BS 9992:2020

BSI Standards Publication

Fire safety in the design, management and use of rail infrastructure — Code of practice

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Published by BSI Standards Limited 2020

ISBN 978 0 580 52282 6

ICS 13.220.01; 45.080

The following BSI references relate to the work on this document:
Committee reference FSH/14
Draft for comment 19/30370288 DC

Amendments/corrigenda issued since publication

Date	Text affected

Contents

Summary of pages
This document comprises a front cover, and inside front cover, pages i to vi, pages 1 to 109, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 April 2020. It was prepared by Technical Committee FSH/14, *Fire precautions in buildings*. A list of organizations represented on this committee can be obtained on request to its secretary.

Relationship with other publications

The British Standard is intended to be read in conjunction with BS 9999:2017.

Information about this document

The British Standard is intended to be used by:

- railway owners, operators and infrastructure managers;
- train operating companies (TOCs) – safety managers, station and tunnel managers and engineers;
- design houses (single and multi-disciplinary) – project managers, project engineers and fire safety engineers;
- architects of railway infrastructure;
- building and construction contractors;
- system design contractors (engineers);
- suppliers and installers of fire protection systems in railway infrastructure (fire detection and fire alarm systems, fire suppression and extinguishing systems, smoke control, pressurization and extract systems, fire-resisting structures and separating elements, materials with fire performance requirements);
- regulators; and
- maintainers.

This British Standard provides recommendations and guidance on the provision of measures to control or mitigate the effects of fire. The primary objective is to ensure that an adequate standard of life safety can be achieved in the event of fire in the premises. A secondary objective is to provide a level of protection for property, the operation of the railway and businesses against the impact of fire, e.g. in close proximity to other premises or as part of the same premises or complex. These objectives can also have the effect of assisting the fire and rescue service and/or of providing environmental protection.

There are references throughout this British Standard to occupant safety, firefighter safety, and business and property protection, to draw attention to the different issues these could raise. It is, however, important to be aware that provisions solely for life safety are unlikely to provide the full level of protection for buildings and property in a fully developed fire scenario.

This British Standard complements BS 9999 and varies from it only where appropriate to support the particular ways in which railway infrastructure is constructed or operated. Where recommendations are not explicitly included, then the default is that BS 9999 be referred to for relevant guidance.

A fire safety engineering approach as detailed in BS 7974 might be more appropriate in the design of some complex railway premises.

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Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. "organization" rather than "organisation").

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Section 1: General

0 Introduction

0.1 General principles

The design of acceptable fire safe railway infrastructure relies upon an understanding of the causes of fire, the materials and systems likely to be involved in fire, human behaviour in fire emergencies, firefighting tactics and the likely spread of fire.

The recommendations and guidance given in this British Standard are based on the assumption that under normal circumstances, a fire is unlikely to start in two different places in a premises.

Whilst certain parts of railway premises lend themselves to being designed in accordance with published guidance for general buildings, the parts of those premises provided for the transit of trains (e.g. tunnels) and the public areas of stations might not. The reasons for this include the following.

- Tunnels offer unique fire safety challenges; they are very often deep underground, with firefighting access and escape distances far greater than those generally recommended for buildings. It is not usually practicable to build shafts or tunnels which would bring those distances into compliance with the guidance for general buildings.
- The design of railway rolling stock is addressed in the BS EN 45545 series of standards; these are based upon certain assumptions about the configuration of tunnels and the fire protection arrangements in them. The treatment of safety in these premises therefore addresses the combined fire protection characteristics of rolling stock and tunnel infrastructure as a single safety system, hence it is important that the fire protection arrangements in tunnels follow the established approach applied to those structures, rather than the standards applied to buildings.
- Railway stations can be regarded, on the whole, as mechanisms for transporting railway passengers from the street to the platforms and onto the trains (and in the opposite direction) efficiently and safely. For the most part, they are designed to cope with a transient population whose time occupying the premises might last no more than a few tens of minutes (although this is not always the case; see Note 1). For this reason, the public areas of stations are often designed with few facilities for comfort, and the fire load permanently present in the public area can usually be restricted so that it is minimal. In addition, travel distances greater than those accepted in other types of buildings can often be safely accommodated.

