

MTA Transit & Bus Committee

April 28, 2014

7 Line Extension Inclined Elevators

MTA Capital Construction



Inclined Elevators



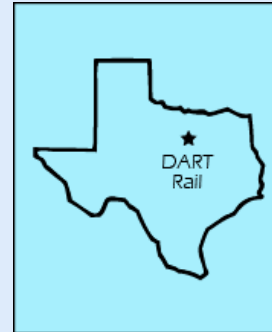
EUROPE



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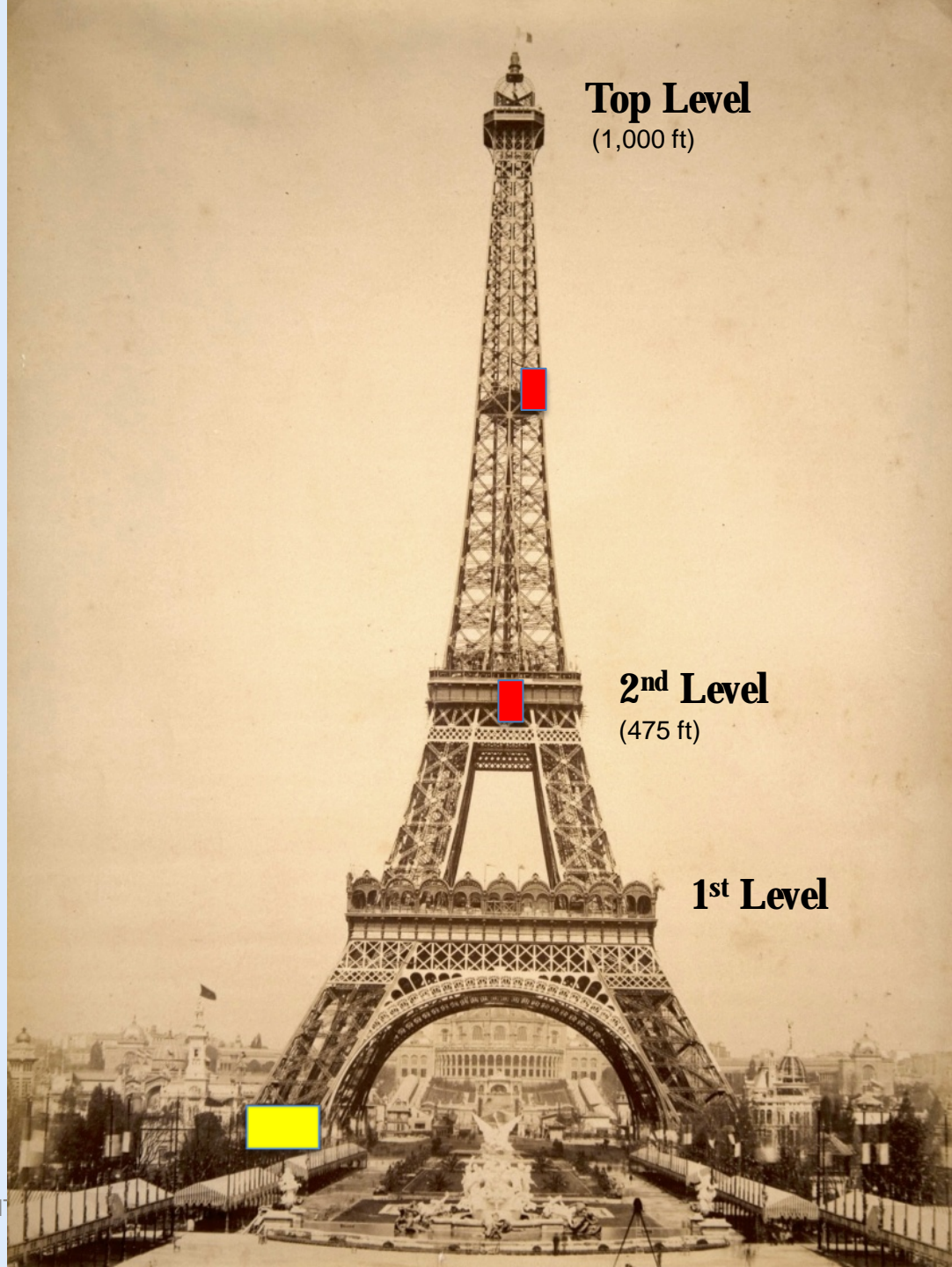
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Paris

