# AEROTRAIN - DULLES AIRPORT TRAIN SYSTEM

When Washington Dulles International Airport's automated airport train system – AeroTrain – goes into service, airline passengers will have a convenient and comfortable train system to transport them between the Main Terminal and Midfield Concourses. It will handle more riders and move more efficiently than the current Mobile Lounges.

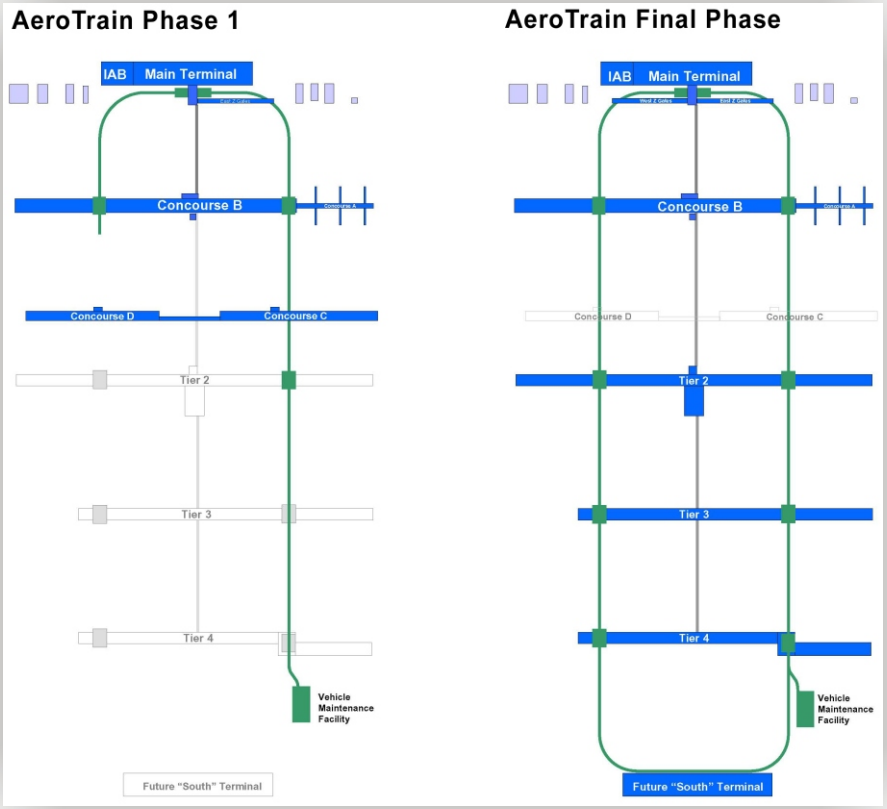
The Metropolitan Washington Airports Authority contracted with Sumitomo Corporation of America who, working with Mitsubishi Heavy Industries, designed, engineered, constructed, and delivered the rubber tire trains to Dulles. When AeroTrain begins service, they will also operate and maintain the system for five years.


The AeroTrain system is similar to other Mitsubishi systems currently operating in Hong Kong, Singapore, Tokyo, Yokohama, Hiroshima, Kobe, and other locations.

**Phase One**

The AeroTrain system will replace most of the Mobile Lounges currently transporting passengers between the Terminal and Midfield Concourses.

The first phase of the project includes a train station at the Main Terminal and tunnels that will connect the Terminal to the east and west ends of Concourse B. This phase also includes construction of a train station at the site of a future permanent Midfield Concourse that will be built when future demand requires. In the interim, passengers will enter Concourses C/D through a connecting passenger tunnel equipped with moving walkways.




The Main Terminal Train Station will be reached through two new spacious, subsurface security screening areas. Once beyond security, passengers may continue to the Z-Gates located at the Terminal, use the passenger walkway to Concourses A and B, or board AeroTrain to the Midfield Concourses. The stations in the Concourses are located at convenient points to minimize walking distances to airline gates.

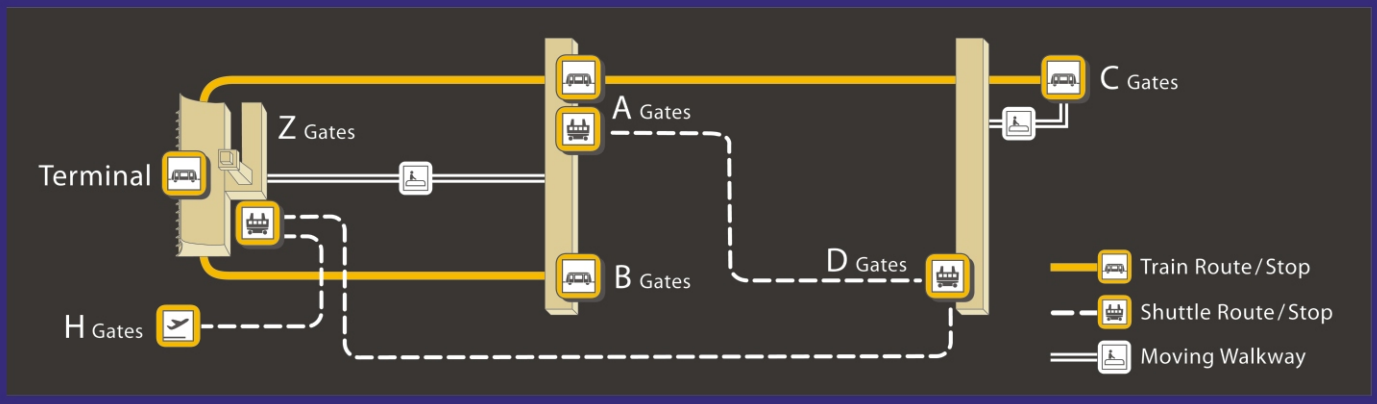
**The Final Layout**

The Master Plan for Washington Dulles International Airport envisions a future that consists of the existing Main Terminal (located at the north end of the airport) and a new "South" Terminal, with four permanent midfield concourses in between. The AeroTrain system will develop concurrently with each new facility until it finally joins into one continuous "loop."

