

Loading Requirements for the Design of Bridges

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Synopsis

This Railway Group Standard sets out the minimum **loading** requirements to be considered in the design of **bridges**.

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Loading Requirements for the Design of Bridges

Part A

Issue Record

This Railway Group Standard will be updated when necessary by distribution of a complete replacement.

Amended or additional parts of revised pages will be marked by a vertical black line in the adjacent margin.

Issue	Date	Comments
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1	May 1997	Supersedes GC/TT0112 "Standard for Bridge Loading"
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Responsibilities

Railway Group Standards are mandatory on all members of the Railway Group* and apply to all activities which fall into the scope of each individual's Railway Safety Case. If any of those activities are performed by a contractor, the contractor's obligation in respect of Railway Group Standards is determined by the terms of the contract between the respective parties. Where a contractor is himself a duty holder of a Railway Safety Case then Railway Group Standards apply directly to the activities described in the Safety Case.

*The Railway Group comprises Railtrack, the duty holders of Railway Safety Cases accepted by Railtrack, and the British Railways Board as long as it owns train operators.

Compliance

The provisions of this Railway Group Standard are mandatory and shall apply from 2 August 1997.

Health and Safety Responsibilities

In issuing this Standard, Railtrack PLC makes no warranties, express or implied, that compliance with all or any Railway Group Standards is sufficient on its own to ensure safe systems of work or operation. Each user is reminded of its own responsibilities to ensure health and safety at work and its individual duties under health and safety legislation.

Supply

Controlled and uncontrolled copies of this Railway Group Standard may be obtained from The Catalogue Secretary, Safety and Standards Directorate, Railtrack PLC, Floor 2, Fitzroy House, 355 Euston Road, London, NW1 3AG.

Loading Requirements for the Design of Bridges

Part B

1 Purpose

This Railway Group Standard sets out the minimum **loading** requirements to be considered in the design of **Bridges**.

2 Scope

This Railway Group Standard applies to the design of all new, reconstructed and altered **Bridges** which cross or support Railtrack Controlled Infrastructure and to all those with the responsibility for the **loading** specification for such **Bridges**.

For **Bridges** not owned by Railtrack only Section 7 and Section 8 of this Railway Group Standard apply.

3 Definitions

Bridge

A structure of one or more spans whose prime purpose is to afford passage over an obstruction or gap. Structures where all parts are buried below the surface at a distance greater than their diameter or span are excluded.

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4 Principles

This Railway Group Standard supports the following HMRI Principles:

- earthworks and structures supporting the track should be capable of carrying and transferring the forces exerted by trains (HMRI Principle No. 7);
- earthworks and structures above or adjacent to the railway should be capable of supporting the loads imposed upon them and afford protection to the railway (HMRI Principle No. 8);

and the general requirements contained in **GC/RT5110** "Design Requirements for Structures".

5 General Requirements

5.1 Loading specification

Adequate provision for all likely loads and load effects shall be included in the **loading** specification for **Bridges**.

Appendix A lists the loads and load effects that shall be considered in all cases. Other loads and load effects may need to be considered in particular situations.

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5.2 General

The **loading** that has been specified shall be clearly documented and approved by Railtrack at the Approval in Principle stage under the procedures identified in **GC/RT5101** "Technical Approval Requirements for Changes to the Infrastructure".

6 Requirements for Traffic Loads

6.1 Bridges carrying rail traffic

6.1.1 New Bridges and Bridges Reconstructed with Complete New Superstructures

Bridges carrying railway traffic of standard gauge shall generally be designed for full RU type **loading** as specified in BD37/88 "Loads for Highway **Bridges**".

Note: BD37/88 covers Railway **Loading** and supersedes BS5400 Part 2.

In exceptional cases, where safety and the safety of interworking are not adversely affected, a lighter **loading** may be permitted which shall be defined by multiplying the RU type **loading** by a factor. The provision also exists for adopting a heavier **loading** on restricted sections where this is appropriate.

