

Information for users

The following document:

NR/L1/CIV/032
Issue 2

has had changes made to it, most recently, with effect from **26 September 2014**.

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NR/BS/LI/176	Issue 1	Expired May 2010	Proceed to letter ►
NR/BS/LI/192	Issue 2	Expired September 2010	Proceed to letter ►
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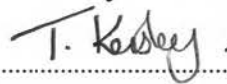
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Level 1

The management of structures

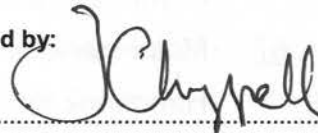
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Issue record

Issue	Date	Comments
2	September 2009	Revision of the text to align with the introduction of risk-based approach to asset management.
1	April 2004	New Specification.

Compliance

This Network Rail standard shall be complied with by Network Rail and its Contractors from 5th December 2009.

Reference documentation

Network Rail standards

NR/CS/OPS/021	Weather - Managing the Operational Risks
NR/L1/CIV/044	Managing Structures Works
NR/L2/AMG/1040	Buried Services Data Feedback
NR/L2/CIV/035	Assessment of Structures
NR/L2/CTM/017	Competence and Training in Civil Engineering
NR/L2/ELP/21087	Maintenance of 25kV Overhead Line Electrification Equipment
NR/L3/CIV/006	Handbook for the Examination of Structures
NR/L3/CIV/028	Management of Reports of Safety Related Events on Earthworks and Structures
NR/L3/CIV/037	Managing the Risk Arising from Mineral Extraction and Landfill Operations
NR/L3/CIV/038	Managing the Potential Effects of Coal Mining Subsidence
NR/L3/CIV/076	Management of the risk of Bridge Strikes from Road Vehicles and Waterborne Vessels
NR/L3/TRK/1010	Management of Responses to Extreme Weather Conditions at Structures, Earthworks and Other Key Locations
NR/SP/CIV/142	Management of Abnormal Road Loads
NR/SP/OHS/069	Lineside Facilities for Personal Safety
NR/SP/TRK/038	Longitudinal Timbers - Design, Installation and Maintenance

Other publications

Locomotive Act 1861

The Construction and Use Regulations, and as subsequently amended (SI 1986 No. 1078)

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Comments

The applicability and content of this standard will be reviewed on a regular basis. Written comments on the accuracy and utility of this standard will be taken into account when assessing the need for a new issue of the standard; such comments should be sent to the Principal Policy and Assurance Engineer (Civil Engineering) at 40 Melton Street, London NW1 2EE.

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1 Purpose

The purpose of this standard is to define the essential procedures that have to be followed so that no unacceptable risk to the safe use or performance of railway infrastructure will arise from the stability, load-bearing capacity, condition or use of existing structures.

2 Scope

This standard applies to all Network Rail owned or managed structures, Shared and Outside Party structures where the term 'structure' is a Civil Engineering form of construction, the more common types of which are listed in Appendix A.

A structure includes its structural elements and components (such as foundations, parapets, safety fences, wing walls and handrails); its permanent access equipment; and its supports and connections to, for example, overhead line electrification equipment and Longitudinal Timbers.

This standard does not cover the management of;

- 1 Reservoirs.
- 2 Track support systems.

This standard does not apply to the general management, maintenance or operation of Buildings or to the management of mechanical, electrical or hydraulic machinery located in them.

This standard does not cover;

- 1 Occupational health and safety requirements.
- 2 Commercial and contractual responsibilities, and approval processes for delivering the requirements of this standard.

3 Roles and responsibilities

For their respective Territory, the *Territory Civil Engineer* (TCE) shall;

- 1 Arrange for information necessary for the effective management of structures to be collected and entered into appropriate database(s).
- 2 Appoint an *Asset Manager* to manage each structure or group of structures (for example, of a particular type or category within a defined geographic area).
- 3 Designate those structures that are to be managed as a Major Structure, see **8.1**.

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- 4 Instruct the production and maintenance of Local Extreme Weather Plan(s), see **9.3**.

For structures allocated to them by the TCE, the *Asset Manager* shall;

- 5 (a) Unless otherwise directed by the TCE, select which of the optional requirements defined in **6**, **7**, **8** and **9** are to be applied to those structures, and (b) for these selected requirements and all the relevant mandatory requirements of **6**, **7**, **8** and **9** make arrangements for them to be met.
- 6 Devise, implement and update a Management Strategy for each Major Structure, see **8.1**.
- 7 As directed, produce and update the relevant parts of the Local Extreme Weather Plan, see **9.3**.

4 Competence

Those appointing others to deliver one or more of the requirements of this standard shall check that the appointees are competent and that they understand their responsibilities. Appointments and responsibilities shall be documented.

Those appointed to deliver one or more of the requirements of this standard shall;

- 1 Have the competency, skill, knowledge and experience necessary to undertake their role commensurate with the form, type and complexity of the structure(s) being managed.
- 2 Be aware of their responsibilities.
- 3 Understand why and be able to judge when urgent action is required to maintain safety.

Competence requirements for specific roles for managing structures are defined in [NR/L2/CTM/017](#): *Competence and Training in Civil Engineering*.