# AEROTRAIN - DULLES AIRPORT TRAIN SYSTEM

AeroTrain
WASHINGTON DULLES INTERNATIONAL AIRPORT TRAIN SYSTEM

## Airport Transit Map




| PROJECT SCHEDULE | |
|---|---|
| Construction Start -Tunnel | October 2002 |
| Notice to Proceed - System | March 2003 |
| First Vehicle Delivery | April 2007<br>4 Vehicles |
| **VEHICLE DATA** | |
| Model of Vehicle | Crystal Mover |
| Vehicle Fleet | 29 |
| Brakes | Electric Command |
| Train Consist | 3-Car Trains (Initial )<br>4-Car Trains (Maximum) |
| Maintenance & Recovery Vehicle | 1 |
| Vehicle Size | 8'9'' wide x 40'5/16" long |
| Door Openings | 78" high and 72" wide |
| Vehicle Weight (empty) | 38,493 pounds |
| Vehicle Build | Mihara Japan |
| Number of Seats | 8 |
| Number of Passengers | 72 |
| Tires | Inflatable Rubber with inner safety wheel |
| Vehicle Material | Aluminum Alloy, Welded |
| **MAJOR SUBSYSTEMS** | |
| Signaling | Radio Based, Fixed Block |
| Power Supply | 750 Vdc rail power |
| Power Consumption | 11,547 Mega Watts per year |
| Power Collection | Guideway -Mounted Power Rail |
| Traction Power Substation | 3 |
| Communications | Public Address System, Train Radio,<br>CCTV, Dynamic Signs, Phone System |
| Head Way | 2 minutes (Peak)<br>4 minutes (Off Peak ) |
| Guidance | Side Guide Beam |

| SYSTEM DESCRIPTION | |
|---|---|
| System Provider | Mitsubishi Heavy Industries |
| Maintenance Building Location | Off – Service Line |
| Number of tracks | 2 |
| System Operation | 1 Pinched Loop (Operation) , Dual Loop (final) |
| Train Control | Fully Automated |
| Peak Hour Capacity (PPHPD) | 6,755 passengers per hour per direction (Operation)<br>9,007 passengers (final) |
| Maximum Grade | 2.6% |
| Top Speed | 43.5 miles per hour (Auto Operation)<br>5 miles per hour (Manual Operation) |
| Round Trip Time | 806 seconds |
| Airside System | 100% |
| Underground Guideway Length | 3.78 miles |
| System Life | 25 Years |
| **FIXED FACILITIES** | |
| Switches | 30 |
| Number of Stations | Dual Side-Center Platform<br>4 (Phase 1), 10 (Final) |
| Number of Station Doors | 32 |
| Average Station Spacing | 1970 feet |
| Platform Length | 400 ft. Main Terminal<br>170 ft. other stations |
| Station Features | Elevator & Escalator |
| Maintenance Building Size | 67,553 square feet |
| Yard Operation | Automated |
| Maintenance Building Storage | 24 Vehicles |
| Maintenance Yard Storage | 20 Vehicles |
| Car Wash | 1 Automated |
| **CONTRACT TERM** | |
| 5 years | |

# MAIN TERMINAL TRAIN STATION

The Main Terminal AeroTrain Station construction site was excavated to approximately 60 feet below ground, directly adjacent to the Main Terminal on the airfield side of the Terminal, and spans its entire length (approximately 1,600 feet) from west to east.

It has four distinct levels: Departures (49,600 square feet), Arrivals (49,600 square feet), Security Mezzanine (121,700 square feet), and the Train Platform (54,500 square feet).

The Security Mezzanine provides critical floor space for a new, expanded passenger security screening function that will provide for more efficient passenger screening and alleviate congestion on the Main Terminal Ticketing Level. Passengers with boarding passes, who do not need to check luggage, will be able to proceed directly to the Security Mezzanine.

The Train Platform has a side-center-side arrangement that will allow departing passengers to enter the train from the center platform after arriving passengers, bound for baggage claim, exit the train onto the side platforms and proceed up to the ground floor (Bag Claim Level) of the Terminal.

The Terminal Station is a bright and airy space. Skylights at roof level allow natural light to filter all the way down to the train platforms and will be supplemented by artificial light designed to play off the glass forms and stainless steel surfaces of the station.

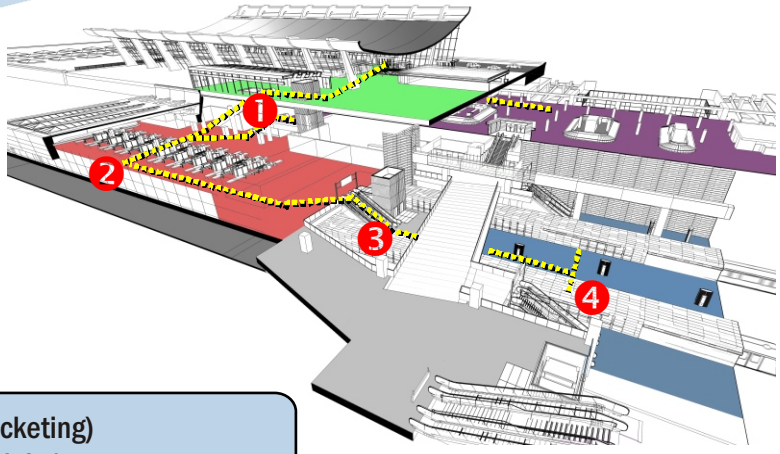
## MAIN TERMINAL TRAIN STATION FACTS:

| | |
|---|---|
| Notice to Proceed: | October 2002 |
| Forecast Completion: | July 2009 |
| Contractors | |
| Design: | Skidmore, Owings and Merrill |
| Construction: | Turner Construction Company |
| Schedule: | 7 years/5 milestones |
| Labor: | Up to 300 people per day (two shifts)<br>estimated 3.8 million manhours at completion |
| Number of Subcontractors: | 75 |
| Four Levels: | |
| Departures (Ticketing) Level: | 49,600 sf |
| Arrivals (Baggage Claim) Level: | 49,600 sf |
| Security Mezzanine Level: | 121,700 sf |
| AeroTrain Platform: | 54,500 sf |
| Total Building Square Footage: | 275,400 sf |
| Total TSA Security Checkpoints: | 26-34 (depending on final TSA configuration) |
| Elevators: | 20 |
| Escalators: | 36 |
| Stairwells: | 23 public |
| MUFIDS: | 16 |
| Mobile Lounge Docks: | 20 |