  NOTE 1 Railway stations often incorporate other uses, such as retail, assembly and recreation, which are accessible from station concourses.

- The operational response to a fire on a train is often to bring it into the next available station, if possible, as it is normally from these locations where means of escape can happen most swiftly, and firefighting access can be most effectively accommodated. It is foreseeable, therefore, that buildings which are almost always lightly occupied might suddenly have to accommodate several thousand occupants concurrently with a significant fire [the train(s) carrying those people], rather than their usual level of patronage. Station designs might have to cater for this scenario, which is not usually faced in other premises.
- Sub-surface stations can be deep underground, and the platforms can be vertically displaced far from the surface structures, often under roadways or other buildings. Guidance on basements in other buildings, which are typically directly underneath the buildings they serve, can be difficult to apply.

NOTE 2 Attention is drawn to the Fire Precautions (Sub-surface Railway Stations) Regulations 1989 [1], and to the Fire Precautions (Sub-surface Railway Stations) (England) Regulations 2009 [2].

- The availability of railway infrastructure can be critical to the normal functioning of a town, city or other transport infrastructure (e.g. an airport). The complete or partial loss of the railway service might necessitate the increased use of other transport modes, which generally do not offer the same capacity as railways. It can affect the daily lives of tens of thousands of people, perhaps causing them to use less safe forms of transport. It can, therefore, be particularly important to establish whether fire protection measures beyond those strictly required for life safety in the premises need to be provided.

The recommendations in this British Standard apply to both existing and new premises, but existing structures, especially historic ones, can offer challenges which are unlikely to arise in new construction. In sub-surface infrastructure, in particular, the cost of driving new tunnels or shafts to improve means of escape and firefighting access is so great that it is not usually practicable unless as part of major works to reconfigure or rebuild the infrastructure. In the case of some surface infrastructure, there can be significant constraints caused by the proximity of existing buildings, or the permanent way itself. The application of this British Standard, in its entirety, might not, therefore, be reasonably practicable for such premises. It is therefore particularly important that, in such cases, the stakeholders are consulted prior to the design being finalized and the works commencing. This helps to ensure that the scope of the fire safety-related works and the standards used are appropriate in the circumstances, and that any significant variations from the recommendations in this British Standard are justified. The stakeholder consultation workshop (see **4.5**) offers a means to help establish that consensus.

In assessing the fire safety management needs of an existing building which is being modified, it is essential to have a full understanding of the existing structure and any fire safety provisions incorporated, and to take into account all of the following:

a) any change in use of the premises which could affect the fire risk profile (e.g. changes in passenger numbers due to revised service patterns or new rolling stock);

b) how the necessary fire safety levels can be practicably achieved in the existing premises;

c) historic and conservation aspects of the premises and to what extent they need to be preserved;

NOTE 3 The conservation of historic building fabric alone is insufficient justification for accepting levels of safety lower than those that would otherwise apply. It can, however, affect which of several options for achieving the same level of safety is chosen.

d) legislation and guidance introduced since the premises were originally constructed or last altered, or since their fire safety was last assessed;

e) the interrelationship between life safety and measures to protect property/contents;

f) systems integration;

g) operational integration;

h) business continuity; and

i) asset protection.

Historic railway infrastructure presents particular challenges, as it might be listed, and permitted material alterations are therefore limited without the agreement of the appropriate authorities. For such premises, it can be advisable to seek the advice of consultative bodies, such as Historic England, Cadw, Historic Scotland and the Northern Ireland Environment Agency, in the early stages of design. The appropriate authorities sometimes agree to modifications to improve life safety where, in turn, there will be added long-term protection and preservation of the original building fabric. In some

cases, the railway operator or infrastructure manager might have specialists who manage their relationship with the conservation authorities and who can be consulted to obtain advice.