5 Definitions

Abnormal Road Load

A road vehicle that because of its weight or weight distribution falls outside the Construction and Use Regulations.

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Accommodation Bridge

A Bridge provided to maintain access to lands that were severed by the construction of the railway and which can only legally be used by the successor to the original landowner whose land was severed; however, subsequent public footpath and bridle rights could have been acquired by others.

Assessment

The determination or confirmation of the stability or safe-load bearing capacity of a structure.

Bridge

A structure of one or more spans greater than or equal to 1.8 metres, whose prime purpose is usually to carry traffic or services over an obstruction or gap.

Bridge Strike

An Incident in which a road vehicle or its load, or a waterborne vessel or its load, impacts with the fabric of a Bridge.

Building

A permanent fixed roofed manned or unmanned structure, other than a Canopy or Train Shed, accessible by people and within which goods may be stored and/or plant and equipment installed.

Buried Service

A live, dormant or disused cable or pipeline that is either (a) intentionally laid below the ground and not directly visible by site inspection, even though indirect signs of its presence (such as access chambers and markers) might be visible, or (b) laid on the surface but, with time, has become covered over with material or vegetation.

Canopy

A roof-like cover that provides a shelter for people and under which goods might be stored. A Canopy could be free standing or be supported by an adjacent structure. The term does not include Train Sheds.

Coastal, Estuarine and River Defence

A structure, comprising a section of works defined by Ordnance Survey grid reference and/or railway track mileage, that protects railway infrastructure against erosion or flooding. It includes protection works (such as training walls), which protect land against erosion and encroachment by such waters and which perform no flood defence role; and defences, which protect against flooding or attack by such waters.

Culvert

A structure with a span or diameter greater than 0.45 metres but less than 1.8 metres whose primary purpose is usually to permit water or services to pass under or adjacent to a railway, road or other Network Rail infrastructure.

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Earthwork

An Embankment, Cutting (soil or rock) or Natural Slope (soil or rock), or nailed or reinforced soil structure whose face angle is less than 70 degrees to the horizontal. Local support (such as dentition), bolting or netting of a rock Cutting shall be classified as part of the Earthwork. The term excludes the Track support system. A single Earthwork comprises either the Up or Down side of the railway; where present, the two sides of an Earthwork are separated by an imaginary line running along the centre of the track(s).

Equipment Support Structure (ESS)¹

A post, pole, stanchion, mast, tower, cantilever, portal, gantry, or platform, which supports equipment such as signals, overhead line electrification equipment (OLE), closed circuit television cameras or screens (CCTV), radio, telecommunications, hoists or drives, lighting, cameras, mirrors, location boxes, feeder stations or equipment boxes. The term generally excludes posts or poles less than 1 metre long but, irrespective of length, includes those that are fixed to the crown of Tunnels to support OLE or which support GSM-R aerials at a Tunnel portal.

Evaluation

An appraisal of all relevant information regarding the stability, load-bearing capacity, condition and use of a structure to determine the actions required to maintain acceptable levels of safety and performance.

Examination

A site visit undertaken to collect data on the condition of a structure, or part of one.

Failure

An unplanned situation that arises when a system or process, item of equipment, asset (or an element of one) is no longer capable of performing one or more of its intended functions.

Hazard

The potential to do harm: this includes ill health and injury; damage to property, plant, products or the environment; production losses; and increased liability.

Incident

An unplanned, uncontrolled event that causes an accident or increases the likelihood of one occurring.

Longitudinal Timber

A timber bearer that lies parallel to and supports a rail, baseplates and chairs.

¹ For OLE, the ESS is the main steelwork as defined in [NR/L2/ELP/21087](#): *Maintenance of 25kV Overhead Line Electrification Equipment*.

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Major Structure

A structure that requires its own bespoke Management Strategy, which defines the specific process and requirements for managing the structure.

Occupation Bridge

A Bridge carrying a private road which generally pre-existed the railway and which can only be used by authorised users - typically the successors of the original users of the road and their invitees, although subsequent public footpath and bridle rights may have been acquired by other users.

Outside Party

A person or organisation, other than Network Rail, that is an infrastructure owner or developer, or is a user or occupier of Network Rail's infrastructure. The term includes Highway Authorities, Roads Authorities, Passenger Transport Executives, public or private developers, and Train Operating Companies.

Preliminary Investigation

A desk study of topographical and geological maps and other readily available information on the composition, history and performance of an Earthwork.

Route Availability rating

Within the scope of this standard, the rating derived in accordance with [NR/L2/CIV/035: Assessment of Structures](#) that expresses the safe load capacity of a structure in terms of its ability to carry the vertical static and dynamic loads generated by different types of rail vehicle.

Retaining Wall

A structure built to support ground at a higher level on one side than the other: it includes nailed or reinforced soil structure whose face angle is greater than 70 degrees to the horizontal. The structure includes any integral struts, reinforcements or anchors.

Minor Retaining Wall

A Retaining Wall that does not support vehicular loading and that retains material either to a height of 0.6 metre or less, or to a height of 1.0 metre or less where the wall is less than 5.0 metres long.

