MTA Transit & Bus Committee

April 28, 2014

7 Line Extension
Inclined Elevators

MTA Capital Construction
Inclined Elevators

EUROPE  VEGAS  D.C.  DALLAS  NYC
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 lead to the use of high pressure, oil driven hydraulic motors to drive pistons

Source: http://www.uh.edu/engines/epi320.htm
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.
Paris

Montmartre inclined Elevators

• 1900: Two inclined elevators were built to reach Monmartre, 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

- EUROPE
- VEGAS
- D.C.
- DALLAS
- NYC
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

Source: The Vertical Transportation Handbook
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

EUROPE  VEGAS  D.C.  DALLAS  NYC
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
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
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

EUROPE  VEGAS  D.C.  DALLAS  NYC
7 Line Extension
New 34th Street Hudson Yards Station
Sectional Perspective of Inclined Tunnel

- Vertical Elevator
- Upper Mezzanine (28 ft below street level)
- Two High Rise Inclined Elevators (Not Shown)
- Lower Mezzanine
- Station Platform
- 108 ft Below Street Level
- 125 ft Below Street Level
- Main Entrance Stairs & Escalators
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

Incline Angle: 27°
### 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:**
- 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

Thank You