2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.


Statement of Problem and Substantiation for Public Input

Associated with the public input on limited combustible materials

Related Public Inputs for This Document

<table>
<thead>
<tr>
<th>Related Input</th>
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<tbody>
<tr>
<td>Public Input No. 72-NFPA 130-2017 [New Section after 4.6]</td>
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</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Committee Statement

Resolution: This document was not added to the body of the standard so it cannot be added to Chapter 2.
2.3.4 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.


Statement of Problem and Substantiation for Public Input

date updates - ASTM E2965 is being added because of its use in the public input recommending adding information on limited combustible materials.

Related Public Inputs for This Document

<table>
<thead>
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<tr>
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<td>Public Input No. 61-NFPA 130-2017 [Section No. I.1.2.4]</td>
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<tr>
<td>Public Input No. 79-NFPA 130-2017 [Section No. 5.2.5.1]</td>
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Submitter Information Verification
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<tr>
<td>Resolution:</td>
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<tr>
<td>Statement:</td>
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</table>

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 21 17:33:17 EDT 2017
Public Input No. 66-NFPA 130-2017 [Section No. 2.3.9]

2.3.9 UL Publications.
Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

Statement of Problem and Substantiation for Public Input

Update the standard.

Submitter Information Verification

Submitter Full Name: Kelly Nicolello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 22 14:50:43 EDT 2017

Committee Statement

Resolution:
Statement: This revision updates references as appropriate
3.3.16.2 * Point of Safety

A point of safety is one of the following:

(1) An enclosed exit that leads to a public way or safe location outside the station, trainway or vehicle
(2) An at-grade point beyond the vehicle, enclosing station or trainway
(3) Any other approved location

Statement of Problem and Substantiation for Public Input

This new definition is for completeness with Public Input No44 - NFPA130-2017 wherein the term "Point of safety" is referred to and requires to be clearly defined.

The emergency provisions of NFPA 130 demand revision in light of the latest statistical information on the nature and severity of fires actually being experienced in modern metros. A combination of improved rollingstock, signalling, power supplies, reliability and operational sophistication has substantially reduced the probability of fires occurring in metros and the size of the fires if they occur and the likelihood of evacuation other than at stations or other predetermined emergency evacuation locations.

Modern metros in Europe and Japan, for the most part, do not use cross passages as the stations serve as places of safety and the systems are considered so reliable, and the risks so small, they are not considered necessary where the distances between station distances are small. Furthermore the latest historical and statistical analysis of Metro Fires suggests a sharp decline in the number of fire incidents in new and modern metros worldwide over the last 10 years or so.

In this context NFPA 130's position as the leading international standard for underground metros is jeopardised by its current prescriptive approach despite the overarching equivalency provisions within the standard. Unfortunately the equivalency provisions are too vague for AHJs and clients. Projects internationally are turning away from NFPA 130 to other regulatory options such as the European TSI for railway tunnels.

Projects currently resisting NFPA130 compliance include those in Egypt, Singapore, Qatar, and Saudi Arabia. There are currently major debates about whether the no cross passage solutions by Japanese design teams should be embraced in other emerging economies, likewise raising the prospect of NFPA130 rejection.

It is in these circumstances I am proposing the following additional amendments to Clause 6.3 of NFPA130.

At 6.3.1.4 – I propose the introduction of a risk engineering analysis that provides the option of an equivalency argument to support an extension of the 762mtr maximum distance to exits and replace it with a distance determined by equivalency to a point of safety which would include exits and stations.

The equivalency analysis specifies factors which must be considered but allows other factors to be included if they are considered relevant.

These factors provide the mechanisms for new railways to explore the safety benefits of improvements to materials, technologies and procedures that impact the spacing requirements to points of safety.

Modifications to Clause 6.3.1.5 allow cross passageways to be used in lieu a point of safety.

Clause 6.3.1.6 allows equivalency arguments to inform the spacings of cross passages in much the same way as points of safety for single tube tunnels.

In this way the prescriptive requirements of NFPA130 are maintained but while at the same time providing a mechanism for the improvements in signalling, material science, reliability, traction power and the like to inform the emergency egress tunnel design.

References


(5) “Investigating train accident risk relating to train operations and rolling stock failures to improve industry risk management: Summary report,” RSSB, 2017


Submitter Information Verification

Submitter Full Name: Arnold Dix
Organization: ALARP Consulting Group; and University of Western Sydney
Affiliation: Government Agencies internationally
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 12 08:03:53 EDT 2017

Committee Statement

Resolution: The current location as a stand-alone definition is preferable. The issues raised by PI 45 are addressed in FR #8.
3.3.40 Point of Safety.

A point of safety is one of the following: (1) an enclosed exit that leads to a public way or safe location outside the station, trainway, or vehicle; (2) an at-grade point beyond the vehicle, enclosing station, or trainway; (3)* any other approved location.

A.3.3.40(3) Refer to 5.3.3.2 and 5.3.3.3 regarding determination of a point of safety within stations.

Statement of Problem and Substantiation for Public Input

The proposed revision is part of a series of revisions intended to improve interpretation of the intent of the Standard. In this case, the proposal provides a link to other locations within a station that may be considered for approval.

Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 15:15:44 EDT 2017

Committee Statement

Resolution: FR-8-NFPA 130-2017
Statement: This revision returns the language to that of a previous version that expresses intent in the context of NFPA 240 more clearly, but includes Annex material for clarification of intent.
Public Input No. 116-NFPA 130-2017 [Sections 3.3.55.1, 3.3.55.2]

Sections 3.3.55.1, 3.3.55.2

3.3.55.1 Enclosed Station or Trainway.
A station, or trainway or portion thereof that does not meet the definition of an open station.

3.3.55.2 Open Station.
A station that is constructed such that it is directly open to the atmosphere and smoke and heat are allowed to disperse directly into having a configuration that inhibits dispersion of smoke and heat to the atmosphere such that the effects of a fire may spread beyond the area of origin to other portions of the station or trainway.

A.3.X.X. Enclosed Station or Trainway. This term is intended to apply to public circulation areas and to refer to configurations in which enclosing construction increases the risk for fire spread and/or the potential for the effects of a fire to impact tenability in egress routes serving the area of fire origin.

3.X.X. Open Station or Trainway.
A station, trainway or portion thereof having a configuration that does not inhibit the direct dispersion of smoke and heat to the atmosphere.

Statement of Problem and Substantiation for Public Input

Revisions are needed to improve appropriate interpretation of the intent of designation as open versus enclosed for purposes of applying related requirements in the text of the Standard. Refer also to proposed changes to A.3.3.55.2, to be renumbered accordingly.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canad
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 14:42:59 EDT 2017

Committee Statement

Resolution: FR-10-NFPA 130-2017
Statement: Revisions are needed to improve appropriate interpretation of the intent of designation as open versus enclosed for purposes of applying related requirements in the text of the Standard. See also FR #11.
3.3.63 Transit Tunnel.
An enclosed trackway for transit vehicle traffic with vehicle access that is limited to portals.

Statement of Problem and Substantiation for Public Input

Although NFPA 130 discusses tunnel provisions extensively, it lacks a formal definition of a transit tunnel. This can cause issues with applicability, particularly with partially enclosed facilities. The proposed text is a suitable adaptation of the definition within NFPA 502.

Related Public Inputs for This Document

<table>
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<td>Public Input No. 15-NFPA 130-2017 [New Section after 6.1.1]</td>
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</table>

Submitter Information Verification

Submitter Full Name: Iain Bowman
Organization: Mott MacDonald Canada Ltd
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Apr 27 17:48:23 EDT 2017

Committee Statement

Resolution: The intent of the proposal is addressed by FR # 10 and FR #11
Public Input No. 127-NFPA 130-2017 [ Section No. 4.2.2 ]

4.2.2
This standard is prepared with the intent of providing minimum requirements for those instances where noncombustible materials (as defined in Section 4.6) are not used due to other consideration in the design and construction of the system elements.

Additional Proposed Changes

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<th>Description</th>
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<td>Intention statement was confusing, appeared to contain a logical fallacy and did not provide much objective guidance</td>
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</tbody>
</table>

Statement of Problem and Substantiation for Public Input
The intention statement was confusing. Please see the attached file.

Submitter Information Verification

Submitter Full Name: Scot Deal
Organization: Excelsior Fire Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 16:34:16 EDT 2017

Committee Statement

Resolution: The proposed language does not provide an improvement over the existing language. The word "reasonable" is not an acceptable term for codes and standards; the term "minimum requirements" suffices.
Delete in its entirety: This standard is prepared with the intent of providing minimum requirements for those instances where noncombustible materials (as defined in Section 4.6) are not used due to other consideration in the design and construction of the system elements.

Replace with:

The intent of this standard is to provide minimum reasonable requirements for life safety through maximizing use of noncombustible materials (as defined in Section 4.6) due to other considerations in the design (e.g., partial sprinkler coverage, either incomplete separation of occupancies or insufficient exit capacity due to renovation to existing facilities, etc.).

A.4.2.2. To expedite verification of non-combustible and low-combustible materials it is recommended that an electronic data vault, for acquisition, storage and retrieval of fire test results (memorialized on letters from recognized fire test laboratories) should be maintained for each major Fixed Guideway Transit System work package. This suggestion would also greatly expedite traditional (paper and plan) submittal of verification documentation to the AHJ.

Once obtained, specifically the test results for smoke production need be inserted into smoke dispersion models for order-of-magnitude assessment of their hazard on minimum safety. A material generating very toxic smoke may be installed with only small quantities throughout a very large station volume. As such the objective hazard of this very toxic material may be tolerable after scaling the test results to actual station dimensions. See Reference 2 in section E.

Statement of Problem and Substantiation for Public Input

The problem is -4.2.2 contains a double negative, and even when working through the double negative the section creates a logical fallacy, and even after the logical fallacy, the gestalt message is confusing, opaque and offers little objective real guidance to the designers regarding the Standard’s intent with minimum safety.

A). Regarding the double negative and the fallacy

-4.2.2 asks us to consider the instances where noncombustibles are not used. If this statement was logically sound, then the contrapositive, by the rules of logic must be true. The contrapositive of "where noncombustibles are not used" is "where there is use of combustibles". However true this contrapositive must be, clause -4.2.2 apparently did not intend for the reader, to think on "where combustibles are used" because one of NFPA 130’s main strategies is where non- and limited-combustibles are used.

B). Regarding the confusing, opaqueiness of the message –

1. This -4.2.2 intent statement ignores when noncombustibles are used. It is noted that NFPA 130 standard in various locations suggests using engineering hazard analyses if deviations from prescriptions are sought, so indeed a designer can, and they have, used limited combustible materials in Fixed Guideway Transit Systems (FGTS).

2. If part A), above was not confusing enough, let us continue with the denotation of the original -4.2.2. If -4.2.2 originally did intend to speak to when "...combustibles are being used", then -4.2.2 would do good by helping the designer with introducing some concrete design mitigation strategies where it speaks to "other considerations in the design." For example, "...those instances where noncombustible materials (as defined in section 4.6) are used due to other considerations in the design (e.g., sprinklers throughout, excess open and/or enclosed egress capacity, passive smoke control, occupant use foam extinguishers, etc.).
The problem without Section – A.4.2.2 is that there is little objective, real design guidance regarding Standard intention for non- and low-combustibility, given to the reader.

Because of the confusion surrounding sprinklers, NFPA 130 seems to put most of its eggs in the low-combustibility design basket (smoke ventilation, though claimed to receive international acceptance[1], has rave reviews[2,3]). We therefore should well ensure low-combustibility in our FGTS materials. There are many low flammability and low smoke production tests cited in NFPA 130, and it is reasonable to ask the designer to wade through them. But a little help is warranted in applying the results of the smoke production tests.

It will help sell more NFPA 130 subscriptions if designers from countries outside the USA are cursorily introduced to the method by which NFPA 130 intends to vet toxic smoke from non-combustible and limited combustible materials. Smoke toxicity scales with concentration. The solution to pollution (after production reduction) is dilution. We need indicate that the designer or installing sub-contractor is not done there—with providing letter from certified fire test laboratory. That smoke production data need be used as input to fire modeling, so the affects of smoke can be judged at the scale of the station installation, not the scale of the cone calorimeter.

This public comment is related to public comment on NFPA 130 & local building code interface (-A.5.1.2), sprinklers (-5.4.4.3)


Submitter Information Verification
This PI has not been submitted yet
Copyright Assignment

I, Scot Deal, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

By checking this box I affirm that I am Scot Deal, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature.
4.7* Limited-Combustible Material.

A material shall be considered a limited-combustible material where one of the following is met:

(1) The conditions of 4.7.1 and 4.7.2, and the conditions of either 4.7.3 or 4.7.4, shall be met.

(2) The conditions of 4.7.5 shall be met.

4.7.1 The material shall not comply with the requirements for noncombustible material in accordance with 4.6.

4.7.2 The material, in the form in which it is used, shall exhibit a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) where tested in accordance with NFPA 259.

4.7.3 The material shall have the structural base of a noncombustible material with a surfacing not exceeding a thickness of \( \frac{1}{8} \) in. (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*.

4.7.4 The material shall be composed of materials that, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, and shall be of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723.

4.7.5 Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, at an incident heat flux of 75 kW/m\(^2\) for a 20-minute exposure and both of the following conditions are met:

(1) The peak heat release rate shall not exceed 150 kW/m\(^2\) for longer than 10 seconds.

(2) The total heat released shall not exceed 8 MJ/m\(^2\).

4.7.6 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible*.

(Also add annex note, as follows, and reference to ASTM E2965 and to NFPA 259 in section 2, and renumber existing 4.7)

A.4.7 Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition are considered combustible. (See NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, and NFPA 220, *Standard on Types of Building Construction*.)

Statement of Problem and Substantiation for Public Input

This text is extracted from NFPA 101-2018, section 4.6.14. The reason this is being proposed to be added is that sections 5.2 (station construction) and 6.2 (trainway construction) allow the use of Type II construction per NFPA 220 and that allows the use of limited combustible materials.

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<td>Public Input No. 73-NFPA 130-2017 [Section No. 2.2]</td>
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<td>Public Input No. 80-NFPA 130-2017 [Section No. 6.2.8.2]</td>
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Submitter Information Verification
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<tr>
<th>Committee Statement</th>
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<tr>
<td><strong>Resolution</strong>: The requirements for limited combustible already exist in other NFPA codes and standards so it is not necessary to add here.</td>
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<table>
<thead>
<tr>
<th>Submitter Full Name</th>
<th>Marcelo Hirschler</th>
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</thead>
<tbody>
<tr>
<td>Organization</td>
<td>GBH International</td>
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<tr>
<td>Street Address</td>
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</table>

| Submittal Date | Thu Jun 22 20:11:11 EDT 2017 |
5.2.2.1

Building construction for all new enclosed stations shall be not less than one of the following:

(1) Type I (442 or 332) construction or Type II (222, 111, or 000) construction or combinations of Type I and Type II noncombustible construction as defined in NFPA 220, in accordance with the requirements of construction type limitations contained in NFPA 101, Chapter 12, for the station configuration or as

(2) Type of construction determined by a fire hazard analysis of potential fire exposure hazards to the structure.

Statement of Problem and Substantiation for Public Input

What this public input does is synchronize the language with the language in NFPA 220. Note that NFPA 220 allows Type II construction to be made of limited combustible materials and, therefore, stating that it must be constructed on noncombustible materials is in conflict with NFPA 220.

Note that NFPA 101 in Table 12.1.6 are included all the construction type limitations and it might be suitable to reference the table rather than just chapter 12.

The other changes are editorial, for improved language.

If the committee wants to continue using Type II construction it needs to define what is a limited combustible materials and I will provide a public input, based on the NFPA 101 2018 language. Note also that the fire resistance ratings for all construction elements of Type II (000) construction are required (Table 4.1.1 of NFPA 200) to have a fire resistance rating of 0 hours, meaning that no fire resistance is required.

Language in NFPA 220, 2015:
4.3 Type I (442 or 332) and Type II (222, 111, or 000) Construction. [5000:7.2.3]
4.3.1 Type I and Type II Construction. Type I (442 or 332) and Type II (222, 111, or 000) construction shall be those types in which the fire walls, structural elements, walls, arches, floors, and roofs are of approved noncombustible or limited combustible materials. [5000:7.2.3.1]

Title of Table 4.1.1 of NFPA 220: Fire Resistance Ratings for Type I through Type V Construction (hr)

Language in NFPA 101, 2015:
12.1.6 Minimum Construction Requirements. Assembly occupancies shall be limited to the building construction types specified in Table 12.1.6, based on the number of stories in height as defined in 4.6.3, unless otherwise permitted by the following (see 8.2.1):

(1) This requirement shall not apply to outdoor grandstands of Type I or Type II construction.
(2) This requirement shall not apply to outdoor grandstands of Type III, Type IV, or Type V construction that meet the requirements of 12.4.9.
(3) This requirement shall not apply to grandstands of noncombustible construction supported by the floor in a building meeting the construction requirements of Table 12.1.6.
(4) This requirement shall not apply to assembly occupancies within mall buildings in accordance with 36.4.4.

Title of Table 12.1.6 of NFPA 101: Construction Type Limitations

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<th>Related Input</th>
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<tbody>
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<td>Public Input No. 69-NFPA 130-2017 [Section No. 6.2.2]</td>
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</table>

Submitter Information Verification

| Submitter Full Name: | Marcelo Hirschler |
Committee Statement

Resolution: FR-12-NFPA 130-2017
Statement: This revision provides clarification on the intended application of construction types to various station configurations, with a stipulation that only noncombustible construction is permitted.
Public Input No. 78-NFPA 130-2017 [ Section No. 5.2.5.1 ]

5.2.5.1

Materials used as interior wall and ceiling finish in enclosed stations shall comply with one of the following requirements:

(1) The materials shall be noncombustible in accordance with Section 4.6.

(2) The materials shall comply with the following requirements when tested in accordance with NFPA 286:

   (3) Flames shall not spread to the ceiling during the 40 kW (135 kBTU/hr) exposure.

   (4) Flames shall not spread to the outer extremities of the sample on any wall or ceiling.

   (5) Flashover, as described in NFPA 286, shall not occur.

   (6) The peak heat release rate shall not exceed 800 kW (2730 kBTU/hr).

   (7) The total smoke released throughout the test shall not exceed 1000 m$^2$ (10,764 ft$^2$).

(8) The materials shall comply with a flame spread index not exceeding 25 and a smoke development index not exceeding 450 when tested in accordance with ASTM E84, except that the materials in 5.2.5.1(4) shall be required to be tested in accordance with NFPA 286.

(9) The following materials shall not be permitted to be used as interior wall and ceiling materials, unless they meet the requirements in 5.2.5.1(2) when tested in accordance with NFPA 286:

   (a) Foam plastic insulation, whether exposed or covered by a textile or vinyl facing

   (b) Textile wall or ceiling coverings

   (c) Polypropylene

   (d) Solid thermoplastics, including but not limited to, polypropylene, high density polyethylene (HDPE), solid polycarbonate, solid polystyrene, and solid acrylic materials that melt and drip when exposed to flame.

Statement of Problem and Substantiation for Public Input

NFPA 101, 2018 edition, updated the requirements to include all solid thermoplastic materials that melt and drip when exposed to flame, instead of simply polypropylene and HDPE. This public input proposes to do the same for NFPA 130 stations.

Note that this public input does not propose any changes to item (2), but only to item (4).

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 23 13:45:07 EDT 2017

Committee Statement

Resolution: FR-9-NFPA 130-2017
Statement: NFPA 101, 2018 edition, updated the requirements to include all solid thermoplastic materials that melt and drip when exposed to flame, instead of simply polypropylene and HDPE. This revision does the same for NFPA 130 stations.
5.2.5.1

Materials used as interior wall and ceiling finish in enclosed stations shall comply with one of the following requirements:

1. The materials shall be noncombustible in accordance with Section 4.6.
2. The materials shall comply with the following requirements when tested in accordance with NFPA 286:
   3. Flames shall not spread to the ceiling during the 40 kW (135 kBTu/hr) exposure.
   4. Flames shall not spread to the outer extremities of the sample on any wall or ceiling.
   5. Flashover, as described in NFPA 286, shall not occur.
   6. The peak heat release rate shall not exceed 800 kW (2730 kBTu/hr).
   7. The total smoke released throughout the test shall not exceed 1000 m$^2$ (10,764 ft$^2$).
3. The materials shall comply with a flame spread index not exceeding 25 and a smoke development index not exceeding 450 when tested in accordance with ASTM E84, except that the materials in 5.2.5.1(4) shall be required to be tested in accordance with NFPA 286.
4. The following materials shall not be permitted to be used as interior wall and ceiling materials, unless they meet the requirements in 5.2.5.1(2) when tested in accordance with NFPA 286:
   a. Foam plastic insulation, whether exposed or covered by a textile or vinyl facing
   b. Textile wall or ceiling coverings
   c. Polypropylene
   d. High-density polyethylene.
5. The materials shall comply with a peak heat release rate not exceeding 150 kW/m$^2$ for longer than 10 seconds and a total heat released not exceeding 8 MJ/m$^2$ when tested in accordance with ASTM E2965, Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter, at an incident heat flux of 75 kW/m$^2$ for a 20 minute exposure.

Statement of Problem and Substantiation for Public Input

It has been shown that testing to ASTM E2965 (an application of the cone calorimeter to very low levels of heat release) results in an excellent means of assessing whether a material generates very low levels of heat release and is, thus, of low fire hazard. In fact, NFPA 101 and NFPA 5000 accepted these criteria to determine whether a material is a limited combustible material and can be used as a Type II construction building material.

The proposed test (ASTM E2965) is a variation of the cone calorimeter (ASTM E1354) with a much larger test specimen (150 mm x 150 mm instead of 100 mm x 100 mm), a larger radiant heat source and a slower duct flow rate. This test has been developed specifically to identify materials that are of very low levels of heat release. If a material has very low levels of heat release it will have very low levels of combustibility. The scope of ASTM E2965 includes the following: "This test method differs from ASTM E1354 in that it prescribes a different specific test specimen size, specimen holder, test specimen orientation, and volumetric flow rate for analyses via oxygen consumption calorimetry. It is intended for use on materials and products that contain only small amounts of combustible ingredients or components e.g. test specimens that yield a total heat release of less than 15 MJ/m2." The significance and use states as follows: "This test method is used primarily to determine the heat evolved in, or contributed to, a fire involving materials or products that emit low levels of heat release. The recommended use for this test method is for materials with a total heat release rate measured of less than 10 MJ over the first 20 min test period, and which do not give peak heat release rates of more than 200kW/m2 for periods extending more than 10 seconds. Also included is a determination of the effective heat of combustion, mass loss rate, the time to sustained flaming, and (optionally) smoke production. These properties are determined on small size test specimens that are representative of those in the
intended end use."

In this public input I propose a very low threshold, of 150 kW/m², just like in NFPA 101 and 5000.

Data from a study by Joe Urbas (2002) indicate that (out of 16 materials assessed) 1 material would qualify easily under the criteria shown, namely SPRF (sprayed fire resistant material on non-combustible backing), and that 5/8" Type X Gypsum Board would most likely qualify (in 3 out of 4 labs) while several other materials would fail primarily on total heat released (the most severe property). On the other hand paper-faced glass wool would fail on peak heat release rate and not on total heat released. A follow up study by Carpenter & Janssens (one of the labs used by the Urbas study) indicates similar types of results.

This shows that the criteria used are consistent with what would happen for limited combustible materials under the present criteria and that nothing unacceptable would "sneak" in. The data was obtained at exposures to 75 kW/m² for 20 min, just like the proposed new criteria.

BDMC interlaboratory cone calorimeter test programme by Joe Urbas (Fire Mater. 2002; 26: 29–35)

Abstract: In the spring of 1997, seven companies and industry associations from the USA and Canada decided to sponsor the cone calorimeter interlaboratory test programme. Reproducibility and repeatability were determined for the scalar variables measured in the cone calorimeter (ASTM E1354) according to the protocol developed by the Board for the Coordination of the Model Codes. The main requirement of the protocol was that the sample irradiance should be 75kW/m². The purpose of the project was to assist the model building code organizations, NFPA and various other groups in the development of a system to determine degrees of combustibility of building materials. Three US and one Canadian laboratory agreed to conduct tests on 16 materials.

