SCOPE AND NATURE

The development of property resulting in a closed or partially enclosed overbuild structure over tracks, shall include design features to ensure adequate ventilation, illumination, emergency egress and fire protection to provide a safe environment for *Amtrak* employees and customers during normal and emergency operations. The Developer shall make all accommodations to the above grade structure, and shall be responsible for the design, construction and maintenance of the systems described below.

This document provides fire-life safety and diesel emissions design criteria for *Amtrak* enclosed station platforms, built-over tunnels, and tunnels. It is recognized that there may be more than one acceptable solution and *Amtrak* is prepared to review any scientific analysis that accomplishes the stated function and cooperate with the Developer to achieve a maintainable and effective overbuild system.

SPECIAL REFERENCE

The effective date of these SPECIAL REFERENCES shall be the date the Force Account Agreement of Covenants and Easements is signed by all involved parties.

Where NFPA is cited, this includes all "*Formal Interpretations*."

Where there is any conflict between this EP and any reference document, the most stringent applies.

American Railway Engineering and Maintenance-of-Way Association, AREMA Manual for Railway Engineering, including but not limited to Chapter 6*, Buildings and Support Facilities* and Chapter 8, *Tunnels.*

American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE Handbook HVAC Applications, *Enclosed Vehicular Facilities*

Illuminating Engineering Society of North America, Lighting Handbook, Chapter 11

National Fire Protection Association,

NFPA 3, Recommended Practice on Commissioning and Integrated Testing of Fire Protection and Life Safety Systems.

NFPA 4, Standard for Integrated Fire Protection and Life Safety Testing.

NFPA 14, Standard for the Installation of Standpipe and Hose Systems"

NFPA 70, National Electrical Code.

NFPA 92B, Standard for Smoke Management Systems in Mall, Atria, and Large Spaces.

NFPA 101, Code for Life Safety Code from Fire in Buildings and Structures

NFPA 110; Standards for Emergency and Standby Power Systems

NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems including annexes as if cited in the body of the standard.

NFPA 502, Recommended Practice on Fire Protection for Limited Access Highways, Tunnels, Bridges, Elevated Roadways and Air Right Structures

U.S. Department of Labor, 29 CFR 1910, OSHA Safety and Health Standards

Van Nostrand Reinhold, Tunnel Engineering Handbook, Chapter 19, Tunnel Ventilation

United States Department of Transportation, Subway Environmental Design Handbook. Volume II, "Subway Environment Simulation Computer Program, SES Version 4.1, Part I User's Manual".

CITY OF NEW YORK {The below text within shaded boxed area applies to projects only within jurisdiction of FDNY. For other locations, consult with local governing agency.}

Fire Department New York "Fire Codes" including but not limited to Appendix B from 2014 Fire Code.

SPECIAL MATERIALS

Not applicable.

PROCEDURE

DEFINITIONS

Ventilation

A *station* is defined as a place for the purpose of loading and unloading passengers, including patron service areas and ancillary spaces associated with the same structure. An enclosed station platform is constructed in such a manner that it is not open to or

substantially restricted to the atmosphere and smoke, and heat are not allowed to easily disperse directly into the atmosphere.

For example, the following existing and proposed structures are enclosed stations:

- Pennsylvania and Moynihan Stations at approximate milepost 0 from 9th Avenue to 7th Avenue in New York City, NY.
- Providence Station at approximate milepost 185 in Providence, RI.
- Back Bay Station at approximate milepost 227 within Back Bay Tunnel in Boston, MA.
- 30th Street Station at milepost 1.5 / MP 88.00 in Philadelphia, PA.
- Chicago Union Station from Madison Street to Congress Street in Chicago, IL.

A *built-over tunnel* is an enclosed trainway having two or more tracks. Built-over tunnels may be adjacent to a station, below an enclosing or covering structure, or a covered entry to a Yard and not having any separation between the tracks. Trains usually stop in built-over tunnels for five minutes or less during normal operations. Trains usually stop in built-over tunnels for 20 minutes or less during non-routine, non-emergency (congested operations).