Eiffel Tower Inclined Elevators

- 1889: The Eiffel Tower opened at the Paris Exhibition
- Gustave Eiffel commissioned the American Otis Elevator Company and two French firms to design elevators to bring visitors to the top of the tower



Eiffel Tower Inclined Elevators

- The original Otis inclined elevators operated until 1910
- The elevators performed well and were relatively quiet and fast for the technology of the time
- Cabs were glass double cars, traveling at 400 ft. per minute, and carried 40 seated passengers
- Pivoted floor-sections were leveled by the operator to compensate for the change in inclination
- The elevators worked on a system of cable pulleys powered by a hydraulic cylinder and water actuated pistons until 1986
- Various stages of modernization since 1900s have led to the use of high pressure, oil driven hydraulic motors to drive pistons

1899 - 1910



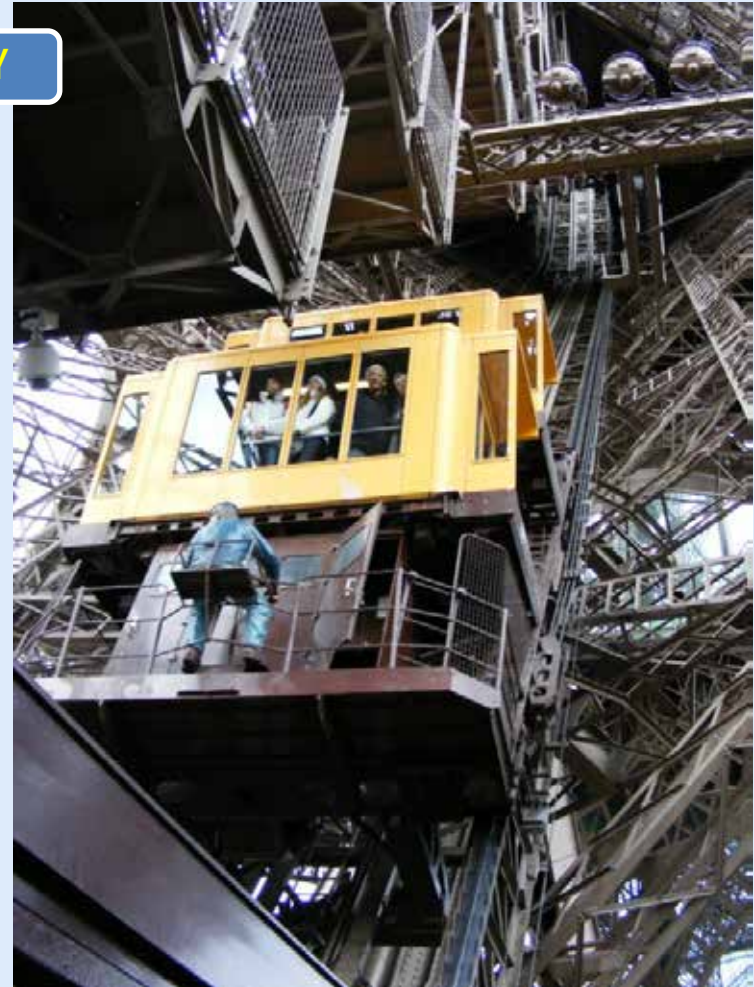
Figure 29.—Section through cabin of the Otis elevator. Note the pivoted floor-sections. As the car traveled, these floor-sections were leveled by the operator to compensate for the change of inclination; however, they were soon removed because they interfered with the loading and unloading of passengers. (From *La Nature*, May 4, 1889, vol. 17, p. 360.)

Vogel, Robert M., *Elevator Systems of the Eiffel Tower, 1889*. United States National Museum Bulletin 228, Washington, D.C.: Smithsonian Institution, 1961.