The results of this round robin show that the cone calorimeter, following the Board for the Coordination of the Model Codes protocol, can provide precision similar to that cited in the current cone calorimeter standards. It is recommended that further improvements of the standards are pursued and provisions are made to improve the quality of operation of the cone calorimeter in commercial laboratories to maintain and possibly improve its repeatability and reproducibility.

Using Heat Release Rate to Assess Combustibility of Building Products in the Cone Calorimeter by Karen Carpenter and Marc Janssens (Fire Technology 41 – 79-92, 2005)

Abstract: Building codes generally permit unlimited use of materials that contribute negligible quantities of heat in the event of a fire. These materials are referred to as non-combustible. Whether a material qualifies as being non-combustible is generally based on performance in a small-scale furnace test, or on its potential heat content measured in an oxygen bomb calorimeter. However, furnace and oxygen bomb methods to assess combustibility have serious limitations. The most significant limitations are that materials cannot be evaluated in their end use configuration, that test conditions are not representative of real fire exposure conditions, and that the test results do not provide a realistic measure of the expected heat release rate.

These limitations lead to the idea of exploring the use of small-scale heat release calorimeters to assess material combustibility. The Cone Calorimeter has emerged in recent years as the most widely used apparatus for this application.

In this paper, an overview is presented of past efforts to assess combustibility based on heat release rate measurements. The main results of the most recent Cone Calorimeter round robin conducted in North America are discussed. It is concluded from the results of this round robin that the Cone Calorimeter is indeed suitable for measuring heat release rate from materials and products with low heat content. Limitations due to Cone Calorimeter specimen size can be alleviated by using a larger calorimeter, such as the Intermediate Scale Calorimeter or ICAL (ASTM E 1623.) However, more research is needed to extend the correlation between Cone Calorimeter and ICAL data to a wider range of materials. The biggest challenge is perhaps the implementation of a system to assess combustibility on the basis of heat release rate in the building codes. Implementation could consist of a classification system that is accepted as an alternative to the present prescriptive requirements and/or promoting the use of heat release rate data in performance-based design.

Note that this public input does not propose any changes to item (2) but just to item (5). A different public input proposes changes to item (4).

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 23 13:54:50 EDT 2017

Committee Statement

Resolution: The requirements for Class A interior finish are sufficient.
**Additional Proposed Changes**

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<td>accessible elevators threshold for installation</td>
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**Statement of Problem and Substantiation for Public Input**

There are some inefficiencies in the Building Code threshold for invoking accessible elevators. Please see attached file. It is realized the proposed numbering within NFPA 130 for this PI is not correct.

**Submitter Information Verification**

- **Submitter Full Name:** Scot Deal
- **Organization:** Excelsior Fire Engineering
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Jun 28 16:51:54 EDT 2017

**Committee Statement**

- **Resolution:** Accessible means of egress is addressed by statute.
5.3.1.2.

Elevators for accessible egress shall be provided where the distance from floor level to level-of-exit-discharge exceeds 11 m.

Statement of Problem and Substantiation for Public Input

The problem is profit before safety motivates elimination of the accessible elevator where they would be justified on the basis of intent and good judgment. Accessible elevators are required where it is judged that arm-carrying disabled persons up stairs requires an unreasonably large effort from fire fighters. Unreasonable effort is judged at more than 3 levels from level of exit discharge. Stations pose many intermediate levels, mezzanines and seldom occupied levels. Counting all these levels may require elevators before they are reasonably needed. Conversely, just a couple of quite deep levels would avoid the requirement for accessible elevators when the vertical arm-carry distance up the stairs would warrant accessible elevators, for instance an exit shaft from a tunnel. Therefore, assuming 12 ft per level and maximum 3 levels from exit discharge, this suggestion takes ad hoc level-of-fire fighter fatigue and converts it to vertical distance before fire fighter fatigue. This suggestion is a more performance-based metric, intended to be applied only to Fixed Guideway Transit Systems, and overriding overriding section 7.5.4.7 (in the older (2009) version) of NFPA 101.

Submitter Information Verification

This PI has not been submitted yet

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5.3.3.1* Platform Evacuation Time.

There shall be sufficient egress capacity to evacuate the platform occupant load as defined in 5.3.2.5 from the station platform in 4 minutes or less. This timeline should be used for locating egress elements and does not include the effects of smoke of hindering egress and the effectiveness of a ventilation system.

Statement of Problem and Substantiation for Public Input

The application of the 4 minute and 6 minutes time lines has been inappropriately combined with the performance of the emergency ventilation system. My understanding is that these timelines are use to locate emergency egress elements. These timelines do not consider how certain egress paths could be rendered untenable due to the type of emergency ventilation system being considered in terms of providing a tenable environment along the egress path.

Submitter Information Verification

Submitter Full Name: Ian Ong
Organization: Mott MacDonald
Street Address:
City:
State:
Zip:
Submittal Date: Fri Oct 28 11:08:57 EDT 2016

Committee Statement

Resolution: The information in the proposal is already included in A.5.3.3.2. See also FR #13.
5.3.3.3 *
For stations where the concourse is protected from exposure to the effects of a fire at the platform by distance, geometry, fire separation, an emergency ventilation system designed in accordance with Chapter 7, or as determined by an appropriate engineering analysis, that concourse shall be permitted to be defined as a temporary point of safety.

Statement of Problem and Substantiation for Public Input

The proposed revisions, along with coordinated revisions to the related Annex A Section, are intended to clarify that the concourse is intended only as a temporary and intermediate point of safety prior to exiting the station. Refer also to proposed revisions to A.5.3.3.1.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canad
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 15:49:49 EDT 2017

Committee Statement

Resolution: Refer to FR #8.
5.3.5.5
Escalators shall be permitted to account for more than one-half of the required means of egress capacity at any one level where the following criteria are met:

1. The escalators are capable of being remotely brought to a stop in accordance with the requirements of 5.3.5.7(3)(b), 5.3.5.7(4), and 5.3.5.7(5).
2. A portion of the means of egress capacity from each station level is stairs.
3. For enclosed stations, at least one enclosed exit stair or exit passageway provides continuous access from the platforms to the public way.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

The problem is preventing BoH stairs and corridors to be used in satisfying the requirements for enclosed stair. It does not seem like a very large problem, however, from a performance point of view. This proposal is made only because it was mentioned that using BoH corridors and exit stairs to satisfy this enclosed exit stair prescription was not the committee intent.

Submitter Information Verification

Submitter Full Name: Scot Deal
Organization: Excelsior Fire Engineering
Affiliation: I am working as contractor for Bureau Veritas. I am not sure they want my name associated with their fame ;-)
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 13:34:35 EDT 2017

Committee Statement

Resolution: Existing text already includes the word 'exit', which imposes requirements that would protect the route against potential hazards in 'back of house' areas.
Public Input No. 115 - NFPA 130-2017 [Revise Section 5.3.5.5]

proposed correction to 5.3.5.5 in 2017 NFPA 130

(3) enclosed stations, at least one enclosed exit stair or exit passageway provides continuous access from the platforms to the public way without using back-of-house corridors or exit accesses.

Statement of Problem and Substantiation for Public Input

The problem is preventing BoH stairs and corridors to be used in satisfying the requirements for enclosed stair. It does not seem like a very large problem, however, from a performance point of view. This proposal is made only because it was mentioned that using BoH corridors and exit stairs to satisfy this enclosed exit stair prescription was not the committee intent.

It is recognized probably (Pb >0.6) there will be high hazard rooms (UPS, battery storage, transformer substation, traction power control, etc.) opening onto BoH exit access and corridors. If passengers on the platform are to use BoH stairs, then these passengers will have to:

a). access BoH through occupancy separation door, and

b) traverse the BoH exit access to the BoH stairs.

The problem with a). is convincing designers that management will want to keep this occupancy separation door locked, and thus convince designers to find a design solution that maintain this BoH access door operable by passengers whom will be trying to access BoH exit stairs from the platform during an emergency. Owner’s management may concede in the design stage to delayed egress hardware on this BoH access door, but such is not allowed for stations built less than 9.1 m underground in IBC jurisdictions. For stations built deeper than 9.1 m underground IBC does not take design responsibility (IBC Section 405.1) so maybe design responsibility in this deep instance reverts to NFPA 5000, since NFPA 130 refers to NFPA 101 that refers to NFPA 5000. This ‘which building code’ gap that exists at 9.1 m is mentioned in proposal on Section

Even if management concedes to delayed egress hardware on the door accessing BoH corridors from the platform, it is quite probable that after 5 years, unwanted alarms and unwanted passengers BoH will motivate owner’s management to change the panic hardware for special tool or knowledge locked hardware. Such changes 5 years on from commissioning probably will not understand the reason why this BoH access door from the platform was needed to be operable by passengers in an emergency: it is highly likely that this exit path is counted as capacity in required means-of-egress evaluated in the 4-minute exit test.

The problem with b). seem minor on a performance basis. It is recognized that the exit should be ‘sterile’ and thus high hazard rooms located BoH should not open onto the BoH corridor if it is counted as part of the exit from the platform. But Metro stations are unusual buildings, and underground stations must face constraints of excavation costs, so a deviation from the ‘sterile’ environment might be in order here. Further, if the BoH corridor is counted as an exit for passengers from the platform, it certainly is no more hazardous than the open stairs most passengers will be using for egress. Lastly the rule of single jeopardy should apply-we design for only one accidental fire at a time: if passengers must evacuate fire in the platform area, there is no rationale for supposing the high-hazard rooms opening onto the BoH corridor (now enclosed exit from the platform) will pose another fire.

The threat to life safety posed from argument b). seems small given the special circumstances of FGTS stations. Argument a) seems to pose a particularly gruesome outcome, with locked exit access doors blocking capacity in a required means of egress.

A further note, it is possible, if the issue of not-locking the BoH access door from the platform is resolved, to make the BoH corridor into an area of refuge for the platform.
In resolving this proposal, it would be good if the committee would give their intention for this prescription. Requiring provision of one enclosed stair to the station, as mitigation to providing > 50% exit capacity by escalator seems unwarranted based on the passenger exit capacity the enclosed stair will carry. Enclosed stairs are expensive, especially in underground stations, so its width is likely to be minimal, further derating its mitigation to providing > 50% exit capacity by escalator. It seems likely this enclosed stair is intended for fire fighter access, rather than passenger egress, and if so, this intention should be revealed to the reader.

This proposal / comment has a related public input to proposed item -A.5.1.2.1, and resolving which Building Code to use for FGTS property deeper than 9.1 m since IBC -405.1 refuses regulatory responsibility in the deep domain.

Submitter Information Verification
This PI has not been submitted yet
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5.4.4.3 Installation of sprinkler systems shall comply with NFPA 13 or applicable local codes as required.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

Man-months of wasted time arguing over what was the intention of these sprinkler requirements. Designing sprinklers without employers or management understanding the liability consequences of their sprinkler design choices. Not presenting clear consequences regarding construction reductions for sprinklered throughout status.

Submitter Information Verification

- **Submitter Full Name:** Scot Deal
- **Organization:** Excelsior Fire Engineering
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Jun 28 16:26:00 EDT 2017

Committee Statement

- **Resolution:**
- **Statement:** The Committee agrees that clarification in requirements for sprinklering is required. The ability to refer to codes in other jurisdictions is implicit. The committee did not agree that the proposed annex language in PI 126 is applicable to stations.
5.4.4.3 Design and installation of sprinkler systems shall comply with NFPA 13 or applicable local code as required.

A.5.4.4.3 For a building to meet the intended level of protection afforded by NFPA 13, sprinklers must be included at high-bay spaces (up to 15.2 m), walk-in coolers, freezers, bank vaults, and similar areas – per 2013 NFPA 13 Section A.8.1.1.

Statement of Problem and Substantiation for Public Input

The problem is -5.4.4.3 in concert with -5.4.4.1 appears arbitrary and self-conflicted. This public input attempts to replace the confusion with time-saving and safety-increasing clarity.

The local building code (not always the same as the local code) should be the apex design guide. Whether that Building Code is IBC, NFPA 5000, inappropriately NFPA 101 (the Code that is not a building code), the Swedish Bokerket’s Building Regulations (~165 refreshingly concise pages) or some other, this building code is where the station designers search for sprinkler guidance should begin. This point is not clearly made in NFPA 130; we say local code – not local building code. NFPA 130 -5.1.2.1 concurs with the apex status of the local codes in station design, although -5.1.2.1 fails to note the apex status of the Building Code. Most building codes require sprinklers in legally ‘underground’ buildings. Most building codes require sprinklers in large assembly occupancies. There should be little question as to the rationale then, for sprinklers in underground Fixed Guideway Transit Systems (Fixed Guideway Transit Systems).

NFPA 130 creates arbitrary confusion with -5.4.4.1 by suggesting with its first prescription - that sprinklers “…shall be provided in concession areas, storage areas, trash rooms and similar…” Logically speaking, -5.4.4.1 does not stop the designer from extending sprinkler protection to other areas of the station, but this is what often happens because profit competes with safety. Clause -5.4.4.2 does not omit sprinklers from areas throughout closed stations, but because profit competes with safety, this clause is not given sufficient pause or just cause. Designers seldom consider the contrapositive of clause -5.4.4.2 which is “Sprinkler protection in enclosed stations shall not be omitted...”. By the laws of logic, if the premise is true (and we take the leap of faith that framers intended for Section -5.4.4.2 to be true and not arbitrary or self-conflicting) then the contrapositive is true. If the contrapositive in this case is not true, then what does that say about the efficiency of -5.4.4.2 as the starting precedent?.

Too many Metro projects have been installed without sprinklers because of:
1). prioritizing the first sprinkler prescription -5.4.4.1.
2). not apply the contrapositive to -5.4.4.2 and
3). a. ignoring the self-conflict that is apparent between -5.4.4.3 and -5.4.4.1, or
3).b. not understanding the importance of building code precedence over subordinate standards, and/or
3).c. not understanding the implication in the building code when it says to ‘install sprinklers throughout per NFPA 13...’

While architects know to go to the Building Code first, few engineers outside the USA realize this is how the NFPA standards are intended to work—at least in the USA. Few designers or engineers outside the USA would realize to stop looking for guidance on Metro sprinkler design in their local building code (if they wandered that far from NFPA 130 in the first place), but to switch their review to a new document where at the somewhat hidden item -A.8.1.1 in the appendix of NFPA 13, the designer at last finds definition of the ‘sprinklered throughout’ intention.

If we really wanted to reduce the world-wide burden of fire and other hazards, and we want to increase sales of our American design standards in standup fashion, then let us clearly say what is our legal intention. Legally, if there were a multiple fire fatality in a Metro station, would we at NFPA pony-up the money for liability, or would we claim no responsibility in these facilities because we told the designers to install sprinklers throughout – if only they had read the third prescription (-5.4.4.3) and not fixated on the first one.

Would a judge think this decision-flow on this design a reasonable one? This loophole has left many a project without sprinklers, and wasted hundreds if not more design-hours, just so we at NFPA can market a non sprinklered station to more cities and nations.
There are compelling reasons for non-sprinklered stations, not the least being NFPA 130 attempts to limit combustibles (or not not-use noncombustibles ;-). Even before the 2010 & 2014 editions of NFPA 130 applied increased pressure to limit combustibles in Fixed Guideway Transit Systems, the fatal fire incidence rate in Germany, UK and USA passenger rails was impressively low. For 10-, 8- and 5.5-year survey periods the literature suggests 0, 1, and 1 fatalities for each country. And the 2 fatalities apparently were sleeping trespassers in parked trains.[1,2,3,4,5,6]. While limited combustibles and historically low fatal fires are good rationale for not installing sprinklers in other nations’ train stations, back in the USA it is ever more prevalent to see sprinklers over rail system structures. Almost all enclosed new USA airport rail-system platforms get sprinklers. Sprinklers in enclosed stations are mandated by California building code, since at least 2013. California Building Code requires sprinklers over enclosed platforms, and California building code also requires an under platform deluge sprinkler system for under train fires at underground or open-cut stations. Despite the lack of movement in NFPA 130 regarding directions for sprinkler locations, the sprinklers are trending upwards in the USA-- throughout enclosed Fixed Guideway Transit System stations.

This comment is related to public input on document intent (-4.2.2) and NFPA 130 interface with building codes (-A.5.1.2.1).

[1]. OPNV TUNNEL SYSTSEM Preasearch Project FEW 70 0788/2009 of the Federal Ministry of Transport, Construction and Housing for the STUVAted – Studiengesellschaft fur unteridische Verkehrsanlagen GmbH – Cologne
[5]. “Commuter Rail Safety Study”, Federal Transit Administration, 10 Nov. 2006

Submitter Information Verification
This PI has not been submitted yet
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5.4.6 Portable Fire Extinguishers.

Portable fire extinguishers in such number, size, type, and location as determined by the authority having jurisdiction shall be provided throughout the station in accordance with NFPA 10.

5.4.6.1

Portable fire extinguishers shall be maintained in accordance with NFPA 10.

**Statement of Problem and Substantiation for Public Input**

NFPA 10, Standard for Portable Fire Extinguishers provides minimum requirements for size, type, quantity and distribution of extinguishers. NFPA 415 requires portable fire extinguishers throughout airport terminal buildings in accordance with NFPA 10. NFPA 130 should be updated with a similar requirement.

**Submitter Information Verification**

- **Submitter Full Name:** Jennifer Boyle
- **Organization:** FEMA
- **Affiliation:** FEMA
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Tue Jun 20 10:35:44 EDT 2017

**Committee Statement**

- **Resolution:** The existing language permits site-specific determination, which the Committee agrees is necessary.
Portable fire extinguishers shall be inspected and maintained in accordance with NFPA 10.

Statement of Problem and Substantiation for Public Input

Monthly inspections and annual maintenance of extinguishers helps ensure an extinguisher will operate effectively and safely when it is needed during a fire emergency.

Submitter Information Verification

Submitter Full Name: Jennifer Boyle
Organization: FEMA
Affiliation: FEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 20 10:38:06 EDT 2017

Committee Statement

Resolution: 
Statement: This revision makes the language consistent with that in NFPA 101 and coordinates with FR #47.
Public Input No. 15-NFPA 130-2017 [New Section after 6.1.1]

6.1.2
Where a trainway or a portion of a trainway is not fully enclosed on both sides, is not fully enclosed on top, or any combination thereof, the decision by the authority having jurisdiction to consider the trainway as a transit tunnel shall be made after an engineering analysis is performed.

Statement of Problem and Substantiation for Public Input

The current standard does not define a transit tunnel. This raises issues, particularly in the consideration of partially enclosed facilities. These facilities may possess many of the attributes of a tunnel, however currently the standard contains no language to require an assessment of the hazards and risks associated with such a partially enclosed facility. The proposed text is intended to require such an assessment to be carried out and its findings to be approved by the AHJ.

Related Public Inputs for This Document

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<td>Defines a transit tunnel</td>
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Submitter Information Verification

Submitter Full Name: Iain Bowman
Organization: Mott MacDonald Canada Ltd
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Apr 27 18:02:00 EDT 2017

Committee Statement

Resolution: The concept of the proposed term “transit tunnel” is addressed in NFPA 130 by the term “enclosed”. See FR #10 and FR #11.
6.2.2 Construction Type.

6.2.2.1* Cut and Cover.

Where trainway sections are to be constructed by the cut-and-cover method, the fire resistance ratings of perimeter walls and related construction shall be not less than as indicated in 6.2.2.1.1, unless otherwise permitted in 6.2.2.1.2.

6.2.2.1.1 The fire resistance ratings of Type I (442 or 332) construction or Type II (222, 111 or 000) construction or of combinations of Type I or, and Type II noncombustible construction as defined in NFPA 220, as determined by an engineering required in NFPA 220.

6.2.2.1.2 Fire resistance ratings determined by a fire hazard analysis of potential fire exposure hazards to the structure.

6.2.2.2 Bored Tunnels.

Where trainway sections are to be constructed by a tunneling method through earth, unprotected steel liners, reinforced concrete, shotcrete, or equivalent shall be used.

6.2.2.3 Rock Tunnels.

Rock tunnels shall be permitted to utilize steel bents with concrete liner if lining is required.

6.2.2.4 Underwater Tubes.

Underwater tubes shall be constructed of materials or assemblies permitted for use in a Type of construction that is, not less than Type II (000) noncombustible construction as defined in accordance with NFPA 220, as applicable.

6.2.2.5 Exit and Ventilation Structures.

Remote vertical exit shafts and ventilation structures shall be constructed of materials or assemblies permitted for use in a Type of construction that is, not less than Type I (332) noncombustible construction as defined in accordance with NFPA 220.

6.2.2.6 Surface.

Construction materials shall consist of materials or assemblies permitted for use in a Type of construction that is, not less than Type II (000) noncombustible material as defined in NFPA 220, as determined in accordance with NFPA 220, unless otherwise permitted by a fire hazard analysis of potential fire exposure hazards to the structure.

6.2.2.7 Elevated.

All structures necessary for trainway support and all structures and enclosures on or under trainways shall be constructed of materials or assemblies permitted for use in a Type of construction that is, not less than Type I or Type II (000) or combinations of Type I or Type II noncombustible construction as defined in accordance with NFPA 220, as determined, unless otherwise permitted by a fire hazard analysis of potential fire exposure hazards to the structure.

Statement of Problem and Substantiation for Public Input

The requirements are not consistent with NFPA 220. This public input changes the requirements to make them consistent with NFPA 220. However, NFPA 220 allows Type II construction to be made of limited combustible materials and Table 4.1.1 indicates that the fire resistance ratings for all construction elements in Type II (000) construction are 0 hours, meaning that no fire resistance rating is required. I don't think that is what the committee intends.

I will submit an alternate public input that actually requires the use of noncombustible construction.

If the committee really wants Type II construction then it needs to define limited combustible materials and I will propose language for that, taken out of NFPA 101 (and 5000) in the 2018 editions.

Related Public Inputs for This Document
Committee Statement

Resolution: FR-42-NFPA 130-2017

Statement: The proposal adds the phrase “fire resistance rating” and clarifies that the intent is to require noncombustible construction for all trainway configurations, regardless of construction type.
6.2.2 Construction Type.
6.2.2.1 Cut and Cover.

Where trainway sections are to be constructed by the cut-and-cover method, the fire resistance ratings of perimeter walls and related construction shall be not less than as indicated in 6.2.2.1.1, unless otherwise permitted in 6.2.2.1.2.

6.2.2.1.1 The fire resistance ratings of Type I (442 or 332) construction or Type II (222, 111) construction or of combinations of the corresponding Type I or Type II noncombustible construction, as defined in NFPA 220, as determined by an engineering required in NFPA 220.

6.2.2.1.2 Fire resistance ratings determined by a fire hazard analysis of potential fire exposure hazards to the structure.

6.2.2.2 Bored Tunnels.

Where trainway sections are to be constructed by a tunneling method through earth, unprotected steel liners, reinforced concrete, shotcrete, or equivalent shall be used.

6.2.2.3 Rock Tunnels.

Rock tunnels shall be permitted to utilize steel bents with concrete liner if lining is required.

6.2.2.4 Underwater Tubes.

Underwater tubes shall be constructed of materials or assemblies permitted for use in a Type of construction that is not less than Type II (000 111) noncombustible construction as defined, in accordance with NFPA 220.

6.2.2.5 Exit and Ventilation Structures.

Remote vertical exit shafts and ventilation structures shall be constructed of materials or assemblies permitted for use in a Type of construction that is not less than Type I (332) noncombustible construction as defined, in accordance with NFPA 220.

6.2.2.6 Surface Construction materials shall be constructed of materials or assemblies permitted for use in a Type of construction that is not less than Type II.
Statement of Problem and Substantiation for Public Input

This public input states that the minimum construction must be Type II (111), which at least requires some fire resistance ratings to be determined for the construction elements. It is consistent with NFPA 220 and also does not require the exclusive use of noncombustible materials, just like one alternate associated public input to this section, which allows (as at present) Type II (000) materials without any fire resistance rating.

Related Public Inputs for This Document

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<thead>
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<td>Public Input No. 71-NFPA 130-2017 [Section No. 6.2.2]</td>
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</table>

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler  
Organization: GBH International  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Jun 22 19:28:25 EDT 2017

Committee Statement

Resolution: FR-42-NFPA 130-2017
Statement: The proposal adds the phrase “fire resistance rating” and clarifies that the intent is to require noncombustible construction for all trainway configurations, regardless of construction type.
6.2.2 Construction Type.

