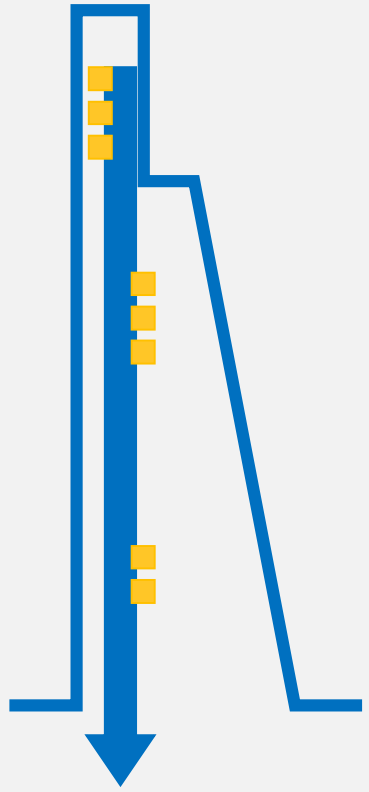
- Disabled people with impaired mobility are defined in the CEN/TS 81-76
- Automatic return of elevators to main evacuation entrance floor (MEEF) from fire signal – elevators taken out of service
- Person in charge can switch the elevator to evacuation use and assist
- Protected firefighters lift (EN81-72, EN81-73) for firemen use
- **Landing calls not served**
- **Total evacuation missing**