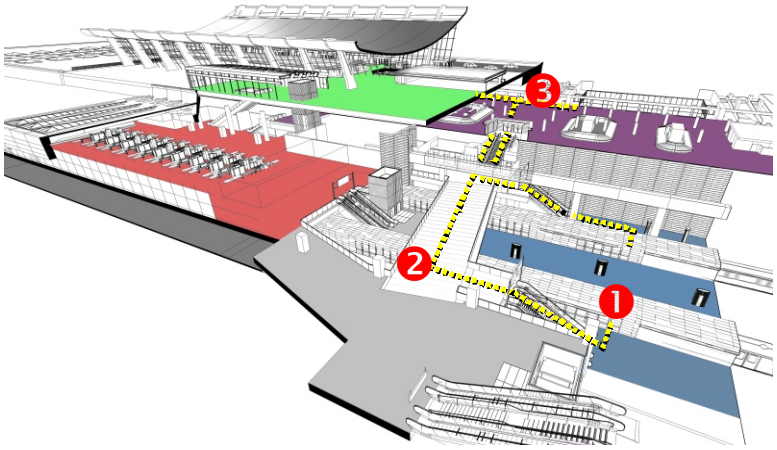
# MAIN TERMINAL TRAIN STATION

***Departing Passengers :***

❶ **From ticketing and bag claim levels, descend to security mezzanine**
❷ **Go through TSA Screening**
❸ **Descend to train platform**
❹ **Board AeroTrain**




**Departures Level** (Ticketing)
**Arrivals Level** (Bag Claim)
**Security Level** - 121,700 square feet of new TSA screening space
**Train Platform** - 40 feet below ground, 54,500 square feet




***Arriving Passengers :***

❶ **Arrive on AeroTrain**
❷ **Ascend to platform bridge**
❸ **Ascend to baggage claim area**

**MAIN TERMINAL TRAIN STATION FACTS (continued)**

| | |
|---|---|
| Excavation: | 220,000 cy |
| Backfill: | 24,000 cy |
| Rebar: | 5,300 tons |
| Concrete: | 47,000 cy |
| Terrazzo Floor: | 186,000 sf |
| Pre-Cast Wall Panels: | 600 each/36,000 sf |
| Skylights: | 140 |
| Train Tube Glass pieces: | 765 each/25,200 sf |
| Curtainwall/Clerestory: | 11,000 sf |
| Plinths: | 4,800 lf |
| Power Rails: | 2,400 lf |
| Guiderails: | 5,000 lf |
| Switches: | 4 |
| Air Conditioning Load: | 1,425 tons |
| Heating Load: | 7,760 MBTU's |
| Substation Size: | 2 substations @ 3,300 kw each |
| Kingpost Truss Span: | 105 ft |
| Cable Size: | 2 ½ in diameter (minimum breaking strength of 432 tons each) |
| Cable Load: | 250 kps |
| Micropiles: | 164 permanent (plus 30 temporary) |
| Support of Excavation: | 123,000 sf |

# TIER 1/CONCOURSE B WEST TRAIN STATION

The Tier 1 East and West Train Stations will serve Concourses A and B.

The Tier 1 West Station was constructed under the same contract as the 15-Gate Addition to Concourse B, that opened in January 2008. Passengers arriving at the Concourse B West Station will exit onto side platforms, while other passengers depart the Station via the center platform.

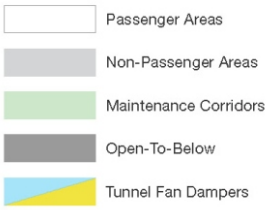
The materials in the station are the same neutral color palette as Concourse B, but with more texture, translucency and depth. Major finishes include terrazzo flooring, exposed aggregate concrete columns, porcelain enamel and ceramic tile for walls and fascia, stainless steel panels, aluminum for wall and base details, and transparent and translucent glass for the train enclosure walls to allow passengers to view trains as they pass through the station.

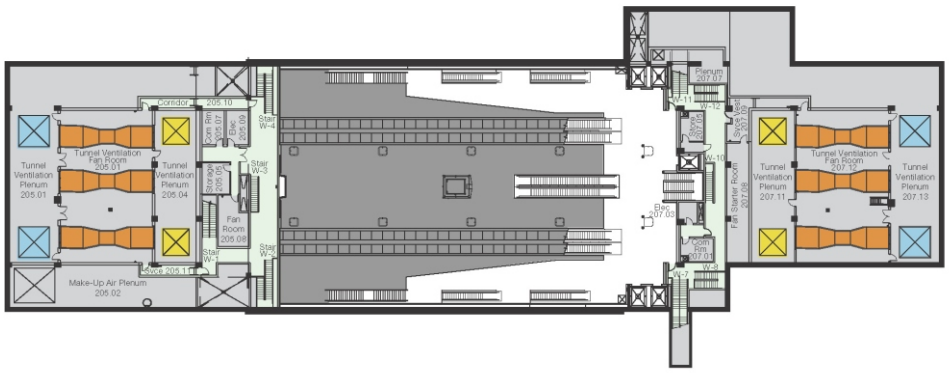
## TIER ONE WEST/CONCOURSE B TRAIN STATION FACTS:

| | |
|---|---|
| Notice to Proceed: | September 2005 |
| Forecast Completion: | October 2008 |
| Contractors | |
| Design: | Hellmuth, Obata + Kassabaum |
| Construction: | Balfour Beatty Construction |
| Schedule: | 3 years/9 milestones |
| Total Manhours: | 1,250,066 |
| Number of 1st Tier Subcontractors: | 60 |
| Total Subcontractors and Suppliers: | 260 |
| | |
| Five Levels: | |
| Club: | 14,060 sf |
| Concourse: | 32,385 sf |
| Apron: | 25,489 sf |
| Mezzanine: | 35,375 sf |
| Platform: | 42,290 sf |
| Total Building Square Footage: | 152,599 sf |
| Space Allocations: | |
| Concessions: | 15,000 sf |
| Concessions Support: | 2,000 sf |
| Tenant: | 2,200 sf |
| Elevators: | 12 |
| Escalators: | 10 |
| Stairwells: | 18 |
| MUFIDS: | 2 banks - 12 monitors/ bank located in existing Concourse |
| | |
| Excavation: | Excavated under previous contract |
| Structural Steel: | 1,000 tons |
| Rebar: | 180 tons |
| Concrete: | 19,800 cy |
| Terrazzo Floor | 36,500 sf |
| Curtainwall/Clerestory: | 7,500 sf |
| Plinths: | 2,050 lf |
| Power Rails: | 1,025 lf |
| Switches: | 2 |
| Electrical Service: | Substation #7 with dual 15kv feeders, 750 kW Emeregency |

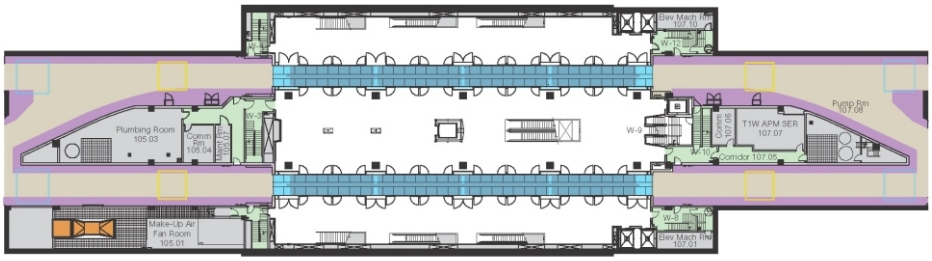
# TIER 1/CONCOURSE B WEST TRAIN STATION

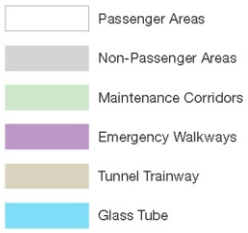
## MEZZANINE LEVEL




## PLATFORM LEVEL




## APRON LEVEL

# TIER 1/CONCOURSE A/B EAST TRAIN STATION

The East Station is located beneath the east end of Concourse B. Initially, due to site constraints, the Concourse A/B East Station will operate in a center platform configuration. Passengers will arrive at and leave the Station from a single platform. It will eventually be expanded into a side/center/side configuration.

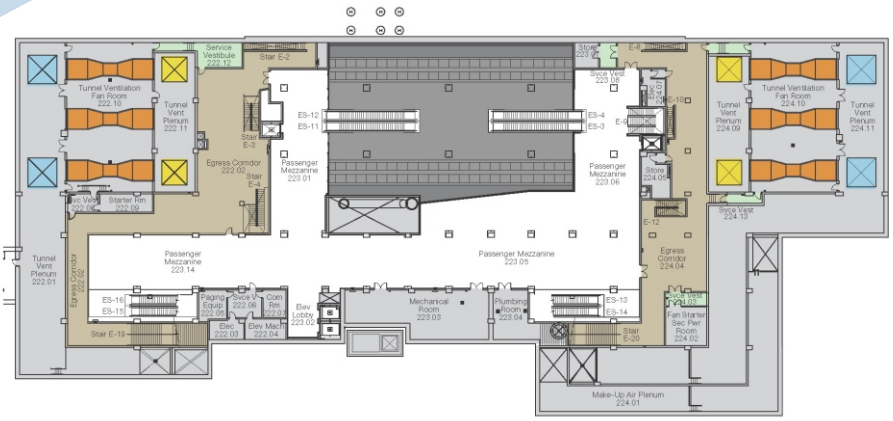
The East Station atrium center has been designed as a destination space emphasized by high ceilings, clerestories, and natural light. Finishes have been selected to coordinate and expand upon the finishes in the existing Concourse B. The color palette retains the existing whites, grays, and silvers, while adding new materials, including exposed aggregate concrete columns, porcelain enamel panels on the walls, terrazzo flooring, and a transparent glass train enclosure to allow passengers to view trains from the center platform as they pass through the station.

## TIER 1 EAST/CONCOURSE A/B TRAIN STATION FACTS:

| | |
|---|---|
| Notice to Proceed: | October 2004 |
| Forecast Completion: | June 2009 |
| Contractors | |
| Design: | Hellmuth, Obata + Kassabaum |
| Construction: | Clark Construction Group |
| Schedule: | 3.5 years/25 milestones |
| | |
| Total Manhours: | 2,462,561 |
| Number Subcontractors and Suppliers: | 70 |
| | |
| Four Levels: | |
| Concourse: | 7,218 sf |
| Apron: | 11,485 sf |
| Mezzanine: | 57,223 sf |
| Platform: | 42,582 sf |
| Total Building Square Footage: | 118,508 sf |
| Elevators: | 4 |
| Escalators: | 8 |
| Stairwells: | 8 |
| MUFIDS: | 1 bank - 12 monitors/bank located in existing Concourse |
| | |
| Excavation: | 103,000 cy |
| Structural Steel: | 5,400 cy |
| Rebar: | 2,550,000 lbs |
| Concrete: | 17,000 cy |
| Terrazzo Floor: | 25,000 sf |
| Plinths: | 1,700 lf |
| Power Rails: | 850 lf |
| Switches: | 2 |
| Air Conditioning Load: | 620 tons |
| Heating Load: | 5,000 MBTUH |
| Substation Size: | 2500KVA |
| Support of Excavation: | Bolts, Shotcrete and wire mesh, 50,400 sf |

