

Asia and its Mega-Cities: Innovative Elevator Technology fosters the Urbanization Process



Interlift Augsburg 2017

Karl-Otto Schöllkopf
thyssenkrupp Elevator

October 19, 2017

engineering.tomorrow.together.

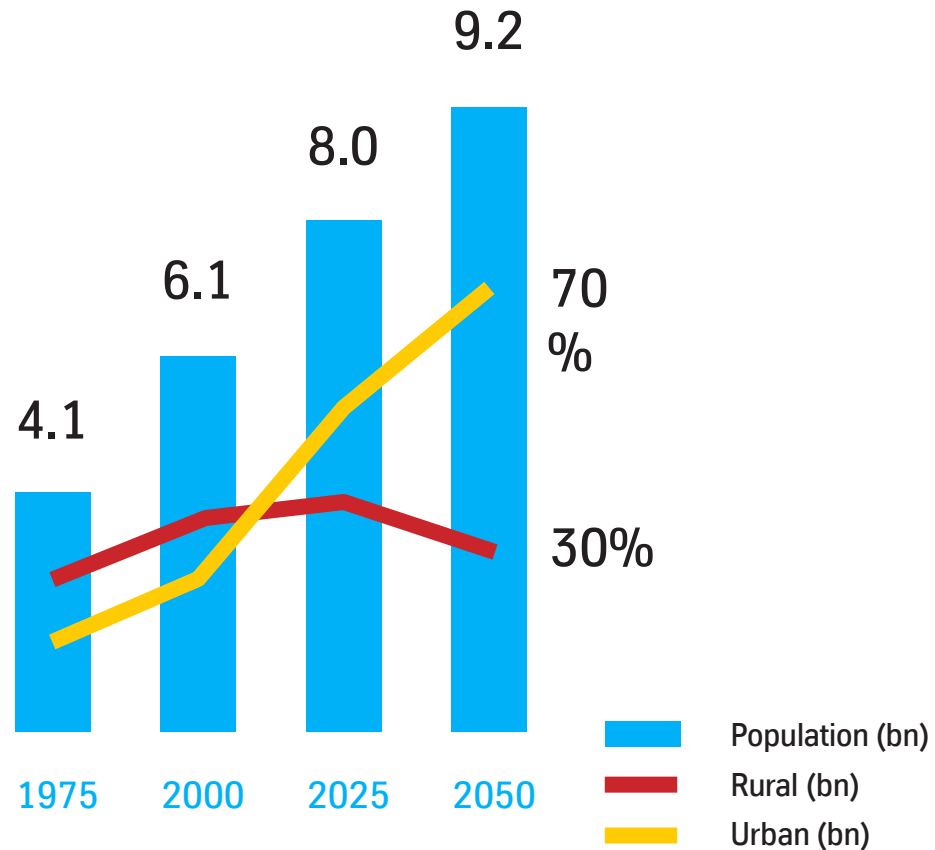


thyssenkrupp

URBANIZATION



DEVELOPMENT OF URBAN POPULATION



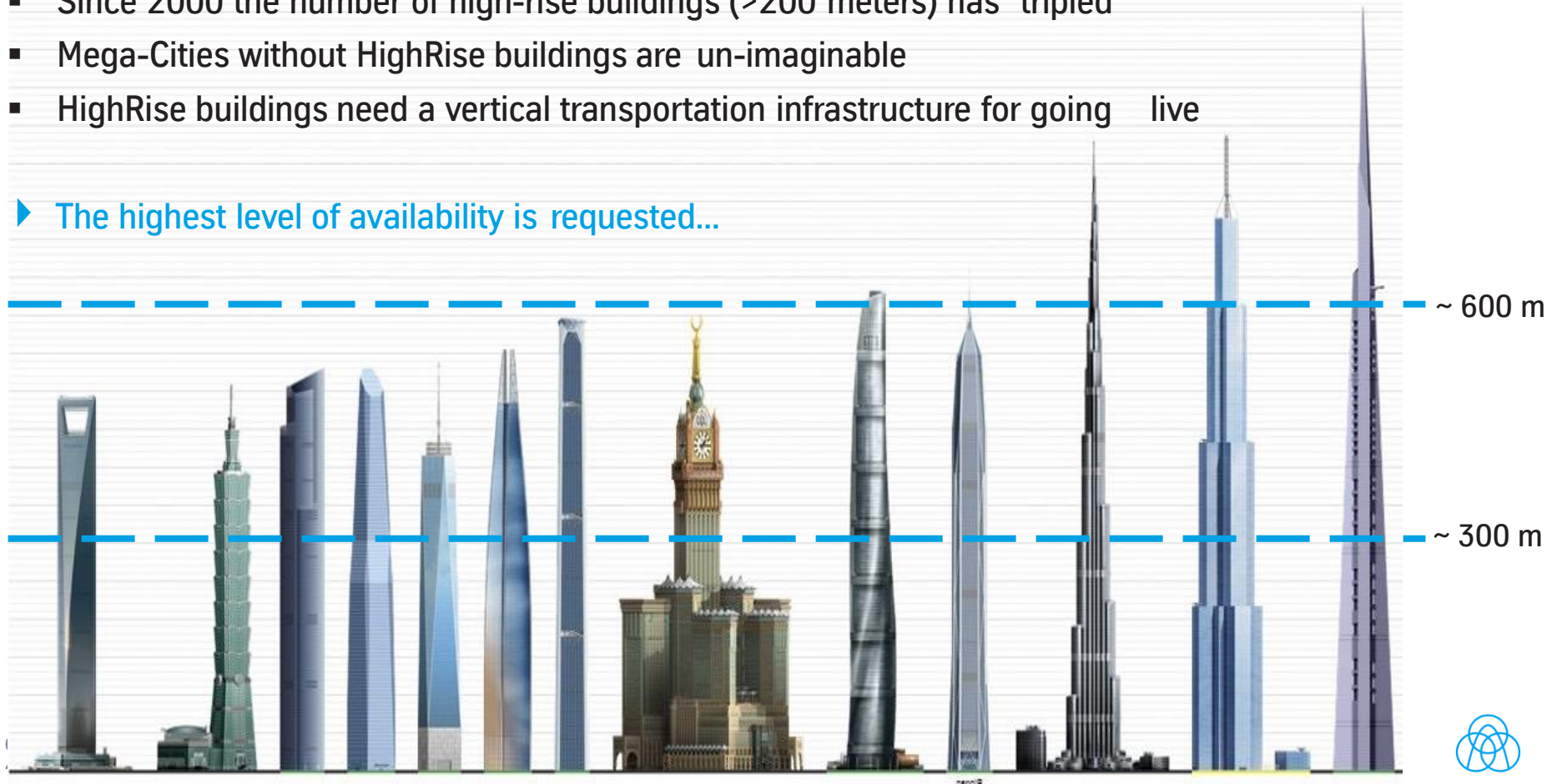
By 2050 cities will contain almost 70% of world population.

Asia and its Mega-Cities – innovative Elevator Technology fosters the Urbanization Process

The 21st Century - The first METROPOLITAN Century

- Actually there are 63 cities worldwide with more than three million inhabitants
- Since 2000 the number of high-rise buildings (>200 meters) has tripled
- Mega-Cities without HighRise buildings are un-imaginable
- HighRise buildings need a vertical transportation infrastructure for going live

► The highest level of availability is requested...



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Globally proposed Super- and Mega- tall buildings

➡ Actual Highrise Buildings under Construction :

- approx. 119 projects with building heights of 250 - 299 m under construction , completion 2016 – 2019
- approx. 107 projects with building heights of 300+ m

➡ Proposed HighRise projects with completion date 2020 and later: (data only up to 2022 available)

- 75 projects with heights of 250 - 299 m
- 131 projects with heights of 300+ m (most of them in China)



2 WTC, New York



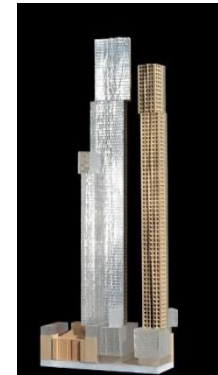
Tradewind Square Kuala Lumpur



Dubai-Tower Jeddah



Rama IX-Tower, Bangkok



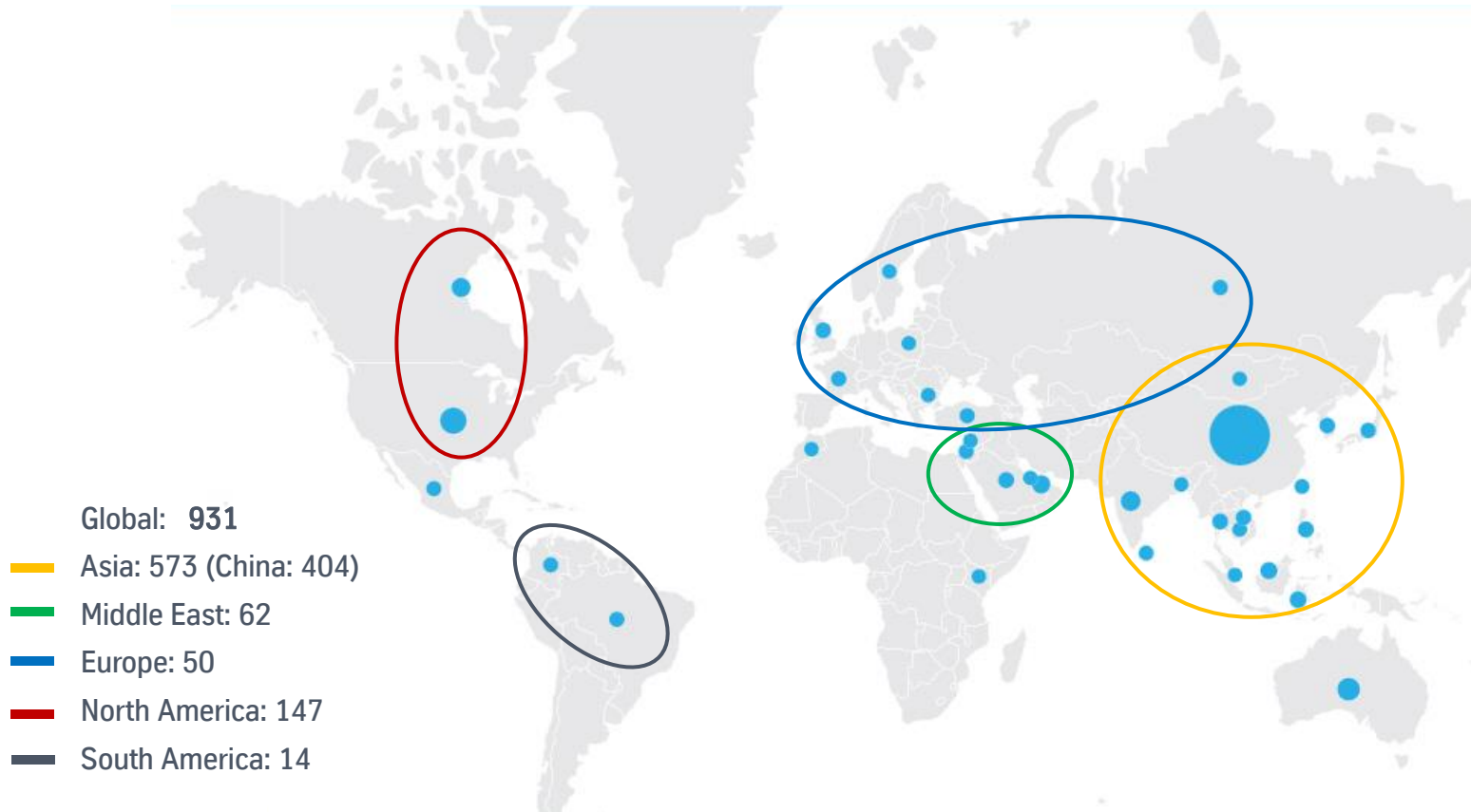
Mirsvish+Gehry Tower Toronto

Ongoing trend in Super- and Mega Tall Buildings expects a significant potential for a new innovation



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Development of Highrise Buildings globally - under construction and proposed