For example, the following *Amtrak* structures are built-over tunnels:

- Overbuilds (Brookfield and Schulweis) of Moynihan Station approach from 9th Avenue to 10th Avenue at approximate milepost W0.7 in New York City, NY.
- Overbuild of Pennsylvania Station approaches from 7th Avenue to the portal in the vicinity of 6th Avenue at approximate milepost E0.5.
- Various contiguous and non-contiguous overbuilds along the Empire Connector from milepost 0.97 to milepost 5.28 in New York City, NY.
- Overbuild for Providence Place Mall development adjacent to Providence Station in Providence, RI.
- Back Bay Tunnel Overbuild from milepost 226.9 to 227.5 in Boston, MA.
- Overbuild north of Union Station from Madison Street to Randolph Street in Chicago, IL.
- Overbuild south of Union Station from Congress Street to Polk Street in Chicago, IL.
- Hudson Yards Development over LIRR West Side Storage Yard west of Eighth Avenue, NYC.

A *tunnel* is an enclosed trainway having one or two tracks, not including stations or built-over tunnels. Trains usually stop in tunnels for five minutes or less during normal operations. Trains usually stop in tunnels for 30 minutes or less during non-routine, non-emergency (congested operations).

For example, the following *Amtrak* structures are tunnels:

- North River Tunnels under the Hudson River from 10th Avenue at approximate milepost W0.7 in New York City, NY to Bergen Portal at

approximate milepost W3.0 in North Bergen Township, Hudson County, NJ.

- East River Tunnels under the East River from the portal in the vicinity of 6th Avenue at approximate milepost E0.5 the Long Island City Portal at approximate milepost E2.5 in New York City, NY.
- Empire Connector North Access Tunnel from approximate milepost 0.41 (10th Avenue Portal) to approximate milepost 0.71 in New York City, NY.
- New Haven Tunnels between approximate mileposts 76.4 and 76.7 in New Haven, CT.
- Three B&P Tunnels from North Avenue Portal at approximate milepost 95.9 to Gilmor Street Portal at approximate milepost 97.5 in Baltimore, MD.
- Union Tunnel from Bond Street Portal at approximate milepost 94.6 to Greenmount Avenue Portal at approximate milepost 95.2 in Baltimore, MD.
- First Street Tunnel from First Street Portal at approximate milepost 134.8 to South Capitol Street Portal at approximate milepost 137.0 on Washington, DC. First Street Tunnel has the "Fan Tracks" or Subway in addition to Station Building and link structure / parking garage ramp; these are all considered to be a hybrid condition

Any overbuild project in the City of New York, shall be considered an *Enclosed Station Platform* or a *Built-Over Tunnel* as defined herein and regardless of actual length shall require mechanical ventilation, lighting, fire protection, equipment to ensure adequate radio communications for the railroad road channel, *Amtrak* Police Department and the New York City Fire Department.

At least one means of egress (an enclosed fire rated stairway if the means of egress is above track level) away from track level. The use of alternating tread design (ships ladder) is permitted only as a means of ingress and only where endorsed by FDNY.

Where an overbuild project depends upon an adjacent property for any systems or elements, such as standpipes, means of egress, etc. the Developer shall submit with initial design submission a clear statement of intent and follow up with submission for final acceptance with copy of executed legal agreement. This agreement shall also identify that Amtrak, and its successors, have the inherent right to monitor for compliance, etc. -

Plans must be submitted to the New York City Fire Department, Bureau of Fire Prevention and the Bureau of Operations Public Transportation Safety Unit, for review and approval.

Projects occurring over the Empire Line shall have fire department standpipe hose valves secured inside Potter Roemer Fire Protection Equipment "NYCT Valve Cabinet (surface) per Potter drawing 12208-36 dated 03-10-03, or approved equal, with modification to use FDNY lockset.

ENCLOSED STATION PLATFORMS and BUILT-OVER TUNNELS

Station public-area fire-life safety facilities shall be in accordance with NFPA 130. Station non-public area (ancillary spaces) fire-life safety facilities shall be designed as per local codes.

Built-over tunnel fire-life safety facilities shall be in accordance with NFPA 130, except that emergency egress facilities shall be sufficient for all those that can self-rescue to exit within 30 minutes.

Built-over non-public area (ancillary spaces) fire-life safety facilities shall be designed as per local codes.

Stations shall be designed to provide a tenable environment in accordance with NFPA 130 Annex B for a period of at least 30 minutes.