EN81-72:2015 Firefighters Lift

EN81-73:2016 Behaviour of Lifts in the Event of Fire

NPR-CEN81/TS 81-76:2011 Evacuation of disabled persons using lifts

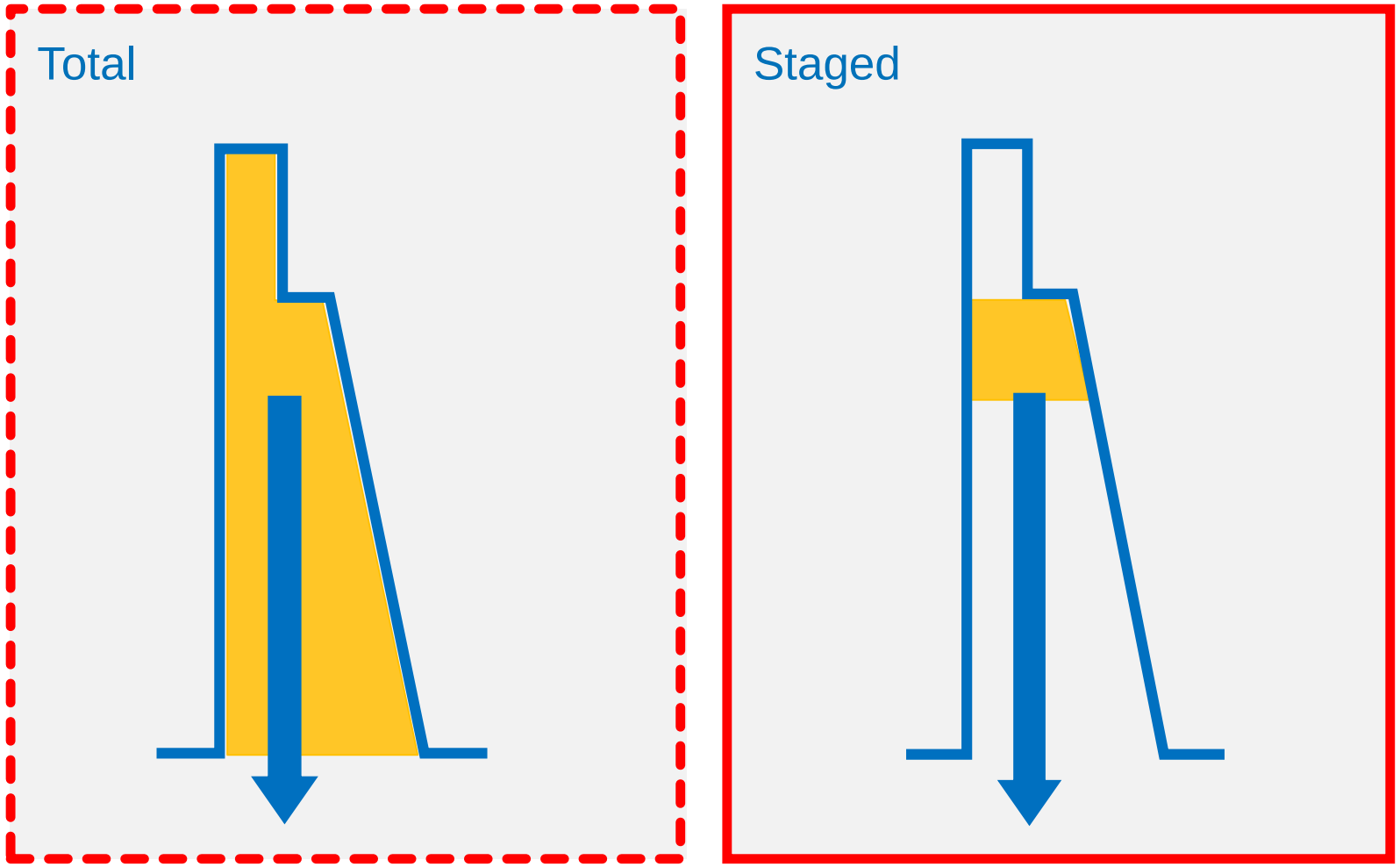
Fractional




Source: CTBUH emergency evacuation elevator systems guideline

# Codes and norms – ASME A17.2003

## OCCUPANT EVACUATION OPERATION (OEO)




Source: CTBUH emergency evacuation elevator systems guideline

### Staged: fire scenarios

- Automatic evacuation from fire signal or manually
- Fire floor and the two floors above and below the fire floor are evacuated