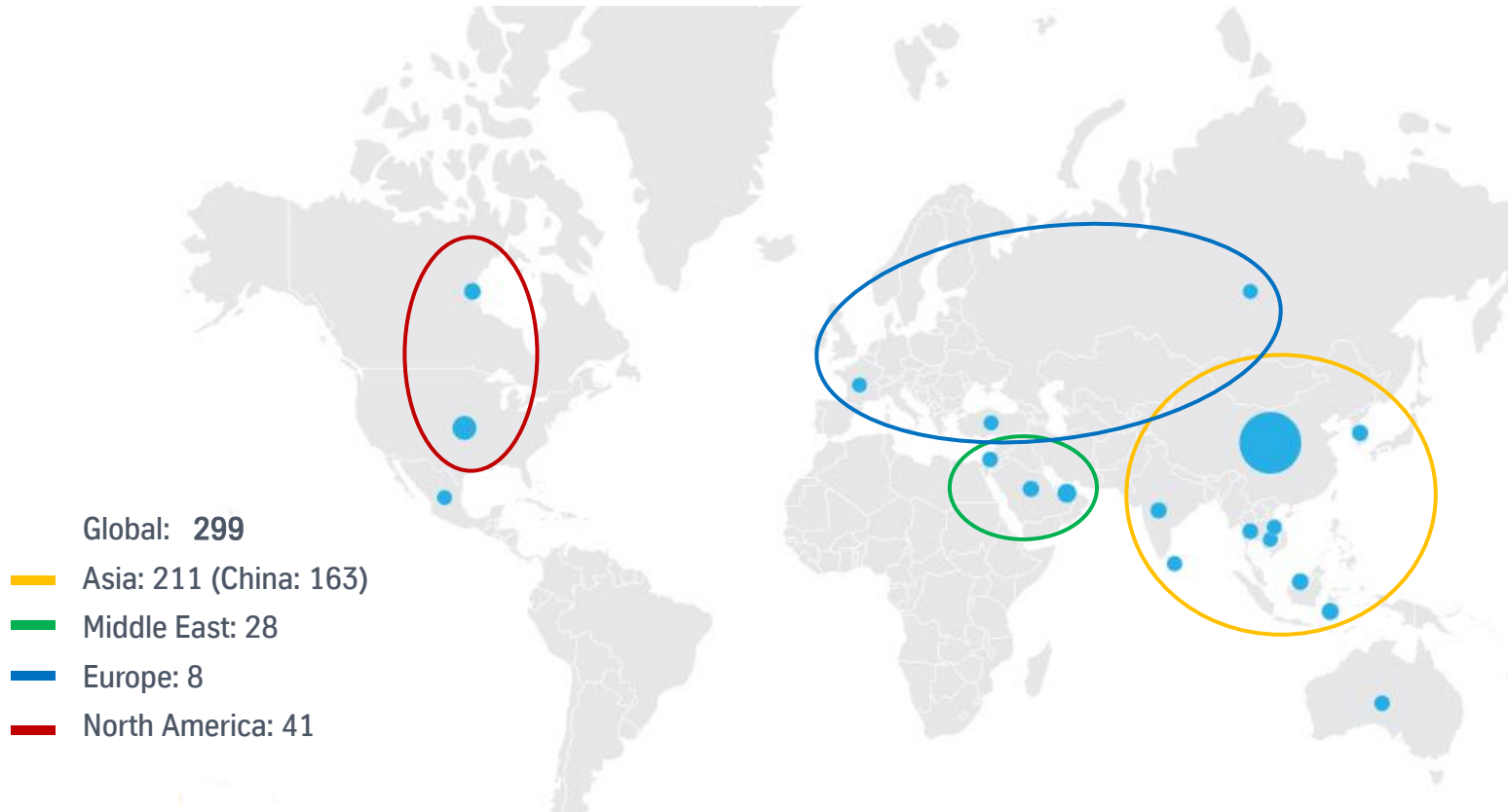
Source: CTBUH Skyscraper Center / Sept.2017

Highrise from 200m+; actual under construction and proposed to market



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Development of Highrise Buildings globally - under construction and proposed



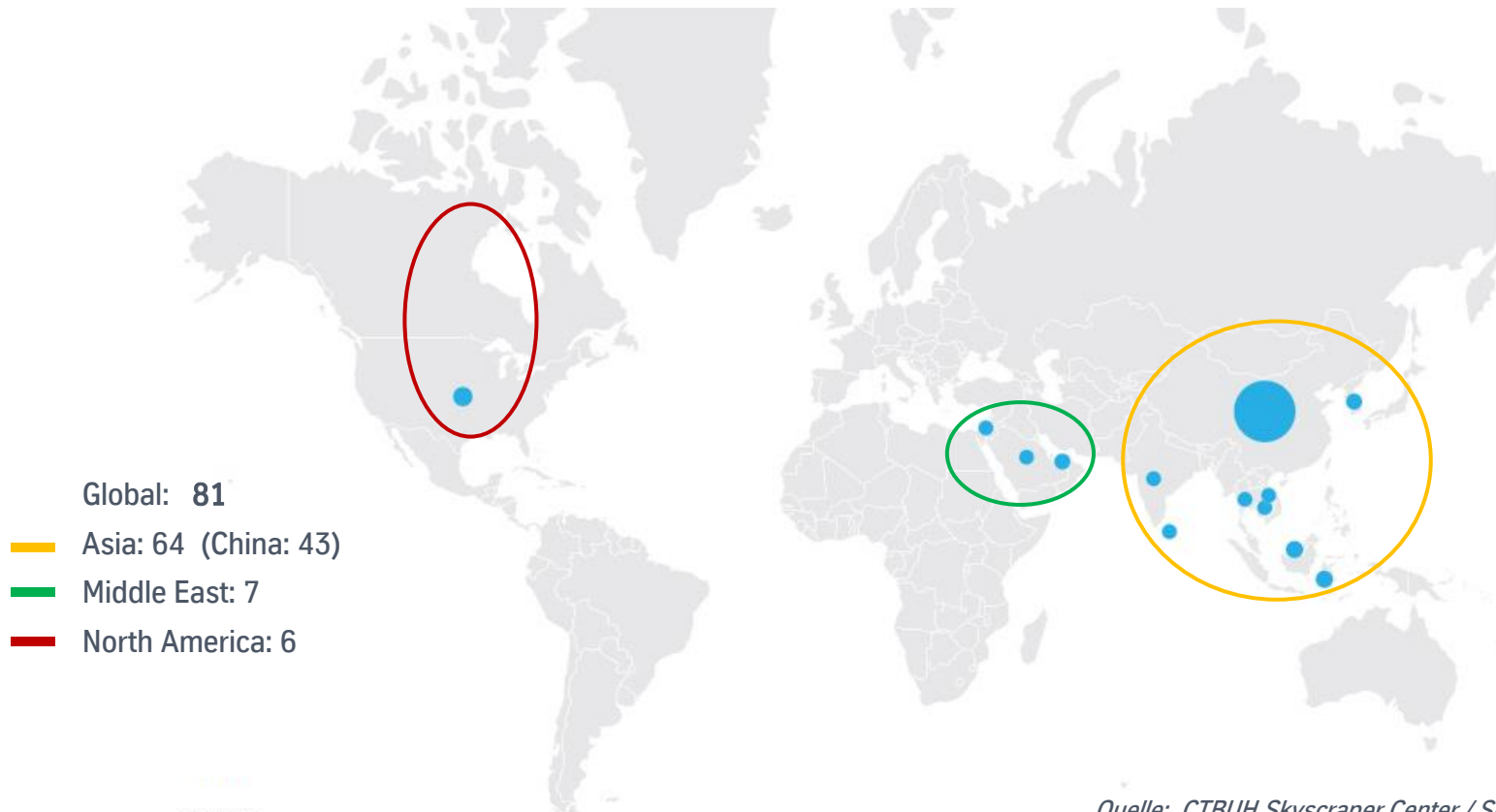
Source: CTBUH Skyscraper Center / Sept.2017

Highrise from 300m+; actual under construction and proposed to market



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Development of Highrise Buildings globally - under construction and proposed



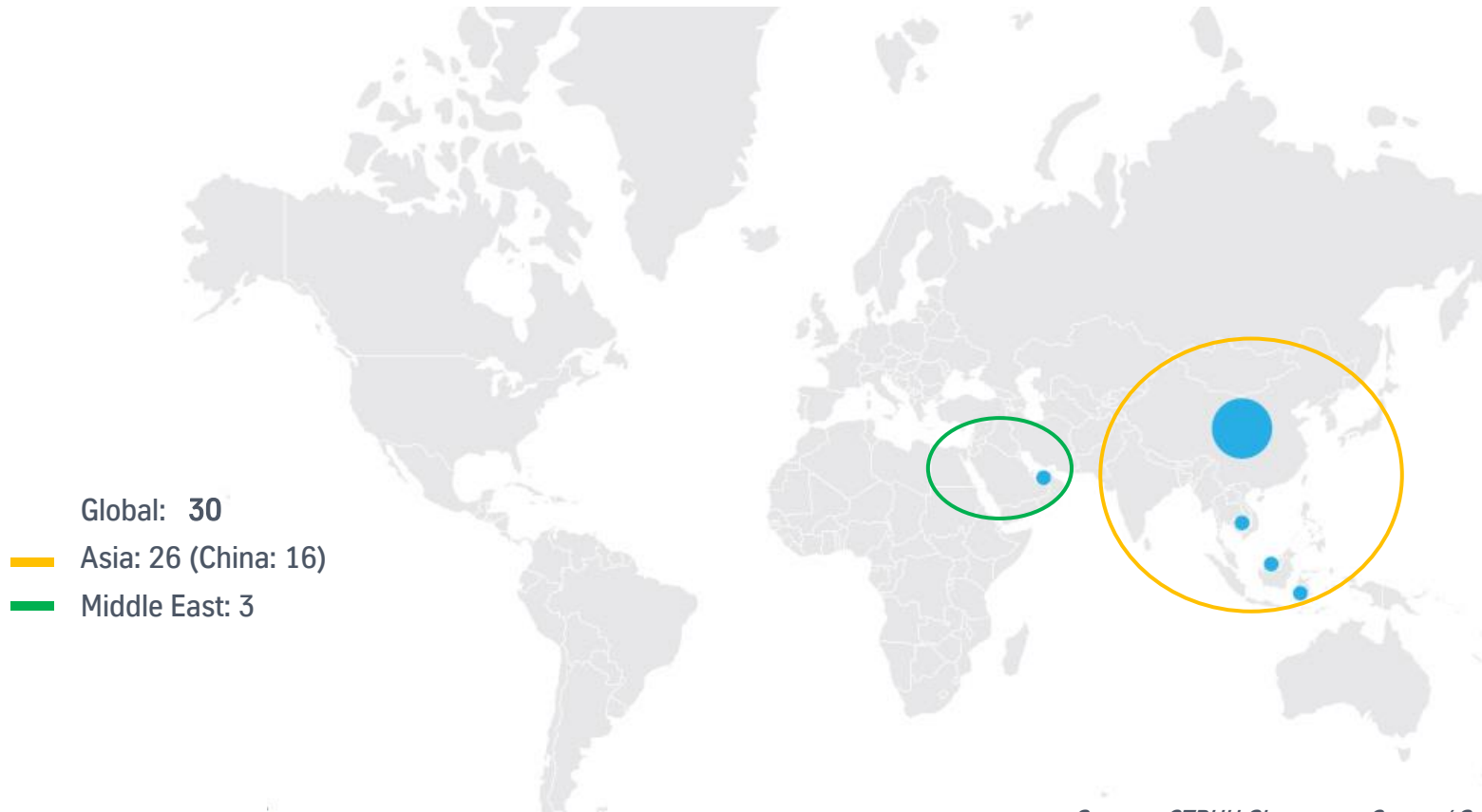
Quelle: CTBUH Skyscraper Center / Sept.2017

Highrise from 400m+; actual under construction and proposed to market



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Development of Highrise Buildings globally - under construction and proposed



