ADDENDA

ANSI/ASHRAE Addendum a to
ANSI/ASHRAE Standard 217-2020

Non-Emergency Ventilation in Enclosed Road, Rail, and Mass Transit Facilities

Approved by ASHRAE and the American National Standards Institute on January 21, 2022.

This addendum was approved by a Standards Project Committee (SPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (https://www.ashrae.org/continuous-maintenance).

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a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

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FOREWORD

Addendum a makes the following changes to ASHRAE Standard 217-2020:

a. Adds a new definition of asset management
b. Modifies the definition of heat-sink
c. Adds a new Section 6.4.3, "Induced Airflows" to Section 6, "Rail Tunnels"
d. Clarifies the application of tunnel ventilation fans and tunnel draft relief in Section 7.3.5 of Section 7, "Mass Transit Tunnels"
e. Adds new Sections 8.1.7, 8.1.8, and 8.2.6 related to airborne pathogens and transmission vector to Section 8, "Mass Transit Stations"
f. Adds reference to asset management in Section 11.4.1 in Section 11, "Operations and Maintenance"
g. Adds concept of operations to Section 11.10.1.1 requirements in Section 11, Operations and Maintenance"
h. Adds explanatory material to Informative Appendix A related to mitigation of airborne transmission at station.
i. Makes other editorial changes and modifies references, renumbers sections accordingly

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum a to Standard 217-2020

Modify Section 4 as shown. The remainder of Section 4 is unchanged.

4. DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

asset management: coordinated activity of an organization to realize value from assets.

[. . .]

heat sink: an area with thermal inertia such that it diverts heat and its temperature remains ~~constant~~ largely unchanged.

Modify Section 6.4 as shown. The remainder of Section 6 is unchanged.

6. RAIL TUNNELS

[. . .]

6.4.3 Induced Airflows. Equipment, such as signal gantries or catenary supports, installed in the tunnel with areas exposed to longitudinal airflow shall withstand aerodynamic forces induced by train movement.

~~6.4.3~~6.4.4 High-Speed Rail. For the purposes of this section, "high-speed rail" (HSR) refers to rail lines used by trains operating at a speed of 125 mph (200 km/h) or greater. The following additional requirements apply to HSR tunnels:

a. **Medical safety limit.** The pressure variation caused by the train operating at its maximum allowable speed shall not exceed 1.45 psi (10 kPa) at any point along ~~its length~~ the train during passage through the tunnel. [***Informative Note:*** The difference between the maximum and minimum pressure on the outside of the train during its journey through the tunnel should not exceed the specified value at any point along its length. The criterion applies to both unsealed and sealed trains on the assumption that a failure of the sealing system could occur (such as window breakage) such that the protection afforded to passengers is lost.]

[. . .]

~~6.4.4~~6.4.5 Analysis. Engineering analysis shall be performed to calculate pressure transients and evaluate pressure control measures. The analysis shall, at a minimum, incorporate the following:

[. . .]

~~6.4.5~~6.4.6 Control Methods. Methods to meet the pressure transient criteria shall include, but are not limited to, pressure relief shafts, portal flares, perforated structures, increased tunnel size, acoustic treatments, train geometry and sealing, and train speed control. Control methods shall be coordinated with the other disciplines for a fully integrated design approach.

~~6.4.6~~6.4.7 Wayside Equipment. Such equipment includes, but is not limited to, cross-passage and exit doors; signal cabinets; and ventilation ductwork, fans, and dampers. Cyclic and maximum pressure transients shall be calculated for the tunnel using computational analysis and shall be incorporated into specifying performance criteria for wayside equipment.

Modify Section 7.3.5 as shown. The remainder of Section 7 is unchanged.

7. MASS TRANSIT TUNNELS

[. . .]

7.3.5 Ventilation. ~~Tunnel draft relief shall be implemented in favor over tunnel ventilation fan operations to control tunnel air temperature and humidity.~~ Tunnel ventilation fans shall be used if the draft relief is insufficient to control tunnel air temperature and humidity. In the case of tunnel ventilation fan operations, engineering analysis shall be performed on the effect of train operation (speed) on active fans and other mechanical equipment.