Eiffel Tower Inclined Elevators

- Since modernization in 1986, the images below depict the current inclined elevators in the Eiffel Tower
- Many technical components of the originally installed inclined elevators still function today
- Otis Duo-lifts travel 500 ft./min

PRESENT DAY



tion

Paris

Montmartre inclined Elevators

- 1900: Two inclined elevators were built to reach Montmartre, the mountaintop neighborhood of Paris
- The inclined elevators were entirely rebuilt in 1935 and 1991
- Today cabs feature panoramic glass tops offering breathtaking views of the Sacré-Coeur basilica
- The inclined elevators are operated by RATP, the Paris Transport Authority



Montmartre inclined Elevators

- Constructed by the Schindler Group
- Travel speed is 785 ft./min.
- Travel length is 350 ft. (elevation is 118 ft.), angle of elevation = 20 deg.
- The elevators are fully automated and work through a cable system



Montmartre inclined Elevators



Today's cabs can hold 60 passengers



Inclined Elevators



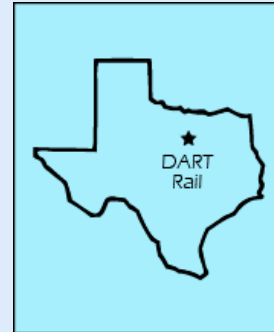
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Las Vegas

Luxor Hotel Inclined Elevators

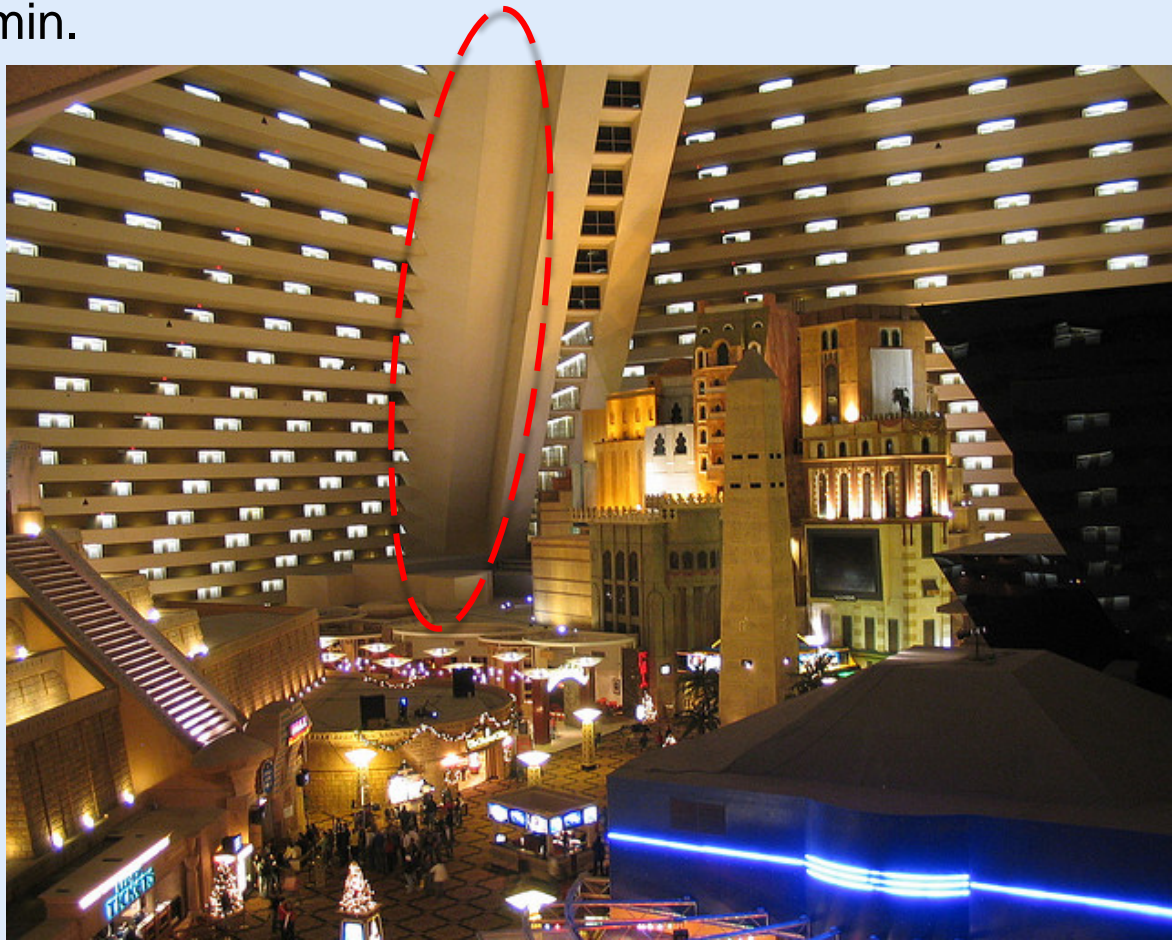
- 1993 - Present: Otis Elevator Company installed 16 high-speed inclined elevators in the pyramid-shaped Luxor Hotel that function on a cable system