6.2.2.1 Cut and Cover.
Where trainway sections are to be constructed by the cut-and-cover method, the fire resistance ratings of perimeter walls and related construction shall be not less than those associated with Type I or Type II or combinations of Type I or Type II noncombustible construction, as defined, in accordance with NFPA 220, as determined by, unless otherwise permitted as a result of an engineering analysis of potential fire exposure hazards to the structure.

6.2.2.2 Bored Tunnels.
Where trainway sections are to be constructed by a tunneling method through earth, unprotected steel liners, reinforced concrete, shotcrete, or equivalent shall be used.

6.2.2.3 Rock Tunnels.
Rock tunnels shall be permitted to utilize steel bents with concrete liner if lining is required.

6.2.2.4 Underwater Tubes.
Underwater tubes shall be not less than Type II (000) noncombustible construction as defined in NFPA 220, as applicable constructed of materials or assemblies permitted for use in Type I noncombustible construction, in accordance with NFPA 220.

6.2.2.5 Exit and Ventilation Structures.
Remote vertical exit shafts and ventilation structures shall be not less than constructed of materials or assemblies permitted for use in Type I (332) noncombustible construction, as defined, in accordance with NFPA 220.

6.2.2.6 Surface.
Construction materials shall be not less than Type II (000) noncombustible material as defined in NFPA 220, as determined, materials or assemblies permitted for use in Type I noncombustible construction, in accordance with NFPA 220, unless otherwise permitted by a fire hazard analysis of potential fire exposure hazards to the structure.

6.2.2.7 Elevated.
All structures necessary for trainway support and all structures and enclosures on or under trainways shall be constructed of not less than Type I or Type II (000) or combinations of Type I or Type II noncombustible construction as defined in NFPA 220, as determined, materials or assemblies permitted for use in Type I noncombustible construction, in accordance with NFPA 220, unless otherwise permitted by a fire hazard analysis of potential fire exposure hazards to the structure.

Statement of Problem and Substantiation for Public Input
This is the third and last public input on the same section and it requires everything to be noncombustible, i.e. Type I construction.

Related Public Inputs for This Document

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Submitter Information Verification
Submitter Full Name: Marcelo Hirschler
Organization: GBH International

Committee Statement
Resolution: FR-42-NFPA 130-2017
Statement: The proposal adds the phrase “fire resistance rating” and clarifies that the intent is to require noncombustible construction for all trainway configurations, regardless of construction type.

Submittal Date: Thu Jun 22 19:50:40 EDT 2017
6.2.8 Rail Ties.

6.2.8.1 Rail ties shall be constructed of materials that have mechanical and physical properties that make them suitable for the application as well as the requirements contained in 6.2.8.2 through 6.2.8.4, as appropriate.

6.2.8.2 Rail ties, used in enclosed locations shall be noncombustible materials in accordance with Section 4.7.

6.2.8.3 Rail ties used outdoors at switch or crossover locations shall be made of materials that comply with one of the following:

(1) Materials that comply with 6.2.8.1
(2) Fire retardant–treated wood in accordance with NFPA 703
(3) Pressure-treated wood materials that exhibit a flame spread index of not more than 75 when tested in accordance with ASTM E84
(4) Plastic composite materials that comply with the requirements of ASTM D7568 and exhibit a flame spread index of not more than 75 in accordance with ASTM E84
(5) Wood encased in concrete such that only the top surface is exposed

6.2.8.4 Rail ties used outdoors at locations other than switch or crossover locations shall comply with one of the following:

(1) Materials that comply with 6.2.8.1 or 6.2.8.2
(2) Pressure treated wood materials
(3) Plastic composite materials that comply with the requirements of ASTM D7568

Statement of Problem and Substantiation for Public Input

This added language is intended to ensure that materials are not chosen for use as rail ties simply as a function of the fire properties.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 23 22:04:06 EDT 2017

Committee Statement

Resolution: The proposal is not within the scope of NFPA 130.
6.2.8.1
Rail ties used in enclosed locations shall be noncombustible materials in accordance with Section 4.2.6.

Statement of Problem and Substantiation for Public Input

This just corrects a typo: section 4.6 deals with noncombustible materials and existing section 4.7 deals with fire life safety system integrity, which is not what this section 6.2.8.1 is intended to reference.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 23 21:59:26 EDT 2017

Committee Statement

Resolution: FR-43-NFPA 130-2017
Statement: This revision corrects a typo: section 4.6 deals with noncombustible materials and existing section 4.7 deals with fire life safety system integrity, which is not what 6.2.8.1 is intended to reference.
6.2.8.2

Rail ties used outdoors at switch or crossover locations shall be made of materials that comply with one of the following:

1. Materials that comply with 6.2.8.1
2. Limited combustible materials in accordance with section 4.7.
3. Fire retardant–treated wood in accordance with NFPA 703
4. Pressure-treated wood materials that exhibit a flame spread index of not more than 75 when tested in accordance with ASTM E84
5. Plastic composite materials that comply with the requirements of ASTM D7568 and exhibit a flame spread index of not more than 75 in accordance with ASTM E84
6. Wood encased in concrete such that only the top surface is exposed

Statement of Problem and Substantiation for Public Input

The requirements for limited combustible materials are proposed to be added to chapter 4. Materials that comply with this requirement are very low heat release materials providing much better fire performance than materials such as fire retardant treated wood permitted in this section. Note that the reference is to the new proposed section 4.7 and not to the existing section 4.7 on fire life safety system integrity.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 23 21:51:57 EDT 2017

Committee Statement

Resolution: The committee is open to the idea of allowing limited combustible materials, however they request that the submitter properly references limited combustible materials in this section.
6.3.1.4
Within enclosed trainways, the maximum distance between exits shall, or trainway egress points, shall not exceed 762 m (2500 ft).

6.3.1.4.1 The distance from an exit in a tunnel shall be measured from the center of an exit door at a tunnel emergency exit.

6.3.1.4.2 The distance from an exit, or trainway egress point, at a station shall be measured from the center of an exit door at a station emergency exit connecting directly from the trainway, from the end of a station platform, or from the designated egress opening in a platform screen or platform edge door system, as applicable.

Statement of Problem and Substantiation for Public Input

Clause A.6.3.1.6(2) provides guidance for measuring the length of a tunnel trainway means of egress route between a cross-passageway and a station. However, there is no guidance provided in the Standard or Annex A for measuring the length of a tunnel trainway means of egress route between stations, or between a tunnel emergency exit and a station, to assess compliance with the maximum distance of 762 m (2500 ft) prescribed by Clause 6.3.1.4.

The proposed changes to Clause 6.3.1.4 are to clarify the exits or egress points from the means of egress routes within an enclosed trainway as being: (1) an exit door to a tunnel emergency exit; or (2) an exit or egress point at a station, defined by the proposed additional text for Clause 6.3.1.4.

The term “trainway egress point” is introduced because the ends of platforms, as currently specified in Clause A.6.3.1.6(2) and proposed for Clause 6.3.1.4, do not qualify as “exits” as defined by NFPA 101. “Trainway egress point” is analogous to the description of egress points from station platforms in Clause 5.3.3.4 Travel Distance, specifically: “a point at which the means of egress route leaves the platform.”

The criteria added to Clause 6.3.1.4, and the reference to Clause A.6.3.1.6(2) added to Clause A.6.3.1.4, provide consistent guidance for measuring the length of a tunnel trainway means of egress route to a station.

Related Public Inputs for This Document

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</table>

Submitter Information Verification

Submitter Full Name: Howard J. Cohen
Organization: AECOM
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 11:21:29 EDT 2017

Committee Statement

Resolution: The phrase “from the center of an exit door” implies a level of accuracy that is not intended in the Standard. A.6.3.1.4 and A.6.3.1.6(2) address concerns raised in the proposal. See also FR #44.
**Sections 6.3.1.4, 6.3.1.5, 6.3.1.6**

### 6.3.1.4*

Within enclosed trainways, the maximum distance between exits shall not exceed 762 m (2500 ft) unless through performing a risk engineering analysis equivalency is demonstrated for an alternative distance to a point of safety.

In performing the equivalency analysis the following factors must be included: the:

1. Probability of a design fire event
2. Probability of a train evacuation being conducted other than at a point of safety
3. Probability that another compartment in the train is a point of safety for the design fire
4. Fire growth rate during the evacuation phase of the design fire event
5. Maximum expected fire load during the evacuation phase of the design fire event
6. Expected fire resistance characteristics of the rollingstock
7. Maximum time necessary for evacuating the train after immobilisation of the train
8. Maximum time necessary for all passengers to reach the nearest station or point of safety
9. Ability of the tunnel vent system to provide a tenable environment along the path to the nearest station or other point of safety
10. The special safety risks of collapse of cross passages and exit shafts during construction may justify varying the exact location of these points of safety so long as equivalency in performance at the revised locations is demonstrated.

### 6.3.1.5

Cross-passageways shall be permitted to be used in lieu of emergency exit stairways to the surface where trainways, “Stations or Exits” as a point of safety where trainways in tunnels are divided by a minimum of 2 hour–rated fire separations or where trainways are in twin bores.

### 6.3.1.6

Where cross-passageways are utilized in lieu of emergency exit stairways, the following requirements shall apply:

- Cross-passageways shall not be farther than 244 m (800 ft) apart.
- Cross-passageways shall not be farther than 244 m (800 ft) from the station or portal of the enclosed trainway.

In performing the equivalency analysis the following factors must be included: the:

1. Probability of a design fire event
2. Probability of a train evacuation being conducted other than at a point of safety
3. Probability that another compartment in the train is a point of safety for the design fire
4. Fire growth rate during the evacuation phase of the design fire event
5. Maximum expected fire load during the evacuation phase of the design fire event
6. Expected fire resistance characteristics of the rollingstock
7. Maximum time necessary for evacuating the train after immobilisation of the train
8. Maximum time necessary for all passengers to reach the nearest station or point of safety
9. Ability of the tunnel vent system to provide a tenable environment along the path to the nearest station or other point of safety
### Statement of Problem and Substantiation for Public Input

**Justification**

The emergency provisions of NFPA 130 demand revision in light of the latest statistical information on the nature and severity of fires actually being experienced in modern metros. A combination of improved rollingstock, signalling, power supplies, reliability and operational sophistication has substantially reduced the probability of fires occurring in metros and the size of the fires if they occur and the likelihood of evacuation other than at stations or other predetermined emergency evacuation locations.

Modern metros in Europe and Japan, for the most part, do not use cross passages as the stations serve as places of safety and the systems are considered so reliable, and the risks so small, they are not considered necessary where the distances between station distances are small. Furthermore the latest historical and statistical analysis of Metro Fires suggests a sharp decline in the number of fire incidents in new and modern metros worldwide over the last 10 years or so.

In this context NFPA 130’s position as the leading international standard for underground metros is jeopardised by its current prescriptive approach despite the overarching equivalency provisions within the standard. Unfortunately the equivalency provisions are too vague for AHJs and clients. Projects internationally are turning away from NFPA 130 to other regulatory options such as the European TSI for railway tunnels.

Projects currently resisting NFPA130 compliance include those in Egypt, Singapore, Qatar, and Saudi Arabia. There are currently major debates about whether the no cross passage solutions by Japanese design teams should be embraced in other emerging economies, likewise raising the prospect of NFPA130 rejection.

It is in these circumstances I am proposing the following additional amendments to Clause 6.3 of NFPA130.

At 6.3.1.4 – I propose the introduction of a risk engineering analysis that provides the option of an equivalency argument to support an extension of the 762mtr maximum distance to exits and replace it with a distance determined by equivalency to a point of safety which would include exits and stations.

The equivalency analysis specifies factors which must be considered but allows other factors to be included if they are considered relevant.

These factors provide the mechanisms for new railways to explore the safety benefits of improvements to materials, technologies and procedures that impact the spacing requirements to points of safety.

Modifications to Clause 6.3.1.5 allow cross passageways to be used in lieu a point of safety.

Clause 6.3.1.6 allows equivalency arguments to inform the spacings of cross passages in much the same way as points of safety for single tube tunnels.

In this way the prescriptive requirements of NFPA130 are maintained but while at the same time providing a mechanism for the improvements in signalling, material science, reliability, traction power and the like to inform the emergency egress tunnel design.
An addition at 3.3.16.2* will also be proposed for completeness as follows:

3.3.16.2* Point of Safety. A point of safety is one of the following:
(1) An enclosed exit that leads to a public way or safe location outside the station, trainway or vehicle
(2) An at-grade point beyond the vehicle, enclosing station or trainway
(3) Any other approved location

References
(5) "Investigating train accident risk relating to train operations and rolling stock failures to improve industry risk management: Summary report," RSSB, 2017

Submitter Information Verification

Submitter Full Name: Arnold Dix
Organization: ALARP Consulting Group and University of Western Sydney
Affiliation: Confidential Government clients internationally
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 12 07:13:01 EDT 2017

Committee Statement

Resolution: FR-44-NFPA 130-2017
Statement: The committee agrees that a cross-reference to A.6.3.1.6(2) is appropriate.

This revision introduces an engineering analysis option to support an extension of the 762 m maximum distance to exits with a distance determined by equivalency to a point of safety which would include exits and stations. The equivalency analysis specifies factors that should be considered but allows other factors to be included if they are considered relevant. These factors provide the mechanisms for new railways to explore the safety benefits of improvements to materials, technologies and procedures that impact the spacing requirements to points of safety.

See also FR #45.
6.3.4.3

To provide isolation from the overhead contact system, the following requirements shall apply:

1. Power conductor(s) (dc or ac, which supply power to the vehicle for propulsion and other loads) shall be secured to insulating supports, bonded at joints, and protected to prevent contact with personnel.

2. Insulating material for the cable. Traction Power cables connecting power to the power rail or OCS shall meet the FT4/IEEE 1202 exposure requirements for cable char height, total smoke released, and peak smoke release rate of ANSI/UL 1685 of chapter 12.

Statement of Problem and Substantiation for Public Input

Chapter 12 specifies the UL 1685 flame test, wet ratings and temperature ratings. Traction power cables need to comply with chapter 12 the same way as all other cables in tunnel.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 11:46:36 EDT 2017

Committee Statement

Resolution: FR-7-NFPA 130-2017
Statement: The information in this section is redundant with respect to the fire test because it is already included in chapter 12. This has been clarified by FR #2.
Public Input No. 57-NFPA 130-2017 [ New Section after 6.4.6 ]

TITLE OF NEW CONTENT
Type your content here ...

PORTABLE FIRE EXTINGUISHERS SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH NFPA 10.

Statement of Problem and Substantiation for Public Input

MONTHLY INSPECTIONS AND ANNUAL MAINTENANCE OF EXTINGUISHERS HELPENSURE AN EXTINGUISHER WILL OPERATE EFFECTIVELY AND SAFELY WHEN IT IS NEEDED DURING A FIRE EMERGENCY.

Submitter Information Verification

Submitter Full Name: Jennifer Boyle
Organization: FEMA
Affiliation: FEMA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 20 10:39:22 EDT 2017

Committee Statement

Resolution:
Statement: This revision makes the language consistent with that in NFPA 101 and coordinates with FR #15.
Public Input No. 135-NFPA 130-2017 [Sections 7.1.2, 7.1.3, 7.1.4]

Sections 7.1.2, 7.1.3, 7.1.4

7.1.2

The requirement for a mechanical or nonmechanical system intended for the purpose of emergency ventilation shall be determined in accordance with 7.1.2.1 through 7.1.2.4.

7.1.2.1 *

For length determination, all contiguous enclosed trainway and underground system station segments between portals shall be included.

7.1.2.2 *

A mechanical emergency ventilation system shall be provided in the following locations: in an enclosed station in an underground or enclosed trainway that is greater in length than 1000 ft (305 m) trainway.

7.1.2.3 *

A mechanical emergency ventilation system shall not be required in the following locations: in an open system station where the length of an underground trainway is less than or equal to 200 ft (61 m) station or trainway.

7.1.2.4 *

Where supported by engineering analysis, a nonmechanical emergency ventilation system shall be permitted to be provided in lieu of a mechanical emergency ventilation system in the following locations:

1. Where the length of the underground or enclosed trainway is less than or equal to 1000 ft (305 m) and greater than 200 ft (61 m)

2. In an enclosed station where engineering analysis indicates that a nonmechanical emergency ventilation system supports the tenability criteria of the project.

7.1.2.5 *

In the event that an engineering analysis is not conducted or does not support the use of a nonmechanical emergency ventilation system for the configurations described in 7.1.2.4, a mechanical emergency ventilation system shall be provided.

7.1.3

The engineering analysis of the emergency ventilation system shall include a validated subway analytical simulation program augmented as appropriate by a quantitative analysis of airflow dynamics produced in the fire scenario, such as would result from the application of validated computational fluid dynamics (CFD) techniques. The results of the analysis shall include computational models that have been validated for their intended purpose.

7.1.3.1

The analysis shall include determination of the no-fire (or cold) air velocities that can be measured during commissioning to confirm that a mechanical ventilation system as built meets the requirements determined by the analysis.

7.1.4 *

Where required by 7.1.2, the mechanical or nonmechanical emergency ventilation system shall make provisions for the protection of passengers, employees, and emergency personnel from fire and smoke during a fire emergency.

The analysis shall include all contiguous enclosed trainway and underground system station segments between portals.
Statement of Problem and Substantiation for Public Input

The proposed revisions to Sections 7.1.2 and 7.1.3 are intended to eliminate prescriptive criteria which does not align with a performance-based approach and current practice. Minor editorial re-organization is also proposed. With reference to revisions in the wording of Section 7.1.3, the existing requirement has been used to enforce a one-dimensional methodology (i.e., SES) for the analysis of an enclosed station with no adjacent tunnel segments, where the one-dimensional assumptions and simplifications were not valid. Refer also to related revisions to Annex A material.

Related Public Inputs for This Document

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Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name: Adrian Milford</th>
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</thead>
<tbody>
<tr>
<td>Organization: Jensen Hughes</td>
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<tr>
<td>Street Address:</td>
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<td>State:</td>
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<td>Submittal Date: Wed Jun 28 20:14:39 EDT 2017</td>
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Committee Statement

<table>
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<tr>
<th>Resolution: The proposal eliminates all prescriptive length criteria without substantiated basis.</th>
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</table>
7.1.2.2*
A mechanical emergency ventilation system shall be provided in the following locations:

(1) In an enclosed station

(2) In an underground or enclosed trainway that is greater in length than 1000 ft (305 m)

Statement of Problem and Substantiation for Public Input

Editorial revision to correspond to terminology currently used in the Standard.

Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 16:15:58 EDT 2017

Committee Statement

Resolution: FR-32-NFPA 130-2017
Statement: Editorial revision to correspond to terminology currently used in the Standard.
7.1.2.3
A mechanical emergency ventilation system shall not be required in the following locations:

(1) In an open system or portion thereof

(2) Where the length of an underground enclosed trainway is less than or equal to 200 ft (61 m)

Statement of Problem and Substantiation for Public Input

Editorial revision to correspond to terminology currently used in the Standard.

Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canad
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 16:14:04 EDT 2017

Committee Statement

Resolution: FR-31-NFPA 130-2017
Statement: Editorial revision to correspond to terminology currently used in the Standard. The phrase “or portion therof” was not added because it weakens the requirement.
The emergency ventilation system shall be designed to do the following:

1. Provide a tenable environment in egress routes serving the area of fire origin.
2. In enclosed trainways, provide a tenable environment along the path of egress from a fire incident in enclosed stations and enclosed trainways.
3. Produce sufficient airflow rates within enclosed trainways to meet critical velocity.
4. Be capable of reaching full operational mode within 180 seconds.
5. Accommodate the maximum number of trains that could be between ventilation shafts during an emergency.
6. Maintain the required airflow rates for a minimum of 1 hour but not less than the required time of tenability as described in Section 7.2.6.

A.7.2.1(1) Refer to Section A.5.3.3.1 regarding the intent of this requirement.
A.7.2.1(2) The intent of this requirement is to require tenability for egress upwind from the location of the train fire.

Statement of Problem and Substantiation for Public Input

The current wording of Section 7.2.1(1) is not clear in terms of the extent of the 'path of egress' that is required to remain tenable. Those requirements are better differentiated regarding intended application in stations versus trainways if listed as separate clauses. The additional Annex A notes are intended to provide additional clarification regarding intent.

Related Public Inputs for This Document

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<tr>
<th>Related Input</th>
<th>Relationship</th>
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<tr>
<td>Public Input No. 119-NFPA 130-2017 [Section No. A.5.3.3.1]</td>
<td>Cross-references added.</td>
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<td>Public Input No. 119-NFPA 130-2017 [Section No. A.5.3.3.1]</td>
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</table>

Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 16:22:43 EDT 2017

Committee Statement

Resolution: The proposed change adds requirements to number of egress routes without basis, and otherwise adds no clarity. Current wording is adequate.
7.2.6 Time of Tenability.

7.2.6.1 The criteria for tenability and time of tenability for stations and trainways shall be established and approved.

7.2.6.2 For stations, the time shall be greater than the calculated egress time used to establish egress capacity in 5.3.3.

Statement of Problem and Substantiation for Public Input

The proposed revisions bring the style of this section in line with other sections under Heading 7.2 Design. Existing Section 7.2.6.2, which is a modifier for existing Section 7.2.6.1, does not provide enough information for appropriate interpretation and application. Instead, revisions to Annex A Section A.7.2.6 are included in a separate proposal to more fully explain the intent.

Related Public Inputs for This Document

<table>
<thead>
<tr>
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<th>Relationship</th>
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</thead>
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<tr>
<td>Public Input No. 129-NFPA 130-2017 [Section No. A.7.2.6]</td>
<td>Related Annex A material</td>
</tr>
<tr>
<td>Public Input No. 128-NFPA 130-2017 [Section No. 7.2.6]</td>
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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 16:38:17 EDT 2017

Committee Statement

Resolution:
Statement: Clause 7.2.6.2 is required to clarify the requirements of Clause 7.2.6.1, and both clauses are needed. The reference to 5.3.3 needs to be removed because the egress time in 5.3.3 is not meant to be associated with time of tenability.

See FR 30 for annex A changes. Items balloting separately.
7.2.6.1
The criteria for tenability and time of tenability for stations and trainways shall be established and approved. The time of tenability should be further defined to make it specific to passengers and first responders.

Statement of Problem and Substantiation for Public Input

Chronologically, the events during the end of the time of tenability apply to either first responders or those that are unable to self-rescue. Those unable to self rescue would either be at a point of safety such as an emergency stairwell or at low level where smoke concentration levels would be more tenable than at standing height. In addition, first responders have protective equipment and air packs allowing them to survive in a more challenging environment.

Submitter Information Verification

Submitter Full Name: Ian Ong
Organization: Mott MacDonald
Street Address: 
City: 
State: 
Zip: 

Committee Statement

Resolution: Proposed revision does not change intent of current 7.2.6, and does not add any clarification. See Annex B.2.3 for time of tenability, and Clause 3.3.58 for tenable environment. Designing for 1st responders conflicts with serving passengers, and there are insufficient technical materials to specify the tenability for first responders. Also violates manual of style - no "should" in main body.
8.4 Flammability, Smoke and Smoke-Toxicity Emission.

8.4.1*
The test procedures and minimum performance for materials and assemblies shall be as detailed in Table 8.4.1 and Table 8.4.3.