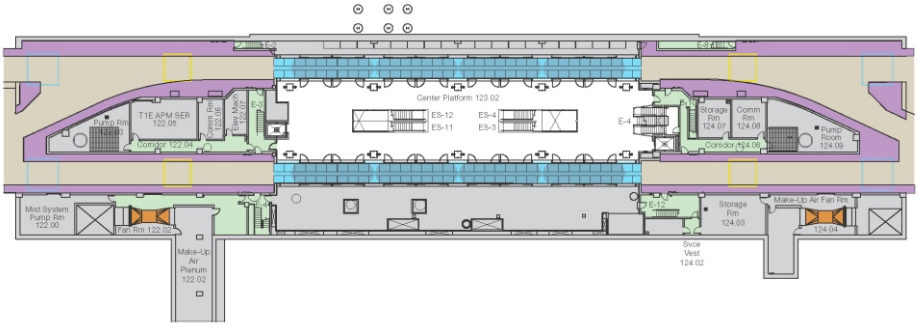
# TIER 1/CONCOURSE A/B EAST TRAIN STATION

## MEZZANINE LEVEL




- Passenger Areas
- Non-Passenger Areas
- Maintenance Corridors
- Open-To-Below
- Egress Corridor
- Tunnel Fan Dampers

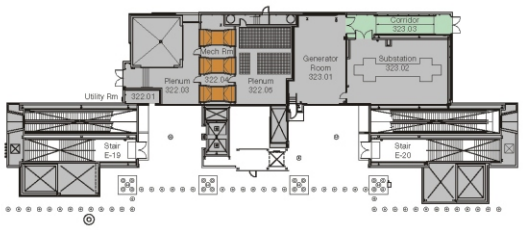
## PLATFORM LEVEL

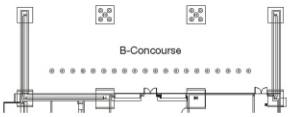



- Passenger Areas
- Non-Passenger Areas
- Maintenance Corridors
- Emergency Walkways
- Tunnel Trainway
- Glass Tube

- Passenger Areas
- Non-Passenger Areas
- Maintenance Corridors

## APRON LEVEL



# TIER 2/CONCOURSE C EAST TRAIN STATION

The Concourse C East Station is being built under the location for a future permanent midfield concourse.

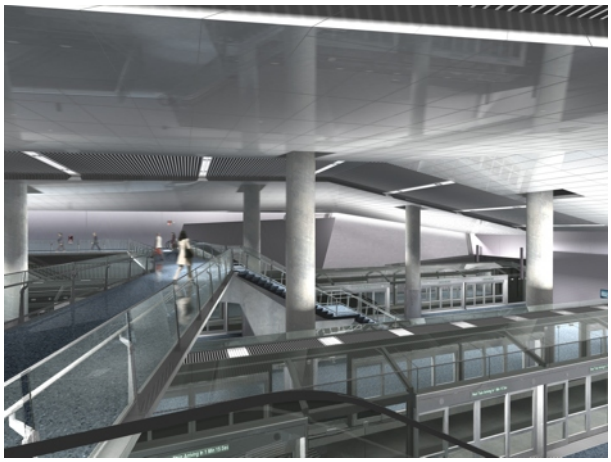
The platform has a side/center/side configuration. In the near term, the Concourse C East Station will serve existing Concourse C passengers via a temporary pedestrian connector tunnel equipped with moving walkways. In the long term, this Station will serve the eastern half of a future 44-gate, domestic and international Midfield Concourse.

The interior finishes for the station include metallic tile walls, inclined stainless steel panel ceilings, with wood and stainless steel accents. Both direct and indirect lighting will illuminate the facility.

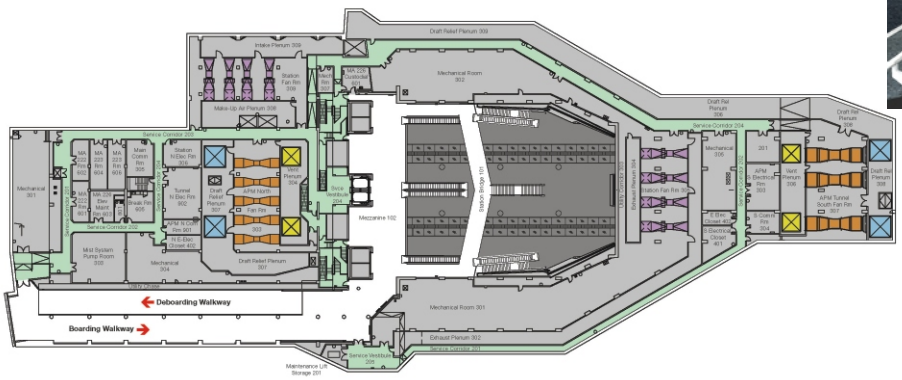
## TIER 2 EAST/CONCOURSE C TRAIN STATION FACTS:

| | |
|---|---|
| Notice to Proceed: | March 2005 |
| Forecast Completion: | May 2008 |
| Contractors | |
| Design: | Kone Pederson Fox Associates |
| Construction: | Facchina Construction Company |
| Schedule: | 39 months/13 milestones |
| | Substantial completion on schedule |
| Total Manhours: | Up to 180 people per day |
| Total On-Site Subcontractors: | 25 total |
| | |
| Five Levels: | |
| Tier 2 Concourse Apron Level: | |
| Tier 2 Concourse Basement Level: | |
| Station Mezzanine Level: | |
| Sation Platform Level: | |
| Track/Pump Room Level | |
| Total Building Square Footage: | 234,215 sf |
| Elevators: | 2 plus 4 future |
| Escalators: | 6 |
| Stairwells: | 2 dual exit stairwells configured to serve all 3 platforms and mezzanine |
| MUFIDS: | None in station, provided inside Concourse C portal |
| | |
| Excavation: | 254,000 cy |
| Backfill: | 65,000 cy |
| Rebar: | 4,200 tons |
| Concrete: | 34,470 cy |
| Concrete Formwork: | 770,000 cy |
| Terrazzo Floor: | 20,000 sf |
| Curtainwall/Clerestory: | 740 sf |
| Plinths: | 1,925 lf |
| Power Rails | 1,000 lf approx. |
| Guiderails: | 1,900 lf approx. |
| Switches: | 4 |
| Heating Load: | 2,700 MBTU's |
| Air Conditioning Load: | 400 tons |
| Substation Size: | Dual 2,500 KVA |
| Support of Excavation: | 13,000 sy |
| Asphalt Pavement: | 38,150 sy (including Bypass Taxilanes) |
| Concrete Pavement: | 30,305 sy (including Bypass Taxilanes) |