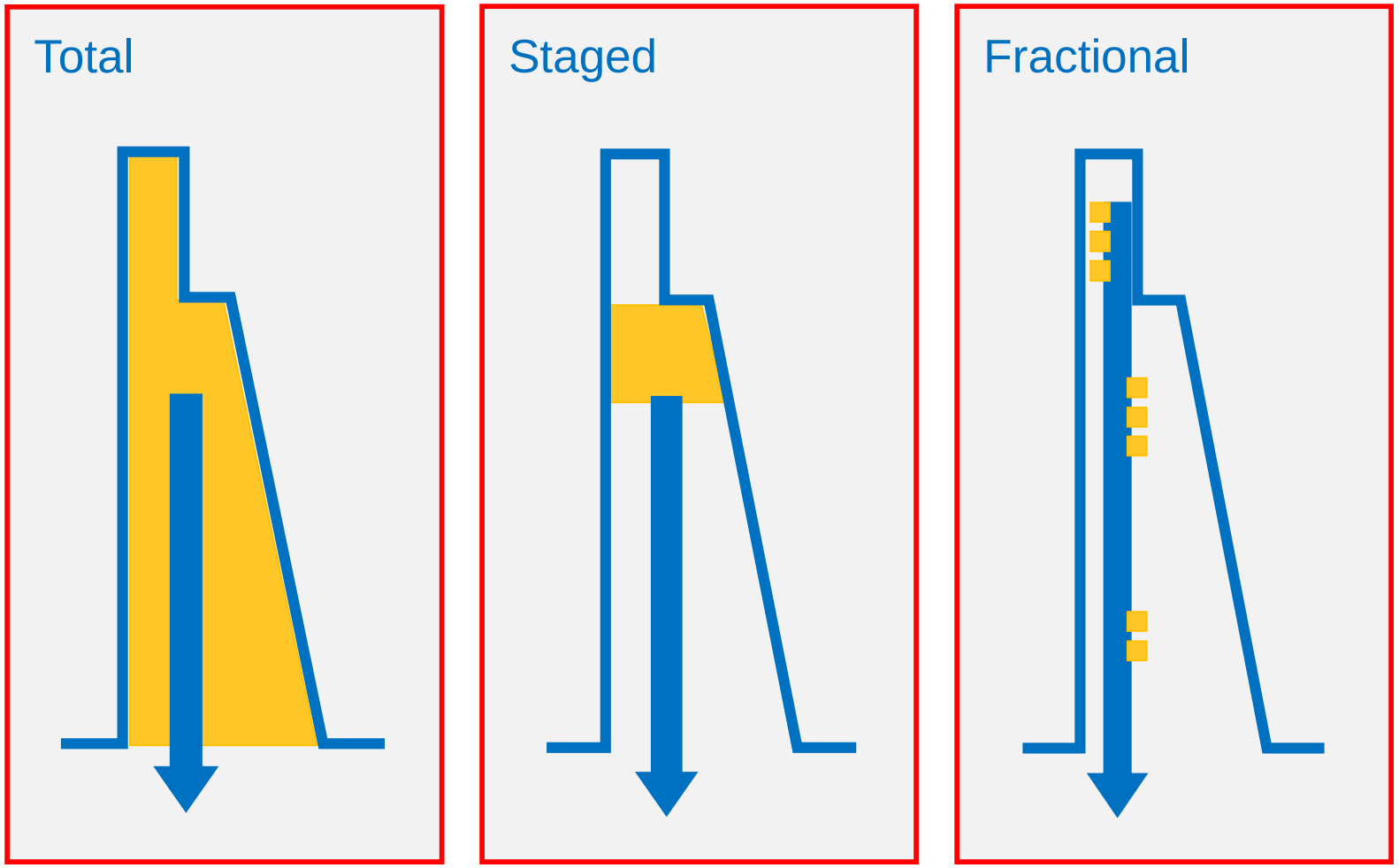
### Total evacuation

- Started from Fire Command Centre (FCC) after fire zone evacuation

**Total evacuation not started immediately after OEO.**

# Codes and norms – ISO TS 18870:2014

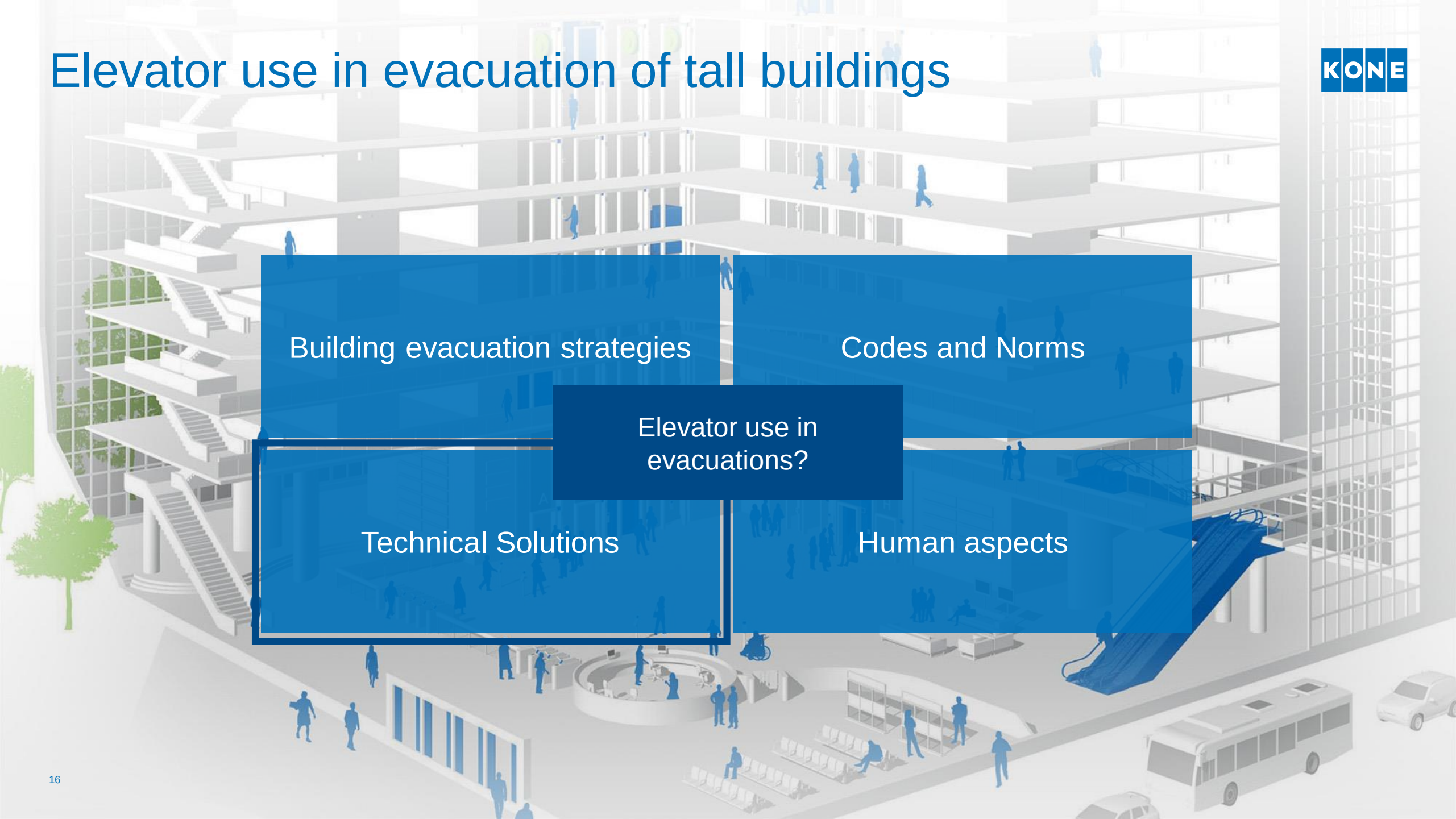
## REQUIREMENTS FOR LIFTS USED TO ASSIST IN BUILDING EVACUATION



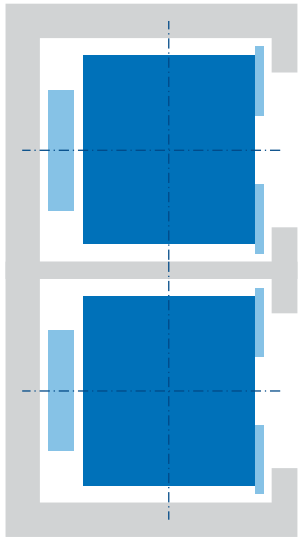

Source: CTBUH emergency evacuation elevator systems guideline

- Technical Specification for automatic evacuation
- The building designer determines the types of emergencies that are automatically detected, and how to direct elevators to or away from the critical area
- The role of the building management system (BMS) or FCC is defined:
  - MEEF can be altered
  - Elevators can be removed or evacuation suspended
- Elevator position is shown and audible signals are given on the landings adjacent to the relevant elevator