Table 8.4.1 Fire Test Procedures and Performance Criteria for Materials and Assemblies

<table>
<thead>
<tr>
<th>Category</th>
<th>Function of Material</th>
<th>Test Method</th>
<th>Performance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cushioning</td>
<td>All individual flexible cushioning materials used in seat cushions, mattresses, mattress pads, armrests, crash pads, and grab rail padding a–e</td>
<td>ASTM D3675</td>
<td>$I_S = 25$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_S (1.5) = 100$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$D_S (4.0) = 175$</td>
</tr>
<tr>
<td>Fabrics</td>
<td>Seat upholstery, mattress ticking and covers, curtains, draperies, window shades, and woven seat cushion suspensions a–c, f–h</td>
<td>14 CFR 25, Appendix F, Part I (vertical test)</td>
<td>Flame time = 10 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Burn length = 6 in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_S (4.0) = 200$</td>
</tr>
<tr>
<td>Other vehicle components</td>
<td>Thermal and acoustical insulation a,b</td>
<td>ASTM E162</td>
<td>$I_S = 35$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_S (1.5) = 100$</td>
</tr>
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<td>$D_S (4.0) = 200$</td>
</tr>
<tr>
<td></td>
<td>HVAC ducting a,b</td>
<td>ASTM E162</td>
<td>$I_S = 25$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$D_S (4.0) = 100$</td>
</tr>
<tr>
<td></td>
<td>Floor covering b,k,l</td>
<td>ASTM E648</td>
<td>CRF = 5 kW/m²</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>$D_S (1.5) = 100$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_S (4.0) = 200$</td>
</tr>
<tr>
<td></td>
<td>Light diffusers, windows, and transparent plastic windscreens b,i</td>
<td>ASTM E162</td>
<td>$I_S = 100$</td>
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<td>$D_S (4.0) = 200$</td>
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<td>Adhesives and sealants a,b</td>
<td>ASTM E162</td>
<td>$I_S = 35$</td>
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<td>$D_S (1.5) = 100$</td>
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<td>$D_S (4.0) = 200$</td>
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<tr>
<td>Category</td>
<td>Function of Material</td>
<td>Test Method</td>
<td>Performance Criteria</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Elastomers a,b,i,j</td>
<td>Window gaskets, door nosings, intercar diaphragms, seat cushion suspension diaphragms, and roof mats</td>
<td>ASTM C1166</td>
<td>Flame propagation = 100 mm (4 in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_s (1.5) = 100$</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>$D_s (4.0) = 200$</td>
</tr>
<tr>
<td>Wire and cable</td>
<td>All</td>
<td>See 8.6.7.1.1.1 through 8.6.7.1.3.</td>
<td></td>
</tr>
<tr>
<td>Structural components m</td>
<td>Flooring, n other o</td>
<td>ASTM E119</td>
<td>Pass</td>
</tr>
</tbody>
</table>

aSee 8.4.1.1.
bSee 8.4.1.2.
cSee 8.4.1.3.
dSee 8.4.1.4.
eSee 8.4.1.5.
fSee 8.4.1.6.
gSee 8.4.1.7.
hSee 8.4.1.8.
iSee 8.4.1.9.
jSee 8.4.1.10.
kSee 8.4.1.11.
lSee 8.4.1.12.
mSee 8.4.1.13.
nSee 8.4.1.14.
oSee 8.4.1.15.

8.4.1.1* Materials tested for surface flammability shall not exhibit any flaming running or flaming dripping.

8.4.1.2 The ASTM E662 maximum test limits for smoke emission (specific optical density) shall be based on both the flaming and the nonflaming modes.

8.4.1.3* Testing of a complete seat assembly (including cushions, fabric layers, and upholstery) according to ASTM E1537 using the pass/fail criteria of California Technical Bulletin 133 and testing of a complete mattress assembly (including foam and ticking) according to ASTM E1590 using the pass/fail criteria of California Technical Bulletin 129 shall be permitted in lieu of the test methods prescribed herein, provided the assembly component units remain unchanged or new (replacement) assembly components possess fire performance properties equivalent to those of the original components tested.
8.4.1.3.1
A fire hazard analysis shall also be conducted that considers the operating environment within which the seat or mattress assembly will be used in relation to the risk of vandalism, puncture, cutting, introduction of additional combustibles, or other acts that potentially expose the individual components of the assemblies to an ignition source.

8.4.1.3.2
The requirements of 8.4.1.5 through 8.4.1.8 shall be met.

8.4.1.4
Testing shall be performed without upholstery.

8.4.1.5
The surface flammability and smoke emission characteristics shall be demonstrated to be permanent after dynamic testing according to ASTM D3574, Test I2 or Test I3, both using Procedure B, except that the test samples shall be a minimum of 150 mm (6 in.) x 450 mm (18 in.) x the thickness used in end-use configuration, or multiples thereof. If Test I3 is used, the size of the indentor described in Section 96.2 of ASTM D3574 shall be modified to accommodate the specified test specimen.

8.4.1.6
The surface flammability and smoke emission characteristics shall be demonstrated to be permanent by washing, if appropriate, in accordance with the manufacturer's recommended procedure. If a washing procedure is not provided by the manufacturer, the fabric shall be washed in accordance with ASTM E2061, Annex A1.

8.4.1.7
The surface flammability and smoke emission characteristics shall be demonstrated to be permanent by dry cleaning, if appropriate, according to ASTM D2724.

8.4.1.8
Materials that cannot be washed or dry cleaned shall be so labeled and shall meet the applicable performance criteria after being cleaned as recommended by the manufacturer.

8.4.1.9
Combustible operational and safety signage shall not be required to meet flame spread or smoke emission requirements if the combustible mass of a single sign does not exceed 500 g (1.1 lb) and the aggregate area of combustible signage does not exceed 1 ft² per foot of car length.

8.4.1.10*
Materials used to fabricate miscellaneous, discontinuous small parts (such as knobs, rollers, fasteners, clips, grommets, and small electrical parts) that will not contribute materially to fire growth in end use configuration shall be exempt from flammability and smoke emission performance requirements, provided that the surface area of any individual small part is less than 100 cm² (16 in.²) in end use configuration and an appropriate fire hazard analysis is conducted that addresses the location and quantity of the materials used and the vulnerability of the materials to ignition and contribution to flame spread.

8.4.1.11
Carpeting used as a wall or ceiling covering shall be tested according to ASTM E162 and ASTM E662 and shall meet the respective criteria of \( I_S = 35 \), \( D_S (1.5) = 100 \), and \( D_S (4.0) = 200 \). (See 8.4.1.1 and 8.4.1.2.)

8.4.1.12
If padding is used in the actual installation, floor covering shall be tested with padding in accordance with NFPA 253 or ASTM E648.

8.4.1.13
Penetrations (ducts, etc.) shall be designed against acting as passageways for fire and smoke, and representative penetrations of each type shall be included as part of test assemblies.

8.4.1.14*
See Section 8.5.
8.4.1.15*

Portions of the vehicle body that separate the major ignition source, energy sources, or sources of fuel load from vehicle interiors shall have fire resistance as determined by a fire hazard analysis acceptable to the authority having jurisdiction that addresses the location and quantity of the materials used, as well as vulnerability of the materials to ignition, flame spread, and smoke generation. These portions shall include equipment-carrying portions of a vehicle’s roof and the interior structure separating the levels of a bi-level car but do not include a flooring assembly subject to Section 8.5. In those cases, the use of the ASTM E119 test procedure shall not be required.

8.4.2*

Materials intended for use in a limited area of the vehicle and not meeting the requirements of Table 8.4.1 shall be permitted only after an appropriate fire hazard analysis establishes, within the limits of precision, that the material produces a contribution to fire hazard equal to or less than a material meeting the appropriate criteria of Table 8.4.1, where the alternative material is used in the same location to fulfill a function similar to the candidate material.

8.4.3

All materials and assemblies shall be tested for toxicity per ASTM D4490 Standard Practice for Measuring the Concentration of Toxic Gases or Vapors Using Detector Tubes during ASTM E662 testing starting at DS (5.0). Performance criteria shall be as detailed in Table 8.4.3.

---

**Additional Proposed Changes**

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**Statement of Problem and Substantiation for Public Input**

The passenger aircraft industry has complied with voluntary toxicity standards for smoke emissions for over 30 years. These same voluntary smoke emission toxicity standards have been used by numerous transit agencies for the materials in their passenger rail vehicles for the better part of 20 years. In the document “Recommended Fire Safety Practices for Rail Transit Materials Selection” (November 2008), the National Association of State Fire Marshals recommends the adoption of toxicity requirements. In addition, the EU has incorporated smoke emission toxicity in CEN TS 45545. The proposed smoke emission toxicity performance requirements are identical to those contained in voluntary standards as such as BSS-7239 and SMP-800C. Incorporation of smoke emission toxicity requirements into NFPA 130 is long overdue.

**Submitter Information Verification**

Submitter Full Name: Ritch Hollingsworth  
Organization: LTK Engineering Services
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Jun 27 15:35:11 EDT 2017

**Committee Statement**

Resolution: Additional toxicity testing research needs to be conducted as to previous studies conducted by NFPA, NIST and FAA to determine if toxicity testing is appropriate. Currently toxicity testing is required by the rail car owners but not by any other regulating organization.
<table>
<thead>
<tr>
<th>TOXIC GAS</th>
<th>RELEASE LIMIT</th>
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<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>CO</td>
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<tr>
<td>3500 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Fluoride</td>
<td>HF</td>
</tr>
<tr>
<td>200 ppm</td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>NO₂</td>
</tr>
<tr>
<td>100 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Chloride</td>
<td>HCL</td>
</tr>
<tr>
<td>500 ppm</td>
<td></td>
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<tr>
<td>Hydrogen Cyanide</td>
<td>HCN</td>
</tr>
<tr>
<td>150 ppm</td>
<td></td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>SO₂</td>
</tr>
<tr>
<td>100 ppm</td>
<td></td>
</tr>
</tbody>
</table>
The test procedures and minimum performance for materials and assemblies shall be as detailed in Table 8.4.1.

Table 8.4.1 Fire Test Procedures and Performance Criteria for Materials and Assemblies

<table>
<thead>
<tr>
<th>Category</th>
<th>Function of Material</th>
<th>Test Method</th>
<th>Performance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cushioning</td>
<td>All individual flexible cushioning materials used in seat cushions, mattresses, mattress pads, armrests, crash pads, and grab rail padding a–e</td>
<td>ASTM D3675</td>
<td>$I_s = 25$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_s(1.5) = 100$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$D_s(4.0) = 175$</td>
</tr>
<tr>
<td>Fabrics</td>
<td>Seat upholstery, mattress ticking and covers, curtains, draperies, window shades, and woven seat cushion suspensions a–c, f–h</td>
<td>14 CFR 25, Appendix F, Part I (vertical test)</td>
<td>Flame time = 10 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Burn length = 6 in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E662</td>
<td>$D_s(4.0) = 200$</td>
</tr>
<tr>
<td>Other vehicle</td>
<td>Seat and mattress frames, wall and ceiling lining and panels, seat and toilet shrouds, toilet seats, trays and other tables, partitions, shelves, opaque windscreens, combustible signage, end caps, roof housings, articulation bellows, exterior shells, nonmetallic skirts, battery case material, and component boxes and covers a,b,i–k</td>
<td>ASTM E162</td>
<td>$I_s = 35$</td>
</tr>
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<td>components</td>
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<td>ASTM E662</td>
<td>$D_s(1.5) = 100$</td>
</tr>
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<td></td>
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<td>$D_s(4.0) = 200$</td>
</tr>
<tr>
<td></td>
<td>HVAC ducting a,b</td>
<td>ASTM E162</td>
<td>$I_s = 25$</td>
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<td>ASTM E662</td>
<td>$D_s(4.0) = 100$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM E648</td>
<td>$CRF = 5 \text{ kW/m}^2$</td>
</tr>
<tr>
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<td>Floor covering b,k,l</td>
<td>ASTM E662</td>
<td>$D_s(1.5) = 100$</td>
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<td></td>
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<td>$D_s(4.0) = 200$</td>
</tr>
<tr>
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<td>Light diffusers, windows, and transparent plastic windscreens b,i</td>
<td>ASTM E162</td>
<td>$I_s = 100$</td>
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</tr>
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<td></td>
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<td>$D_s(4.0) = 200$</td>
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<tr>
<td></td>
<td>Adhesives and sealants a,b,p</td>
<td>ASTM E162</td>
<td>$I_s = 35$</td>
</tr>
<tr>
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<td>ASTM E662</td>
<td>$D_s(1.5) = 100D_s(4.0) = 200$</td>
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<tr>
<td>Category</td>
<td>Function of Material</td>
<td>Test Method</td>
<td>Performance Criteria</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------</td>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Elastomers&lt;sup&gt;a,b,i,j&lt;/sup&gt;</td>
<td>Window gaskets, door nosings, intercar diaphragms, seat cushion suspension diaphragms, and roof mats</td>
<td>ASTM C1166</td>
<td>Flame propagation = 100 mm (4 in.)</td>
</tr>
<tr>
<td>Wire and cable</td>
<td>All</td>
<td>See 8.6.7.1.1.1 through 8.6.7.1.3.</td>
<td>See 8.6.7.1.1.1 through 8.6.7.1.3.</td>
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<tr>
<td>Structural components&lt;sup&gt;m&lt;/sup&gt;</td>
<td>Flooring, n other&lt;sup&gt;o&lt;/sup&gt;</td>
<td>ASTM E119</td>
<td>Pass</td>
</tr>
</tbody>
</table>

<sup>a</sup>See 8.4.1.1.<br>
<sup>b</sup>See 8.4.1.2.<br>
<sup>c</sup>See 8.4.1.3.<br>
<sup>d</sup>See 8.4.1.4.<br>
<sup>e</sup>See 8.4.1.5.<br>
<sup>f</sup>See 8.4.1.6.<br>
<sup>g</sup>See 8.4.1.7.<br>
<sup>h</sup>See 8.4.1.8.<br>
<sup>i</sup>See 8.4.1.9.<br>
<sup>j</sup>See 8.4.1.10.<br>
<sup>k</sup>See 8.4.1.11.<br>
<sup>l</sup>See 8.4.1.12.<br>
<sup>m</sup>See 8.4.1.13.<br>
<sup>n</sup>See 8.4.1.14.<br>
<sup>o</sup>See 8.4.1.15.<br>
<sup>p</sup>See 8.4.1.16

**Statement of Problem and Substantiation for Public Input**

Guidance is needed for fire testing of adhesives and sealants because ASTM E162 provides no guidance on testing either adhesives or sealants and ASTM E662 provides guidance on adhesives but not sealants. The difference between an adhesive and a sealant is that the sealant is exposed and covers/adheres to one surface, whereas an adhesive joins two surfaces and is not exposed. Details are in an associated public input.

**Related Public Inputs for This Document**

<table>
<thead>
<tr>
<th>Related Input</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Input No. 104-NFPA 130-2017 [New Section after 8.4.1.15]</td>
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**Submitter Information Verification**
**Submitter Full Name:** Marcelo Hirschler
**Organization:** GBH International

<table>
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<td>FR-17-NFPA 130-2017</td>
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<td>This revision coordinates with FR #16.</td>
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</table>

**Submittal Date:** Tue Jun 27 16:35:53 EDT 2017
8.4.1.10*

Materials used to fabricate miscellaneous, discontinuous small parts (such as knobs, rollers, fasteners, clips, grommets, and small electrical parts) where the surface area of any individual small part is less than 100 cm$^2$ (16 in.$^2$) in end use configuration and that will not contribute materially to fire growth in end use configuration shall comply with either 8.4.1.10.1 or 8.4.1.10.2.

8.4.1.10.1 The materials shall be exempt from flammability and smoke emission performance requirements, provided that the surface area of any individual small part is less than 100 cm$^2$ (16 in.$^2$) in end use configuration and an appropriate fire hazard analysis is conducted that addresses the location and quantity of the materials used and the vulnerability of the materials to ignition and contribution to flame spread.

8.4.1.10.2 The materials shall be tested in accordance with ASTM E1354, Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter, at an initial test heat flux of 50 kW/m$^2$ (4.4 Btu/sec·ft$^2$) in the horizontal orientation with a retainer frame and they shall meet the performance criteria of a 180-second average heat release rate not exceeding 100 kW/m$^2$ (8.8 Btu/sec·ft$^2$) and a test average smoke extinction area not exceeding 500 m$^2$/kg (2441.2 ft$^2$/lb).

Statement of Problem and Substantiation for Public Input

A careful reading of this section indicates that the materials in these very small parts are only allowed not to be tested for flame spread and smoke if a fire hazard assessment has been conducted. The annex to this section has long said that it is appropriate (but only in a non-mandatory way) for the testing of the materials contained in these very small parts to be done using the cone calorimeter (ASTM E1354) instead of a fire hazard assessment. The use of ASTM E1354 as an alternate option for the materials in these very small parts should be allowed to be an alternate option in the mandatory part of the standard for the materials in these small parts.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 17:28:05 EDT 2017

Committee Statement

Resolution: FR-18-NFPA 130-2017
Statement: This revision allows an alternate method of qualifying small discontinuous commercial off-the-shelf components that are not typically formulated to meet the traditional flammability and smoke emissions requirements.
8.4.1.14*
See Section 8.5.1.

Statement of Problem and Substantiation for Public Input

Sections 8.5.2 and 8.5.3 are not relevant to flooring assemblies. Section 8.5.1.2 is also not relevant but 8.5.1.3 is where test details are included and it is best just to refer to 8.5.1 rather than split sections.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 27 17:01:11 EDT 2017

Committee Statement

Resolution: FR-19-NFPA 130-2017
Statement: Section 8.5.1 is where the details reside for the floor assemblies. This change guides the reader to that specific section rather than the general Section of 8.5.
8.4.1.6 Testing of adhesives and sealants

8.4.16.1 Adhesives and sealants shall be tested both in ASTM E162 and in ASTM E662 as a composite system, including a substrate, as shown in 8.4.16.2 through 8.4.16.4, as appropriate.

8.4.16.2 If the assembly or system for which the adhesive or sealant is intended is known, that system shall be tested.

8.4.16.3 In the absence of a specified assembly or system, adhesives and sealants intended for application to combustible base materials, shall be applied to the smooth face of ¹⁄₄-in. (6.4-mm) thick tempered hardboard, nominal density 800 to 960 kg/m³ (50 to 60 lb/ft³), using recommended (or practical) application techniques and coverage rates. Tests shall also be conducted on the hardboard alone, and these values shall be recorded as supplemental to the measured values for the composite specimen.

8.4.16.4 Adhesives and sealants intended for application to noncombustible substrate materials, shall be applied to the smooth face of 6.4 mm (¹⁄₄-in.) thick inorganic reinforced cement board, nominally 1762 ± 160 kg/m³ (110 ± 10 lb/ft³) in density, using recommended (or practical) application techniques and coverage rates.

Statement of Problem and Substantiation for Public Input

The information presented here is (partially) contained in ASTM E662 but there is no information in ASTM E162 on the method of testing.

Related Public Inputs for This Document

<table>
<thead>
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<th>Related Input</th>
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<td>Public Input No. 103-NFPA 130-2017 [Section No. 8.4.1 [Excluding any Sub-Sections]]</td>
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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 16:41:01 EDT 2017

Committee Statement

Resolution: FR-16-NFPA 130-2017
Statement: This new section provides guidance on the method of testing for adhesives and sealants.
8.5.2 Vehicle Sides and Ends.
A fire hazard analysis shall be conducted to demonstrate that fires originating outside the vehicle shall not extend into the passenger and crew areas before the vehicle is evacuated.

**6/16/2017**

The following change proposal is provided to address fire safety issues associated with open gangway vehicle design in the next version of NFPA 130:

1. **Modify current section 8.5.2 “Vehicle Sides and Ends” as follows:**

   8.5.2 A fire hazard analysis shall be conducted to demonstrate that fires originating outside the vehicle shall not extend into the passenger and crew areas before the vehicle is evacuated.

   8.5.2.1 For vehicle designs having end frame assemblies equipped with self closing hinged or sliding doors, floor fire testing shall be as specified in 8.5.1.3.

   8.5.2.2 For car designs equipped with open gangways between adjacent cars a 12’ long specimen including the connection between cars shall be floor fire tested as specified in 8.5.1.3 if design features to deter car to car smoke and fire spread are not provided in the car design. Acceptable design features are smoke curtain components at open gangway entry points and/or approved detection and suppression systems.

2. **Add the following definitions to NFPA 130 Chapter 3:**

   “End Frame Assembly:” Components at car ends incorporating the structural end frame and necessary non-structural components at the car interior. These may include components between car ends creating weather-tight passageways.

   “Open Gangway Configuration:” A passenger railcar consist design without fire resisting separations in the form of vertical assemblies equipped with hinged or sliding doors between adjacent passenger cars in an assembled consist.

3. **Rationale statement supporting the proposed change:**

   Use of open gangway designs to connect cars in consists including for passenger rail applications in underground operating environments as well as on surface trackways is increasing (see [https://en.wikipedia.org/wiki/Gangway_connection](https://en.wikipedia.org/wiki/Gangway_connection) for history and contemporary design examples).

   Proposals to purchase hundreds of heavy rail cars with open gangway designs connection one car to another for underground operating environments are being considered currently (see - “NYC Finally Gets On Board With the Subway Car of the Future” [https://www.citylab.com/transportation/2016/02/open-gangway/459300](https://www.citylab.com/transportation/2016/02/open-gangway/459300)).

   A basic tenent of fire safety engineering as found in the NFPA Decision Tree is “manage exposed.” In high rise buildings for example we rely on areas of refuge above and below fire effected floors to “manage exposed.”

   Similarly, for rail passenger car fires - until the train can be safely evacuated - the current “manage exposed” strategy takes the form of moving passengers from a car experiencing a growing fire or smoke incident to an adjacent car. In this case, the incident car assumingly is separated by doors separating the incident car from adjoining cars.

   Conversely, for cars with open gangway design, no such separations exist and smoke and flame can travel unimpeded from car to car.

   A recent peer reviewed study ["Fire safety assessment of Open Wide Gangway underground trains in tunnels using coupled fire and evacuation simulation"](https://doi.org/10.1007/s10712-016-0073-9) by Galea, et. al (Fire and Materials, 2016) presents results consistent with the intent of this proposed change. It stresses that a binary treatment of flashover occurrence (flashover or no flashover; time to flashover) for a given scenario is not the only factor be considered in decision making with respect to car and system designs.

   Certainly operating environment features including open or enclosed operation, presence or absence of emergency exitways in areas where evacuation may be needed and properties of fires themselves all need to be integrated. One example of this can be considered from Galea’s data from a luggage fire which, while not an ultrafast fire, could in an open gangway configuration lead to smoke spread and attendant disorientation of passengers remote from the car where the fire originates prior to evacuation. As such, pre-flashover impacts of effluents from growing fires needs to be factored in with open gangway designs as they will have effects on tenability beyond a car of origin.

   To mitigate rapid and potentially lethal travel of smoke and flame from a car where an incident originates to neighboring vehicles, a robust detection capability will need to be incorporated in open gangway car designs. To address this - because of differences in ceiling heights at ends of open gangway vehicles as compared to car center - detection capability incorporated at car ends and car center to sense travel of products of combustion toward and past car ends must be sufficient to trigger necessary associated suppression activity promptly.
Another option would be to incorporate a “fire door(s)” that stay open during normal operation but when smoke is detected closes automatically or can be closed manually. Dependent on car and gangway width, a bi-parting door design with sufficient space to house the doors in the door pockets when not closed could be incorporated.

In the absence of such features, open gangway designs should not be permitted without demonstrable, as yet unproven, mitigation features.

The experience of car to car fire spread in in the BART 1979 transbay tube fire - in which a modestly fire resisting end cap with self closing door prevented car to car fire spread until evacuation of the 42 passengers and crew was complete. Conversely, the car-to-car fire spread in the Daegu fire in S. Korea - which had an open gangway design and engulfed all six cars of the train rapidly - demonstrates the hazard of these proposed designs in the absence of fire safety design features to reduce the likelihood of car-to-car spread.

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Statement of Problem and Substantiation for Public Input

Rationale statement supporting the proposed change:

Use of open gangway designs to connect cars in consists including for passenger rail applications in underground operating environments as well as on surface trackways is increasing (see https://en.wikipedia.org/wiki/Gangway connection for history and contemporary design examples).

Proposals to purchase hundreds of heavy rail cars with open gangway designs connection one car to another for underground operating environments are being considered currently (see - “NYC Finally Gets On Board With the Subway Car of the Future - https://www.citylab.com/transportation/2016/02/...open-gangway/459300).

A basic tenent of fire safety engineering as found in the NFPA Decision Tree is “manage exposed.” In high rise buildings for example we rely on areas of refuge above and below fire effected floors to “manage exposed.”

Similarly, for rail passenger car fires - until the train can be safely evacuated -the current “manage exposed” strategy takes the form of moving passengers from a car experiencing a growing fire or smoke incident to an adjacent car. In this case, the incident car assumedly is separated by doors separating the incident car from adjoining cars.