# TIER 2/CONCOURSE C EAST TRAIN STATION



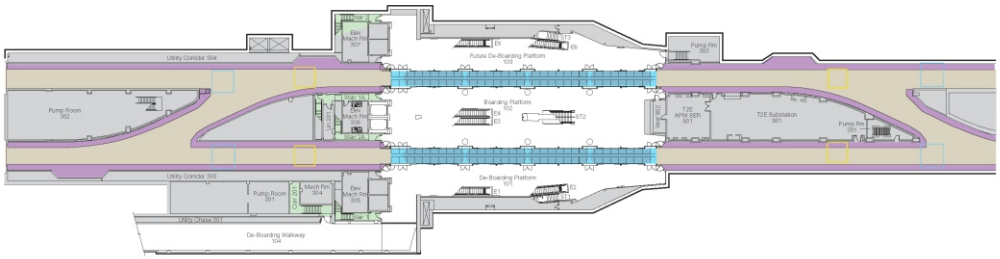
## MEZZANINE LEVEL



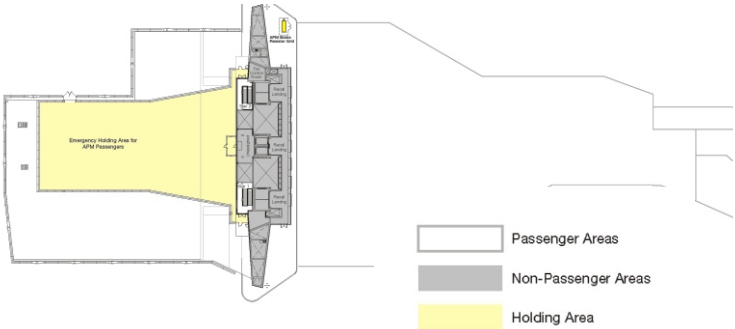

- Passenger Areas
- Non-Passenger Areas
- Maintenance Corridors
- Open-To-Below
- Tunnel Fan Dampers

## PLATFORM LEVEL

- Passenger Areas
- Non-Passenger Areas
- Maintenance Corridors
- Emergency Walkways
- Tunnel Trainway
- Glass Tube

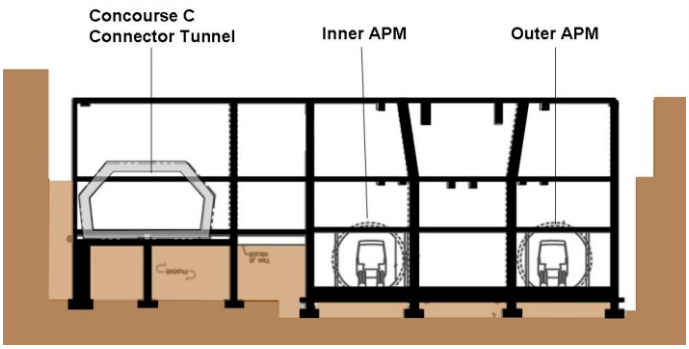


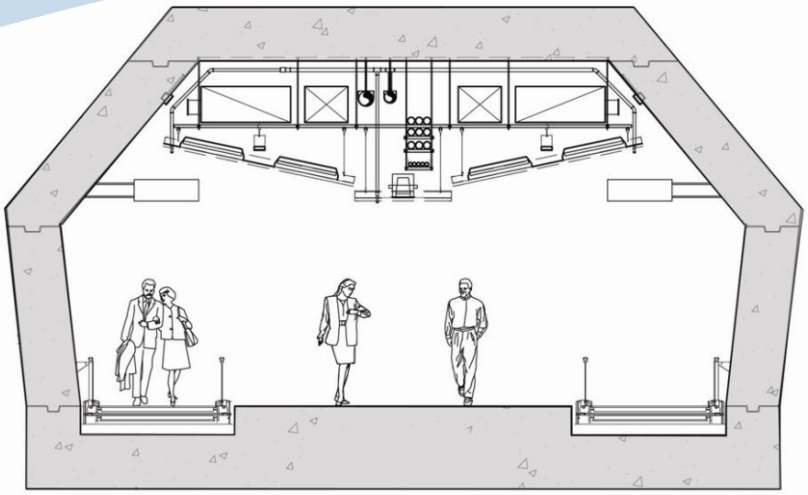
## APRON LEVEL




- Passenger Areas
- Non-Passenger Areas
- Holding Area

# TIER 2/CONCOURSE C CONNECTOR TUNNEL



## TIER 2 EAST/CONCOURSE C CONNECTOR TUNNEL FACTS:

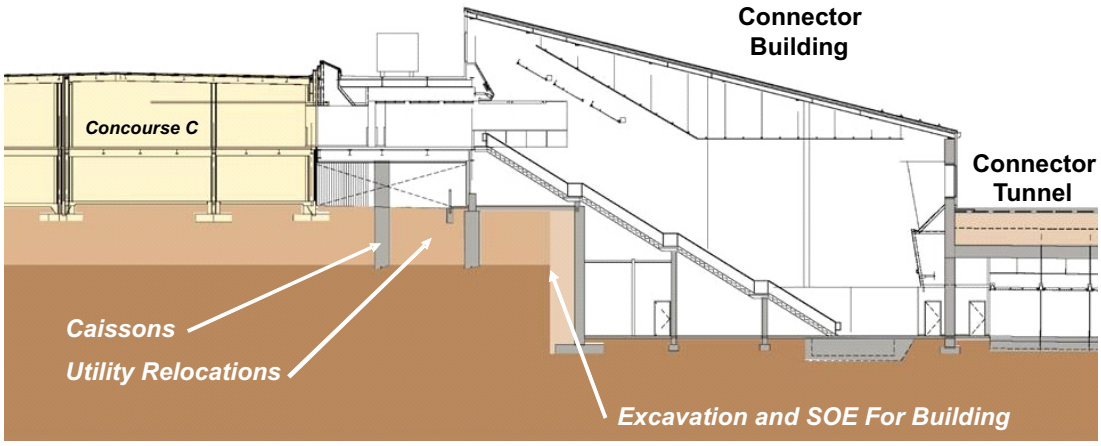
| | |
|---|---|
| Notice to Proceed: | November 5, 2007 |
| Forecast Completion: | May 2009 |
| Contractors | |
| Design: | Kone Pederson Fox Associates |
| Construction: | Clark Construction Group |
| Schedule: | 19 months/multiple phases and milestones |
| | Substantial completion on schedule |