# Elevator use in evacuation of tall buildings

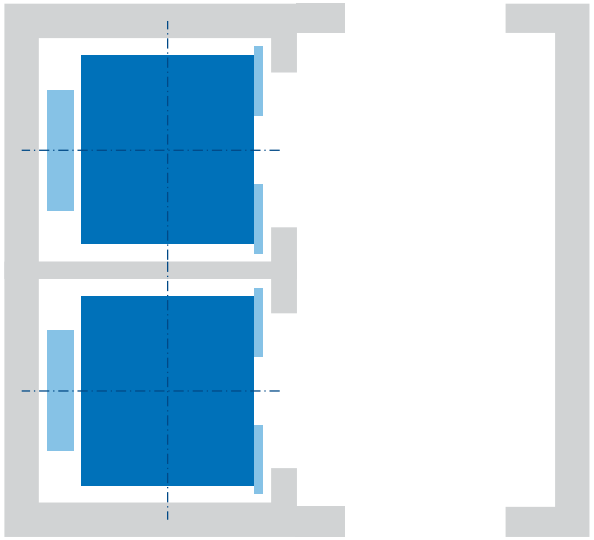


# Technical approaches to managing evacuation



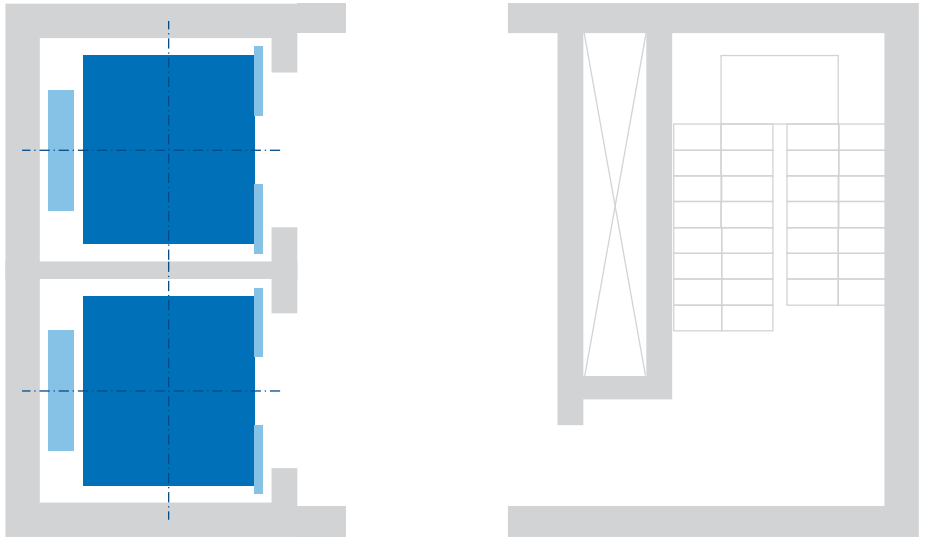
## Standard elevator

1. Elevator car in standard hoistway
2. Unenclosed elevator lobby



## Enhanced elevator

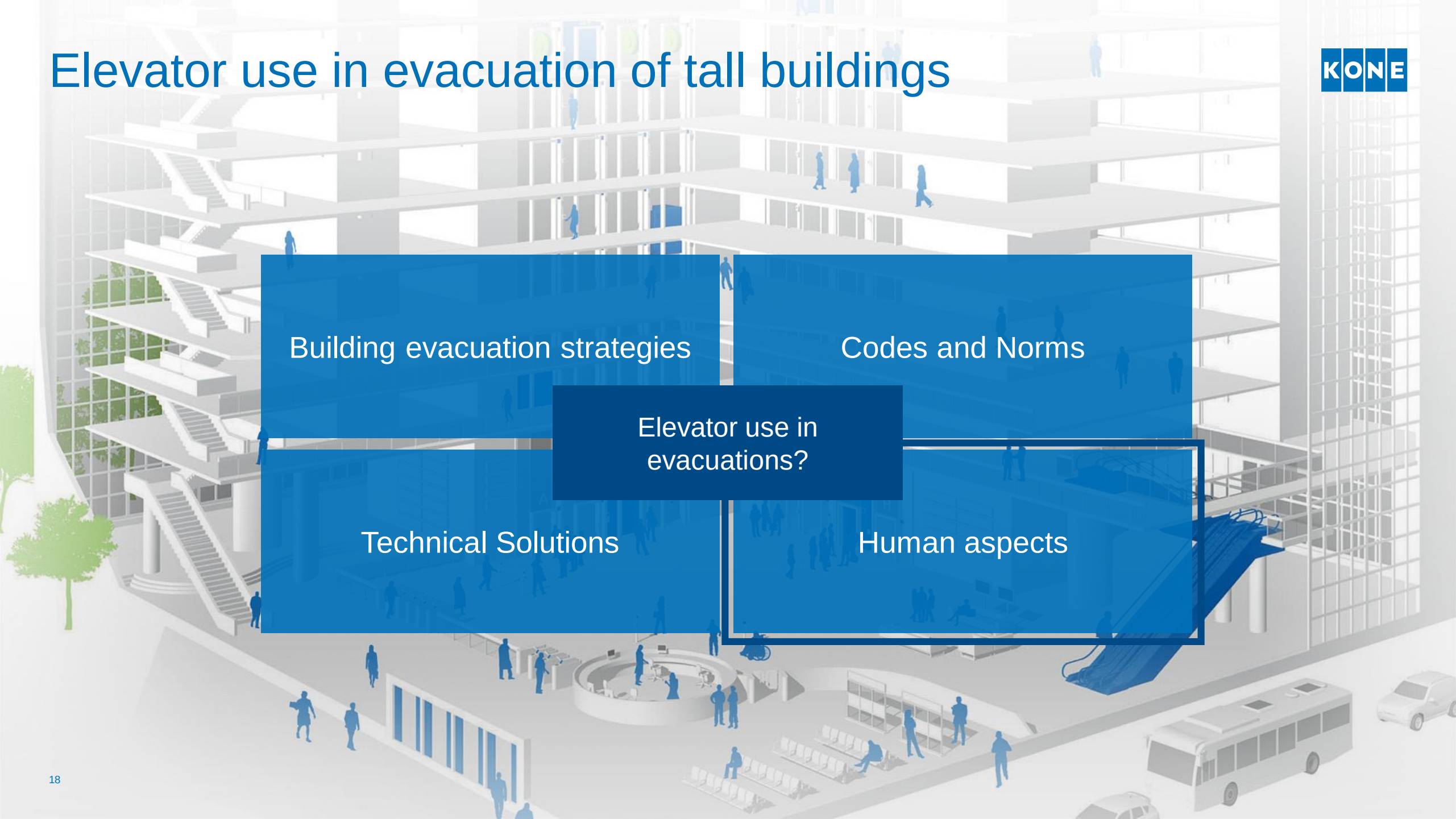
1. Hoistway improved with sensors; heat and water resistance of electrical components
2. Lobby provided with smoke-control doors



## Protected elevator

1. Pressurized elevator car in hoistway improved with sensors, heat and water resistant electrical components, and pressurization and blast-resistant walls
2. Lobby provided with two-hour rated fire doors, fire pressurization shaft, and direct access to emergency stairs within a separate fire and blast-protected compartment
3. Standpipe and hoseracks in lobby

# Elevator use in evacuation of tall buildings




elevator C to
floor 32
C


destination
10 KONE Escalators
9 KONE Elevators
8 Coffee Beans
7 Jinyang Enterprises
6 Corporate Headquarter
5 Conference Center
4 Conference Center
3 Toy Factory
2 Software Center
1 Monkey Business
KONE


evacuation mode
5
EXIT
KONE


evacuation mode
next elevator
in 3 minutes
KONE


your lift
9:46
B
9
3

# How should evacuation elevators be promoted?

Investment is required (building and elevator system)

Typical approaches include narrowing stairs or cutting the number of staircases required by a third (IBC)

Investing in advanced evacuation systems may enable greater net rentable floor space

- No need to sacrifice stairs width for additional floor space.
- City authorities and decision makers have key role in this!

Picture: http://geoffmaritz.blogspot.fi/2016/04/the-international-space-station-iss.html

# Conclusions

All megatall buildings use elevators for evacuation

In buildings over 20–30 floors high, elevators are the fastest means of evacuation

Local authorities have key role in enabling more $m^2$ when investing in advanced evacuation systems

Operation rehearsals required to train users how to use advanced systems

# Thank you

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