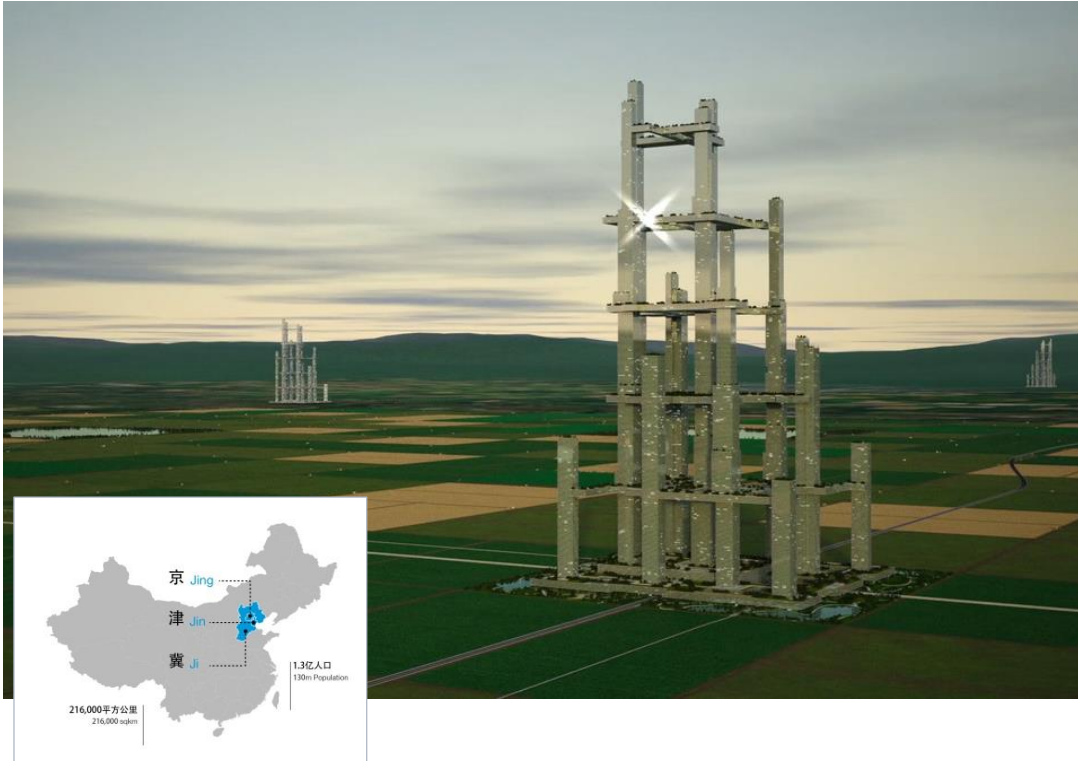
Source: CTBUH Skyscraper Center / Sept.2017

Highrise from 500m+; actual under construction and proposed to market



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The „Jing / Jin / Ji – Development“



The today's metropolis Beijing and Tianjin together with Hebei province (Ji) will be integrated to a vast megacity. stretching over an area of 216,000 square kilometers with a projected population of 130 million, more than the current population of Japan.

➡ the birth of future „Vertical Cities“

Source:
Vertical City Conference, Tianjin 2016



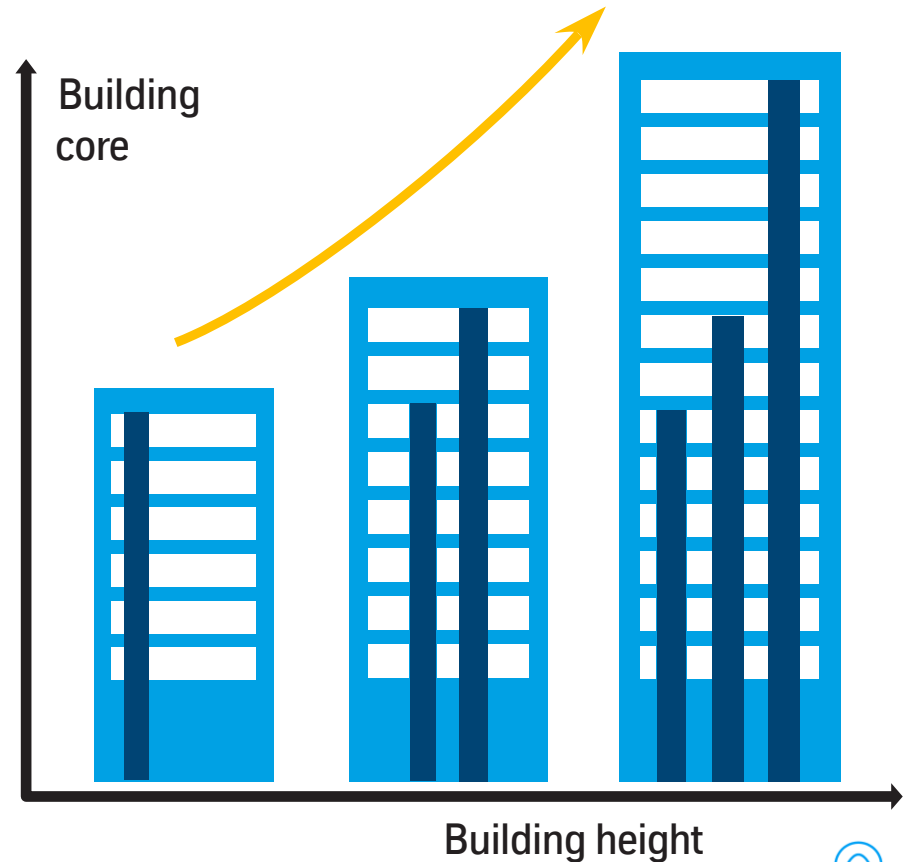
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Elevators are the bottleneck of evolution of high rise buildings

Elevator footprint vs. usable space



Increasing loss of usable space



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The challenge

Highest Building Efficiency:

- Figure of Merit:
Proportion of usable area to brutto Area needs to be maximised (> 80%)
- Facility Net Ratio:
Proportion of required area for technical equipment (e.g. elevators) to the usable area needs to be minimized

➤ As less elevators as possible!

Highest Traffic Performance:

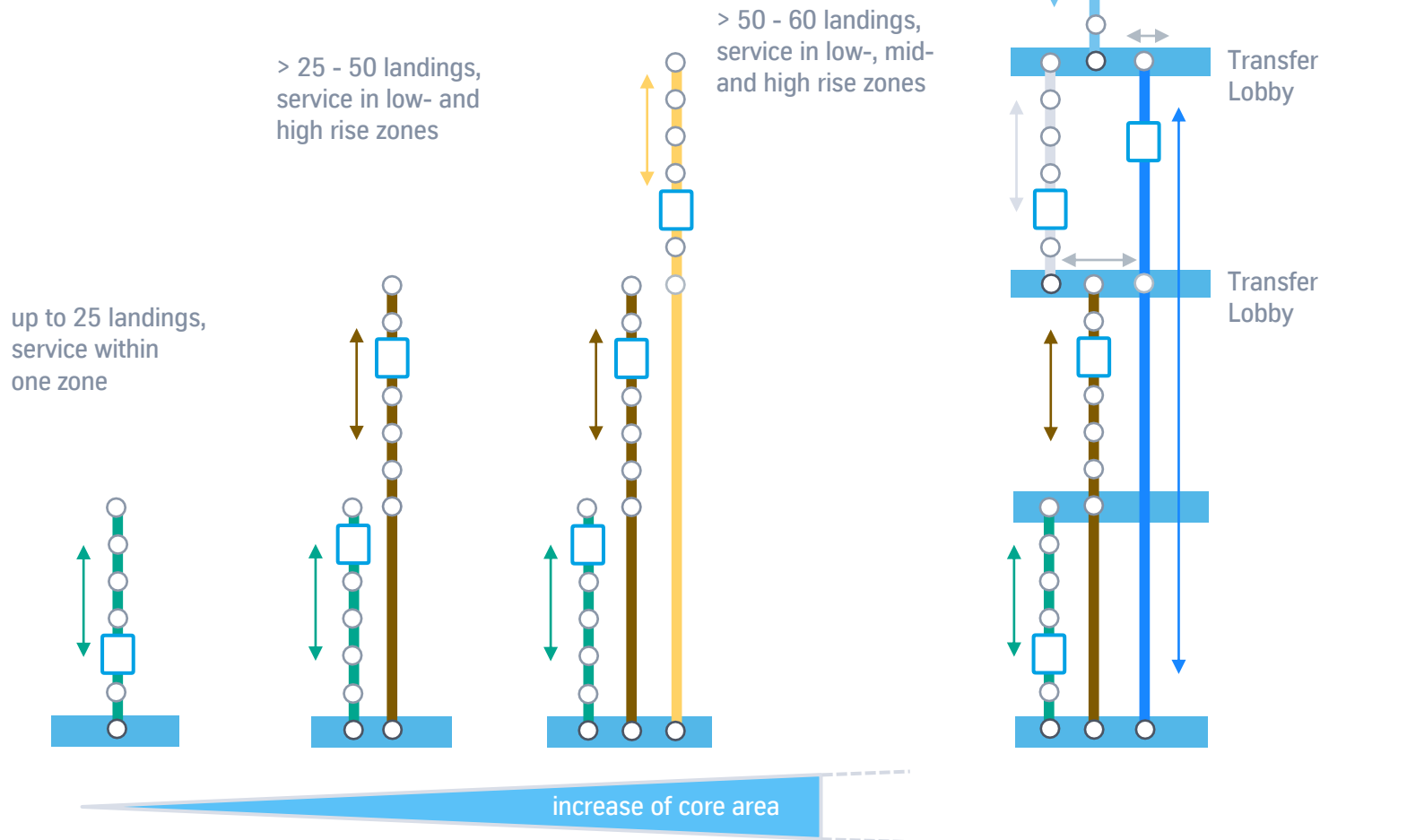
- Sufficient Traffic Performance for optimal passenger and material transportation
- Low Passenger Waiting Times and Times to Destination

➤ As many elevators as possible!



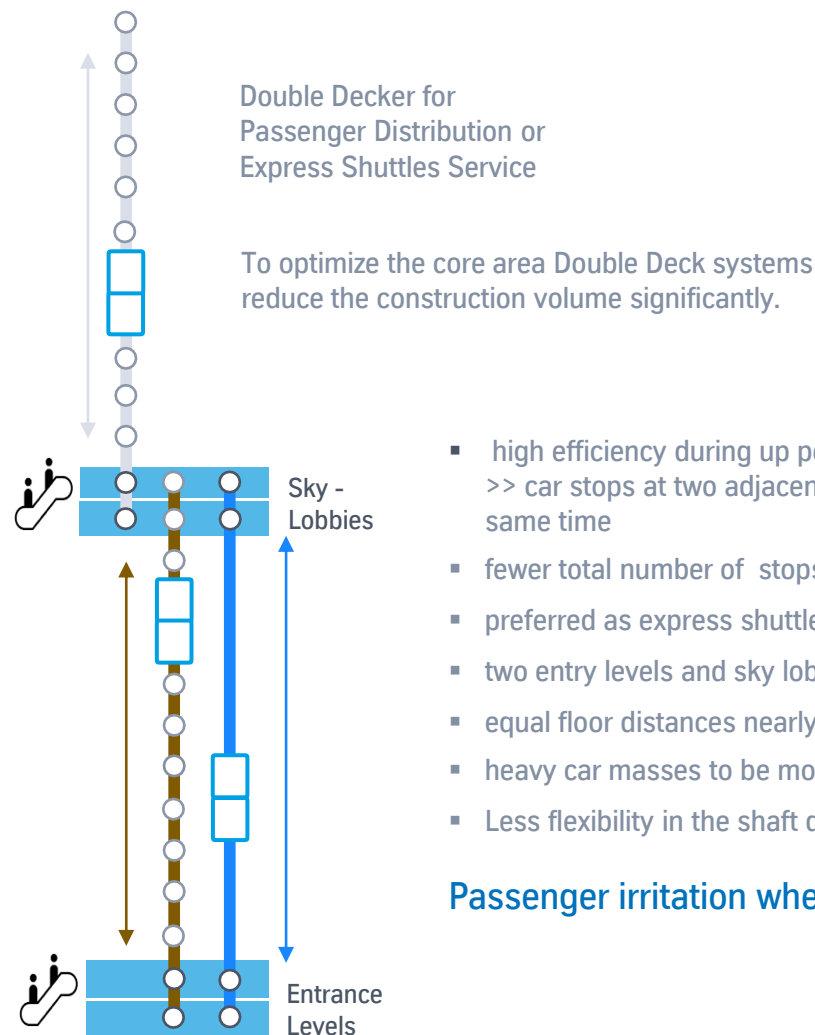
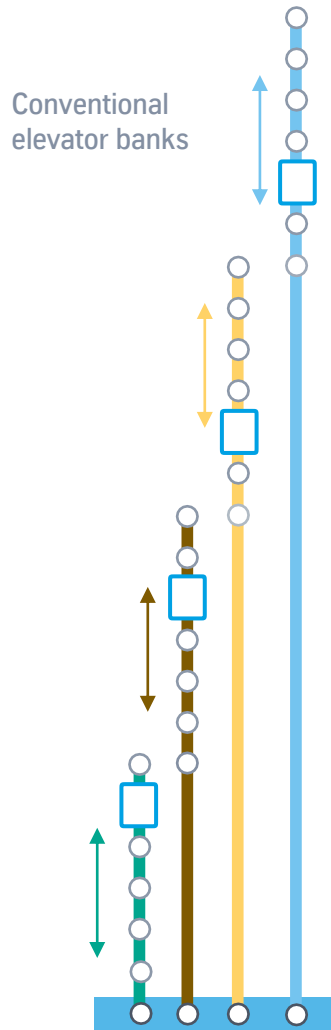
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Conventional concepts reduce core area by organizing hoistway structure