Conversely, for cars with open gangway design, no such separations exist and smoke and flame can travel unimpeded from car to car.

To mitigate rapid and potentially lethal travel of smoke and flame from a car where an incident originates to neighboring vehicles, a robust detection capability will need to be incorporated in such open gangway car designs. To address this - because of differences in ceiling heights at ends of open gangway vehicles as compared to car center - detection capability incorporated at car ends and car center to sense travel of products of combustion toward and past car ends must be sufficient to trigger necessary suppression activity promptly.

Another option would be to incorporate a “fire door(s)” that stay open during normal operation but when smoke is detected closes automatically or can be closed manually. Dependent on car and gangway width, a bi-parting door design with sufficient space to house the doors in the door pockets when not closed could be incorporated.

In the absence of such features, open gangway designs should not be permitted without demonstrable, as yet unproven, mitigation features.
The experience of car to car fire spread in in the BART 1979 transbay tube fire - in which a modestly fire resisting end cap with self closing door prevented car to car fire spread until evacuation of the 42 passengers and crew was complete. Conversely, the car-to-car fire spread in the Daegu fire in S. Korea - which had an open gangway design and engulfed all six cars of the train rapidly - demonstrates the hazard of these proposed designs in the absence of fire safety design features to reduce the likelihood of car-to-car spread.

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Submitter Information Verification

Submitter Full Name: Joseph Zicherman  
Organization: BEAR - Berkeley Engineering  
Affiliation: NA  
Street Address:  
City:  
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Zip:  
Submittal Date: Mon Jun 19 10:26:56 EDT 2017

Committee Statement

Resolution: FR-26-NFPA 130-2017  
Statement: The additional testing and analysis due to the recent interest to utilize open gangways between rail cars is appropriate in order to provide a safe passageway between car bodies due to an exterior fire and to prevent fire spread from car to car in an interior fire scenario. See also FR #27 & FR #28.
All wires and cables shall be listed as being resistant to the spread of fire and shall have, as having, reduced smoke emissions by complying with 8.6.7.1.1.1 or 8.6.7.1.1.2.

Statement of Problem and Substantiation for Public Input

At present the requirements is just for the cables to be tested but the requirement should be for the cables to be listed, just as in stations.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: City:
State: Zip: Submittal Date: Wed Jun 21 18:47:52 EDT 2017

Committee Statement

Resolution: Currently cables used in rail car construction are not listed. The current practice in the industry is to test the cables and wiring for each car contract.
8.6.7.1.1.1—*

All wires and cables shall comply with the FT4/IEEE 1202 exposure requirements for cable char height and with ANSI/UL 1685 for total smoke released and peak smoke release rate of ANSI/UL 1685 when using the FT4/IEEE 1202 exposure.

Statement of Problem and Substantiation for Public Input

I have received queries that suggest that some users do not understand that all the requirements are based on the FT4/IEEE 1202 exposure of UL 1685 and not just the smoke ones. This public input, and the associated proposed new annex note should clarify.

Related Public Inputs for This Document

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Submitter Information Verification

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<th>Submitter Full Name:</th>
<th>Marcelo Hirschler</th>
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<td>GBH International</td>
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Committee Statement

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<tr>
<td>Statement:</td>
<td>The proposal adds clarification as to the test protocol used and the performance requirements.</td>
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</table>
Public Input No. 90-NFPA 130-2017 [Section No. 8.6.7.1.1.1]

8.6.7.1.1.1
All wires and cables shall comply with the following.

(1) FT4/IEEE 1202 exposure requirements for cable char height of 4' 11" or less, and with ANSI/UL 1685 for total smoke released of 150 m2 or less, and peak smoke release rate of 0.40 m2/s or less.

(2) FST requirements for Smoke ASTM E662, Toxicity BSS 7239 and Flame test per CFR 49 part 238 appendix B. (ICEA S-19-1981)

Statement of Problem and Substantiation for Public Input

Clarify the total smoke and peak smoke value and test method. UL 1685 has two smoke measurements methods, the values represent method 2. All train car wiring needs to pass FST in addition to UL 1685.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 11:25:32 EDT 2017

Committee Statement

Resolution: This proposal is covered by PI 64 (see FR #20). The ASTM E662 does not contain flame or toxicity requirements. CFR 238 does not include anything about wire and cable, and BSS 7239 is a private standard.
8.6.7.1.2

Low voltage power and control wires and cables (i.e., less than 100 V ac and 150 V dc) except of communication cables, shall comply with 8.6.7.1.1 and either of the following:

1. The physical, mechanical, and electrical performance requirements of ICEA S-95-658/NEMA WC-70 or ICEA S-73-532/NEMA WC-57, as applicable

2. The physical, mechanical, and electrical performance requirements of ANSI/UL 44 for thermosetting insulation and ANSI/UL 83 for thermoplastic insulation as applicable.

Statement of Problem and Substantiation for Public Input

Communication cable do not comply with UL 44 or UL 83 and they do not meet the physical, mechanical and electrical requirements of UL 44 or UL 83. Communication cable materials are thinner and they are not rated as 600V.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 11:36:00 EDT 2017

Committee Statement

Resolution: If the communication cables are to be the exception the author needs to identify the regulations that the communication cables do meet so that they can be incorporated into the Standard. PI 87 does not provide a suitable set of requirements for communication cables.
8.6.7.1.3 *
Communication and data cables shall comply with 8.6.7.1.1 and the corresponding specifications following:
(1) Corresponding specification as described in A.8.6.7.1.3
(2) The cables shall comply with selected mechanical and physical tests prescribed in AAR RP-585 as required by the AHJ.

Statement of Problem and Substantiation for Public Input

Communication cables do not follow section 8.6.7.1.2 since they do not follow UL 44 or UL 83 and they will not meet the required physical, mechanical and electrical in 8.6.7.1.2. North America authorities have been accepting mechanical tests like abrasion, cold temperature, oil test and crush test that are specified in AAR RP-585.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 27 11:05:19 EDT 2017

Committee Statement

Resolution: This proposal refers the reader to the Annex material for performance requirements. The material in the Annex is for guidance. In addition, the selected material and physical tests that are described in AAR RP-586 should be added to this section if appropriate.
600V and 2000V cables shall comply with AAR RP-585 and other local authorities requirement. This includes FST requirements such as Smoke ASTM E662, Toxicity BSS 7239 and Flame test per CFR 49 part 238 appendix B. (ICEA S-19-1981)

Statement of Problem and Substantiation for Public Input

Train cars wiring (600V and 2000v) require the compliance to the new section 8.6.7.1.5 by North America authorities as part of project submittal. Section 8.6.7.1.2 requires the physical, mechanical and electrical performance from Low voltage power under 100V AC, the new section 8.6.7.1.5 covers all other 600V and 2000V wiring (full wall) for physical, mechanical, electrical and FST in addition to UL 1685.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 27 10:01:12 EDT 2017

Committee Statement

Resolution: This proposal requires testing to CFR 49 Part 238 appendix B. published in 1999. There are no requirement in the current CFR 49 Part 238 Appendix B for wire and cable. Further it refers to other local authorities requirements and BSS 7239 toxicity test which is a private company test. non-specific local authorities requirements do not belong in this Standard. The committee requests that RP-585 be provided for review.
PUBLIC INPUT NO. 84-NFPA 130-2017 [NEW SECTION AFTER 8.6.7.1.4]

TITLE OF NEW CONTENT
8.6.7.1.6 600V reduced diameter wire shall comply with 8.6.7.1.5 or as modified by the AHJ.

STATEMENT OF PROBLEM AND SUBSTANTIATION FOR PUBLIC INPUT

Train cars reduced diameter wiring (600V) require the compliance to the new suggested section 8.6.7.1.5 by North America authorities as part of project submittal. Section 8.6.7.1.2 requires the physical, mechanical and electrical performance for Low voltage power under 100V AC, the new section 8.6.7.1.6 covers 600V reduce diameter wire that is not the same 600V wire in the new suggested 8.6.7.1.5. The new section 8.6.7.1.6 for reduce diameter wire covers the physical, mechanical, electrical and FST in addition to UL 1685.

SUBMITTER INFORMATION VERIFICATION

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 10:13:58 EDT 2017

COMMITTEE STATEMENT

Resolution: This proposal refers to requirements in the proposed 8.6.7.1.5 (PI 83) which has been resolved.
Public Input No. 85-NFPA 130-2017 [ Section No. 8.6.7.1.4 ]

8.6.7.1.4
Wires and cables used for heat, smoke, or other detection system shall comply with 8.6.7.1.1 and one of the following:

(1) Be capable of having 15-minute circuit integrity when tested in accordance with IEC 60331-11

- Demonstrate that, if circuit integrity is tested during the vertical flame test, a current continues operating for at least 5 minutes during the test

(1) ANSI / UL 2196

(2) Have circuit integrity cable in accordance with NFPA 70

Statement of Problem and Substantiation for Public Input

ANSI / UL 2196 is required by chapter 12 for circuit integrity cables, UL 2196 is a more consistent and reliable test than IEC 60331-11. There is no procedure or industry standard for the test specified in (2) for circuit integrity test during a vertical flame test.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 10:44:23 EDT 2017

Committee Statement

Resolution: No justification has been provided to increase the severity of the fire test required to assess the circuit integrity of these cables.
8.6.7.2 - Minimum Wire Size.

In no case shall single conductor wire (not part of multi-conductor cable) smaller than the following sizes be used:

1. 14 AWG (cross-section 2.1 mm$^2$) for wire pulled through conduits or wireways or installed exposed between enclosures

2. 22 AWG (cross-section 0.33 mm$^2$) for all wires, including those used on electronic units, equipment within a rack, cards, card racks, and wire laid in wireways

Statement of Problem and Substantiation for Public Input

This section is not needed. Smaller AWG size than 14 AWG are installed outside conduit. (As small as 22 AWG).

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 27 11:00:25 EDT 2017

Committee Statement

Resolution: The current requirement was incorporated to insure sufficient mechanical properties to withstand the rigors of transit applications. Considering the harsh environment seen in rail cars and rail construction the current section is still necessary. Deletion of this section is not appropriate.
TITLE OF NEW CONTENT
11.3.4 Signaling cables shall comply with chapter 12

Statement of Problem and Substantiation for Public Input

Part of the reliability of the control and signaling system is cable wet rating and temperature rating per chapter 12. The section is added to clarify the compliance of signaling cables to chapter 12.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 11:41:26 EDT 2017

Committee Statement

Resolution: The scope of Chapter 12 includes all of the cables in Chapter 11.
12.1.2 *
All wiring materials and installations other than for traction power shall conform to the requirements of NFPA 70 except as modified herein.

Statement of Problem and Substantiation for Public Input

Traction power cables should be part of chapter 12 and follow the wet rating, temperature, flame test and NRTL listing that are required for all transit infrastructure cables.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 27 12:52:14 EDT 2017

Committee Statement

Resolution: It is appropriate to retain the reference to traction power cables because they do not conform to the requirements of the NEC. See also FR #2.
12.2.1—

Wires and cables used in enclosed stations and trainways shall be listed as being resistant to the spread of fire and shall have reduced smoke emissions, by complying with one of the following:

(1) All wires and cables shall comply with the FT4/IEEE 1202 exposure requirements for cable char height, total smoke released, and peak smoke release rate of ANSI/UL 1685 UL 1685 when using the FT4/IEEE1202 exposure .

(2) Wires and cables listed as having adequate fire-resistant and low-smoke producing characteristics, by having a flame travel distance that does not exceed 1.5 m (5 ft) and generating a maximum peak optical density of smoke of 0.50 and a maximum average optical density of smoke of 0.15 when tested in accordance with NFPA 262, shall be permitted for use instead of the wires and cables specified in item (1).

Statement of Problem and Substantiation for Public Input

I have received queries that suggest that some users do not understand that all the requirements are based on the FT4/IEEE 1202 exposure of UL 1685 and not just the smoke ones. This public input, and the associated proposed new annex note, should clarify.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler  
Organization: GBH International  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jun 21 13:09:39 EDT 2017

Committee Statement

Resolution: FR-3-NFPA 130-2017

Statement: PI 94 included control and signaling cables, but the committee agrees that all cables from Chapter 11 are relevant. Traction power was added to clarify the requirements for flame and smoke after a separate section was created for them. Queries have been received that suggest that some users do not understand that all the requirements are based on the FT4/IEEE 1202 exposure of UL 1685 and not just the smoke ones. This revision clarifies these issues.

NOTE: The annex material for A.12.2.1(1) is being balloted separately as Detail FR #4. This should not be considered when voting on FR #3.
Public Input No. 94-NFPA 130-2017 [ Section No. 12.2.1 ]

12.2.1
Wires and cables used in enclosed stations and trainways including control and signaling cables and traction power cables shall be listed as being resistant to the spread of fire and shall have reduced smoke emissions, by complying with one of the following:

(1) All wires and cables shall comply with the FT4/IEEE 1202 exposure requirements for cable char height, total smoke released, and peak smoke release rate of ANSI/UL 1685.

(2) Wires and cables listed as having adequate fire-resistant and low-smoke producing characteristics, by having a flame travel distance that does not exceed 1.5 m (5 ft) and generating a maximum peak optical density of smoke of 0.50 and a maximum average optical density of smoke of 0.15 when tested in accordance with NFPA 262, shall be permitted for use instead of the wires and cables specified in item (1).

Statement of Problem and Substantiation for Public Input

Traction power and signaling cables shall follow chapter 12. Authorities do not require signaling cables to be a NRTL listed cable and they are usually installed on a messenger that is not permitted by previous revisions of NFPA 130. Traction power are excluded from chapter 12 in previous revisions of NFPA 130 for an unknown reason.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 11:52:00 EDT 2017

Committee Statement

Resolution: FR-3-NFPA 130-2017
Statement: PI 94 included control and signaling cables, but the committee agrees that all cables from Chapter 11 are relevant. Traction power was added to clarify the requirements for flame and smoke after a separate section was created for them. Queries have been received that suggest that some users do not understand that all the requirements are based on the FT4/IEEE 1202 exposure of UL 1685 and not just the smoke ones. This revision clarifies these issues.

NOTE: The annex material for A.12.2.1(1) is being balloted separately as Detail FR #4. This should not be considered when voting on FR #3.
Public Input No. 95-NFPA 130-2017 [ Section No. 12.4.2 ]

**12.4.2**
All conductors, except radio antennas and train signaling cables and traction power cables, shall be enclosed in their entirety in armor sheaths, conduits, or enclosed raceways, boxes, and cabinets except in ancillary areas. **Signal cables may be installed on a messenger as approved by the AHJ and in accordance with local installation practices.**

**Statement of Problem and Substantiation for Public Input**

Signaling cables and Traction power cables are usually not installed in enclosed raceways or armor. Chapter 12 needs to address the common installation practices to allow the addition of these cables to chapter 12.

**Submitter Information Verification**

**Submitter Full Name:** Gilad Shoshani  
**Organization:** RSCC Wire & Cable  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Tue Jun 27 12:44:05 EDT 2017

**Committee Statement**

**Resolution:** FR-5-NFPA 130-2017  
**Statement:** This revision clarifies which cables are not required to be enclosed. The messenger requirements are more appropriately placed in an annex note, as opposed to in the body of the standard. They have also been revised editorially.
A.3.3.55.2 Open Station or Trainway.

Direct dispersion. This is passing to atmosphere intended to apply to public circulation areas and to refer to configurations in which dispersion to the atmosphere is without ducting, without accumulation in occupied areas, and without entering or passing through another occupied level of the station impacting tenability in egress routes serving the area of fire origin.

Statement of Problem and Substantiation for Public Input

This revision is linked to other revisions to definitions for both open and enclosed stations and trainways. The intent is to improve interpretation for clarity of intended application of related requirements in the text of the Standard.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting CAN
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 15:03:16 EDT 2017

Committee Statement

Resolution: FR-10-NFPA 130-2017
Statement: Revisions are needed to improve appropriate interpretation of the intent of designation as open versus enclosed for purposes of applying related requirements in the text of the Standard. See also FR #11.
Public Input No. 120-NFPA 130-2017 [ New Section after A.5.1.2 ]

TITLE OF NEW CONTENT
-A.5.1.2.1  (see attached file)...

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

In my work with Metro design, this is the # 1 problem. It affects design and interface of so many issues. Worker-months of time have been wasted over the many Metro projects wresting with this fundamental issue: gaps between NFPA 130 and the local building code. Safety may not be greatly compromised-yet, because the accidental fire incidence in Metros is acceptably low. But then, a good portion of the planets 165+ existing Metros have not yet reached a mature age when gaps created at design will exacerbate. There is a lot at stake: subscription revenues and minimum level of reasonable safety. This public input is related to other public inputs on sprinklers (5.4.4.3), to accessible elevators (5.3.1.2), and enclosed stair compensating for > 50% exit capacity-by-escalator (5.3.5.5).

Submitter Information Verification

Submitter Full Name: Scot Deal
Organization: Excelsior Fire Engineering

Committee Statement

Resolution: The proposed language is not suitable for use as an annex because it does not provide guidance.
Sometimes, deep stations do not have an applicable local code. In such case, the designer should consider NFPA 130 often refers to NFPA 101 for station design, and that NFPA 101 refers to NFPA 5000. The utility of a local -building-code can be, and has been, under rated and under used, to the detriment of design time, safety and liability coverage. A building code can resolve the questions of: which is the apex document for station design, how to limit duplicate and conflicting subordinate standards (by authorizing only those standards, tests and guides explicitly cited by number and adopted year in its reference section), where legal liability coverage is provided when the intentions of its minimum safety levels are respectfully designed towards, and where is the most populated collection of lessons learned from diverse types of the local area’s completed construction projects.

Statement of Problem and Substantiation for Public Input

The problem is there is a huge gap between local building code and NFPA 130 station design, at a most fundamental level. This gap does not appear only in construction projects far from USA borders where using the local building code as apex design guide is not always a rigorous design practice. This gap also occurs inside the USA borders, where the International Building Code and NFPA 130 fail to meet at deep Metro (Fixed Guideway Transport Systems) property. IBC -405.1 rejects regulatory liability for deep Metro property since 2003, but most interestingly retains regulatory liability for FGTS property shallower than 9.1 m. Without receiving direct response after asking both IBC and NFPA, the proposer is left to guess ‘what was the intention here?’ If we remember 2003, friction between these organizations was heavy. My guess (with just 67% certainty) is that IBC judged as unacceptable, the safety level of deep FGTS properties, perhaps due to NFPA 130’s obfuscatory and self-conflicting sprinkler recommendations at - 5.4.4. However, the FGTS exception at IBC -405.1 is a legacy adoption from the former BOCA code. Perhaps an old BOCA framer will remember – and share-- the reasons why BOCA drew a line in the sand 9.1 m under the ground: no below and go above. Sharing the intention for a design prescription goes a long way to facilitate future implementation of the intended minimum standard of safety.

This suggested Appendix insertion does not intend to fix the gap, although the second sentence of the proposed addition - could do just that. Much more importantly this Appendix insertion intends to alert the design at whatever part of the globe, as to the importance of:

1. a Building Code as the apex design guide,
2. a clear precedence of design documents under the Building Code to limit wasted design time ,
3. exclusion of almost all subordinate design guides that overlap-in-almost-any-manner:
   a. the subject matter of explicit regulations found between the Building Code’s own covers, and
   b. the subject matter in subordinate standards adopted through legal reference from the Building Code
4. the balanced safety consciously aimed for by the Building Code with its carefully selected legal references to a select chosen few subordinate standards and tests
5. the safety imbued within the Building Code due to its application in practice.

Hundreds if not thousands of engineer-hours have been wasted simply for: a). not getting this design guide precedence correctly sorted at the project’s tender phase, and b). doubting the ability of the local building code to adequately guide design of engineering sub-disciplines. If the Building Code has maturity, it has accepted many revisions to its regulations, and to the coordination among its select, legally referenced subordinate standards. Ignoring the Building Code by using non-referenced design guides ignores these thousands,if not tens-of-thousands, of hard-won, trial-and-error lessons gained from completed construction projects and cataclysmic disasters. If the designer uses non-legally binding subordinate design standards, they do so at their own peril since such ad hoc design has not much proof of demonstrated success. Sometimes, though, ad hoc innovation makes an outstanding creation, at least that is what evolutionary biology suggests to us.

This comment has a related comment at -5.3.5.5 which could use a Building Code to determine exit hardware (panic or delayed-egress hardware on the door from platform accessing BoH).

This comment has a relation to comment on 5.4.4.3
Submitter Information Verification

This PI has not been submitted yet

Copyright Assignment

I, Scot Deal, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

By checking this box I affirm that I am Scot Deal, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature.
A.5.3.2.2

Consideration of control of the access to platforms might be necessary so that the station occupant load does not exceed the station egress capacity.

In rationalizing a point-of-safety, demonstration should be made as to available safe egress time having a safety factor relative to the required safe egress time (RSET). Often this factor is 2, but for very short RSET the safety factor should be larger.

Statement of Problem and Substantiation for Public Input

Point of safety can be 'whatever is agreed upon by stakeholders'. The challenge is that some objective reality should be inserted into 'whatever that agreement' as to Point of Safety resolves into.

Submitter Information Verification

Submitter Full Name: Scot Deal
Organization: Excelsior Fire Engineering
Street Address:
City:
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Zip:
Submittal Date: Wed Jun 28 17:24:12 EDT 2017

Committee Statement

Resolution: This is not relevant to 5.3.2.2. Refer also to the action on PI 122
A.5.3.3.1

The stipulated time is only intended as a baseline for determining the required capacity and maximum travel distances for platform egress routes considering only the occupant load calculated in accordance with Section 5.3.5.2 against the egress flow capacities and travel speeds stipulated in Sections 5.3.4 and 5.3.5. It is not intended that this calculation be required to account for delays due to premovement time or to products of combustion or debris along an egress route or delays due to the movement of those who are unable to achieve self-evacuation.

In coordinating this requirement with requirements for tenability as described in Annex B, the intent is for tenability to be evaluated along egress routes from the point at which occupants leave the platform, with the goal of moving all occupants to a point of safety within 6 minutes as stated in Section 5.3.3.2. Refer also to Section 5.3.3.7 regarding options for expanded engineering analysis where the design does not comply with the prescriptive requirements for platform egress.

Statement of Problem and Substantiation for Public Input

The proposed revision is intended to further clarify the intent of Sections 5.3.3.1 and 5.3.3.2 and to provide coordination between application of other requirements in the Standard with regard to those requirements.

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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 15:25:10 EDT 2017

Committee Statement

Resolution: FR-13-NFPA 130-2017
Statement: This revision is intended to further clarify the intent of Sections 5.3.3.1 and 5.3.3.2 and to provide coordination between application of other requirements in the Standard with regard to those requirements.
A.5.3.3

The use of the term 'temporary point of safety' in this context is intended to refer to an intermediate area, imply
within the station, that the design of the station egress routes permits continued egress from the concourse to
will remain tenable for the time required to achieve evacuation of that area. Egress routes from the temporary
point of safety should be sized to permit continuous egress flow to the exterior of the station.

Statement of Problem and Substantiation for Public Input

Refer to the rationale provided for related changes to Section 5.3.3.3.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 15:53:41 EDT 2017

Committee Statement

Resolution: This is not required based on the action on PI 118 (see FR #8).
Public Input No. 114-NFPA 130-2017 [Section No. A.6.3.1.4]

A.6.3.1.4

See also A.6.3.1.6(2)

Previous editions of NFPA 130 addressed this requirement by prescribing the maximum travel distance to an exit. The intent of this requirement was often misinterpreted. NFPA 101 requires, at a minimum, that two means of egress be provided within a building or structure and prescribes the maximum travel distance to an exit. This same requirement is applied in NFPA 130. Where two means of egress are required, the maximum travel distance to an exit occurs at the midpoint. For example, in a building with two exits, in the event of a fire adjacent to an exit rendering that exit unavailable, NFPA 101 recognizes that an individual in proximity to the affected exit must travel twice the prescribed exit travel distance to the alternative exit. Since two means of egress are required from any one point in an enclosed trainway, the exits cannot be more than twice the travel distance, or 762 m (2500 ft) apart.