Hotel stands
350 ft. high
(30 stories)



Luxor Hotel Inclined Elevators

- Each inclined edge of the pyramid contains a four-car elevator core – elevators travel at a 39 degree angle
- Only the elevators in 1 corner travel all the way to the top floor
- The other elevators travel to designated floors
- Travel speed is 700 ft. per min.
- Regular maintenance involves cab wheel replacement (cabs travel on incline rails)
- Emergency escape hatch located on the side rather than top



Luxor Hotel Inclined Elevators

- Capacity of the cabs is 3,500 lbs (approx. 14 people)
- There are no observation windows in the inclined elevator cabs
- A single door opens from the center



Inclined Elevators



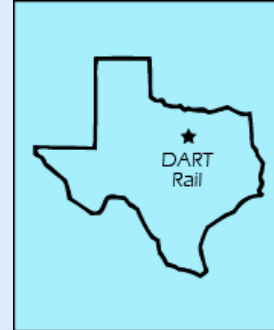
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Washington Metro (WMATA)

Huntington Station Inclined Elevator

- 1983: The Huntington Metro Station, located in Huntington, VA was opened by the Washington Metropolitan Area Transit Authority (WMATA)
- The station is built into a hillside and provides access to the south mezzanine via escalator and inclined elevator



Washington Metro (WMATA)

Huntington Station Inclined Elevator

- The inclined elevator manufacturer is Mid-American Elevator, Chicago
- Distance traveled is approx. 115 ft. (rise is 57 ft.)
- Angle of elevation = 30 deg.
- Reliability is good per operating department
- Maintenance performed in-house by WMATA
- Speed is approx. 75 ft./min.



Washington Metro (WMATA)

Huntington Station Inclined Elevator

- Capacity of the cab is 2500 lbs. (approx. 10 people)
- Cabs feature two sets of doors – for entry and exit
- ADA Compliant