Built-over tunnels shall be designed to provide a tenable environment in accordance with NFPA 130 Annex B for a period of at least 60 minutes.

Station ventilation systems shall be designed for train fires, platform fires and wayside fires. Tunnel ventilation systems may be used for the ventilation of stations and built-over tunnels and vice versa.

A platform or wayside fire may involve trash, maintenance materials or other combustibles. The fire heat release rate for a platform fire shall be one megawatt (MW) (3.412 million British Thermal Units per hour [MBtu/hr]). The fuel burn rate shall be 0.0254 kg/s (0.0556 lbm/s). The combustion products release rate shall be 0.3624 kg/s (0.7992 lbm/s). The opaque products release rate shall be 0.0042 kg/s (0.0092 lbm/s). (Note: this data is written to three or four-decimal place accuracy to assist the comparison of simulation outputs by different engineers. This does not imply the accuracy of the data).

The platform or wayside fire growth rate shall be “fast” as defined by NFPA 92. A fast fire growth rate is parabolic at 46.892 w/s² (160 Btu/hr - sec²) and reaches 1 MW (3.412 MBtu/hr) in approximately 150 seconds. A train fire is a fire beginning in one car of a train and spreading to other cars in the same train and to other trains that are in the station. The means of egress of the involved train set shall be via the most remote door exit on the car adjacent to the car involved in the incident depending upon the type of equipment.

Amtrak will, upon request, define the details of the train set consist and consist equipment to be used as the design basis. Following train fire heat and fire smoke release rates shall be used in the ventilation analysis for enclosed stations and built-over tunnels having two or more tracks not separated by a platform.

TIME	HEAT RELEASE RATE	HEAT RELEASE RATE
Seconds	MW	MBtu/hr
0	0	0
180	5	17.060
600	5	17.060
780	10	34.120
1200	10	34.120
1560	52	177.476
> 1560	52	177.476

The fuel burn rate shall be 0.0254 kg/(s-MW)[0.0164 lbm/(s-MBtu/hr)].

The combustion products release rate shall be 0.3624 kg/(s-MW) [0.2342 lbm/(s-MBtu/hr)].

The opaque products release rate shall be 0.0042 kg/(s-MW)(0.0269 lbm/[s-MBtu/hr]).

The following train fire heat and fire smoke release rates shall be used in the ventilation analysis for enclosed stations and built-over tunnels having one track, or two tracks separated by a platform.

TIME	HEAT RELEASE RATE	HEAT RELEASE RATE
Seconds	MW	MBtu/hr
0	0	0
180	5	17.060
600	5	17.060
780	10	34.120
1200	10	34.120
1380	31	106.200
> 1380	31	106.200

The fuel burn rate shall be 0.0254 kg/(s-MW)(0.0164 lbm/[s-MBtu/hr]).

The combustion products release rate shall be 0.3624 kg/(s-MW) (0.2342 lbm/[s-MBtu/hr]).

The opaque products release rate shall be 0.0042 kg/(s-MW)(0.0269 lbm/[s-MBtu/hr]).

The emergency ventilation analysis shall be done using publicly available computational fluid dynamics (CFD) software such as FLUENT, CFX, Star-CD. Certain geometries may be analyzed either by using the CFD Package FDS or by not using CFD at all. *Amtrak* may approve the use of FDS or the waiver of CFD after the engineer submits a request documenting the appropriateness of the recommended change.

The design philosophy of an enclosed station or built-over tunnel ventilation system shall be to maintain a tenable environment in the path of evacuation for the time periods specified above. Note the ventilation system may mechanical or non- mechanical (natural or buoyancy driven).

However, tunnel ventilation systems which depend on interface with adjacent properties or developers, such as for source of makeup air, shall submit with initial design submission clear statement of intent and follow up with submission for final acceptance with copy of executed legal agreement. This agreement shall also identify that Amtrak, and its successors, have the inherent right to monitor for compliance, etc.

Design for Diesel emissions shall be as per A*SHRAE HVAC Applications Handbook.* The design criteria shall be 5 ppm of nitrogen dioxide at an elevation of 14 feet above the top of rail. The ventilation systems shall be energized when the NO2 concentration at this elevation reaches 3 ppm. In the event that normal operations train idling is no greater than ten train-minutes per hour, no analysis need be made. Instead, it shall be assumed that the emergency ventilation systems can be operated in such a manner as to purge diesel emissions from the station or built-over tunnel when the 3 ppm concentration is reached.