Statement of Problem and Substantiation for Public Input

See Statement of Problem and Substantiation for Public Input No. 113-NFPA 130-2017, repeated here:

Clause A.6.3.1.6(2) provides guidance for measuring the length of a tunnel trainway means of egress route between a cross-passageway and a station. However, there is no guidance provided in the Standard or Annex A for measuring the length of a tunnel trainway means of egress route between stations, or between a tunnel emergency exit and a station, to assess compliance with the maximum distance of 762 m (2500 ft) prescribed by Clause 6.3.1.4.

The proposed changes to Clause 6.3.1.4 are to clarify the exits or egress points from the means of egress routes within an enclosed trainway as being: (1) an exit door to a tunnel emergency exit; or (2) an exit or egress point at a station, defined by the proposed additional text for Clause 6.3.1.4.

The term “trainway egress point” is introduced because the ends of platforms, as currently specified in Clause A.6.3.1.6(2) and proposed for Clause 6.3.1.4, do not qualify as “exits” as defined by NFPA 101. “Trainway egress point” is analogous to the description of egress points from station platforms in Clause 5.3.3.4 Travel Distance, specifically: “a point at which the means of egress route leaves the platform.”

The criteria added to Clause 6.3.1.4, and the reference to Clause A.6.3.1.6(2) added to Clause A.6.3.1.4, provide consistent guidance for measuring the length of a tunnel trainway means of egress route to a station.

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Submitter Information Verification

Submitter Full Name: Howard J. Cohen
Organization: AECOM
Street Address:
City:
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Zip:
Submittal Date: Wed Jun 28 12:10:52 EDT 2017

Committee Statement

Resolution: FR-44-NFPA 130-2017
**Statement:** The committee agrees that a cross-reference to A.6.3.1.6(2) is appropriate.

This revision introduces an engineering analysis option to support an extension of the 762 m maximum distance to exits with a distance determined by equivalency to a point of safety which would include exits and stations. The equivalency analysis specifies factors that should be considered but allows other factors to be included if they are considered relevant. These factors provide the mechanisms for new railways to explore the safety benefits of improvements to materials, technologies and procedures that impact the spacing requirements to points of safety.

See also FR #45.
A.6.3.2.1
Maintaining a clear space above the walking surface is important to ensure that projections do not encroach into the means of egress. The envelope created by the boundary limits defined by this paragraph is intended to gradually change from point to point. With respect to clearances to the vehicle, the measurements should be to the static vehicle envelope. (See Figure A.6.3.2.1.)

Figure A.6.3.2.1 Unobstructed Clear Width for Trainway Walkway.
Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

The existing graphic included in Annex A Section A.6.3.2.1 is not accurately scaled and does not adequately illustrate that the dimensions are to be measured symmetrically across a central axis. This has led to misinterpretation for some transit projects. The proposed graphic provides more detail regarding the dimensional intent.

Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Committee Statement

Resolution: FR-46-NFPA 130-2017

Statement: The existing graphic included in Annex A Section A.6.3.2.1 is not accurately scaled and does not adequately illustrate that the dimensions are to be measured symmetrically across a central axis. This has led to misinterpretation for some transit projects. The proposed graphic provides more detail regarding the dimensional intent.
A.7.1.2.2 —

Individual project geometries can impose constraints that make the length requirement of 7.1.2.2(2) onerous to meet. Proposals to the authority having jurisdiction for relief based on engineering analysis might be made to address this. The following elements and performance goals should be considered in the development and justification of an alternative approach. A mechanical system intended for the purpose of emergency ventilation can be considered for waiver from an enclosed trainway if the length of the enclosed trainway is less than or equal to the length of that system’s most prevalent train, provided that each vehicle within that most prevalent train permits a protected passenger egress route from each vehicle to the one (or two) adjoining vehicles. A rationale for selection and acceptance of the most prevalent train would be part of the justification. Conversely, a mechanical system intended for the purpose of emergency ventilation should not be waived in an enclosed trainway if the length of the enclosed trainway is equal to or greater than twice the NFPA recommendation (see 6.2.2.2) for the maximum distance that an evacuating passenger should have to travel before reaching an emergency exit stairway [381 m (1250 ft)]. The need for a mechanical system intended for the purpose of emergency ventilation should be analyzed further (as approved) if an enclosed trainway meets one of the following criteria:

1. The length of the enclosed trainway is less than 762 m (2500 ft) but greater than that of the system’s most prevalent train.

2. The length of the enclosed trainway is less than that of the system’s most prevalent train and each vehicle within that most prevalent train does not permit a protected passenger egress route from that vehicle to the one (or two) adjoining vehicle(s).

In the event that no analysis is performed or the justification is not approved, the default enclosed trainway design should include an emergency ventilation system.

Statement of Problem and Substantiation for Public Input

The proposed revisions to Section A.7.1.2.2 are intended to eliminate prescriptive criteria which does not align with a performance-based approach and current practice, where requirements are determined through engineering analysis that includes factors relevant to the system being evaluated.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Adrian Milford
Organization: Jensen Hughes
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 20:25:20 EDT 2017

Committee Statement

Resolution: This revision is not necessary because PI 135 was resolved. Annex language remains valid unless and until base language is modified.
A.7.2.6
The time of tenability should consider the possibility of one or more egress paths being blocked by fire or smoke (as may be demonstrated by analysis) and for other considerations. Annex B provides guidance on factors that should be considered in applying tenability concepts to the design and evaluation of emergency ventilation systems. For stations, the required time will be greater than the calculated egress time used to establish egress capacity in 5.3.3, due to consideration of factors that are not accounted for in the egress capacity calculations. (See B.2 for additional information to be considered.)

Statement of Problem and Substantiation for Public Input

This proposal is related to other proposed revisions to Section 7.2.6. The revision relocates non-specific text as Annex language where the intent can be more fully explained. The proposed revision also eliminates language that is being misinterpreted as requiring the discounting of egress routes regardless of engineering analysis that does not suggest that as an outcome. The intent of that language is better addressed in the proposed revisions to Annex B submitted separately by Jensen Hughes.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Katherine Fagerlund
Organization: JENSEN HUGHES Consulting Canada
Street Address: 
City: 
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Submittal Date: Wed Jun 28 16:49:59 EDT 2017

Committee Statement

Resolution: FR-30-NFPA 130-2017
Statement: See substantiation for FR #29. Moving clause 7.2.6.2 to annex material would soften the requirements. The proposed language does not provide an improvement to the existing language.
A.8.4.1.1

ASTM E162 might not be suitable for materials that exhibit flaming running or flaming dripping because the test apparatus is not designed to accommodate this kind of burning behavior. ASTM E162 states that, if during a test of one or more of the test specimens, materials exhibit rapid running or dripping of flaming material due to melting and the steep inclination of the specimen during test, these occurrences are to be noted within the test report and no radiant panel index is to be reported for that test. A fire hazard analysis seeking to demonstrate the acceptability of such materials as permitted in 8.4.2 should include not only the contribution to the generation of heat and smoke at the original ignition site but also any contribution resulting from burning material that melts and/or flows away from that site. The fire hazard analysis also should address the risk of spread to and ignition of other car components from either of these potential ignition sources.

Statement of Problem and Substantiation for Public Input

The public input presents information contained in section 11.11 of ASTM E162 that clarifies that test results are invalid if the materials exhibit rapid running or dripping of flaming material. ASTM E162 continues by stating that such invalid test results mean that no radiant panel index is to be reported.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 17:20:28 EDT 2017

Committee Statement

Resolution: FR-21-NFPA 130-2017
Statement: This revision presents information contained in section 11.11 of ASTM E162 that clarifies that the test results are invalid if the materials exhibit rapid running or dripping of flaming material.
A.8.4.1.3

The test methods in ASTM E1537 [for upholstered furniture, 19 kW (65 KBtu/hr) exposure] and ASTM E1590 [for mattresses, 18 kW (61 KBtu/hr) exposure] are deemed to be adequate procedures for testing individual items of upholstered furniture or mattresses for purposes of fire hazard assessment in some public occupancies. However, such individual stand-alone (not fixed in place) items are not normally found in rail transportation vehicles. Thus, the applicability of the test methods to rail transportation vehicles has not been validated, and they probably are not sufficiently representative of the situation and might require some modifications for better applicability. The use of alternative ignition sources (by varying the location, the gas flow intensity, or the exposure time) for ASTM E1537 or ASTM E1590 might be a means of addressing some very high challenge fire scenarios that could potentially occur in rail transportation vehicles. Examples of more powerful ignition sources that could be used include a 50 kW gas burner [Hirschler, 1997], shown to be relevant to detention mattresses or the oil burner used for aircraft seat cushions [FAR 25.853(c)], but the measurements should involve the same fire properties as in ASTM E1537 or ASTM E1590. If the ignition source used for a test method is inadequate, the result can be misleading, for example if the upholstery materials melt or drip and, thus, avoid full exposure to the ignition source; it has been shown that, in some such cases, upholstered furniture and mattresses that are totally consumed when using the appropriate ignition source appear to perform well when using the ignition sources in ASTM E1537 and ASTM E1590, respectively.

Statement of Problem and Substantiation for Public Input

Editorial clarification. It is only when upholstery materials melt or drip away from the ignition source flame that ASTM E1537 and ASTM E1590 do not properly assess the fire performance of the products.

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 17:07:55 EDT 2017

Committee Statement

Resolution: FR-22-NFPA 130-2017
Statement: This is an editorial clarification regarding melting and dripping of upholstery material.
A.8.6.7.1.1 The requirements to be met consist of the following: (a) char height for each specimen of less than 1.5 m (4 ft 11 inches) when measured from the lower edge of the burner face, (b) total smoke released in 20 min for each specimen that does not exceed 150 m$^2$, and (c) peak smoke release rate for each specimen that does not exceed 0.40 m$^2$/s.

Statement of Problem and Substantiation for Public Input

This is associated with the public input to 8.6.7.1.1.1 and is intended to clarify, using the language from UL 1685.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 21 18:56:41 EDT 2017

Committee Statement

Resolution: The proposed language is not necessary because it is covered in 8.6.7.1.1.1 (see FR #20).
Examples for train cars communication cables are: CAT 5, CAT 5E, CAT 6, CAT 7, MVB, WTB, CANBUS, RS-485 rtc. The electrical properties of data and communication cables should comply with requirements for category cable or local electrical requirements. Different system authorities specify data and communication cables that have specific electrical requirement other than voltage.

Statement of Problem and Substantiation for Public Input

Clarification and examples of communication data cables.

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 27 11:16:37 EDT 2017

Committee Statement

Resolution: FR-23-NFPA 130-2017
Statement: This revision adds examples of the common communication cables used in rail cars.
A.9.8.1

The command post should be located at a site that is convenient for responding personnel, easily identifiable, and suitable for supervising, coordinating, and communicating with participating agencies.

Where station design lends itself, and emergency response agencies agree, pre-planning one command post location into the OCC offers obvious savings in space, savings from duplication of control equipment, and most importantly it greatly improves communication between those who know the most (OCC staff) about MEP operations with those who most need to know (incident commander) about MEP operations during the emergency. While space provisions may not be of ultimate convenience in this combined control and command center, the active emergency response operations within this consolidated space should not last more than a couple of hours, even during a large emergency. Large accidental emergencies have historically not occurred in many fixed guideway transit system property with more than a one in 900 chance per station per year--during the early years of a stations service life. Considering these frequencies, dedicating interior space to a command center is costly.

Statement of Problem and Substantiation for Public Input

This is an optimization problem between safety and money. This proposer does not represent, nor is directly paid by either a fixed guideway transit system operator or emergency response department. This proposal was made in the interests of optimizing operations efficiency and construction costs, with increased communication accuracy and speed during an emergency due to face-to-face interactions.

Submitter Information Verification

Submitter Full Name: Scot Deal
Organization: Excelsior Fire Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 18:33:53 EDT 2017

Committee Statement

Resolution: This is already covered by 5.4.1.
A.12.2.1 (1) The requirements to be met consist of the following: (a) char height for each specimen of less than 1.5 m (4 ft 11 inches) when measured from the lower edge of the burner face, (b) total smoke released in 20 min for each specimen that does not exceed 150 m$^2$, and (c) peak smoke release rate for each specimen that does not exceed 0.40 m$^2$/s.

Statement of Problem and Substantiation for Public Input

This is associated with the public input to 12.2.1 and is intended to clarify, using the language from UL1685.

Related Public Inputs for This Document

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Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>Marcelo Hirschler</th>
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<tbody>
<tr>
<td>Organization:</td>
<td>GBH International</td>
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<tr>
<td>Street Address:</td>
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Committee Statement

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A.12.1.2
The life safety and fire protection requirements for the traction power substations, the breaker station's power distribution, and control cabling are described in other parts of this standard. Signaling cables are constructed to AREMA standards (10.3.16, 10.3.17)

Statement of Problem and Substantiation for Public Input

Control and signaling cables should be part of chapter 12, they are not described in other parts of NFPA 130. These cables are made to AREMA standards and not to NEC type TC. The insulation and jacket material are thicker than the NEC type TC.

Submitter Information Verification

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Submittal Date: Tue Jun 27 12:59:06 EDT 2017

Committee Statement

Resolution: The information about the AREMA standards has been added to A.12.1.3.
A.12.2.1 (1) The requirements to be met consist of the following: (a) char height for each specimen of less than 1.5 m (4 ft 11 inches) when measured from the lower edge of the burner face, (b) total smoke released in 20 min for each specimen that does not exceed 150 m$^2$, and (c) peak smoke release rate for each specimen that does not exceed 0.40 m$^2$/s.

Statement of Problem and Substantiation for Public Input

This is associated with the public input to 12.2.1 and is intended to clarify, using the language from UL 1685.

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Annex B – Fire Risk and Emergency Ventilation

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 General.

The purpose of this annex is to provide guidelines for the potential compatibility of the emergency ventilation system with the system employed with normal ventilation of trainways and stations. This annex does not present all factors to be considered in the normal ventilation criteria. For normal ventilation, refer to the Subway Environmental Design Handbook (SEDH) and the ASHRAE handbooks: Fundamentals, Applications, and Systems and Equipment.

Current technology is capable of analyzing and evaluating all unique conditions of each property to provide proper ventilation for normal operating conditions and for pre-identified emergency conditions. The same ventilating devices might or might not serve both normal operating conditions and pre-identified emergency requirements. The goals of the subway ventilation system, in addition to addressing fire and smoke emergencies, are to assist in the containment and purging of hazardous gases and aerosols such as those that could result from a chemical/biological release.

B.2 Tenable Environments.

B.2.1 Environmental Conditions.

Some factors that should be considered in maintaining a tenable environment for periods of short duration are defined in B.2.1.1 through B.2.1.5.

B.2.1.1 Heat Effects.

Exposure to heat can lead to life threat in three basic ways:

(1) Hyperthermia
(2) Body surface burns
(3) Respiratory tract burns

For use in the modeling of life threat due to heat exposure in fires, it is necessary to consider only two criteria: the threshold of burning of the skin and the exposure at which hyperthermia is sufficient to cause mental deterioration and thereby threaten survival.

Note that thermal burns to the respiratory tract from inhalation of air containing less than 10 percent by volume of water vapor do not occur in the absence of burns to the skin or the face; thus, tenability limits with regard to skin burns normally are lower than for burns to the respiratory tract. However, thermal burns to the respiratory tract can occur upon inhalation of air above 60°C (140°F) that is saturated with water vapor.

The tenability limit for exposure of skin to radiant heat is approximately 1.7 kW·m⁻². Below this incident heat flux level, exposure can be tolerated almost indefinitely without significantly affecting the time available for escape. Above this threshold value, the time to burning of skin due to radiant heat decreases rapidly according to Equation B.2.1.4a.

\[ t_{\text{toll}} = 1.33 t^{-1.95} \]  

[B.2.1.4a]

where:

\( t \) = time in minutes
\( q \) = radiant heat flux (kW/m²)

As with toxic gases, an exposed occupant can be considered to accumulate a dose of radiant heat over a period of time. The fraction equivalent dose (FED) of radiant heat accumulated per minute is the reciprocal of \( t_{\text{toll}} \).

Radiant heat tends to be directional, producing localized heating of particular areas of skin even though the air temperature in contact with other parts of the body might be relatively low. Skin temperature depends on the
balance between the rate of heat applied to the skin surface and the removal of heat subcutaneously by the
blood. Thus, there is a threshold radiant flux below which significant heating of the skin is prevented but above
which rapid heating occurs.

Calculation of the time to incapacitation under conditions of exposure to convected heat from air containing less
than 10 percent by volume of water vapor can be made using either Equation B.2.1.1b or Equation B.2.1.1c.

As with toxic gases, an exposed occupant can be considered to accumulate a dose of convected heat over a
period of time. The fraction equivalent dose (FED) of convected heat accumulated per minute is the reciprocal
of $t_{\text{conv}}$.

Convected heat accumulated per minute depends on the extent to which an exposed occupant is clothed and the
nature of the clothing. For fully clothed subjects, Equation B.2.1.1b is suggested:

$$ t_{\text{conv}} = \left( 4.1 \times 10^8 \right) T^{-3.61} \quad \text{[B.2.1.1b]} $$

where:
- $t_{\text{conv}}$ = time in minutes
- $T$ = temperature (°C)

For unclothed or lightly clothed subjects, it might be more appropriate to use Equation B.2.1.1c:

$$ t_{\text{conv}} = \left( 5 \times 10^7 \right) T^{-3.4} \quad \text{[B.2.1.1c]} $$

where:
- $t_{\text{conv}}$ = time in minutes
- $T$ = temperature (°C)

Equations B.2.1.1b and B.2.1.1c are empirical fits to human data. It is estimated that the uncertainty is ±25
percent.

Thermal tolerance data for unprotected human skin suggest a limit of about 120°C (248°F) for convected heat, above which there is, within minutes, onset of considerable pain along with the production of burns. Depending
on the length of exposure, convective heat below this temperature can also cause hyperthermia.

The body of an exposed occupant can be regarded as acquiring a “dose” of heat over a period of time. A short
exposure to a high radiant heat flux or temperature generally is less tolerable than a longer exposure to a lower
temperature or heat flux. A methodology based on additive FEDs similar to that used with toxic gases can be
applied. Provided that the temperature in the fire is stable or increasing, the total fractional effective dose of
heat acquired during an exposure can be calculated using Equation B.2.1.1d:

$$ FED = \sum \left[ \frac{1}{t_{\text{heat}}} + \frac{1}{t_{\text{conv}}} \right] \Delta t $$

\text{[B.2.1.1d]}

Note 1: In areas within an occupancy where the radiant flux to the skin is under 2.5 kW · m$^{-2}$, the first term in
Equation B.2.1.1d is to be set at zero.

Note 2: The uncertainty associated with the use of this last equation would be dependent on the uncertainties
with the use of the three earlier equations.

The time at which the FED accumulated sum exceeds an incapacitating threshold value of 0.3 represents the
time available for escape for the chosen radiant and convective heat exposures.

As an example, consider the following:

1. Evacuees lightly clothed
2. Zero radiant heat flux
3. Time to FED reduced by 25 percent to allow for uncertainty in Equations B.2.1.1b and B.2.1.1c
4. Exposure temperature constant
5. FED not to exceed 0.3

Equations B.2.1.1c and B.2.1.1d can be manipulated to provide the following:
where:
\[ t_{exp} = \text{time of exposure (min.) to reach a FED of 0.3} \]

This gives the values in Table B.2.1.1.

Table B.2.1.1 Maximum Exposure Time

<table>
<thead>
<tr>
<th>Exposure Temperature</th>
<th>Without Incapacitation (min.)</th>
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<tbody>
<tr>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>80</td>
<td>176</td>
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<tr>
<td>75</td>
<td>167</td>
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<tr>
<td>70</td>
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<td>65</td>
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<td>60</td>
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<td>10.1</td>
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</tr>
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<td>9.5</td>
<td>122</td>
</tr>
<tr>
<td>8.8</td>
<td>113</td>
</tr>
<tr>
<td>8.4</td>
<td>104</td>
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</table>

B.2.1.2 Air Carbon Monoxide Content

An exposed occupant can be considered to accumulate a dose of carbon monoxide over a period of time. This exposure to carbon monoxide can be expressed as a fractional effective dose, according to Equation B.2.1.2a; see B.2.1.2.1, reference [1] page 6, equation (2):

\[ FED_{CO} = \sum \frac{[CO]}{35000} \Delta t \]  

where:
\[ \Delta t = \text{time increment in minutes} \]
\[ [CO] = \text{average concentration of CO (ppm) over the time increment } \Delta t \]

It has been estimated that the uncertainty associated with the use of Equation B.2.1.2a is ±35 percent. The time at which the FED accumulated sum exceeds a chosen incapacitating threshold value represents the time available for escape for the chosen carbon monoxide exposure. As an example, consider the following:

1. Time to FED reduced by 35 percent to allow for the uncertainty in Equation B.2.1.2a
2. Exposure concentration constant

This gives the values in Table B.2.1.2 for a range of threshold values.

Table B.2.1.2 Maximum Carbon Monoxide Exposure

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Tenability Limit AEGL</th>
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<tbody>
<tr>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>0.5</td>
<td>1.706</td>
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<tr>
<td>0.4</td>
<td>1.719</td>
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<td>2.420</td>
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<tr>
<td>0.8</td>
<td>2.834</td>
</tr>
<tr>
<td>1.0</td>
<td>3.138</td>
</tr>
<tr>
<td>1.5</td>
<td>4.100</td>
</tr>
<tr>
<td>2.0</td>
<td>5.028</td>
</tr>
<tr>
<td>3.0</td>
<td>6.833</td>
</tr>
<tr>
<td>4.0</td>
<td>11.38</td>
</tr>
<tr>
<td>5.0</td>
<td>18.95</td>
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<tr>
<td>6.0</td>
<td>50.20</td>
</tr>
<tr>
<td>7.0</td>
<td>104.40</td>
</tr>
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</table>

A value for the FED threshold limit of 0.5 is typical of healthy adult populations [1]. 0.3 is typical in order to provide for escape by the more sensitive populations [1], and the AEGL 2 limits are intended to protect the general population, including susceptible individuals, from irreversible or other serious long-lasting health effects [2].

The selection of the FED threshold limit value should be chosen appropriate for the fire safety design objectives. A value of 0.3 is typical. More conservative criteria may be employed for use by especially susceptible populations. Additional information is available in references [1] and [3].

B.2.1.2.1

The following references are cited in B.2.1.2:

B.2.1.3 - Smoke Obscuration Levels.
Smoke obscuration levels should be maintained below the point at which a sign internally illuminated at 80 lx (7.5 ft-candles) is discernible at 30 m (100 ft) and doors and walls are discernible at 10 m (33 ft).

B.2.1.4 - Air Velocities.
B.2.1.4.1
Air velocities in enclosed stations and trainways should be greater than or equal to 0.75 m/sec (150 fpm).

B.2.1.4.2
Air velocities in enclosed stations and trainways that are being used for emergency evacuation or by emergency personnel should not be greater than 11.0 m/sec (2200 fpm).

B.2.1.5 - Noise Levels.
Criteria for noise levels should be established for the various situations and potential exposures particular to the environments addressed by this standard. The intent of the recommended criteria is to maintain at least a minimal level of speech intelligibility along emergency evacuation routes. This might require additional noise control measures and acoustical treatment to achieve. Exceptions taken to the recommended noise levels for reasons of cost and feasibility should be as few and as slight as reasonably possible. For example, local area exceptions to the recommended acoustic criteria could be required to be applied for defined limited distances along the evacuation path that are near active noise sources. Other means of providing emergency evacuation guidance using acoustic, nonacoustic, or combined methods might be considered. Starting points for various design scenarios should be considered as follows:

1. Where reliance on unamplified speech is used as part of the emergency response inside a tunnel, the speech interference level (SIL) during emergency response from all active systems measured along the path of evacuation at any point 1.52 m (5 ft) above the walking surface should not exceed 78 dBZ L eq "slow" over any period of 1 minute, using the arithmetic average of unweighted sound pressure level in the 500, 1000, 2000 and 4000 Hz octave bands.

2. For intelligible communication between emergency evacuation responders and the public, where reliance on amplified speech is used as part of the emergency response within a station, refer to NFPA 72.