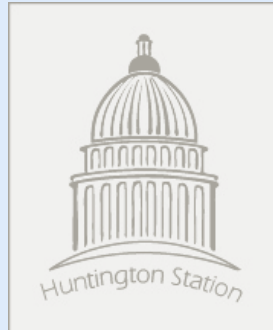
Inclined Elevators



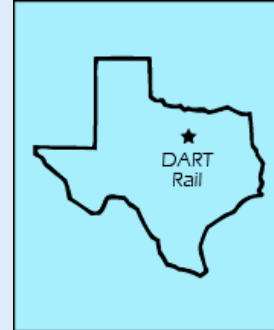
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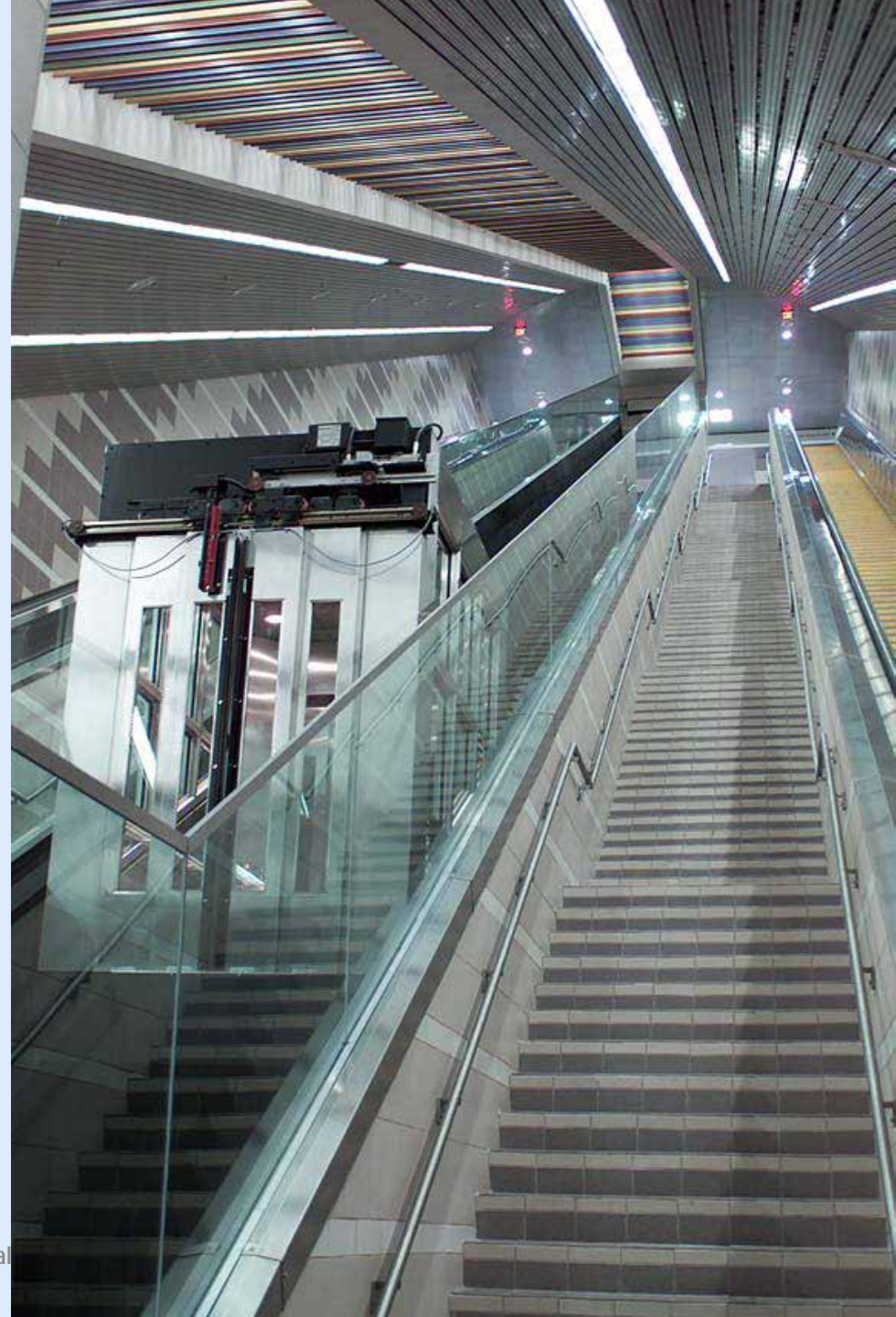
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Dallas (DART)

Cityplace/Uptown Station Inclined Elevators

- The station was completed in 2000 and features two inclined elevators designed and installed by Mid-American Elevator, Chicago
- Passengers descend 10 stories below ground level via stairs, three pairs of escalators, or by riding 135 ft. inside the windowed inclined elevator
- Travel speed is approx. 100 ft./min
- Maintenance is contracted out
- Some door problems have been identified



Dallas (DART)

Cityplace/Uptown Station Inclined Elevators

- The inclined elevator cabs are ADA compliant and feature two doors - for entering and exiting
- 16 people fit comfortably in a cab