The principles and recommendations in this British Standard apply straightforwardly where the premises have a single main use as railway infrastructure and are contained in a single, separate building. Complications might arise, however, where a building comprises two or more different main uses (such as retail facilities within or connected to a railway station, or office accommodation within the station). In such cases it is important to consider the effect of one risk on another. A fire in a shop or unattended office could have serious consequences for the railway. Similarly, a high fire risk in one part of a premises could seriously affect other areas in another part of that premises.

The following are factors that need to be taken into account in establishing a minimum package of fire protection measures:

1) the potential users of the building (staff, maintainers and members of the public);
2) the hazard posed by other occupancies or premises, including boundary conditions;
3) ignition sources, types and extent of fire loads, and available ventilation;
4) the provision for giving warning in the event of fire, including any automatic fire detection;
5) the provision of automatic fire suppression or extinguishing systems;
6) smoke clearance and smoke control arrangements;
7) the overall management and control of the premises, including staffing numbers and whether those vary throughout the period during which the premises are occupied;
8) structural fire protection and compartmentation;
9) the fire performance of the materials from which the premises will be constructed, both internally and externally;
10) firefighting access to the building (including for vehicles);
11) the facilities provided for firefighters;
12) fixed and portable firefighting equipment;
13) fire safety signage;
14) emergency lighting; and
15) the security of and access to the building and its effect on fire safety.

The inclusion of an item in this list does not necessarily mean that it is required in all premises, but all of these items need to be actively assessed when developing the package.

0.2 Approval, assurance and verification arrangements for railway works

Building works for railways might not be subject to third-party approval. The railway operators or infrastructure managers (the duty holders) might be able to self-approve even major construction work under safety case and safety certification arrangements that enable them to offer a railway service. For this reason, it is important that the approval and acceptance process for such works is clearly communicated to suppliers of both design services and the works themselves by the railway client(s) before the work of the suppliers commences, including information that specifically describes the arrangements pertinent to fire safety.

Under their safety certification arrangements, some duty holders might impose mandatory technical requirements, including their own internal technical standards or specifically referenced national guidance. The duty holder might require that any variation from those standards is subject to their specific and prior approval, before it is introduced on the operating railway. This might mean that

standards which would be regarded as guidance in other types of building become mandatory in railway-related works.

Some duty holders have specific requirements for the assurance and verification of fire safety-related railway works before accepting them into use, and these can be significantly more thorough than works of a similar nature for other types of premises. Where these requirements exist, the duty holder needs to ensure that they are communicated to those constructing, commissioning and delivering the works sufficiently early that the requirements can practicably be complied with. Where these arrangements require the endorsement of the safety and functionality of the works by fire safety specialists, it is advisable for those specialists to be appointed before any works involving assets that have a fire safety function commence on site. There needs to be continuity of such specialist surveillance throughout the life of the project, including appropriate arrangements for cooperation or handover if the appointment involves more than one person. The form of endorsement expected needs to be clearly defined by the duty holder, and the specialists need to be afforded sufficient authority over the conduct of the works that they can practicably deliver that assurance.

Where the works are being delivered by a number of suppliers then the duty holder needs to define how the interfaces between those delivery packages are to be managed, to deliver integrated railway infrastructure that is acceptably fire safe. For example, a line extension might involve several principal contractors delivering different pieces of infrastructure, or line-wide systems might involve a single contractor designing and installing equipment on a number of sites. All those involved in the works need to cooperate and coordinate those works so that fire safety is effectively managed.

1 Scope

This British Standard gives recommendations and guidance on the design, management and use of railway buildings and the permanent way to achieve reasonable standards of fire safety for all people in and around rail infrastructure (railways and guided systems).

It covers:

- stations (surface, sub-surface and enclosed);
- platforms;
- tunnels;
- viaducts;
- elevated rail;
- train care depots and maintenance facilities;
- training facilities;
- sidings;
- signalling/control facilities; and
- ancillary buildings.

This British Standard is primarily intended for life safety but also gives guidance on protection of property, business and operations.

This British Standard is applicable to the design of new premises, and to material alterations, extensions and material change of use of existing premises.

This British Standard does not cover fire safety of rolling stock, or fire safety design strategies for extreme events such as terrorist actions.