3. Where reliance on amplified speech is used as part of the emergency response within a tunnel, the sound pressure level from all active systems measured inside a tunnel along the path of evacuation at any point 1.52 m (5 ft) above the walking surface should be designed to support speech intelligibility of fixed voice communication systems to achieve a measured STI of not less than 0.45 (0.65 CIS) and an average STI of not less than 0.5 (0.7 CIS) as per D.2.4.1 of NFPA 72. Refer to Annex D of NFPA 72 for further information on speech intelligibility for voice communication systems.
### B.2.2 Geometric Considerations

Some factors that should be considered in establishing a tenable environment in stations are as follows:

1. **The evacuation path requires a height clear of smoke of at least 2 m (6.6 ft).** For low-ceiling areas, selection of the modeling method and the criteria to be achieved should address the limitations imposed by ceiling heights below 3 m (9.84 ft). At low-ceiling areas in an evacuation path, beyond the immediate vicinity of a fire, smoke should be excluded to the greatest extent practicable.

2. **The application of tenability criteria at the perimeter of a fire is impractical.** The zone of tenability should be defined to apply outside a boundary away from the perimeter of the fire. This distance will be dependent on the fire heat release rate, the fire smoke release rate, local geometry, and ventilation and could be as much as 30 m (100 ft). A critical consideration in determining this distance will be how the resultant radiation exposures and smoke layer temperatures affect egress. This consideration should include the specific geometries of each application, such as vehicle length, number of vehicles open to each other, fire location, platform width and configuration, and ventilation system effectiveness, among others, and how those factors interact to support or interfere with access to the means of egress.

3. **The beneficial effects of an emergency ventilation system during a fire incident will not become completely available until the system is operated and reaches full capacity.** During the time between initiation of a fire incident and the desired ventilation response achieving its full capacity, the smoke can spread into the intended zone of tenability. The ventilation system should have sufficient capacity to counter this pre-ventilation smoke spread. Whenever possible, the design of the space geometry should consider arrangements to minimize the pre-ventilation smoke spread. The overall extent of pre-ventilation smoke spread should also be considered with respect to its potential effect on egress.

4. **During the emergency ventilation response, short-term transient events due to step-like changes in geometry can momentarily provide a significant boost to the fire heat and smoke release rate.** Examples include vehicle doors opening or the failure of vehicle windows. The ventilation system should have sufficient capacity to counter such short-term transients affecting smoke spread.

### B.2.3 Time Considerations

Some factors that should be considered in establishing the time of tenability are as follows:

1. **The time for fire to ignite and become established**

2. **The time for fire to be noticed and reported**

3. **The time for the entity receiving the fire report to confirm existence of fire and initiate response**

4. **The time for all people who can self-rescue to evacuate to a point of safety**

5. **The time for emergency personnel to arrive at the station platform**

6. **The time for emergency personnel to search for, locate, and evacuate all those who cannot self-rescue**

7. **The time for fire fighters to begin to suppress the fire**

### B.2.4 Modeling Accuracy

Where modeling is used to determine factors such as temperature, visibility, and smoke layer height, an appropriate sensitivity analysis should be performed.
B.3 – Configurations.

Configurations can vary among properties, but engineering principles remain constant. The application of those principles should reflect the unique geometries and characteristics of each property.

Enclosed stations and trainways might be configured with the following characteristics:

1. High or low ceilings
2. Open or doored entrances
3. Open or screened platform edges
4. End-of-station or midtunnel fan shafts
5. End-of-station or midtunnel vent shafts
6. Single, double, or varying combinations of tracks in tunnels
7. Intersecting tunnels
8. Multilevel stations
9. Multilevel tunnels
10. Varying depths below the surface
11. Varying grades and curvatures of tracks and tunnels
12. Varying blockage ratios of vehicles to tunnel cross-section
13. Varying surface ambient conditions
14. Varying exit points to surface or points of safety

B.4 – Draft Control.

B.4.1 –

For patron comfort in stations, the air velocities induced by train motion should be evaluated carefully by designers. Infrequent exposure to higher velocities can be tolerated briefly but are to be avoided wherever possible. Refer to the Subway Environmental Design Handbook (SEDH), the ASHRAE Handbook — Fundamentals, and the Beaufort Scale.

B.4.2 –

Draft control can be achieved by the placement of shafts along the tunnel length between stations. Shafts can be arranged with the fan shafts at the ends of stations, with vent shafts midtunnel if required or with vent shafts at the ends of stations and fan shafts midtunnel. End-of-station shaft configurations should be related to the station geometries in the consideration of patron comfort in the station relative to train piston draft effects.

B.5 – Temperature Control.

B.5.1 –

Temperature control for patron comfort in the station can be achieved by circulating ambient air in moderate climates or by providing heating and/or cooling in more extreme regions. Preferred temperature goals should be defined in the criteria developed for the design of an individual property relative to the local climate and the length of station occupancy, such as train headways specific to the property during which the patron would be exposed to the station temperatures.

B.5.2 –

Temperature control and ventilation for ancillary areas housing special equipment should reflect the optimum operating conditions for the specific equipment to ensure the availability of critical equipment and should also give consideration for intermittent occupancy by maintenance personnel. These systems should be separate from the emergency ventilation system for stations and tunnels and should be considered in the design of the emergency ventilation system.

B.6 – Under-Platform Ventilation System.

B.6.1 –

An under-platform ventilation system should be considered for the extraction of heat from traction and braking devices. Intakes should be provided below the platform level and should be situated relative to the heat-producing devices on a train berthed in a station.
B.6.2 - Ceiling ventilation, by powered or gravity design, to aid in the removal of smoke and/or heat should be considered.

B.7 - Platform Edge and Screen Doors.

B.7.1 - Platform edge doors and platform screen doors are sometimes incorporated into stations for various reasons, such as climate control, separation between passengers and trainway hazards (especially in driverless systems), and ventilation control in enclosed trainways. When used, these system walls and doors should provide resistance rating structural strength relative to the train and ventilation system pressures.

B.7.2 - In a tunnel-to-station evacuation scenario, access to the platform level from the trainway should be considered.

B.8 - Non-Emergency Ventilation for Enclosed Trainways.

B.8.1 - Congested Operations.
Where trains might be stopped or delayed in an enclosed trainway for a period of time, the vehicle ventilation system should be capable of maintaining an acceptable level of patron comfort. If not operating in a fire or other emergency scenario, the emergency ventilation fans can be used to augment the vehicle system capability.

B.8.2 - Maintenance Activities.
Maintenance activities within station and tunnel areas can include heat-, dust-, or fume-producing operations such as grinding, welding, or painting; operation of fuel-powered vehicles or equipment; and other operations that affect tunnel air quality or temperature. If not operating in a fire or other emergency scenario, the tunnel ventilation fans can be used to address the safety and comfort of employees working in the affected tunnel and station areas. In such cases, velocities should consider the comfort levels of employees required to be in the tunnels.

B.8.3 - Tunnels in Gassy Ground.
Tunnels in gassy ground could be subject to ingress of flammable or other hazardous gases. Gases of concern include hydrogen sulfide (H₂S) and methane (CH₄). The ventilation system should be designed to satisfy two objectives:

1. To avoid pockets of gases forming
2. To achieve dilution of gas inflows through a design crack

The ventilation design should be coordinated with the gas detection and alarm system type and the activation levels selected. The design should consider two general conditions:

1. Ongoing or periodic ventilation requirements to meet expected average gas ingress rates
2. Reaction to potential abrupt increases in gas ingress, such as might result from future construction, climate events, or seismic activity

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

Proposed revisions are intended to improve cohesion and relevance in the explanatory material related to design of transit system emergency ventilation systems. Annexes B, D, G and H are combined as one Annex. Refer also to the 'restructuring summary' uploaded with the proposed revisions.
Related Public Inputs for This Document

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Submittal Date: Wed Jun 28 01:31:30 EDT 2017

Committee Statement

Resolution: FR-34-NFPA 130-2017
Statement: This revision consolidates current Annex material related to fire and emergency ventilation to establish new Annex B reorganization and numbering format, and relocates non-emergency ventilation requirements to a revised Annex D. Current annex material relating to these topics is spread through four separate annexes.

Note that for this Global Revision, the only changes to the text occur in the introductory material for each annex. All other text remains the same and is simply renumbered. Any changes to the text have been done under separate First Revisions and are to be voted on separately.
Annex D - Rail Vehicle Fires  Non-Emergency Ventilation

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1  Introduction

General

This annex provides additional information on the hazards associated with burning vehicles and the impact of a burning vehicle on the evacuation of passengers and crew to a point of safety. Emergency evacuation from a vehicle containing a fire could include exiting a vehicle containing the fire to an adjacent vehicle, exiting the train into the operating environment (station, tunnel, etc.) where the train is located, and moving through the operating environment to the point of safety. Chapter 8 contains minimum prescriptive requirements that are intended to provide sufficient time for passengers and crew to safely evacuate from a train containing a fire. This annex provides guidance for designing and evaluating train fire performance. A fire involving a train will have an impact on the conditions in the operating environment, and this type of fire is often used to design emergency systems in operating environments. Chapters 5 through 7 provide requirements on design of the operating environment to ensure that passengers can safely egress to a point of safety.

D.2 – Initial Fire Development Inside Vehicles.

The development of a fire inside a vehicle is dependent on the fire performance of interior finish materials, the size and location of the initiating fire, the size of the enclosure where the fire is located, and the ventilation into the enclosure.

D.2.1  – Material fire performance is most often considered in the evaluation of fire performance of the vehicle. Material fire performance is measured in terms of ignitibility, heat release rate, and smoke and toxic gas production. Flame spread and fire development are dependent on the material's ignitibility and heat release rate as well as the severity of the initiating fire and surrounding environment.

D.2.1.1  – The ignitibility, heat release rate, and smoke and toxic gas production can be measured in the ASTM E1354 cone calorimeter. It is recommended that all combustible materials on a train be tested in the cone calorimeter. At a minimum, tests should be conducted at a heat flux of 50 kW/m² in duplicate. For a more detailed evaluation of the material performance, cone calorimeter tests should be performed at three different heat fluxes where the material ignites (e.g., 25, 50, and 75 kW/m²). The cone calorimeter can also be used to measure the critical heat flux of the material, which is the lowest heat flux at which the material will ignite. The critical heat flux can be used to determine the ignition temperature of the material. Analysis to predict flame spread along materials will require the more detailed set of cone calorimeter data along with the critical heat flux of the material.

D.2.1.2  – In Chapter 8, the minimum fire performance of many interior finish materials is required to be measured using the ASTM E162 flame spread test. Though this downward flame spread test will screen out many poorly performing materials, the test does not provide a measure of wind-aided flame spread (i.e., upward flame spread or flame spread along a ceiling). Wind-aided flame spread is the fastest type of flame spread and is the type of flame spread that will cause the maximum surface area of material to become involved in the fire. The amount of upward flame spread is affected by the size of the initiating fire and the material fire performance. Some materials might not exhibit any flame spread when exposed to a small fire (e.g., a newspaper fire), but when exposed to something slightly larger (e.g., burning bag of trash with paper and plastic) will readily spread flame.
D.2.1.3
Smoke and toxic gas production can have an impact on the operating environment through which passengers will need to evacuate. Some materials naturally produce more smoke and toxic gases. Some fire-retardant additives can cause more smoke and toxic gases to be produced compared to untreated materials. The amount of smoke and toxic gas produced will be a function of the amount of material burning. Therefore, limiting fire propagation on materials will also help limit the amount of smoke and toxic gas production.

D.2.2
The size and location of the initiating fire will have a significant impact on whether materials become ignited and spread flame. Materials exposed to higher levels of heat (heat fluxes) will ignite more readily, release more heat, and usually will result in more flame spread. Research has shown that increasing the physical size and the heat release rate of the fire will increase the heat flux produced by the initiating fires. Increasing the heat release rate of the fire will also increase the flame height, which will expose larger areas of material to the high heat fluxes in the flaming region. The location of the initiating fire will also affect the heat fluxes produced by the fire. For the same size fire, higher heat fluxes are produced when the fire is located in a corner instead of against a flat wall.

D.2.3
The gas temperature inside of the enclosure containing a fire can have a significant impact on the growth rate of the fire. Elevated gas temperatures will pre-heat unignited material and will potentially accelerate flame spread across the material. Gas temperatures in an enclosure can be affected by the size of the enclosure, the ventilation into the enclosure, and the heat release rate of the fire. The gas temperature will increase when the enclosure size is decreased and the heat release rate is increased.

D.3 - Fire Development Outside Vehicles.
Outside a vehicle, flames can spread along continuous pieces of combustible materials or ignite adjacent materials if exposed to sufficient heat. Underneath vehicles, combustible items that are adequately spaced will prevent the spread of fire. If the car is moving, flames can be longer, making safe separation distances longer. It might also be possible for flames from fires underneath vehicles to extend out to the sides and ends of the vehicle. These undercar fires can ignite and initiate flame spread along combustible materials on the sides and ends of the vehicle. Combustible materials on the sides and ends of the vehicle might also be vulnerable to other types of fires that could occur on the exterior of the vehicle.

D.3.1
An increasing amount of the exterior vehicle body is being manufactured of fiber-reinforced resin composite materials. End caps have been made of composite materials for years, and other vehicle body components are being constructed of composite materials to make vehicles lighter in weight. Even if these materials meet the ASTM E162 requirement in Chapter 8, they can ignite and flames can spread up the height of the vehicle exterior.

D.3.2
Initiating fires on the exterior of the vehicle could range from a small trash fire to a vehicle fire. Although the trash fire might be small, it could be possible for it to ignite combustible components on the exterior and for flames to spread up the vehicle. Some trains are operated in close proximity to automobiles. Automobile fires can become quite large (~5 MW) and can include fuel spills. If such a fire occurred close to a train, the fire could ignite nearby combustible exterior components on the vehicle.

D.3.3
Connections between vehicles can be particularly vulnerable to exterior fires. Some vehicles are connected by articulating bellows, which are constructed of relatively thin, flexible, combustible materials. The materials used for these components should be carefully screened to ensure that exterior fires do not extend into the vehicle before passengers have been safely evacuated.

D.3.4
Spread of fire from one vehicle to an adjacent vehicle can cause the total heat release rate of the train fire to significantly increase. This could occur if the fire on the outside of one vehicle radiates enough heat to ignite the combustible components of the adjacent vehicle. Vehicle-to-vehicle spread could also occur if a fire inside a vehicle has reached flashover and flames extending outside of the vehicle through windows or doors are able to ignite the nearby vehicle. Where the intended vehicle consist contains multiple units connected by articulating sections creating a single car volume (no separating walls or doors), consideration should be given to resulting effects such as heat release rate of the train fire, the fire profile, and impacts on vehicle and station egress.

D.4 - Vehicle Fire Heat Release Rate History.
The heat release rate history of a vehicle fire should include the heat release rate during all stages of the fire. Fires inside of vehicles that are allowed to grow sufficiently large can reach flashover, where all of the items inside of the vehicle ignite. The largest heat release rates are expected after flashover occurs (i.e., postflashover). The heat release rate during postflashover is particularly important since many tunnel and station smoke control system designs are based on the maximum expected heat release rate. The heat release rate of the vehicle fire will also affect the heat that passengers could be exposed to during evacuation. The magnitude of the heat release rate during postflashover will be a function of the amount of air drawn into the vehicle, the material fire properties, and the potential heat release rate of the burning fuels inside of the vehicle.

D.4.1

The fire properties of a material will determine the impact of the material on the postflashover fire conditions. The postflashover fire is a balance of heat gains and heat losses. As a result, the ratio between the material heat of combustion and heat of gasification is particularly important. The heat of combustion is the amount of energy produced per gram of material burned (heat gain), while the heat of gasification is the energy required to convert solid material into gas (heat loss). If this ratio is high (heat of combustion several times greater than the heat of gasification), then the material will contribute more heat to the fire compared with the amount it takes to produce the gas. This scenario will result in a more intense fire. As the ratio becomes closer to 1, the fire will burn with less intensity. Depending on the conditions, materials with a ratio close to 1 might not be able to self-support a postflashover fire environment.

D.4.2

The amount of air drawn into a postflashover fire will be a function of the number of ventilation openings. Initially, this could be doors or windows where passengers have evacuated from the train. Many vehicles will contain mostly polycarbonate windows. As the fire continues to burn, polycarbonate windows will thin and begin to develop holes (Strege et al. 2003). Glass windows will crack, shatter, and fall out. Eventually, these areas will be completely open to allow air in and smoke to exhaust from the vehicle fire.

D.4.2.1

The impact of additional ventilation openings is dependent on the heat losses and gains to the vehicle fire. Additional openings will allow more energy to be lost from the vehicle fire through radiation and convection. However, the additional air into the vehicle fire allows more heat to be released inside the vehicle. If the fuels inside the vehicle can produce a heat release rate, then the fire will burn at that higher heat release rate. It is also possible that when the windows fail, the energy losses might outweigh the heat that can be produced by the materials, and the fire will begin to diminish in size. This also happens when the fire begins to go into the decay stage: the fire inside of the vehicle can no longer produce sufficient heat to outweigh the heat losses.

D.4.3

The heat release rate of the train fire will also affect the amount of heat the passengers are exposed to during the evacuation. Larger heat release rate fires will produce longer flames that could extend out of the vehicle openings. If the vehicle is inside a tunnel, these flames could impinge on the ceiling and extend down away from the burning vehicle. Radiation from these flames to nearby evacuating passengers could be significant.

D.5 – Volume of Smoke Produced by Burning Vehicles.

D.5.1

The volume of smoke produced by a fire is dependent on the entrainment into the smoke plume. The entrainment into the smoke plume varies depending on the geometry. For example, a free-burning circular pool fire will produce a different volume of smoke compared with the same heat release rate fire burning in a line. Natural or ventilation-induced air currents can have an impact on entrainment.

D.5.2

Volume of smoke from fires inside of vehicles will be exhausted out of the vehicle through open doors or window openings. As a result, the volume of smoke produced by a vehicle fire will be the smoke volume produced by a series of window plumes. The volume of smoke produced will be dependent on how high the gases are allowed to rise before they impinge on the ceiling or reach the upper smoke layer interface.

D.5.3

Volume of smoke from undercar fires or fires involving the outside of the vehicle can be modeled by assuming that the fire is a line fire. The volume of smoke produced will be dependent on how high the gases are allowed to rise before they impinge on the ceiling or reach the upper smoke layer interface.

The purpose of this annex is to provide guidelines for normal ventilation of trainways and stations. Considerations and guidance for emergency ventilation is addressed in Annex B. This annex does not present all factors to be considered in the normal ventilation criteria. For normal ventilation, refer to the National Fire Protection Association Report.
D.2 Draft Control. D.2.1
For patron comfort in stations, the air velocities induced by train motion should be evaluated carefully by designers. Infrequent exposure to higher velocities can be tolerated briefly but are to be avoided wherever possible. Refer to the Subway Environmental Design Handbook (SEDH), the ASHRAE Handbook — Fundamentals, and the Beaufort Scale.

D.2.2
Draft control can be achieved by the placement of shafts along the tunnel length between stations. Shafts can be arranged with the fan shafts at the ends of stations, with vent shafts midtunnel if required or with vent shafts at the ends of stations and fan shafts midtunnel. End-of-station shaft configurations should be related to the station geometries in the consideration of patron comfort in the station relative to train piston draft effects.

D.3 Temperature Control. D.3.1
Temperature control for patron comfort in the station can be achieved by circulating ambient air in moderate climates or by providing heating and/or cooling in more extreme regions. Preferred temperature goals should be defined in the criteria developed for the design of an individual property relative to the local climate and the length of station occupancy, such as train headways specific to the property during which the patron would be exposed to the station temperatures.

D.3.2
Temperature control and ventilation for ancillary areas housing special equipment should reflect the optimum operating conditions for the specific equipment to ensure the availability of critical equipment and should also give consideration for intermittent occupancy by maintenance personnel. These systems should be separate from the emergency ventilation system for stations and tunnels and should be considered in the design of the emergency ventilation system.

D.4 Under-Platform and Over-track Ventilation Systems. D.4.1
In hot climates under-platform and/or over-track exhaust systems may be beneficial for controlling temperatures. The effectiveness of these systems will depend upon a number of factors including the configuration and location of the heat-producing equipment on the vehicles, the position of the intakes, and the exhaust flow rates. Computational analysis (1) has indicated that the efficiency of an under-platform exhaust system may be lower than has been traditionally assumed, and the factors affecting heat extraction of these systems should be technically substantiated based upon the specific configuration being evaluated.

D.4.2
Ceiling ventilation, by powered or gravity design, to aid in the removal of smoke and/or heat should be considered.

D.5 Platform Edge and Screen Doors. D.5.1
Platform edge doors and platform screen doors are sometimes incorporated into stations for various reasons, such as climate control, separation between passengers and trainway hazards (especially in driverless systems), and ventilation control in enclosed trainways. When used, these system walls and doors should provide resistance rating structural strength relative to the train and ventilation system pressures.

D.5.2
In a tunnel-to-station evacuation scenario, access to the platform level from the trainway should be considered.

Where trains might be stopped or delayed in an enclosed trainway for a period of time, the vehicle ventilation system should be capable of maintaining an acceptable level of patron comfort. If not operating in a fire or other emergency scenario, the emergency ventilation fans can be used to augment the vehicle system capability. The thermal acceptance criteria will be dependent upon the potential for occupants to be directly exposed to elevated temperatures in public areas such as station platforms, or indirectly exposed when inside trains that are equipped with air conditioning units and other equipment with a permitted temperature range for continued
D.6.2 Maintenance Activities.

Maintenance activities within station and tunnel areas can include heat-, dust-, or fume-producing operations such as grinding, welding, or painting; operation of fuel-powered vehicles or equipment; and other operations that affect tunnel air quality or temperature. If not operating in a fire or other emergency scenario, the tunnel ventilation fans can be used to address the safety and comfort of employees working in the affected tunnel and station areas. In such cases, velocities should consider the comfort levels of employees required to be in the tunnels.

D.6.3 Tunnels in Gassy Ground.

Tunnels in gassy ground could be subject to ingress of flammable or other hazardous gases. Gases of concern include hydrogen sulfide (H2S) and methane (CH4). The ventilation system should be designed to satisfy two objectives:

1. To avoid pockets of gases forming
2. To achieve dilution of gas inflows through a design crack

The ventilation design should be coordinated with the gas detection and alarm system type and the activation levels selected. The design should consider two general conditions:

1. Ongoing or periodic ventilation requirements to meet expected average gas ingress rates
2. Reaction to potential abrupt increases in gas ingress, such as might result from future construction, climate events, or seismic activity

D.6.4 References

The following references are cited in this annex:

| Resolution: | FR-34-NFPA 130-2017 |
| Statement:  | This revision consolidates current Annex material related to fire and emergency ventilation to establish new Annex B reorganization and numbering format, and relocates non-emergency ventilation requirements to a revised Annex D. Current annex material relating to these topics is spread through four separate annexes. |
|            | Note that for this Global Revision, the only changes to the text occur in the introductory material for each annex. All other text remains the same and is simply renumbered. Any changes to the text have been done under separate First Revisions and are to be voted on separately. |
Annex D: Non-Emergency Ventilation

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1B.1 General.

The purpose of this annex is to provide guidelines for the potential compatibility of the emergency ventilation system with the system employed with normal ventilation of trainways and stations. Considerations and guidance for emergency ventilation is addressed in Annex B. This annex does not present all factors to be considered in the normal ventilation criteria. For normal ventilation, refer to the Subway Environmental Design Handbook (SEDH) and the ASHRAE handbooks Fundamentals, Applications, and Systems and Equipment.

Current technology is capable of analyzing and evaluating all unique conditions of each property to provide proper ventilation for normal operating conditions and for pre-identified emergency conditions. The same ventilating devices might or might not serve both normal operating conditions and pre-identified emergency requirements. The goals of the subway ventilation system, in addition to addressing fire and smoke emergencies, are to assist in maintaining temperatures within acceptable limits during normal and congested operation and to assist in the containment and purging of hazardous gases and aerosols such as those that could result from a chemical/biological release.

B.4D.2 Draft Control. B.4.1D.2.1

For patron comfort in stations, the air velocities induced by train motion should be evaluated carefully by designers. Infrequent exposure to higher velocities can be tolerated briefly but are to be avoided wherever possible. Refer to the Subway Environmental Design Handbook (SEDH), the ASHRAE Handbook — Fundamentals, and the Beaufort Scale.