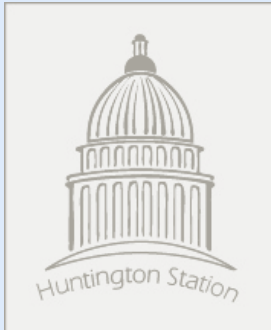
Inclined Elevators



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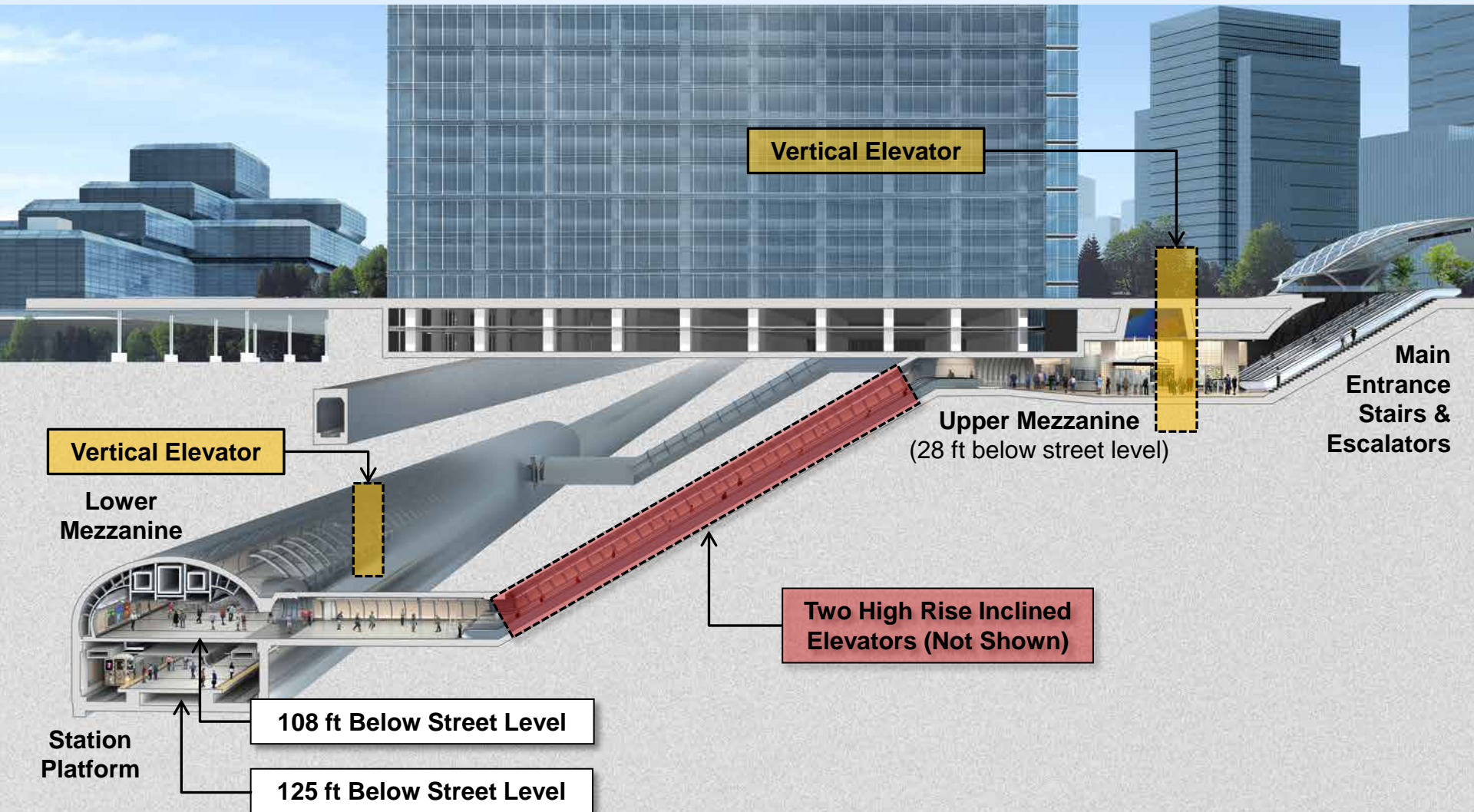
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7 Line Extension