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Conventional concepts - increase transportation capacity



- high efficiency during up peak
>> car stops at two adjacent floors at same time
- fewer total number of stops
- preferred as express shuttles to serve sky lobbies
- two entry levels and sky lobby required
- equal floor distances nearly always required
- heavy car masses to be moved in case of low traffic demand
- Less flexibility in the shaft due to connected cars

Passenger irritation when other deck is loading / unloading



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Multiple car systems – using same hoistway

Expanding capacity with TWIN®

- Two cabs independent in one shaft
- Up to 30% more capacity
- Up to 40% reduction in space requirements
- Advanced destination dispatch algorithm
- Optimized in energy consumption



TWIN® has a certified safety concepts in most regions of the world

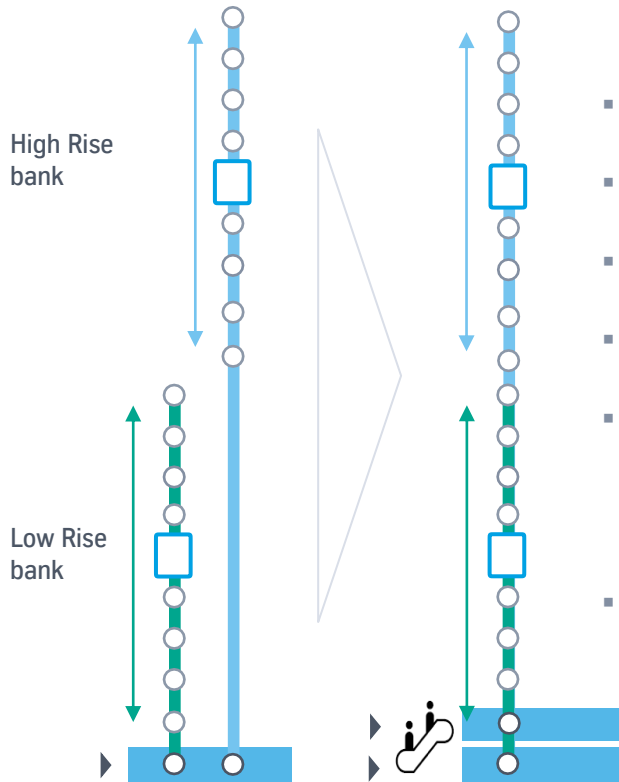


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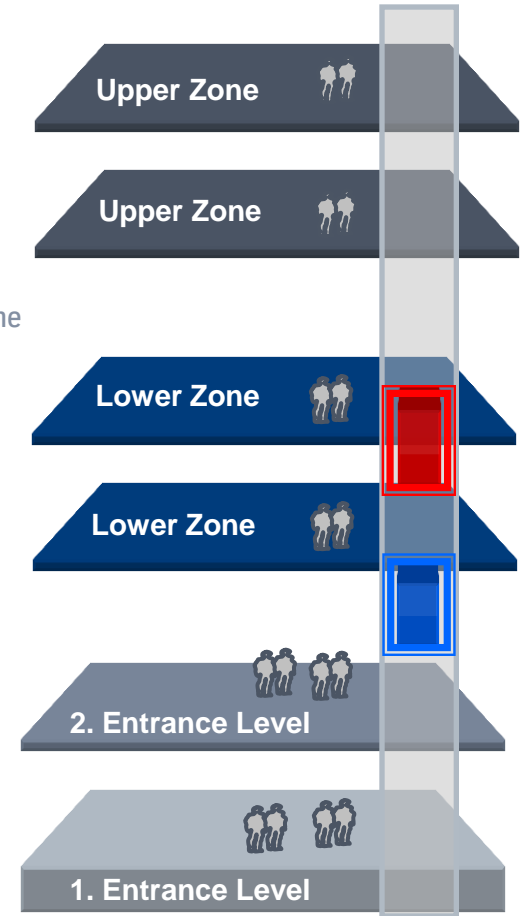
Multiple car systems – using same hoistway

Concepts with Multi-Cabin-Systems TWIN®

- Bring together a low rise and a high rise groups
- Enable 2 entrance levels

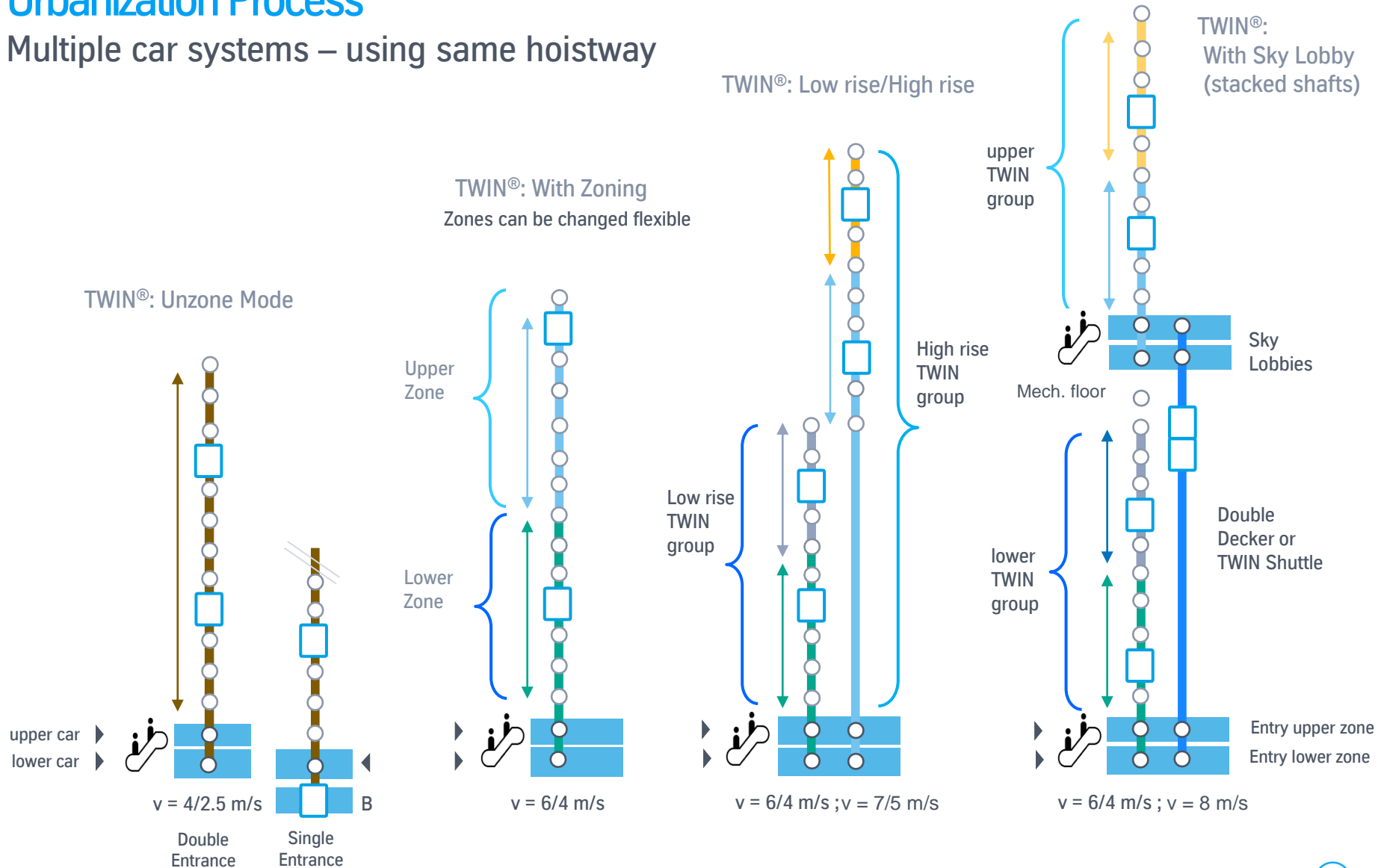


- two cars moving in one shaft independently
- both cars using the same guide rails and the same landing doors
- minimum clearance between both cars is guaranteed by a special safety concept
- advanced destination dispatch algorithm
- flexibility to switch between zoned and un-zoned operation, depending on traffic demands system and safety certification available in most regions globally
- up to 40% reduction in space requirements



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Multiple car systems – using same hoistway



Optional: thyssenkrupp + BA + additional management structure (not legal entity). If not needed, delete this line via first master slide

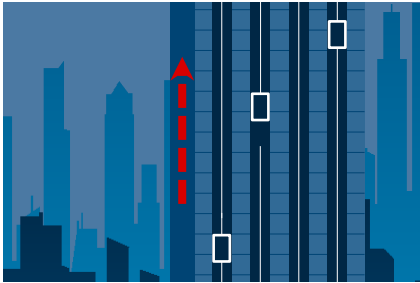
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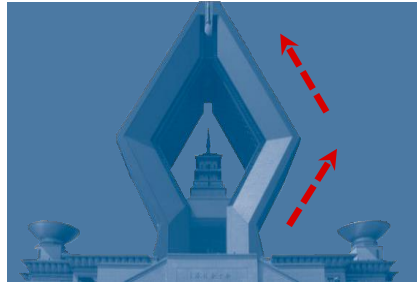
Where innovative building design challenges the VT industry

Buildings, growing in heights demand more extended travel heights of elevators.



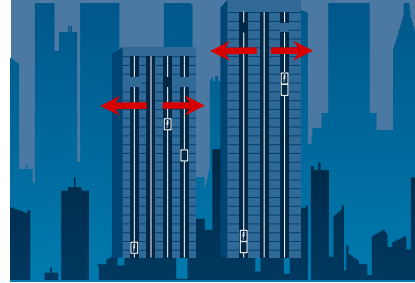
Eliminating rope suspension should not limit vertical hoisting anymore

Shapes of High Rise buildings get out of the vertical direction



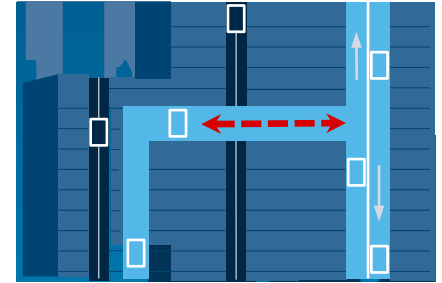
Inclined hoisting should not be limited by behaviour of suspension means.

Buildings, stretching to the sky have to be elastic.



Moving without ropes would not cause distinctive rope sway effects in Super High Rise buildings.

Direct horizontal links between buildings or public facilities will foster urban mobility



Means of vertical and horizontal passenger transportation highly appreciated.

It's the challenge to eliminate these limitations by a new ground braking technology.



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The first ropeless elevator in the world – MULTI enables new dimensions



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What it is MULTI[®] ?