B.4.2D.2 Draft control can be achieved by the placement of shafts along the tunnel length between stations. Shafts can be arranged with the fan shafts at the ends of stations, with vent shafts midtunnel if required or with vent shafts at the ends of stations and fan shafts midtunnel. End-of-station shaft configurations should be related to the station geometries in the consideration of patron comfort in the station relative to train piston draft effects.

B.5D.3 Temperature Control. B.5.1D.3.1

Temperature control for patron comfort in the station can be achieved by circulating ambient air in moderate climates or by providing heating and/or cooling in more extreme regions. Preferred temperature goals should be defined in the criteria developed for the design of an individual property relative to the local climate and the length of station occupancy, such as train headways specific to the property during which the patron would be exposed to the station temperatures.

B.5.2D.3.2

Temperature control and ventilation for ancillary areas housing special equipment should reflect the optimum operating conditions for the specific equipment to ensure the availability of critical equipment.
and should also give consideration for intermittent occupancy by maintenance personnel. These systems should be separate from the emergency ventilation system for stations and tunnels and should be considered in the design of the emergency ventilation system.

**B.6D.4 Under-Platform and Over-track Ventilation Systems.**

An under-platform ventilation system should be considered for the extraction of heat from traction and braking devices. In hot climates under-platform and/or over-track exhaust systems may be beneficial for controlling temperatures. The effectiveness of these systems will depend upon a number of factors including the configuration and location of the heat-producing equipment on the vehicles, the position of the intakes, and the exhaust flow rates. Computational analysis (1) has indicated that the efficiency of an under-platform exhaust system may be lower than has been traditionally assumed, and the factors affecting heat extraction of these systems should be technically substantiated based upon the specific configuration being evaluated. Intakes should be provided below the platform level and should be situated relative to the heat-producing devices on a train berthed in a station.

**B.6D.2 Ceiling Ventilation.**

Ceiling ventilation, by powered or gravity design, to aid in the removal of smoke and/or heat should be considered.

**B.7D.5 Platform Edge and Screen Doors.**

Platform edge doors and platform screen doors are sometimes incorporated into stations for various reasons, such as climate control, separation between passengers and trainway hazards (especially in driverless systems), and ventilation control in enclosed trainways. When used, these system walls and doors should provide resistance rating structural strength relative to the train and ventilation system pressures.

**B.8D.6 Non-Emergency Ventilation for Enclosed Trainways.**

Where trains might be stopped or delayed in an enclosed trainway for a period of time, the vehicle ventilation system should be capable of maintaining an acceptable level of patron comfort. If not operating in a fire or other emergency scenario, the emergency ventilation fans can be used to augment the vehicle system capability.

The thermal acceptance criteria will be dependent upon the potential for occupants to be directly exposed to elevated temperatures in public areas such as station platforms, or indirectly exposed when inside trains that are equipped with air conditioning units and other equipment with a permitted temperature range for continued operation.
B.8.2D.6.2 Maintenance Activities.

Maintenance activities within station and tunnel areas can include heat-, dust-, or fume-producing operations such as grinding, welding, or painting; operation of fuel-powered vehicles or equipment; and other operations that affect tunnel air quality or temperature. If not operating in a fire or other emergency scenario, the tunnel ventilation fans can be used to address the safety and comfort of employees working in the affected tunnel and station areas. In such cases, velocities should consider the comfort levels of employees required to be in the tunnels.


Tunnels in gassy ground could be subject to ingress of flammable or other hazardous gases. Gases of concern include hydrogen sulfide (H₂S) and methane (CH₄). The ventilation system should be designed to satisfy two objectives:

1. To avoid pockets of gases forming
2. To achieve dilution of gas inflows through a design crack

The ventilation design should be coordinated with the gas detection and alarm system type and the activation levels selected. The design should consider two general conditions:

1. Ongoing or periodic ventilation requirements to meet expected average gas ingress rates
2. Reaction to potential abrupt increases in gas ingress, such as might result from future construction, climate events, or seismic activity

D.6.4 References

The following references are cited in this annex:

Public Input No. 138-NFPA 130-2017 [Chapter E [Title Only]]

Fire Hazard Analysis Process for Vehicle Assessment and Evaluation

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

Revised title clarifies scope of Annex E.

Related Public Inputs for This Document

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Submitter Information Verification

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<td>Adrian Milford</td>
<td>Jensen Hughes</td>
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Submittal Date: Wed Jun 28 21:09:47 EDT 2017

Committee Statement

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# NFPA 130 Annex B Framework

## PROPOSED REVISIONS TO CURRENT NFPA 130 - 2017 ANNEX STRUCTURE

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- **Draft control**
- **Temperature control**
- **UPE recommendation (requires updating)**
- **PSD/PED**
- **Non-emergency, congested, maintenance**

**Combine into one coherent, consistent annex with clear rationale re: fire/emergency ventilation**

**Separate from rest in another annex**

**Update title to clarify annex material is specific to vehicle assessment for purposes of evaluating suitability of specific vehicle design**
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E.2 Fire Hazard Analysis.

The prescriptive-based vehicle fire performance requirements in Chapter 8 of this standard are based on individual material tests. With the use of the fire hazard analysis process, it should be possible to ascertain the fire performance of vehicle materials and assemblies in the context of actual use. The result of such a fire hazard analysis should be a clear understanding of the role of materials, geometry, and other factors in the development of fire in the specific vehicles studied. By identifying when or if specific conditions are reached such that materials begin to contribute to the fire hazard, fixed guideway transit and passenger rail systems vehicle designers and authorities having jurisdiction will have a better foundation on which to base appropriate vehicle and system design and the evaluation of the fire performance of such vehicle designs. By showing the relative contribution of a particular design feature or material, it is possible to make a more realistic assessment of the necessity for specific vehicle design requirements to meet fire/life safety objectives and criteria.

The *SFPE Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings* [2] provides a framework for these assessments. Other useful references include ASTM E2061 [3] and APTA PR-PS-RP-005-00 [4]. On May 12, 1999, the Federal Railroad Administration (FRA) issued a rule containing passenger rail equipment fire safety regulations [5]. The FRA issued a clarification/revision of the fire safety regulations on June 25, 2002 [6]. 49 CFR 238.103 requires that materials used for passenger rail cars and locomotive cabs meet certain fire safety performance criteria and that fire safety (e.g., hazard) analysis be conducted for all new and existing rail passenger equipment.

In addition, scenarios are used to assess the adequacy of vehicle designs considered and ultimately selected. Accordingly, initiating events as referenced from the ASTM rail fire assessment guide [3] are specified for analysis. Although developed for the analysis of existing equipment, the APTA-recommended fire safety practice provides a framework and resources for the application of fire hazard analysis in vehicles that might be applicable to new or retrofitted equipment.

Finally, it is important to note that the fire hazards relating to the vehicle-operating environment must be considered.

If the outcome predicted by assessment of the scenarios evaluated is bound by the performance criteria stated, then the objectives will have been met, and the life safety characteristics of a proposed vehicle design can be considered to be consistent with the goals of this standard. It must be assumed that if a design fails to comply with the life safety goals and objectives and associated performance criteria, the design must be changed and reassessed iteratively until satisfactory performance levels are attained.

On June 25, 2002, the FRA published a Federal Register Notice that clarified several items relating to the fire tests and performance criteria, and revised certain parts of the fire safety analysis requirements [6].

Documentation of assessment parameters, such as those used with scenarios, is critical. The approval and acceptance of a fire/life safety design is dependent on the quality of the documentation used in this process.

Per international standard-of-care in design of life safety systems (i.e. structural engineering, bio-med hazard laboratory ventilation, fire safety etc.), independent third party review is warranted upon assumptions, basis, forecasts, raw input files, simulation tools, etc. Third party reviewers should provide their name, credentials, financial support and stakeholder affiliation onto the approval.

It is good practice to ask of the fire safety design team to memorialize a minimum amount of information and leave this summary inside the Fire Alarm Control Unit. Information could include reasonable worst-case design fire, substantiation for design fires, design fire derating due to fire suppression systems, fire escalation due to high-velocity ventilation systems, simulated occupancy load vs reasonable-maximum occupant load (~5 Pesons/m2), exit path occupant flow arrows, safety factors provided, uncertainty in the safety factors provided, sensitivity of safety factors to impairment of key sub-components (exit capacity, suppression system, ventilatin system, etc.), forecasted change in RAM values for system sub-components on 3, 10 and 25 year basis, (including human error), expected service life of sub-components.

Statement of Problem and Substantiation for Public Input

Some fire safety plans for Metro facilities having 1,000+ passengers located more than 9.1 m underground, do not reflect a level of professionalism commensurate with the hazard. These are suggestions for fire life safety plan reviewers to abet their due diligence, better justify their pay and hopefully increase the trust the public places in them.
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Submittal Date: Wed Jun 28 17:45:38 EDT 2017

Committee Statement

Resolution: This proposal does not add any substance or clarification to the material in Annex E material.
Public Input No. 74-NFPA 130-2017 [ Section No. E.2 ]

E.2 Fire Hazard Analysis.

The prescriptive-based vehicle fire performance requirements in Chapter 8 of this standard are based on individual material tests. With the use of the fire hazard analysis process, it should be possible to ascertain the fire performance of vehicle materials and assemblies in the context of actual use. The result of such a fire hazard analysis should be a clear understanding of the role of materials, geometry, and other factors in the development of fire in the specific vehicles studied. By identifying when or if specific conditions are reached such that materials begin to contribute to the fire hazard, fixed guideway transit and passenger rail systems vehicle designers and authorities having jurisdiction will have a better foundation on which to base appropriate vehicle and system design and the evaluation of the fire performance of such vehicle designs. By showing the relative contribution of a particular design feature or material, it is possible to make a more realistic assessment of the necessity for specific vehicle design requirements to meet fire/life safety objectives and criteria.

The SFPE Engineering Guide to Performance-Based Fire Protection, Analysis and Design of Buildings , [2] provides a framework for these assessments. Other useful references include ASTM E2061 [3] and APTA PR-PS-RP-005-00 [4]. On May 12, 1999, the Federal Railroad Administration (FRA) issued a rule containing passenger rail equipment fire safety regulations [5]. The FRA issued a clarification/revision of the fire safety regulations on June 25, 2002 [6]. 49 CFR 238.103 requires that materials used for passenger rail cars and locomotive cabs meet certain fire safety performance criteria and that fire safety (e.g., hazard) analysis be conducted for all new and existing rail passenger equipment.

In addition, scenarios are used to assess the adequacy of vehicle designs considered and ultimately selected. Accordingly, initiating events as referenced from the ASTM rail fire assessment guide [3] are specified for analysis. Although developed for the analysis of existing equipment, the APTA-recommended fire safety practice provides a framework and resources for the application of fire hazard analysis in vehicles that might be applicable to new or retrofitted equipment.

Finally, it is important to note that the fire hazards relating to the vehicle-operating environment must be considered.

If the outcome predicted by assessment of the scenarios evaluated is bound by the performance criteria stated, then the objectives will have been met, and the life safety characteristics of a proposed vehicle design can be considered to be consistent with the goals of this standard. It must be assumed that if a design fails to comply with the life safety goals and objectives and associated performance criteria, the design must be changed and reassessed iteratively until satisfactory performance levels are attained.

On June 25, 2002, the FRA published a Federal Register Notice that clarified several items relating to the fire tests and performance criteria, and revised certain parts of the fire safety analysis requirements [6]. Documentation of assessment parameters, such as those used with scenarios, is critical. The approval and acceptance of a fire/life safety design is dependent on the quality of the documentation used in this process.

Statement of Problem and Substantiation for Public Input

When the 2nd edition of the SFPE Guide was published, it was changed to the SFPE Engineering Guide to Performance-Based Fire Protection.

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Submittal Date: Fri Jun 23 09:06:50 EDT 2017
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<td><strong>Statement:</strong> This revision updates the title of the 2nd edition of the SFPE guide.</td>
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E.4 References.

The following references are cited in this annex.


Statement of Problem and Substantiation for Public Input

The title of the SFPE Guide was changed when the 2nd edition was published in 2007 to SFPE Engineering Guide to Performance-Based Fire Protection.

Submitter Information Verification

Submitter Full Name: Chris Jelenewicz
Organization: SFPE
Street Address:
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Submittal Date: Fri Jun 23 09:13:27 EDT 2017
### Committee Statement

**Resolution:** FR-48-NFPA 130-2017  
**Statement:** This revision updates the title of the SFPE Guide.
Statement of Problem and Substantiation for Public Input

New references to support the new proposals

Submitter Information Verification

Submitter Full Name: Gilad Shoshani
Organization: RSCC Wire & Cable
Committee Statement

Resolution: FR-49-NFPA 130-2017
Statement: This revision updates references as appropriate.
Annex G - Onboard Fire Suppression System

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

Onboard fire suppression systems (e.g., mist systems), while relatively new in the passenger rail and fixed guideway industry, have been successfully used on a number of passenger rail and diesel powered light rail systems outside of the United States. The applications for this type of system can range from protection of diesel engine compartments to the interior of passenger rail vehicles. The use of a fire suppression system could save lives in the incident vehicle during a fire condition; minimize damage to the train, tunnel, and the station which it has entered; reduce or eliminate potential use of station sprinklers; reduce or eliminate the need for down-stands; significantly reduce the impact of designing for fire emergencies on station architecture; reduce tunnel ventilation capacities by approximately 40 percent; reduce the number and/or diameter of emergency ventilation fans at each end of each station and within the tunnels, thus reducing structure sizes; decrease shaft airflow cross section areas by approximately 40 percent; and decrease tunnel ventilation shaft portal areas that correspond to the required fans sizes/velocities. When considering the addition of a fire suppression system, several design challenges should be met by the rail vehicle manufacturer. These challenges include the type of extinguishing medium used, which all must be approved by the authority having jurisdiction, the size and number of medium canisters and where on the vehicle to place them for easy access for maintenance; the resultant increased energy consumption caused by the increase in weight of the suppression system; the maintenance intervals; the cost of the system; the testing and commissioning of the system; and the cost and difficulties associated with retrofitting vehicles.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

Annex G has been absorbed in proposed revisions to Annex B. Refer to uploaded Rationale graphic.

Related Public Inputs for This Document

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<td>Part of overall revisions to Annexes B, D, G and H.</td>
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Submitter Information Verification

Submitter Full Name: Adrian Milford
Organization: Jensen Hughes
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 28 21:12:22 EDT 2017

Committee Statement

Resolution: FR-34-NFPA 130-2017
**Statement:** This revision consolidates current Annex material related to fire and emergency ventilation to establish new Annex B reorganization and numbering format, and relocates non-emergency ventilation requirements to a revised Annex D. Current annex material relating to these topics is spread through four separate annexes.

Note that for this Global Revision, the only changes to the text occur in the introductory material for each annex. All other text remains the same and is simply renumbered. Any changes to the text have been done under separate First Revisions and are to be voted on separately.
**NFPA 130 Annex B Framework**

**PROPOSED REVISIONS TO CURRENT NFPA 130 - 2017 ANNEX STRUCTURE**

|----------------------|-----------------------------|-----------------------------------------------------------|----------------------------------|----------------------------------------|
| • General ventilation references  
• Tenability  
• Detailed FED, CO, T calculations  
• Air velocity, noise  
• Zone of tenability/configuration  
• Time considerations  
• Modelling accuracy | • Fire development within trains  
• Material fire performance  
• Initiating Fires  
• Vehicle Fire HRR  
• Impact of Ventilation  
• Volume of smoke | • FHA overview  
• FHA process for vehicles – context, scenario, hazard, consequences  
• Vehicle performance and objectives – “to allow designer to adopt ..”  
• Evaluate suitability of vehicle design | • High level discussion on impact/considerations | • Fire scenarios – train + other  
• Fire profiles, references to critical velocity  
• CFD modelling  
• Reference to fire tests, limited discussion of context |

- **Separate from rest in another annex**

- **Combine into one coherent, consistent annex with clear rationale re: fire/emergency ventilation**

- **Update title to clarify annex material is specific to vehicle assessment for purposes of evaluating suitability of specific vehicle design**
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<td><strong>Annex I</strong>: Informational References</td>
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Annex H – Fire Scenarios and Fire Profiles

This annex is not part of the requirements of this NFPA document but is included for informational purposes only.

H.1 – Introduction.
This annex presents information on fire scenarios and methodologies used for predicting fire profiles. The engineering approach for predicting fire profiles has changed over time. Because this is a rapidly developing field, designers should be careful to justify the appropriateness of the methodology selected.

H.2 – Fire Scenarios.
Representative design fire scenarios include the following:

(1) A fire originates outside the vehicle interior, such as below the floor or rooftop. The fire causes the train to stop in a tunnel or station and could burn through the floor or rooftop into the vehicle’s interior.

(2) A fire originates in a vehicle’s interior. Some recent train fire studies suggest that an NFPA 130-compliant car will not flashover, unless the event is initiated with two or more liters of a flammable liquid or accelerant. The designer should verify this possibility, as ventilation requirements can vary greatly depending on flashover expectations.

(3) The fire spreads from car-to-car. The fire might spread from car-to-car. Parameters that affect this are the fire resistances of the car ends, whether the interior car doors are left open or closed, whether or not the cars have “bellows” connecting them, the tunnel ventilation moving the heat from the fire site downstream to the next car, whether the car exterior windows are glass or polycarbonate, and whether or not the station has sprinklers.

(4) A fire consumes trash, luggage, wayside electrical equipment, and so forth, in the stations or tunnels.

(5) A fire occurs in a nontransit occupancy that is not protected by sprinklers, such as a kiosk or small shop.

(6) A fire in a dual-powered vehicle (diesel and electric traction) results from the puncture of a fuel tank or rupture of a fuel line.

(7) A fire originates in a maintenance vehicle or work train. If maintenance vehicles are never in the stations or tunnels during periods of revenue operations, then maintenance vehicle or work train fire scenarios do not have to be considered as design fire scenarios.
H.3 – Fire Profiles.

As per 7.2.1(2), critical velocity is the criterion for determining the required tunnel airflow and hence the ventilation system fan capacities required for tunnel fire incidents. The most commonly used software is the Subway Environment Simulation (SES) computer program [1]. The peak fire heat release rate is the primary fire input.

Tunnel ventilation systems usually predict by computational fluid dynamics (CFD) programs. The design fire profile is an input to the CFD programs, which predict temperatures, visibilities, and carbon monoxide concentrations as a function of the three-dimensional location in the station and the time since the initiation of the fire. Any combustible materials that could contribute to the fire load at the incident site should also be evaluated.

Several references provided a reasonably good overview of a number of methodologies for predicting design fire profiles [2][3][4]. More recent methodologies include, but are not limited to, the following:

**CFD Modeling of Fire Profiles with Cone Calorimeter Tests of Train Materials.** This methodology includes cone calorimeter tests of train materials and computer modeling of fire growth and decay for a fire that originated in a train's interior in the presence of accelerants. Several CFD programs have been used in predicting fire profiles for transit and rail projects in the United States since 2005. The CFD programs are validated for their intended use and predict pre- and post-flashover fire profiles. When selecting a computer program, it is important to select the program that best fits the need of the problem rather than to select the program based on availability. The following conditions should be considered when building a CFD model for predicting fire profiles: 1) quantity and properties of accelerants; 2) fire characteristic of car interior materials measured according to ASTM E1354; 3) layout of the car interiors, including seating layouts, orientations, and dimensions; 4) bags and luggage carried by passengers; 5) overall thermal transmission value for vehicle body; 6) openings, including windows and doors; 7) oxygen levels; and 8) mechanical and natural ventilation.

**Full-Scale Fire Tests.** A handful of full-scale train fire tests have yielded data to estimate the fire profiles. The 1995 EUREKA project [5] showed that an intercity train reached a peak fire heat release rate of 12 MW in 25 minutes, while a Metro train car reached a peak fire heat release rate of 35 MW in 5 minutes. A Baku Metro train fire (Azerbaijan, 1995) was estimated to reach 100 MW in about 30-45 minutes, and in 2002 a Frankfurt Metro fire model reached 5.6 MW in 30 minutes [3]. The fire profile studies focused on accidental fires such as debris or transient car loadings becoming ignited or mechanical failure causing the train car itself to ignite.

More recent full-scale fire tests have focused on fires where a deliberate attempt was made to ignite and fluidover the train car. The full-scale fire tests in Sweden [6] used a commuter train and found that the maximum fire heat release rate of 76.7 MW was achieved in 12.7 minutes in one of the tests, and the corresponding value for another test with the train walls and ceiling covered by aluminum was 77.4 MW and occurred 117.9 minutes after ignition. The general shape of the two fire curves are almost the same. Other full-scale fire tests in Canada used a subway car, which reached a maximum FHRR of 52.5 MW in 2.3 minutes, and a railway car, which reached a peak FHRR of 32 MW in 18 minutes [7]. A fourth test was performed in Australia, where a passenger rail car reached a maximum FHRR of 13.9 MW in 2.3 minutes [8].

Modern trains that are fire hardened have not been readily tested. Research has been on older model trains where the degree of fire hardening has not been quantified. Initiating fires in order to combust the trains have been disproportionately large in consideration of the ignition source typically found on a train and have been conspicuously located in the worst-case location in order to combust the train. The above results in a premature growth to the combustible lining materials on the train than would ordinarily be present from ignition sources; this yields extremely large fires that overcome the fire hardening characteristics and result in very large peak heat release rates. Consideration should also be given to ventilation conditions, different types of lining materials, especially at the ceilings, and the interconnection of train cars.

H.4 – Impacts on Ventilation System Design.

The train fire profile has a major impact on the station and tunnel ventilation design. The design fire scenarios and fire profiles should be determined based on the perceived threats. In response to increased awareness that transit and passenger rail systems are potential terrorist targets, some systems are designed for significant incendiary fires and others are not. The decision could be based on cost, the inferred risk, or a formal threat and vulnerability assessment.
H.5 - References.
The following references are cited in this annex:


Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

Annex H is absorbed in proposed revisions to Annex B.

Related Public Inputs for This Document

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<td>Part of overall revisions to Annexes B, D, G and H.</td>
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Submitter Information Verification

Submitter Full Name: Adrian Milford
Organization: Jensen Hughes
Street Address:
City:
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Submittal Date: Wed Jun 28 21:14:31 EDT 2017

Committee Statement

Resolution: FR-34-NFPA 130-2017
**Statement:** This revision consolidates current Annex material related to fire and emergency ventilation to establish new Annex B reorganization and numbering format, and relocates non-emergency ventilation requirements to a revised Annex D. Current annex material relating to these topics is spread through four separate annexes.

Note that for this Global Revision, the only changes to the text occur in the introductory material for each annex. All other text remains the same and is simply renumbered. Any changes to the text have been done under separate First Revisions and are to be voted on separately.
# NFPA 130 Annex B Framework

## PROPOSED REVISIONS TO CURRENT NFPA 130 - 2017 ANNEX STRUCTURE

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- Update title to clarify annex material is specific to vehicle assessment for purposes of evaluating suitability of specific vehicle design
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Public Input No. 61-NFPA 130-2017 [Section No. I.1.2.4]

I.1.2.4  ASTM Publications.
ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

Statement of Problem and Substantiation for Public Input
date updates

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler  
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Submittal Date: Wed Jun 21 17:41:40 EDT 2017

Committee Statement

Resolution: FR-49-NFPA 130-2017
Statement: This revision updates references as appropriate.
Statement of Problem and Substantiation for Public Input

When the 2nd edition of the SFPE guide was published, its name was changed to SFPE Engineering Guide to Performance-Based Fire Protection.

Submitter Information Verification

Submitter Full Name: Chris Jelenewicz
Organization: SFPE
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 23 09:18:11 EDT 2017

Committee Statement

Resolution: FR-49-NFPA 130-2017
Statement: This revision updates references as appropriate.
I.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.


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**Statement of Problem and Substantiation for Public Input**

Chapters 61, 62 and 63 of the SFPE Handbook of Fire Protection Engineering provide methodologies on how to estimate tenability.

**Submitter Information Verification**

- **Submitter Full Name:** Chris Jelenewicz
- **Organization:** SFPE
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Jun 23 09:29:42 EDT 2017

**Committee Statement**

- **Resolution:** FR-49-NFPA 130-2017
- **Statement:** This revision updates references as appropriate.