Add new Sections 8.1.7, 8.1.8, and 8.2.6 as shown. The remainder of Section 8 is unchanged.

8. MASS TRANSIT STATIONS

[. . .]

8.1.7 Transmission Vector. For the purposes of this standard, the term "transmission vector" will be used to mean an agent, such as water vapor and dust, that transmits a pathogen from one organism or source to another.

8.1.8 Airborne Pathogens. For the purposes of this standard, the term "airborne pathogens" includes aerosolized pathogens carried by passengers and spread throughout the station via breathing, coughing, sneezing, or any other airborne transmission vector.

[. . .]

8.2.6 Airborne Pathogens

8.2.6.1 The station ventilation system shall be designed to minimize the concentration of airborne pathogens from the breathing zone of passengers as they traverse the station.

8.2.6.2 The station ventilation systems shall be designed for the mitigation of infectious aerosol dissemination.

Modify Section 11 as shown. The remainder of Section 11 is unchanged.

11. OPERATIONS AND MAINTENANCE

[. . .]

11.2.5 The ventilation equipment shall have a remote control, and diagnostic instrumentation and monitoring system to enable the O&M staff to manage from a central control center or remote service locations. Guidelines shall be in place with necessary response time established for each category of defects.

[. . .]

11.3.2 ~~Operating agencies need to employ the system-trained~~ Trained personnel ~~to~~ shall operate the ventilation system of the enclosed transportation facilities and provide continuous and reliable levels of service.

[. . .]

11.4.1 The owner of each vehicular facility shall be responsible for maintenance and asset management of ventilation systems.

Informative Note: Refer to Appendix D for reference material on asset management.

11.4.2 Maintenance of the ventilation system and its associated components, such as oil changes, filter changes, cleaning of blades, and replacing of belts or bearings, shall be performed by trained specialists or trained staff ~~who have completed a certified program of formal education and on-the-job training. Maintenance includes, but is not limited to, oil changes, filter changes, cleaning of blades, and replacing belts or bearings~~. A regular training program on all aspects of the ventilation system in use shall be provided to maintenance staff, including refresher courses. Records shall be kept of the training received by staff and the reviews undertaken to identify the need for such training and its suitability.

[. . .]

11.10.1.1 Ventilation system equipment and its associated components shall be operated in a manner consistent with the O&M manual:

a. Supervised road tunnels shall have their own dedicated management/maintenance resources that take responsibility for safety and comfort operation of the facility, including response to incidents.
b. Unsupervised road tunnel ventilation systems shall be designed to operate as fully automatic facilities. The owner shall be responsible for providing a ~~rapid~~ timely response in the event of failure of equipment or its associated components or other emergencies. Concept of operation shall identify response time and responsible agencies.

Modify Section 12 as shown. The remainder of Section 12 is unchanged.

12. NORMATIVE REFERENCES

1. ASHRAE. ~~2016~~2019. ANSI/ASHRAE Standard 62.1, *Ventilation for Acceptable Indoor Air Quality*. Atlanta: ASHRAE.
2. NFPA. ~~2017~~2020. NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*. Quincy, MA: National Fire Protection Association.
3. NFPA. ~~2016~~2020. NFPA 130, *Standard for Fixed Guideway Transit and Passenger Rail Systems*. Quincy, MA: National Fire Protection Association.
4. ASHRAE. ~~2013~~2020. ANSI/ASHRAE Standard 55, *Thermal Environmental Conditions for Human Occupancy*. Atlanta: ASHRAE.
5. AMCA. 2016. ANSI//AMCA Standard 210/ASHRAE ~~ASHRAE~~ Standard 51, *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating*. Arlington Heights, IL: Air Movement and Control Association.

Modify Appendix A as shown.

INFORMATIVE APPENDIX A
EXPLANATORY MATERIAL

A1. SECTION 5.2.9.1

The consideration of visibility criteria in the design of the tunnel ventilation system is required due to the need for visibility levels that exceed the minimum vehicle stopping distance at the design speed. There are two primary sources of particulate matter (PM) in tunnels: exhaust emissions and non-exhaust emissions. Non-exhaust PM consists of tire and brake wear, road surface abrasion, and resuspended dust. Exhaust emissions consist of PM emanating from the tailpipe resulting from combustion.