New 34TH Street Hudson Yards Station

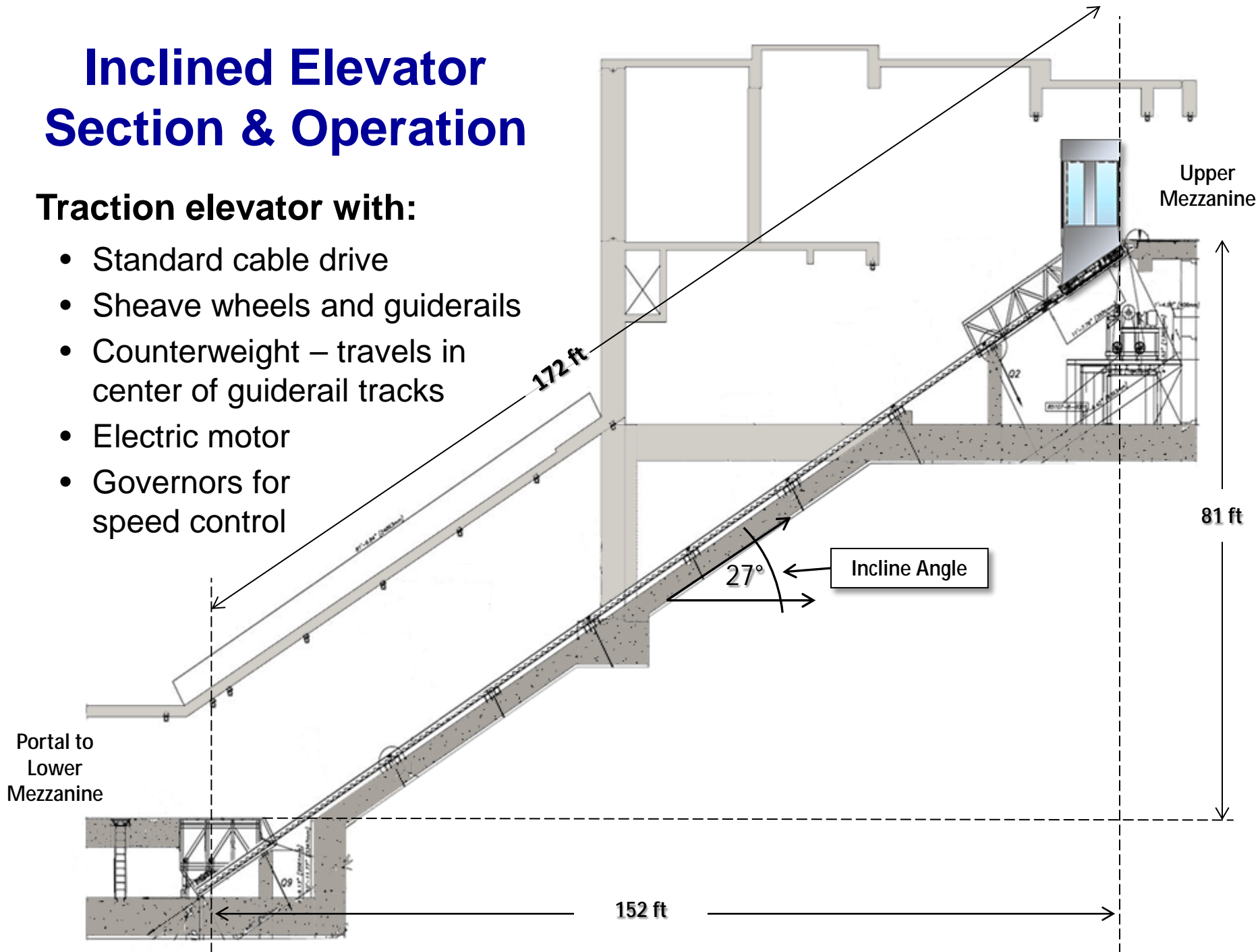
Sectional Perspective of Inclined Tunnel



Inclined Elevator Section & Operation

Traction elevator with:

- Standard cable drive
- Sheave wheels and guiderails
- Counterweight – travels in center of guiderail tracks
- Electric motor
- Governors for speed control



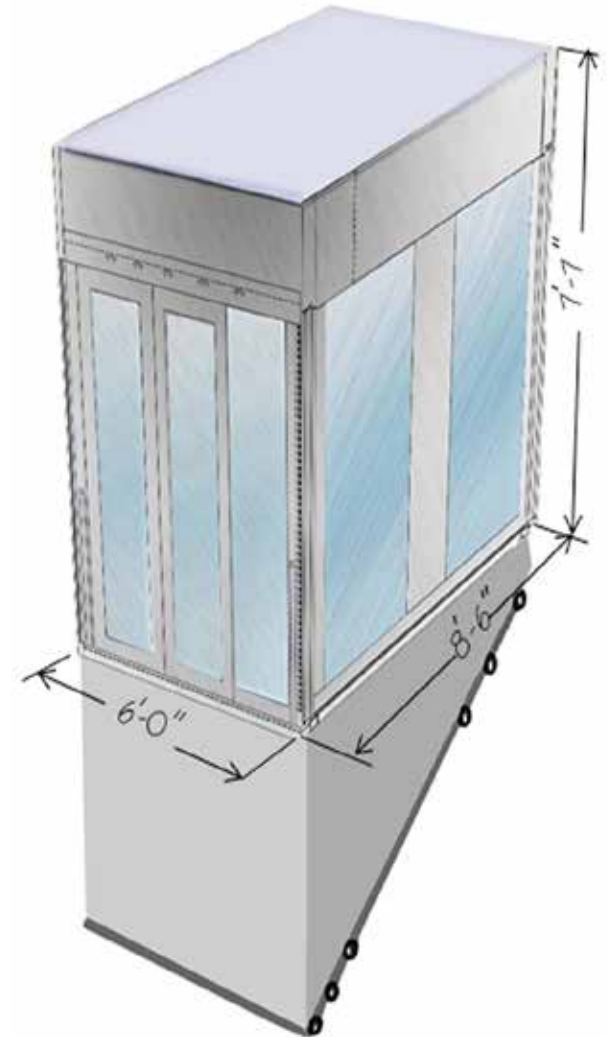
Operational Characteristics

Elevator Weight Capacity:	5,000 lbs. per cab
Occupant Capacity:	Approximately 15 standing or 5 wheelchair-bound persons
Speed:	100 feet per minute.
Estimated Travel Time:	Approximately 2 minutes, from door close to door open.
Elevator Doors:	<ul style="list-style-type: none">- Doors located on opposite ends of cab- Dwell time: 5 seconds



Inclined Elevator Cabs

Exterior Cab Dimensions:	6'-0" X 8'-6" X 7'-7"
Interior Cab Dimensions:	5'-3" X 7'-6" X 7'-5" (clear headroom)
Cab Material:	Almost completely clear laminate tempered glass and Type 316 stainless steel trim, with a brush satin finish
Manufacturer:	Maspero Elevatori (Fabricator/Supplier) Appiano Gentile Como, Italy
Installer:	Kone Inc. Coal Valley, Illinois
Cost:	\$2.7 Million – fabrication and installation. (For both Inclined Elevators only.)





Inclined Elevator During Manufacturing

Inclined Elevator During Manufacturing





Inclined Elevator Cab

- Clamped to guiderails with roller wheels
- Elevator Cab platform remains horizontal to incline
- Pushbutton control panel

Fail Safe Operation

In case of a power failure elevators will:

- Run on battery back-up power
- Be capable of traveling the inclined length two times to allow for passenger evacuation

Each elevator cab is equipped with:

- Emergency alert button
- In-cab telephone



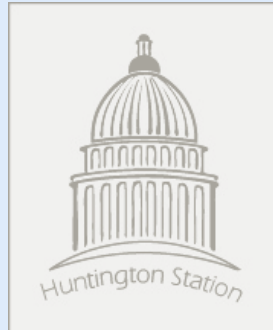
Inclined Elevators



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Thank You