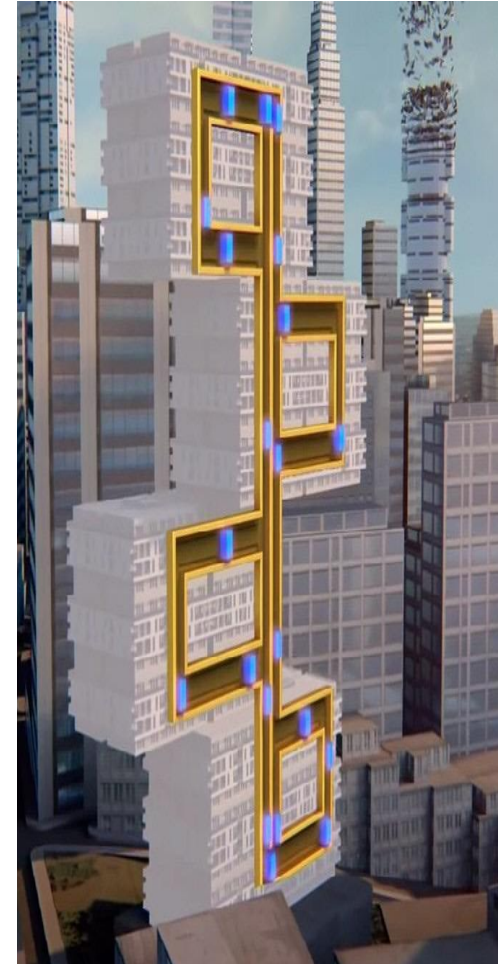
- A revolutionary idea, but it's not just a new elevator – It's an exciting new “vertical and horizontal transportation system”.
- NO CABLES and no traveling cable required
- Application of totally new technologies, like
 - Linear motor and drive
 - Exchanger, which moves cabin from one shaft to the other
- New materials (light weight cabin & cabin door)
- It's a shaft-changing cabin system with multiple cabins, running in one shaft – loop. However horizontal links between several loops or to a horizontal track is possible at exchanger levels



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What it is MULTI[®] ?

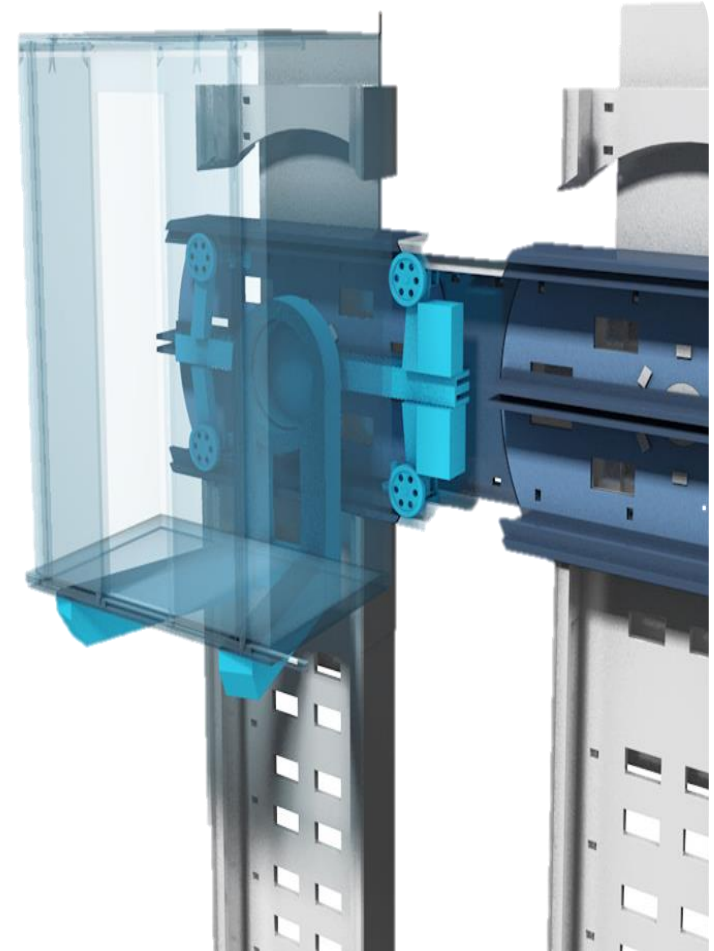
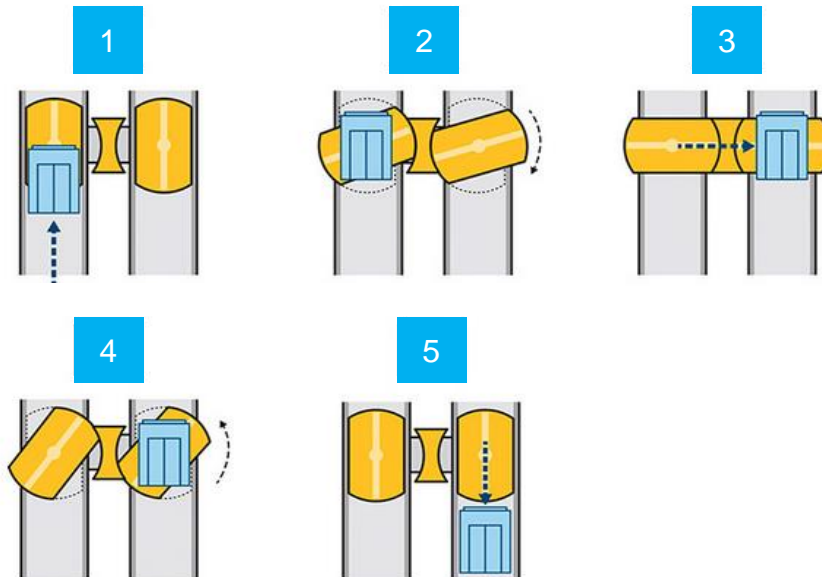
- The basic approach is a circulating system (paternoster) with an available cabin every 15 - 30s
- The safety concept is based on the TWIN know-how, collision prevention and high level safety features
- Targeted speed: up to 5m/s, extension possible up to 7 m/s
- Ideal with 8 - 10 cabins per side which means 16 - 20 in total in one loop for 600m driveway or 300m height - however not limited



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Linear Motor to turn vertical into horizontal ...

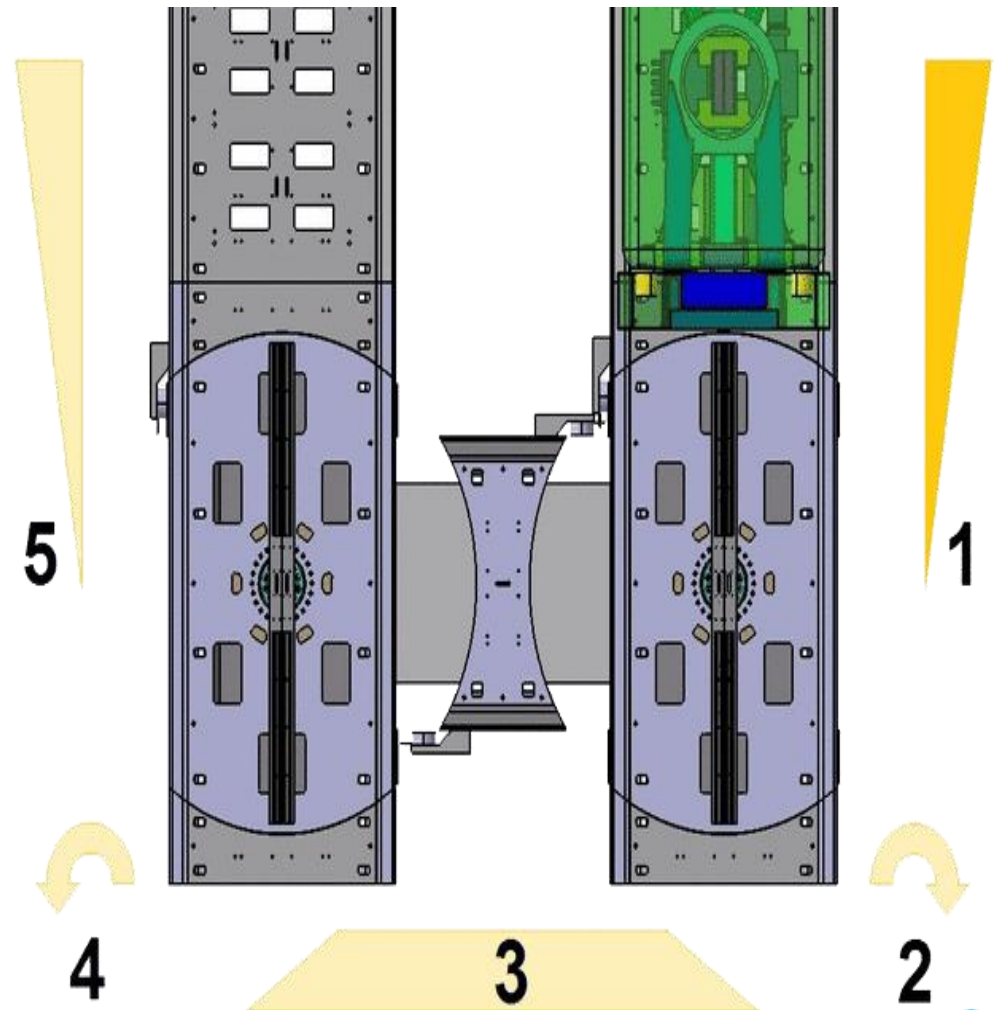
- The fundamental idea of an elevator moving horizontally is the use of linear drive
- To apply an exchanger system, which allows a 90° turning (or between) of the linear drive and guiding equipment



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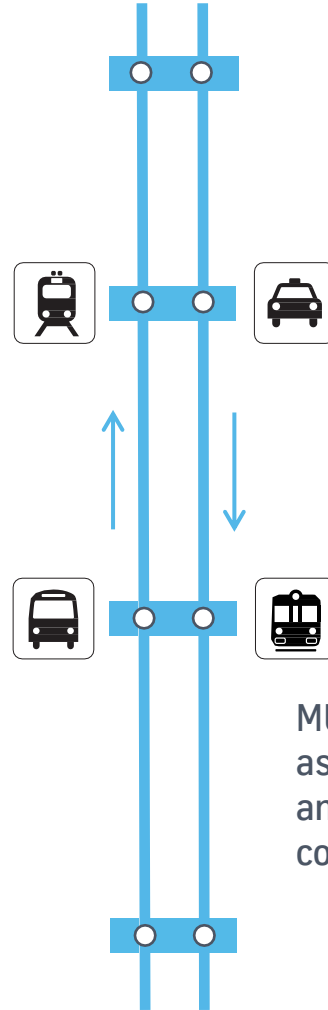
Switch point for moving out of the vertical ...

- Exchanger module can be placed where needed
- Modular design, with great potential for modular construction
- Horizontal movement provides separate service space



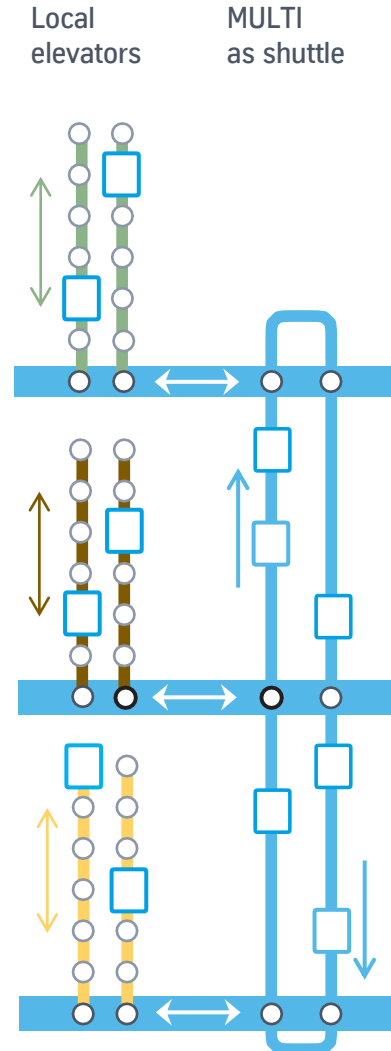
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Traffic Concept for Super- and Mega High Rise