Three Levels:
- Tunnel Level (approx. Station Mezzanine Level)
- Apron Level at Concourse C
- Concourse Level at Concourse C

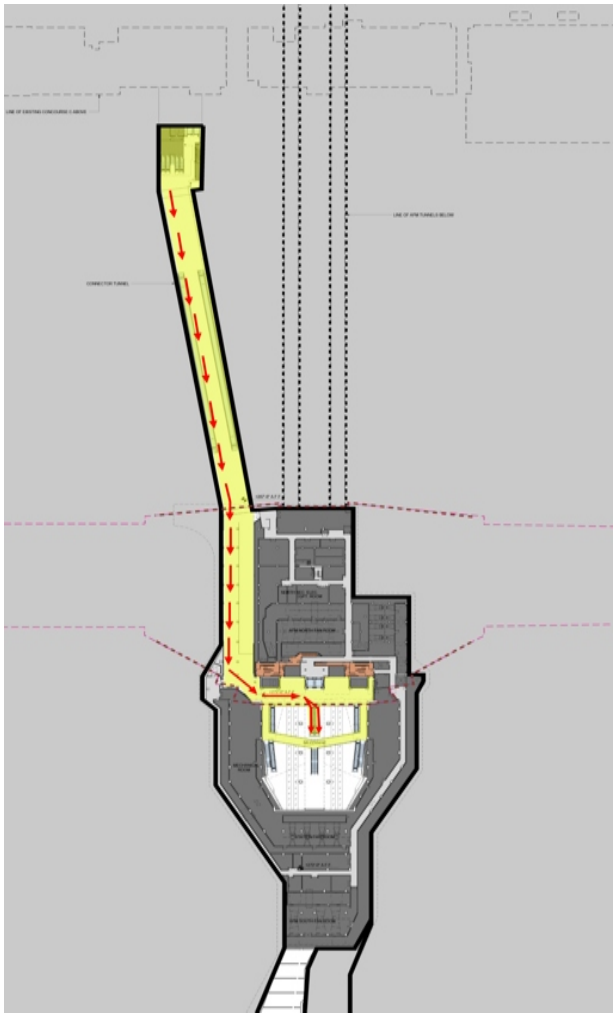
| | |
|---|---|
| Total Connector Building and Tunnel: | 25,740 sf |
| Tunnel Inside Dimensions: | 30 ft wide x 450 ft long |
| Elevators: | 2 |
| Escalators: | 4 |
| Stairwells: | 3 - 2 New in Connector Building, 1 existing in Station |
| MUFIDS: | Provided just inside Concourse C portal |
| Mobile Lounge Docks: | None. Existing C docks will be closed when APM begins service. |
| Moving Walkways: | 2/250 ft long |
| Walk from Center Platform to Concourse C: | 3-5 minutes |

| | |
|---|---|
| Excavation: | 30,000 cy |
| Rebar: | 630 tons |
| Concrete Formwork: | 100,000 cy |
| Cast-in-Place Concrete: | 6,800 cy |
| Concrete Pavement Replacement: | 5,000 sy |
| Structural Steel : | 52 tons |
| Air Conditioning Load: | 610 tons |
| Heating Load: | 1,300 mbh |
| Substation Size: | Powered from Concourse C and Tier 2 Station |