K = 0.0009 ft^{-1} (0.003 m^{-1}) represents clear tunnel air (visibility of several hundred metres).

K = 0.0021 ft^{-1} (0.007 m^{-1}) represents a haziness of the tunnel air.

K = 0.0027 ft^{-1} (0.009 m^{-1}) represents a foggy atmosphere.

The threshold value $K = 0.012\ m^{-1}$ results in a very uncomfortable tunnel atmosphere and shall not be exceeded during operation.

A2. SECTION 5.6.4

To achieve the right balance, there are two main approaches: absorption and diffusion. Products that have absorptive properties include foam and rigid mineral wool, and they absorb the sound energy, turning it into heat through friction. Diffusion is the scattering of sound energy using multi-faceted surfaces. Diffusers are commonly made of wood, plastic, or polystyrene.

A3. SECTION 6.3.5(d)

When the system is first constructed, the deep-ground temperature is lower than it will become after some years of system operation. The rate of heat transfer from tunnel structure to deep ground therefore reduces over time before reaching a quasi-equilibrium condition. With less heat transfer, the tunnel structure remains at a higher temperature and, therefore, so does the tunnel air. Considering a mature system represents a conservative approach.

A4. SECTION 8.2.6.2

The station ventilation system design should consider airflow pattern in the station to minimize the spread of exhaled air from passengers to other passengers. The station ventilation system outdoor-air intakes should be located to mitigate the introduction of airborne transmission vectors from the surface traffic into the station. Subject to engineering analysis, station/tunnel emergency ventilation systems may be used to remove airborne contaminants during peak hours, as long as all noise and other air quality requirements are met inside and outside of the station.

A5. SECTION 8.2.6.3

Based on the latest ASHRAE Position Document on Infectious Aerosols dated 4/14/2020, ASHRAE recommends non-health-care buildings have a plan for an emergency response that includes the following:

a. The means for the station ventilation system to eliminate return air, which is intended to provide the system with the ability to utilize a 100% outdoor air system, if required, and bypass energy recovery ventilation system. Design station ventilation system to accommodate return air filtration with purification systems, both intended for airborne pathogens. ASHRAE recommends minimum filter efficiency of MERV-13.
b. Design station ventilation system to accommodate air disinfection equipment such as ultraviolet germicidal irradiation (UVGI).
c. Design station ventilation system to maintain temperature and humidity as applicable to the infectious aerosol of concern.

A6. SECTION 8.3.1.3

Appropriate thermal environment may be evaluated using an appropriate thermal comfort methodology such as the Relative Warmth Index described in *Subway Environmental Design Handbook, Volume I: Principles and Applications* (see Informative Appendix D). For example, a passenger's metabolic rate would be different when he or she enters the station from a transit vehicle versus when entering through the station entranceway.

Add new references to Appendix D as shown.

INFORMATIVE APPENDIX D
INFORMATIVE REFERENCES

AASHTO. 2013. *Executive Summary—AASHTO Transportation Asset Management Guide—A Focus on Implementation*, 2nd Edition. Washington, DC: American Association of State Highway and Transportation Officials.

[. . .]

CEN. 2020. EN 14067-5, *Railway Applications—Aerodynamics*, Part 5: "Requirements and Assessment Procedures for Aerodynamics in Tunnels." Brussels, Belgium: European Committee for Standardization.

[. . .]

ISO. 2014. ISO 55000, *Asset Management—Overview, Principles and Terminology*. Geneva, Switzerland: International Organization for Standardization.

ISO. 2014. ISO 55001, *Asset Management—Management Systems—Requirements*. Geneva, Switzerland: International Organization for Standardization.

ISO. 2018. ISO 55002, *Asset Management—Management Systems—Guidelines for The Application of ISO 55001*. Geneva, Switzerland: International Organization for Standardization.

[. . .]

NASEM. 2015. *Guide for the Preservation of Highway Tunnel Systems*. Washington, DC: The National Academies Press.

[. . .]

PIARC. 2019. PIARC Innovative Approaches to Asset Management. Paris, France: World Road Association.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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