Public traffic concept with
Long Distance Train
and local traffic links

MULTI –
as long distance VT-system
and local traffic by
conventional elevators

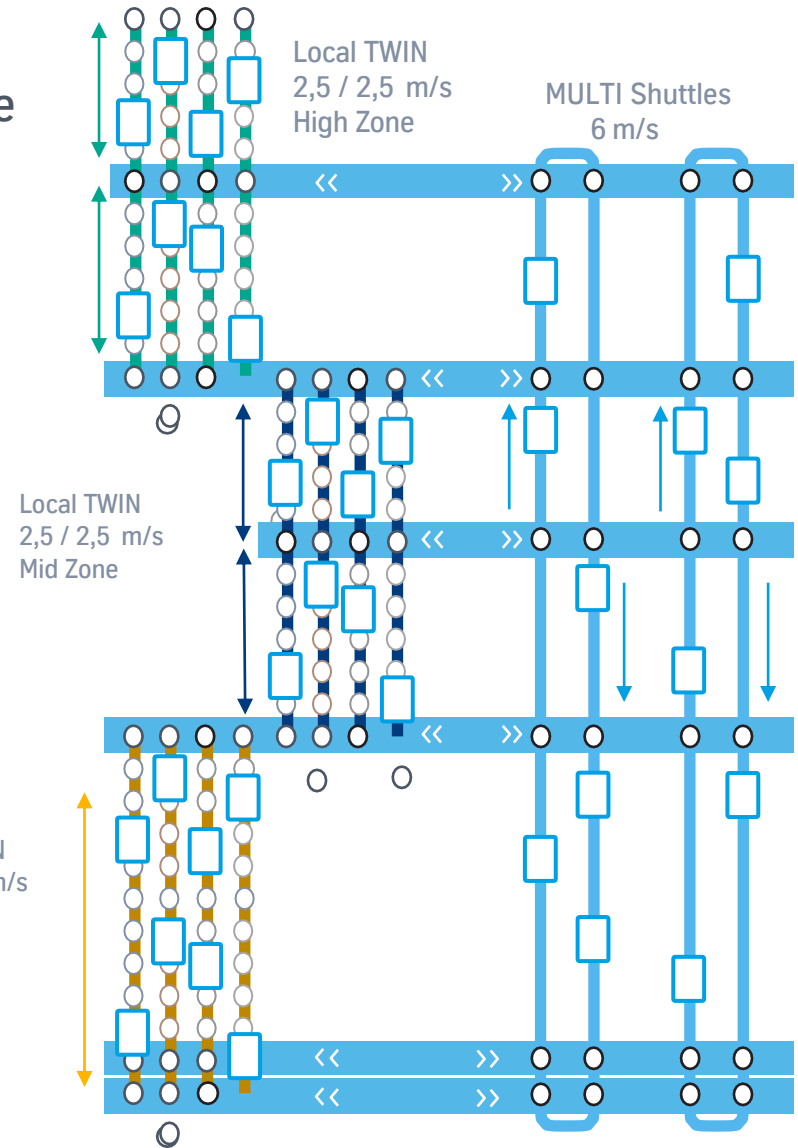
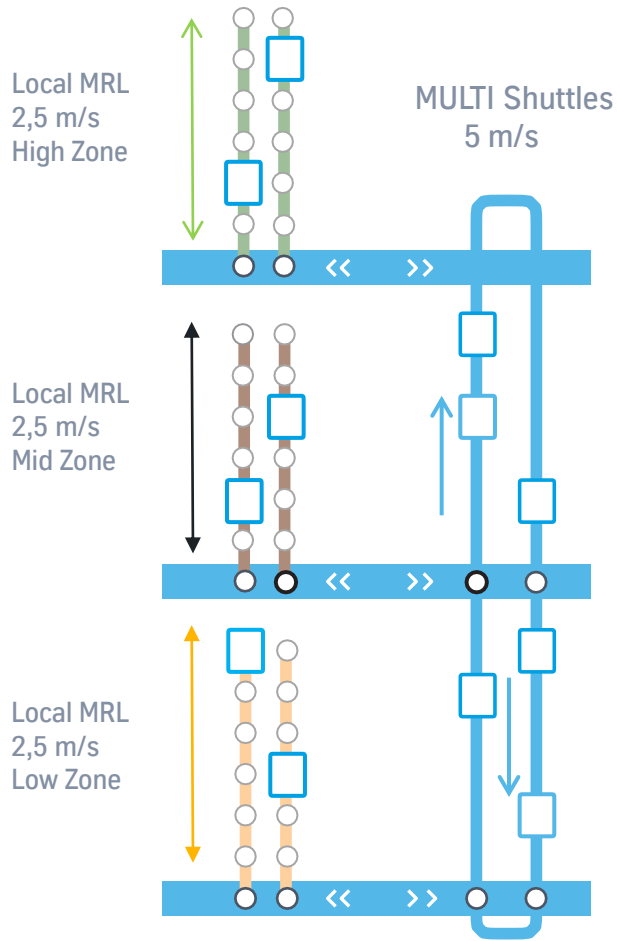


Transform what we are used to utilize in public mobility ...



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Traffic Concept for Super- and Mega High Rise

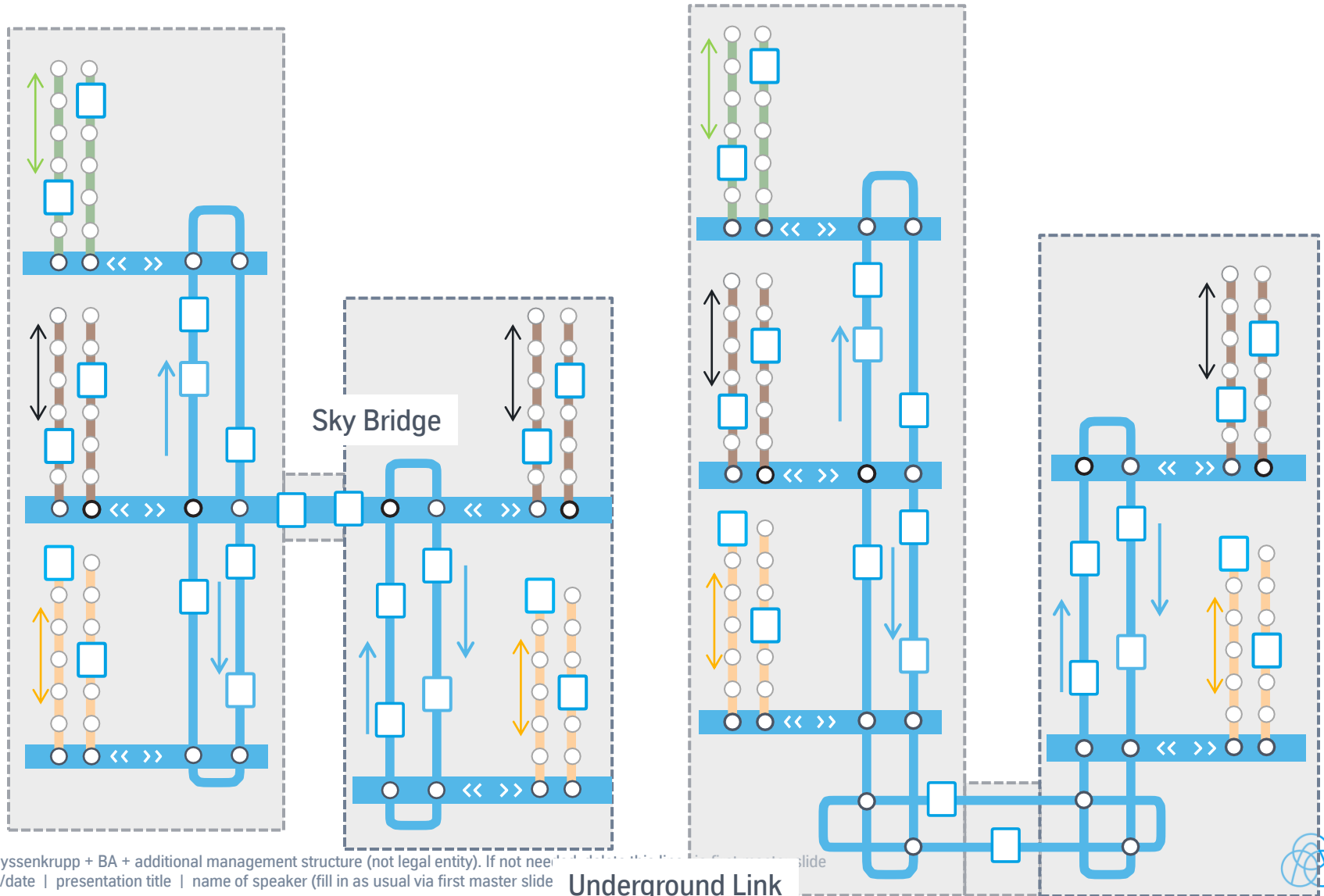


Examples of VT configurations with MULTI



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Traffic Concept for Super- and Mega High Rise – Link between buildings



Optional: thyssenkrupp + BA + additional management structure (not legal entity). If not needed

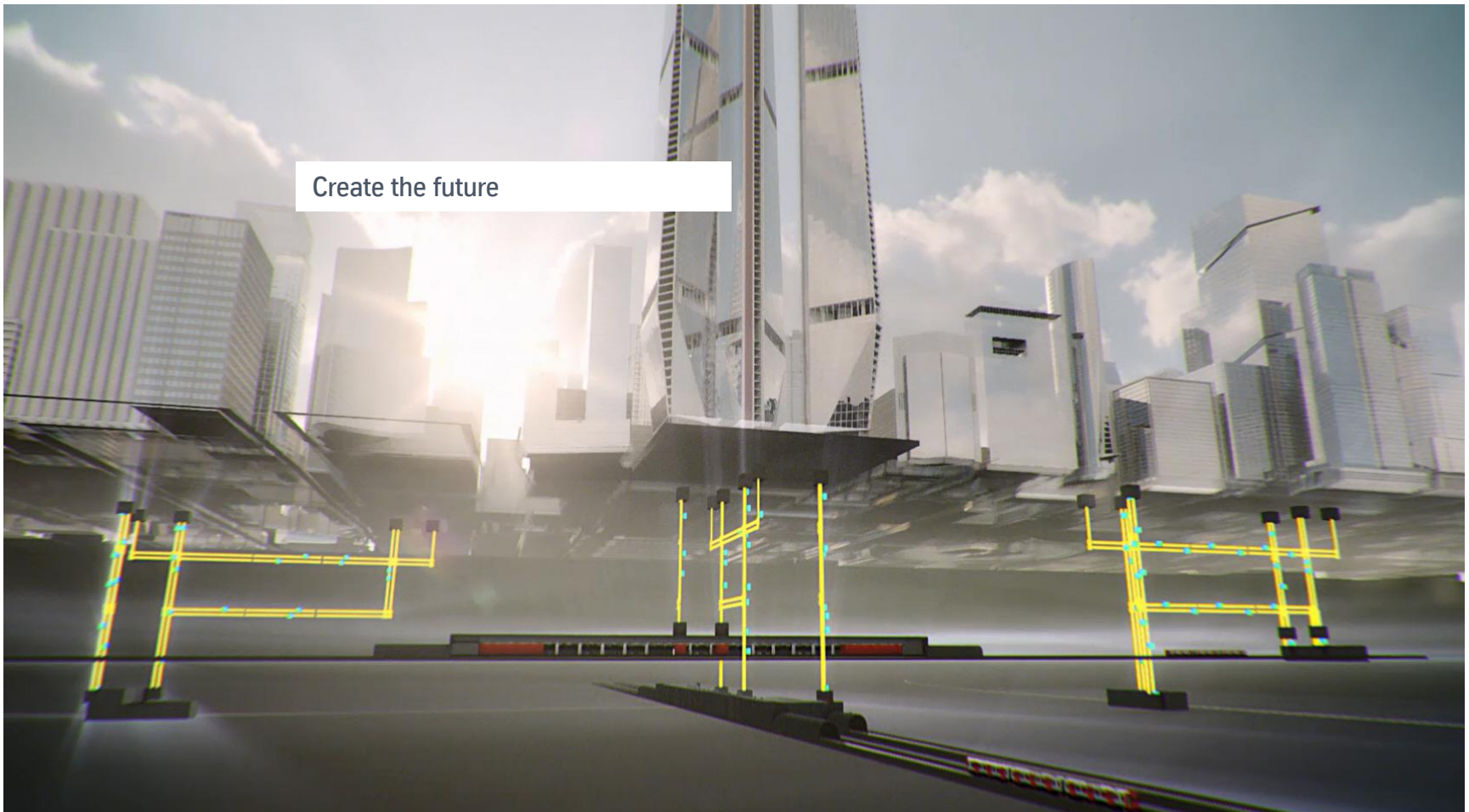
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Underground Link