The factor to be applied to the full RU type **loading** shall not be less than 0.75. Written approval to the use of a **loading** other than full RU type **loading** shall be obtained from Railtrack at the Approval in Principle stage of the project under the procedures identified in Railway Group Standard **GC/RT5101** "Technical Approval Requirements for Changes to the Infrastructure". In all such cases an appropriate traffic mix for fatigue shall be established taking account of the design life of the structure and the proposed rail traffic and any reasonably foreseeable changes to the rail traffic using the structure.

6.1.2 Additional **Loading** for continuous **Bridges**

The RU type **loading** was developed for simply supported **Bridges** and covers the special vehicle Type 6 shown in Appendix 101 of UIC Leaflet 776-1R "Loads to be considered in the design of railway **Bridges**". In continuous Bridge construction the effects due to vehicle Type 6 may not be covered by the RU Load Model. The effects due to the SW/0 Load Model shown in Figure 1 of this Railway Group Standard shall therefore be considered unless otherwise specified by Railtrack. This Load Model corresponds to vehicle Type 6.

On multi-track **Bridges**, only one track shall be loaded with the SW/0 Load Model.

The SW/0 Load Model does not have to be considered in any fatigue check.

Loading Requirements for the Design of Bridges

Whereas RU type loading shall be curtailed as necessary in order to produce the most unfavourable load effect, Load Model SW/0 shall not be curtailed and need not be repeated.

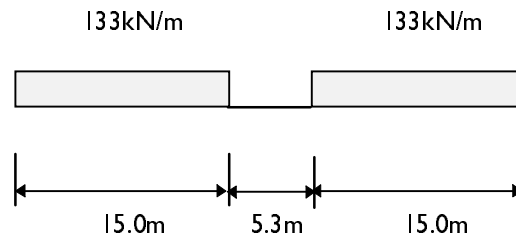


Figure 1 - SW/0 Load Model

6.1.3 Altered Bridges

For altered Bridges, where it is proposed to alter the structure of the Bridge, the loading specified shall meet the requirements of the Principles of this Railway Group Standard, and shall be such that the lesser of the following applies:

- the loading capacity of the Bridge is not reduced;
- the requirements of clauses 6.1.1 and 6.1.2 of this Railway Group Standard are met.

The effect of the new elements on the remaining elements of the structure shall be considered, particularly with regard to compatibility of stiffnesses.

6.1.4 Temporary Bridges

Temporary Bridges designed to carry rail traffic shall in general be designed in accordance with 6.1.1 and 6.1.2 of this Railway Group Standard. In exceptional cases, where safety and the safety of interworking are not adversely affected, a lesser loading may be permitted. In all such cases, the loading shall take into account the rail traffic that will be permitted to use the temporary Bridge, the intended life of the temporary Bridge, any site specific hazards and any control measures required to prevent overloading of the temporary Bridge.

Any loading lesser than that required in 6.1.1 and 6.1.2 of this Railway Group Standard shall be suitably justified.

6.1.5 Deformations

Deformations for Bridges carrying rail traffic shall be in accordance with UIC Leaflet 776-3R "Deformation of Bridges". In section 8 of Leaflet 776-3R, the values in Table 5 shall apply.

Lesser deformations may need to be specified for appropriate levels of passenger comfort.

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6.2 Bridges carrying road traffic

Bridges carrying road traffic shall generally be designed for standard highway loading as specified in BD37/88.

For all public highway Bridges, the number of units of HB loading and any requirements for abnormal indivisible loads shall be determined in conjunction with the Highway Authority.

For occupation and accommodation Bridges, a lesser load than that specified in BD37/88 for accommodation Bridges may be permitted as long as safety and the safety of interworking are not adversely affected and all other legal obligations are met. Any lesser loading shall be suitably justified.

For Bridges designed to carry other types of road or vehicular traffic the loading shall be specified by Railtrack.