TUNNELS

Tunnel fire-life safety facilities shall be in accordance with NFPA 130. Tunnel non-public area (ancillary spaces) fire-life safety facilities shall be designed as per local codes. Trains usually stop in tunnels for 20 minutes or less during non-routine, non-emergency (congested operations).

The fire heat release rate used to design the tunnel ventilation system shall be 31.12 MW (106.2 MBtu/hr). The fuel burn rate shall be 0.7898 kg/s (1.7417 lbm/s). The combustion products release rate shall be 11.2788 kg/s (24.8667 lbm/s). The opaque products release rate shall be 0.1295 kg/s (0.2853 lbm/s).

The design philosophy of the tunnel ventilation system will be the control of the direction of smoke movement (i.e., the prevention of back-layering).

The analysis shall be done using the latest publicly available version of the Subway Environment Simulation (SES) computer program.

VENTILATION EQUIPMENT

Ventilation equipment and subsystems shall be as per NFPA 130. The words "for a minimum of one hour" in the Ventilation Chapter of NFPA 130 shall be replaced by "for one hour, or for the anticipated evacuation time plus 30 minutes, whichever is greater".

Ventilation Equipment and subsystems shall be designed to provide N+1 level of reliability unless Reliability Analysis as required by NFPA 130 requires higher level of reliability. Ventilation system reliability analysis that, as a minimum, considers the following shall be submitted to *Amtrak* for approval: Electrical; Mechanical; and Supervisory Control. [NFPA 130 7.2.3(7)].

Damper control motors / actuators, etc. shall be design to run to destruction in event of an incident.

The Developer shall be responsible to make sure (at their cost) that Ventilation systems for all overbuilds on the Empire Line shall be connected to and monitored by *Amtrak* Engineering personnel assigned to the "C3" Room, located on the 2nd Floor of 400 west 31st Street, Manhattan. Personnel in the "C3" Room must have the capability to operate these fans in the event of a failure of the automatic activation system(s) for the overbuild fans. Local control panels (for manual control of the fans) shall be located at each fan plant. Fan plants shall be connected to an emergency power source in the event of a power outage.

Illumination

Lighting shall be provided. Illumination levels of track and walking surfaces shall not be less than 2 foot-candles with a train in position (lights on opposite side of train will not provide illumination to bench wall on the opposite side. Exit lights, essential signs and emergency lights shall be included in an emergency lighting system powered by a standby power system as defined below. Unless specific color rendition is required, Light Emitting Diodes (LED) fixtures should be used for general illumination.

Egress

At least one emergency exit stairway shall be provided, and additional exits if required spaced so the distance to an emergency exit shall not exceed 800 feet. The stairway shall lead directly to the outdoors, or to a *safe refuge* area away from the railroad right of way. Signs shall indicate direction and distance to the nearest exit. Egress points shall be illuminated. Emergency telephones, in secure, protective boxes, compatible with the *Amtrak* wayside communications system, shall be provided by the Developer. If the Egress path uses a pocket or storage track, provide illumination in this area.

The overbuild developer/owner will maintain an adequate access/egress stairway(s), to include fire protection devices, lighting, stairs, handrails, landing fall protection and doors at street and track level. For security reasons the street level doors shall be equipped with cylinder locks keyed to an *Amtrak* "102 Key" lock. Heavy duty, secure lock boxes will be provided by the overbuild Developer/owner and permanently mounted next to, and slightly above the door at street level. An *Amtrak* "102 Key" will be provided by *Amtrak* and placed in the box for use by emergency responders.

The lock box will be secured with a New York City Fire Department "1620 Key" locks as appropriate.

Emergency and Standby Power Generation:

The Emergency Power Supply System, (EPSS), shall be classified as Level I (Life Safety) type 10 transfer time, and class 72 hours of run time per NFPA 110. Provide fixed load bank for onsite testing. This system shall be supervised by SCADA system integrated with Amtrak system.