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Traffic Concept for Super- and Mega High Rise – a vision gets realistic



Create the future



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The benefits for future buildings design

No building height or shape restrictions

Significant gain of Facility Net Ration

Continuous passenger transportation

Less passenger queuing enables to reduce lobby areas

Reduced footprint vs. capacity

More uptime availability due to more cabins in the loop



Thank You

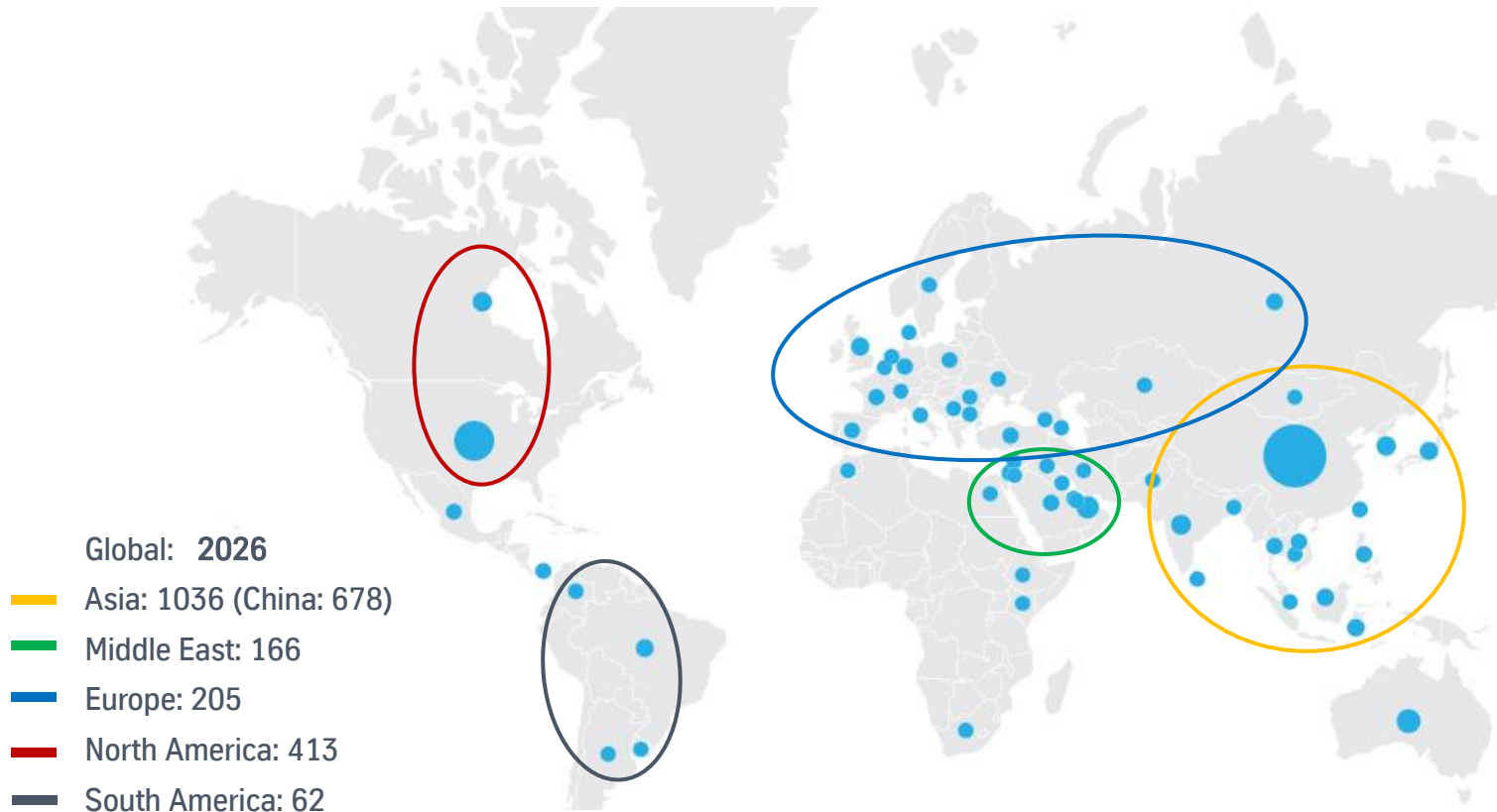


Back Up



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Development of Highrise Buildings globally - under construction, proposed to the market and in vision



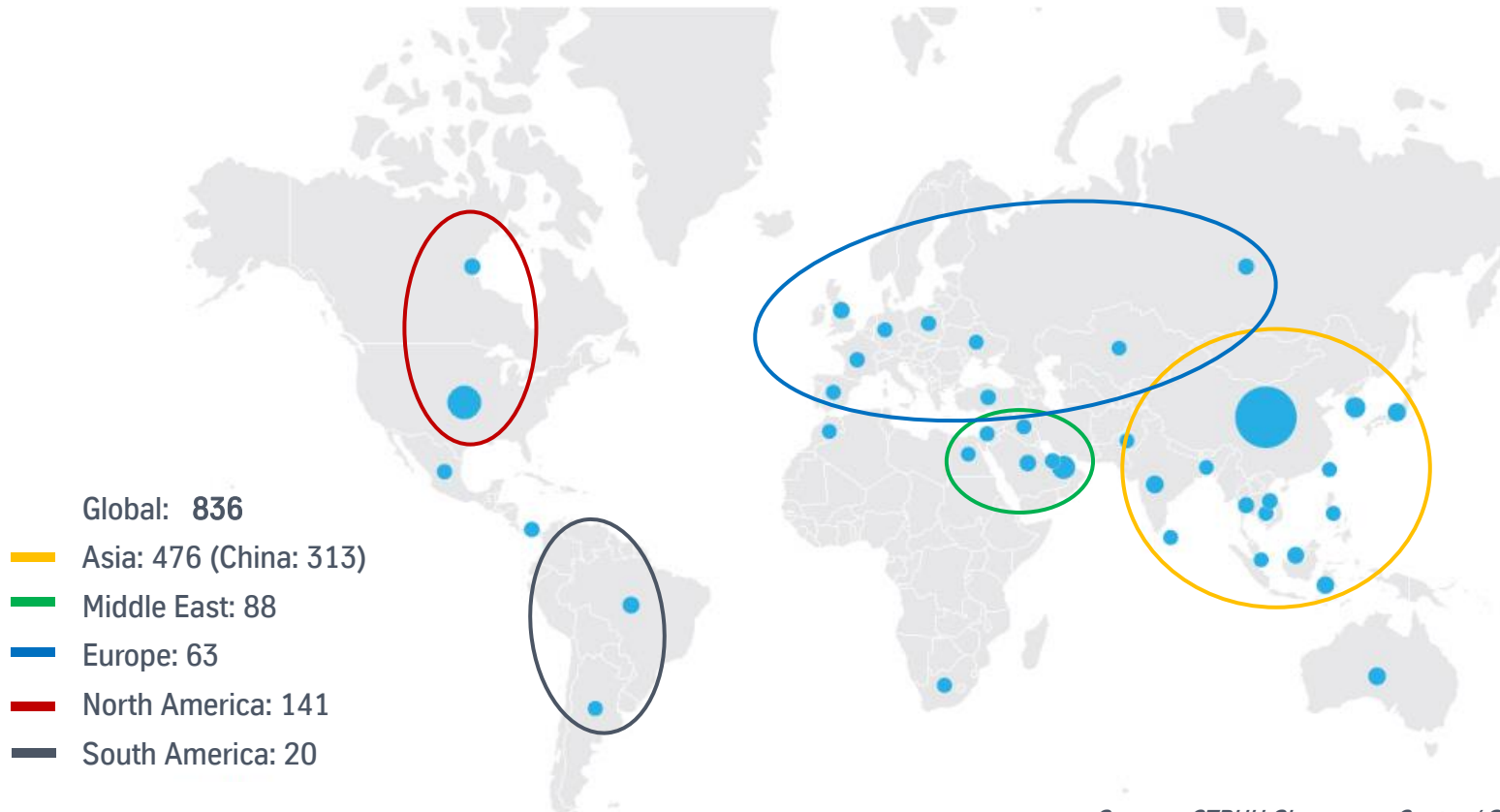
Source: CTBUH Skyscraper Center / Sept.2017

High Rise from 200m+; actual in construction, proposed to market and in vision for the future



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Development of Highrise Buildings globally - under construction, proposed to the market and in vision



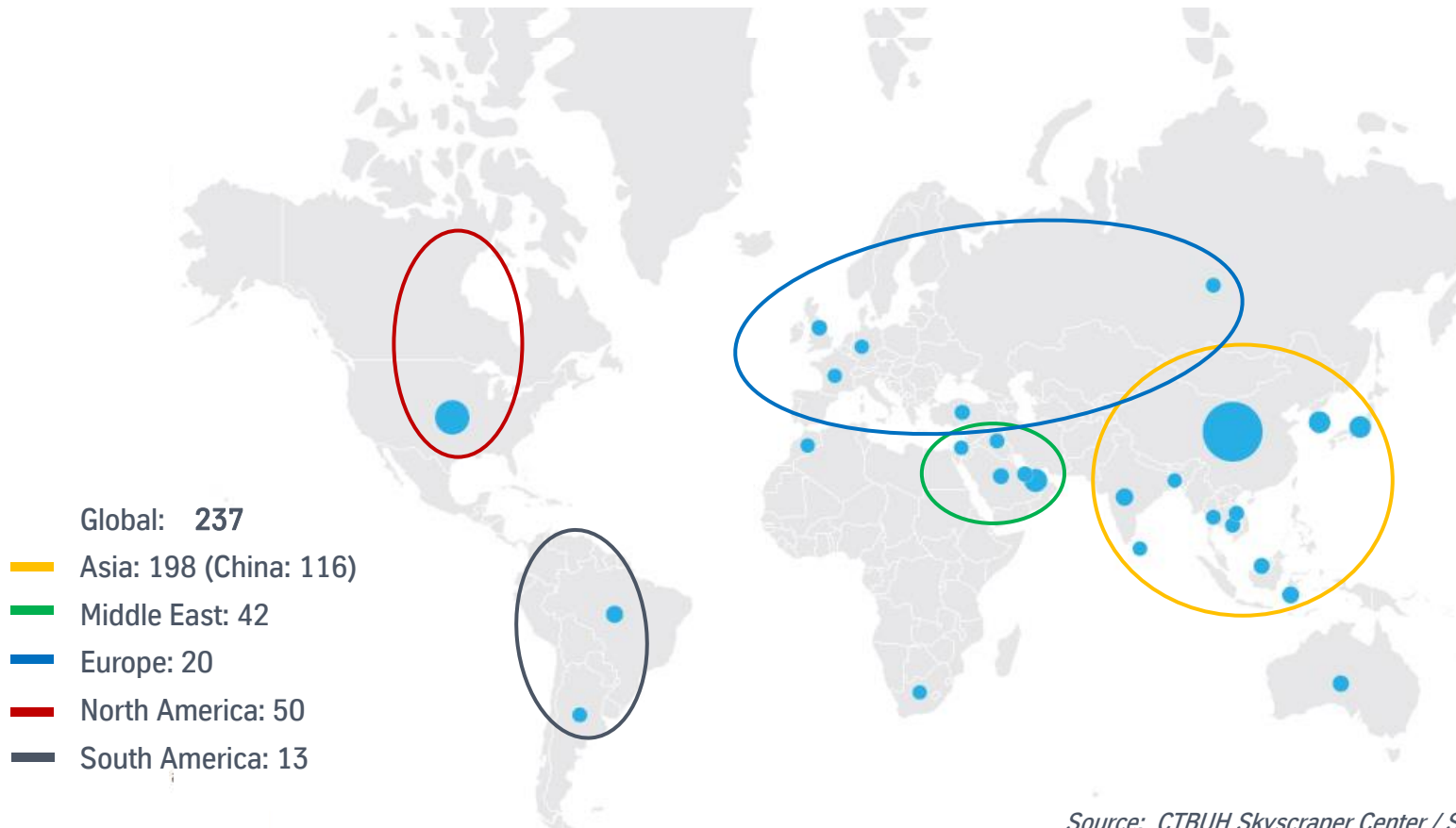
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High Rise from 300m+; actual in construction, proposed to market and in vision for the future