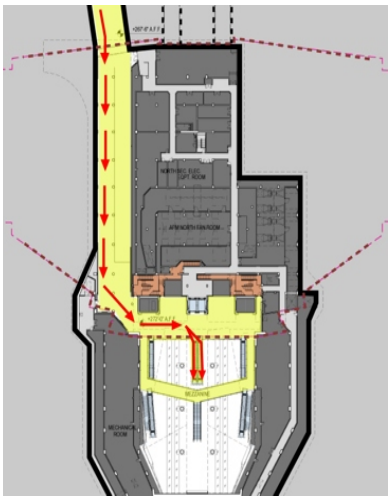
# TIER 2/CONCOURSE C CONNECTOR TUNNEL



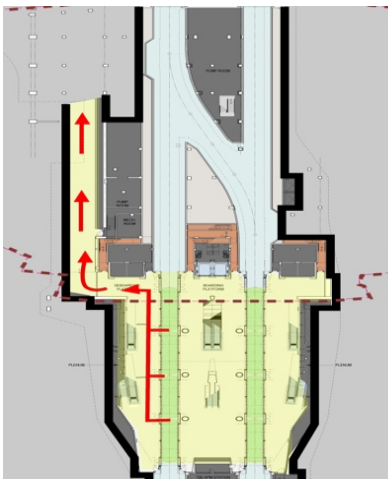

## MEZZANINE LEVEL W/CONNECTOR



## MEZZANINE LEVEL



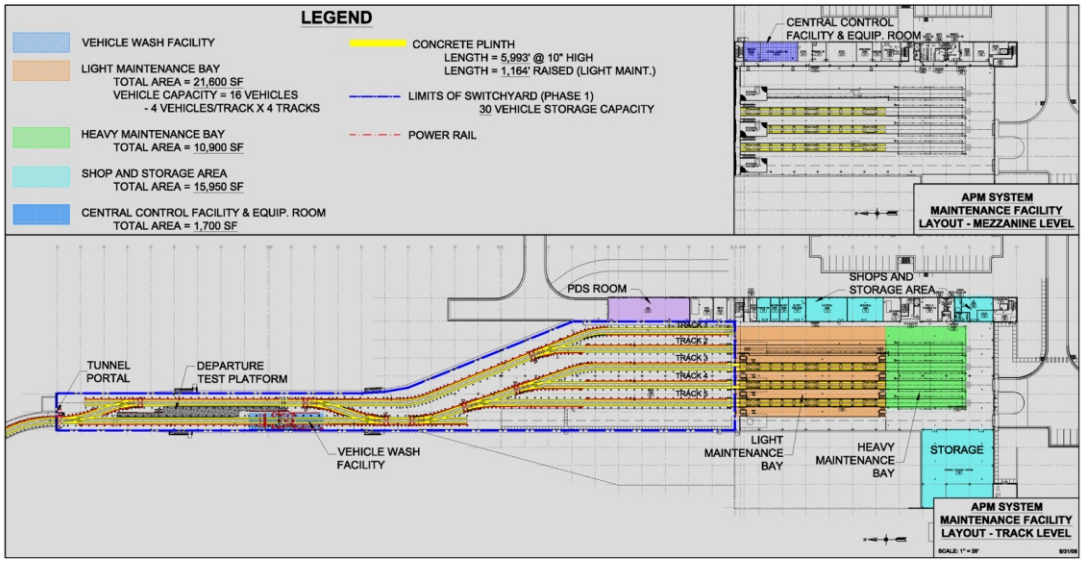
## PLATFORM LEVEL



# VEHICLE MAINTENANCE FACILITY

The AeroTrain Vehicle Maintenance Facility (VMF) is a multi-use facility from which all of the testing, operation, and monitoring of the AeroTrain System, as well as all of the heavy and light maintenance of the AeroTrain cars, will take place.

Major components of the VMF comprise a Vehicle Wash Facility, Switchyard, Light and Heavy Maintenance Bays, the Central Control Facility and Equipment Room, and a Shop and Storage Area.




# TUNNELS

The total AeroTrain system tunnel length is approximately 19,958 track feet (3.78 miles). Three tunneling methods were used to excavate these tunnels.

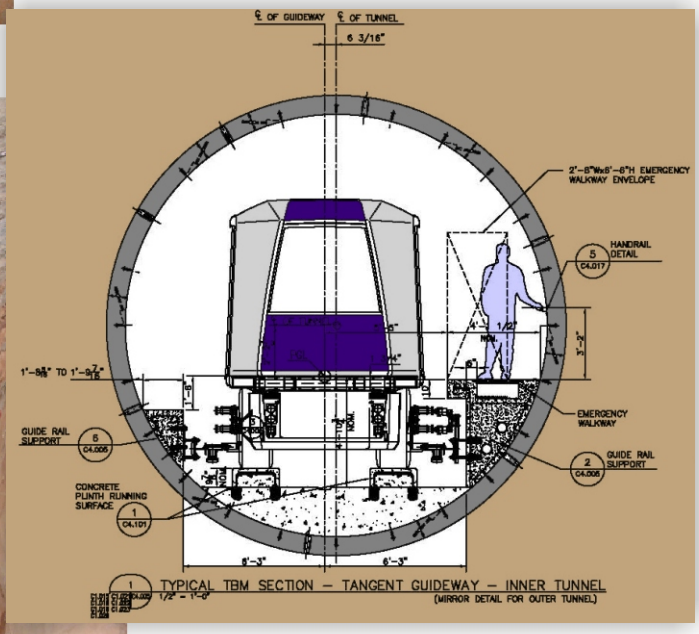
The first method, called “cut and cover,” was used to excavate approximately 7,700 track feet with a process that involves excavating a large trench down from the surface. This method was used close to existing facilities and where above ground access was available without disrupting airport activity.

*Cut and Cover*

The New Austrian Tunneling Method (NATM), a more traditional system of mining, was used in areas where the tunnels curve (3,650 track feet). NATM uses a combination of means to grind the rock face in layers. Shotcrete is immediately applied to the exposed tunnel walls to provide support.


*New Austrian Tunneling Method (NATM)*

Finally, the Tunnel Boring Method (TBM) was used to bore approximately 4,300 track feet, for the straight tunnel runs. The 23’ diameter machine, known as a mole, bored through solid rock, approximately 55’ below grade. Precast concrete wall lining segments were mechanically put into place by the mole as it moved forward.




*Tunnel Boring Method*

# AEROTRAIN SUMMARY FACTS

## General Information:

| | |
|---|---|
| ▪Number of Cars: | 29 |
| ▪Waiting Time: | 1.9 minutes |
| ▪Maximum Speed: | 42 mph |
| ▪Distance Between Stations: | 2,150 feet |
| ▪Travel Time Between Stations: | 72 seconds |

## Dimensions:

Phase 1

| | |
|---|---|
| Total Track Feet: | 19,958 (3.78 miles) |
| Main Terminal Station: | 440 feet long x 120 feet wide x 39 feet high (public area) |
| Concourse Stations: | 180 feet long x 120 feet wide x 30 feet high (typical public area) |
| Tunnels: | 16 feet x 18 feet |

## Contractors:

**Train and Systems:**

| | |
|---|---|
| Design/Build: | Sumitomo Corporation of America |

**Main Terminal Train Station:**

| | |
|---|---|
| Design: | Skidmore, Owings and Merrill |
| Construction: | Turner Construction Company |

**Concourse A-B Train Stations:**

| | |
|---|---|
| Design: | Hellmuth, Obata & Kassabaum |
| Construction: | Atkinston/Clark/Shea (East Station) |

**Concourse C Train Station:**

| | |
|---|---|
| Design: | Kohn Pederson Fox Associates, P.C. |
| Construction: | Facchina Construction Company, Inc. |

**Tunnels and Vehicle Maintenance Facility**

| | |
|---|---|
| Design: | HNTB Corporation |
| Construction: | Turner Construction Company (VMF)<br>Atkinson/Clark/Shea (East Tunnels)<br>Clark/Shea (West Tunnels) |

## Estimated Completion:

Main Terminal Station and Train to Concourses A, B and C: 2009

## Estimated Program Costs:

| | |
|---|---|
| Trains and System: | $215 million |
| Tunnels, Station Shells & Maintenance Facility: | $519 million |
| Main Terminal Train Station and Security Mezzanine: | $395 million |
| Concourse Stations (3): Tier 1/A-B East, Tier1/B West, Tier 2/C | $285 million |