Fire Protection

A dry fire standpipe system, minimum 4 inch, shall be provided when the length of the overbuild exceeds the maximum length of fire hose (permitted by the local authority having jurisdiction) minus the distance from the portal to the nearest hydrant or approved water source. The standpipe system shall extend under adjacent streets bridges or viaducts where no coverage exists. Where there may be pocket or storage tracks within the area of the project extend stand pipe coverage.

Security/Intrusion Detection Devices/Video Capability New York City Only

The Developer/overbuild owner shall provide and maintain intrusion detection devices and video surveillance equipment provided for all access and egress doors. These devices shall be connected via Amtrak furnished SCADA link to the *Amtrak* "C3" Room located at 400 West 31st Street, and monitored by *Amtrak* personnel.

Coordinate with Amtrak for data communication details. Developer shall provide video surveillance equipment providing full video coverage of the track bed where the use of pan-tilt-zoom (PTZ) is not permitted to achieve full coverage. The control room housing this equipment and control equipment serving emergency tunnel ventilation systems shall be fire rated and secure with Amtrak issued lock set. Where the local environmental conditions require the use of mechanical ventilation or cooling to maintain the space temperature below the electrical equipment operating limits, such mechanical ventilation or cooling systems shall be designed so that the failure of any single air moving or cooling unit or controls, does not result in the loss of the electrical supply, or control, to the emergency tunnel ventilation fans during the specified period of operation This applies where ever the subject control equipment is located. Power for this equipment shall be derived from EPSS.

Radio Communications

If required by *Amtrak* Radio Engineering the Developer/overbuild owner shall be responsible to provide and maintain equipment to enhance and ensure adequate radio communications for the *Amtrak* Road Channel and *Amtrak* Police Department radio frequency in operation for that area. This equipment shall be powered from EPSS. Coordinate with local authorities for additional requirements.

In addition the developer/overbuild owner shall provide and maintain equipment to ensure adequate emergency radio communication as required by the New York City Fire Department where applicable.

Commissioning and Integrated Testing:

Systems shall be commissioned per NFPA 3, Recommended Practice on Commissioning and Integrated Testing of Fire Protection and Life Safety Systems. Commissioning shall be performed by independent third party reporting directly to Amtrak but paid for by the Developer.

Integrated system testing shall be in accordance with NFPA 4, Standard for Integrated Fire Protection and Life Safety Testing.

Construction Period Restrictions.

During the construction period, the Developer shall not negatively impact the operations of the RailRoad or the ability of adjacent site(s) to provide required life safety functions as required by this Practice. This may mean the platform enclosing the over-build shall not completed until the systems being provided by this Developer are operational and accepted. Developer shall submit comprehensive CFD, or equal, modeling showing that the opening left in the platform will enable the required performance.

Noise Levels:

Provide acoustical modeling / analysis to confirm noise levels should be a maximum of 115 dBa for a few seconds and a maximum of 92 dBa for the remainder of the exposure.

Refuge Niches (bays)

Developer shall provide refuge niches (bays) in the adjacent crash walls in accordance with AREMA Manual Chapter 8, *Tunnels*, section 11.2.7 requirements to allow Amtrak roadway workers to safely clear the tracks for passing trains. Provide similar niches, such as in bench walls of tunnels, under platforms, etc. where similar conditions are appropriate.

Local Authorities Review and Approval

Plans, CFD models, etc. must be submitted to the New York City Fire Department, Bureau of Fire Prevention and the Bureau of Operations Public Transportation Safety Unit, for review and approval. Submit concurrent copy to Amtrak for coordination.

REPORTING

Not Applicable.

RESPONSIBILITY

Designers of overbuild structures.

Comply with standards and procedures.

Deputy Chief Engineer, Structures

Review design submittals for compliance.

Division Engineer

Ensure compliance with EP 4006 with an inspection program, where all of the systems outlined in the current EP 4006, and the recommendations in this memo are inspected routinely (by *Amtrak* personnel) for compliance by the responsible developer/overbuild owner.

During construction, the site should be inspected at least weekly (more frequently if dictated by conditions at the site) by *Amtrak* personnel. A site specific checklist should be developed by the Developer so the *Amtrak* employee inspecting the site is aware of the life safety and security issues of interest to *Amtrak* (as dictated by *Amtrak*, *Amtrak* EP 4006, NFPA 130, the New York City Fire Department)

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