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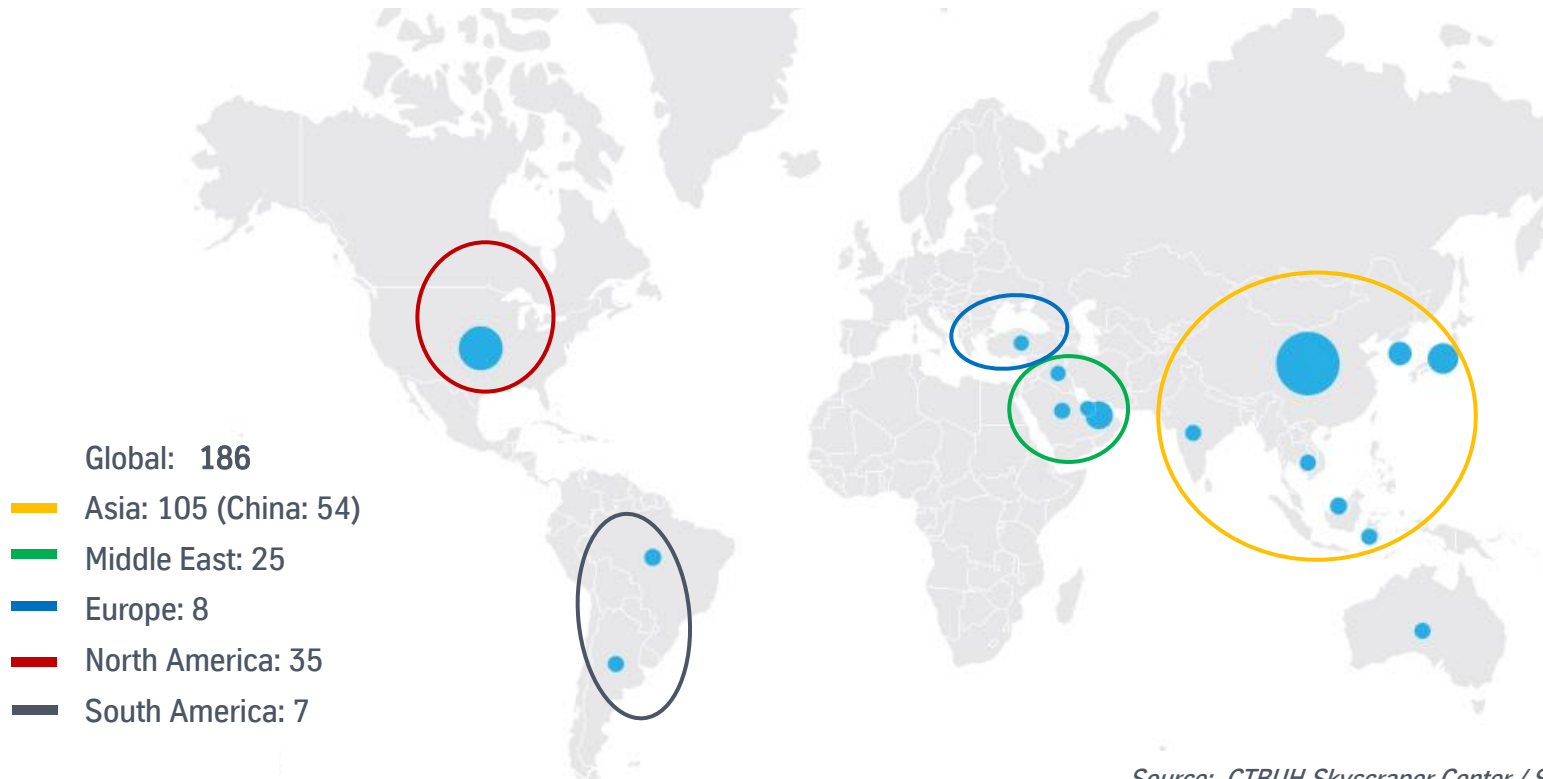
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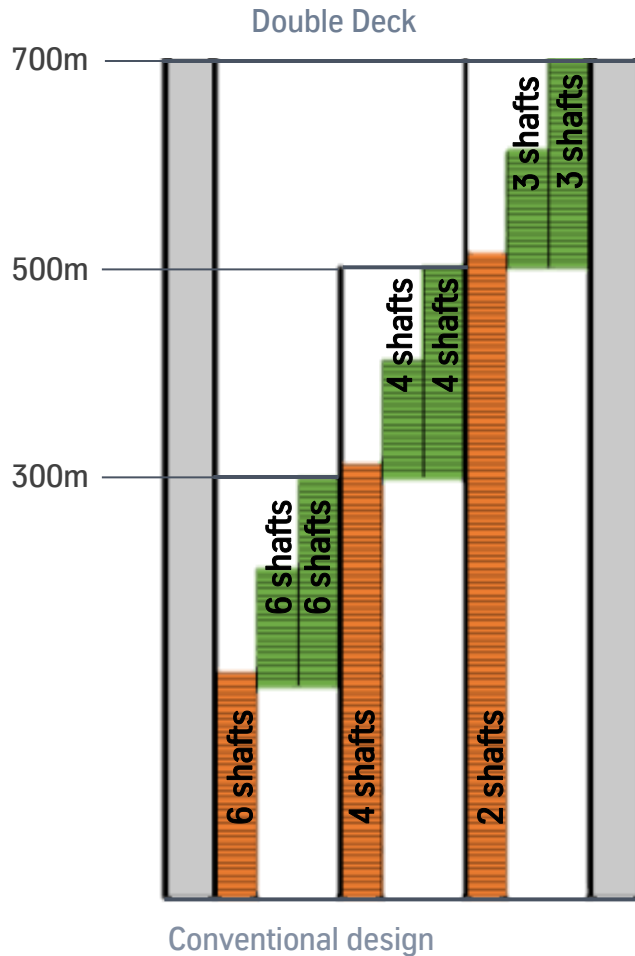
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High Rise from 500m+; actual in construction, proposed to market and in vision for the future

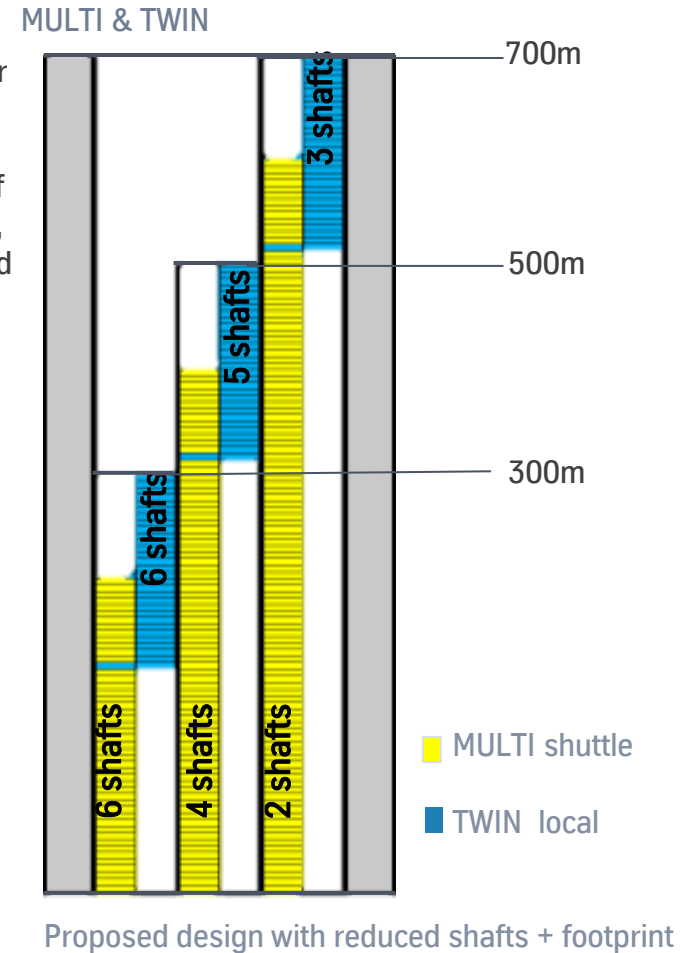


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Compare concepts with Multi-Cabin-Systems



This comparison is made for the shuttles and local elevators above the sky lobbies. The lower section of the tower is not considered, because MULTI is not applied



Example of a realistic project in Middle East

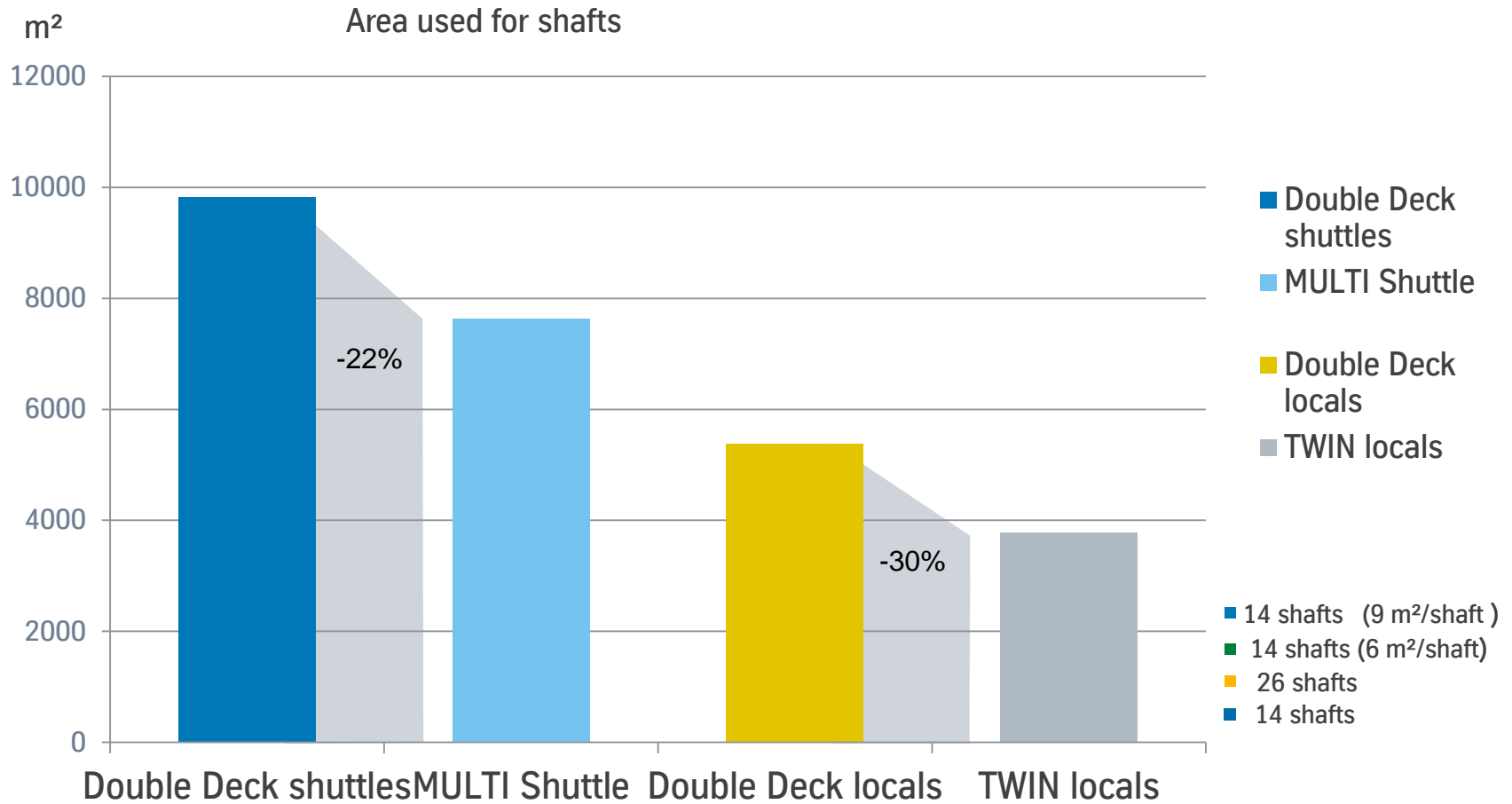
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Compare concepts with Multi-Cabin-Systems



Example of a realistic building project in Middle East