6.3 Bridges Carrying Pedestrian and/or cycle traffic (including equestrian traffic)

For Bridges supporting footways and/or cycle tracks open to the public, the loading shall generally be designed in accordance with the requirements of BD37/88.

For other Bridges, the loading to be considered for pedestrian traffic shall generally be in accordance with the requirements for service walkways given in UIC Leaflet 776-IR.

Where Bridges are designed to carry pedestrian or cycle traffic only, suitable provision shall be made to prevent use of the Bridge by vehicular traffic which could affect safety of train operations.

6.4 Bridges Carrying other Traffic

The loading shall be determined in conjunction with the relevant authority and shall meet the requirements of the Principles contained in this Railway Group Standard.

7 Bridges not owned by Railtrack

Where the Bridge is not owned by Railtrack, Railtrack shall use its best endeavours to ensure that the loadings to which the Bridge is designed comply with the requirements of this Railway Group Standard.

Where this is not the case, the details shall be recorded and the relevant authority notified.

Where the safety of train operations or the safety of interworking is likely to be affected the matter shall be brought to the attention of the HMRI.

Loading Requirements for the Design of Bridges

8 Records

Railtrack shall ensure that:

- the **loading**, together with any risk/reliability analyses used to specify the **loading of Bridges**, is fully documented and retained in accordance with **GC/RT5142** "Management of Infrastructure Records";
- such information shall be made available to the person or organisation responsible for maintaining the Bridge.

Loading Requirements for the Design of Bridges

Appendix A

Load and Load Effects

This Appendix lists the loads and load effects that shall be considered in the loading specification for Bridges.

A.1

Loads and load effects due to traffic using the Bridge

- traffic loads and their effects (e.g. road traffic, rail traffic, pedestrian traffic) including:
 - dynamic effects;
 - effects of repeated loading (fatigue);
 - traction and braking forces;
 - nosing forces (rail traffic only);
 - centrifugal forces;
 - skidding forces (road traffic only);
 - deformations (including track twist);
 - aerodynamic effects;
 - effects of track/Bridge interaction;
 - deck acceleration and resonance effects.

A.2

Permanent and other site specific loads and load effects

- permanent loads related to the Bridge:
 - self weight of the Bridge;
 - non-structural loads carried by the Bridge (including an adequate allowance for the variability of ballast depth where appropriate);
 - internal forces (e.g. prestressing, creep).
- other site specific loads and load effects, including those due to the following:
 - soil pressures;
 - settlement (including effects of mining subsidence);
 - water pressures (including those from exceptional flows, storms and flooding);
 - scour;
 - erection, construction or maintenance activity;
 - environmental influences (e.g. wind, temperature).

A.3 Accidental loads and load effects

- accidental loads due to the following:
 - impact from train derailments, both on and beneath a Bridge;
 - impact from errant road vehicles, both on and beneath a Bridge;
 - impact from vessels beneath a Bridge over a navigable waterway;
 - other accidental loads and load effects, such as those due to soil subsidence, may need to be considered at particular sites.

Loading Requirements for the Design of Bridges

References and Other Associated Documents

Railway Group Standards Referred to

GC/RT5101	Technical Approval Requirements for Changes to the Infrastructure
GC/RT5110	Design Requirements for Structures
GC/RT5142	Management of Infrastructure Records

Associated Railway Group Standards

GC/TI0063	Bridge Data Manual
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Note: It is intended that this Railway Group Standard will be superseded and the requirements transferred to GC/RT5142 when the latter Railway Group Standard is revised.

Other related Industry standards Referred to

BD37/88	Loads for Highway Bridges (Department of Transport publication)
UIC Leaflet 776-3R	Deformation of Bridges
UIC Leaflet 776-1R	Loads to be considered in the design of Railway Bridges
BS 5400 Part 2	Steel, concrete and composite bridges - Part 2. Specification for loads