Safety Related Event

A Failure or an Incident that generates a Hazard.

Scour

The removal of material from, under or around a structural support, foundation or Earthwork by the action of flowing water.

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Shared structure

A structure whose ownership and/or management is/are shared between Network Rail and an Outside Party.

Site Investigation

A combination of desk-based studies and site works undertaken to provide an understanding of the geological setting, mining environment, and the characteristics of a site, and the identification of potential or actual failure mechanisms. The term includes engineering, geological and geomorphologic mapping, in situ testing, laboratory testing, and the installation and monitoring of instruments (such as piezometers and movement indicators).

Track support system

The structure that provides immediate support to the track; it includes the formation, capping layers, blanketing, ballast, geosynthetics that are integral with the support system, and Longitudinal Timbers.

Train Shed

The roof of a station or depot that spans across operational railway lines: it includes supporting structures and structural elements of adjacent Buildings that provide support to the roof.

Tunnel

A structure provided to allow a railway or service to pass under higher land, Buildings and/or water. The term includes the bore, Shafts, adits, portals, invert and drainage system within or attached to the structure of the Tunnel, but excludes track drains which are not integral with the structure.

Undertrack Crossing

The route of a Buried Service passing under the track(s) beneath the underside of the sleepers or track slab, which is neither a Bridge nor a Culvert. The term excludes services laid through a Bridge span or in the roadway beneath a Bridge span.

Watercourse

A river, stream, canal or other similar body of flowing water, or a channel that has, or might carry flowing water; for example, following heavy rainfall.

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Works

Maintenance Works

Works that involves the reinstatement of the components of a structure without resulting in a change to the general form of the structure or a reduction in structure gauge. The term includes;

- 1 Like-for-like repairs and replacement of components.
- 2 Repair and replacement of components in similar or modern equivalent materials - provided that such substitution does not detrimentally affect the safe operation or the performance of the railway infrastructure.
- 3 Good housekeeping activities, such as cleaning and vegetation management.
- 4 Planned preventative Works.

Structures Works

Substantial Works such as strengthening (temporary or permanent), replacement (of a structure or part of one), and non-routine maintenance works.

Zone of Influence

An area of land above and/or around a structure that could be influenced by the presence or use of that structure.

6 Management process

6.1 Overview

Structures shall be managed over their life cycle by the integrated three-part process idealised in Figure 1: such a process forms the backbone of all structure management systems. This standard and [NR/L1/CIV/044: Managing Structures Works](#) define the essential requirements of this process.

In managing the steady state of the large stock of railway structures it would be impractical and unnecessary to set down a unique management plan for each structure. For practicality, management is effected through the appropriate application of;

- 1 Routine management procedures, which are applicable to most structures - and are described in **7**.
- 2 Structure specific management procedures, which have been devised for particular types of structure - and are described in **8**.
- 3 Risk specific management procedures, which have been devised to manage particular risks - and are described in **9**.

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How these procedures are applied varies according to the risks posed by and to the continued use of the structure; that is, according to the characteristics of the structure (such as its function, size, complexity and location), the likelihood of a change (whether deliberate or accidental) in the stability, load-bearing capacity, condition or use of the structure, and the likely consequences of such a change.

Broad variations in the application of some of the procedures (for example, in terms of the type of structure) are described in this standard, whereas finer variations are described in supporting standards, such as [NR/L3/CIV/006](#): *Handbook for the Examination of Structures*.

6.2 Categorisation of structures

To help define the management regime for a stock of structures, and assign responsibilities for delivering this, Civil Engineering forms of construction should be allocated to the most appropriate structure category; Appendix **A** provides guidance on the categorisation of the more common types of structure. For effective management sub-categories are defined in supporting standards; such as for category **A**: Bridges and Culverts, in [NR/L3/CIV/006](#).

By virtue of their type or location, some structures could be assigned to more than one category. An example of the former is an Embankment that acts as a Coastal Defence: usually in such cases it is necessary to adopt the most stringent management regime for the structure (in this case category **F**). An example of the latter is a footbridge within a Station: in such cases the structure shall be managed using the relevant procedures of both categories (in this case **A** and **E**). For their respective Territory, the TCE is the final arbiter on the categorisation of structures.

By virtue of its size, complexity, design, form of construction etc, and/or because a particular technique(s), knowledge or competency is required to (for example) examine, assess or maintain it, a structure may be designated as a Major Structure. In such cases a bespoke Management Strategy shall be devised and implemented for that structure; the Strategy shall draw, as necessary, from the procedures defined in **7**, **8** and **9**.

A Bridges and Culverts

A Tunnel formed by the cut and cover method of construction may be managed as a Bridge.

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B Retaining Walls

This category includes;

- 1 Gabion walls.
- 2 Catch walls.

But does not include;

- 1 Wing walls that form part of a Bridge or Culvert.
- 2 Platform walls.

Except for **7.5** and **7.6**, the procedures described in **7**, **8** and **9** need not be applied to those Minor Retaining Walls, boundary walls and free-standing walls where, in the opinion of the Asset Manager, the probability of their Failure is unlikely or where their Failure would not pose an unacceptable risk to the safe use or performance of railway infrastructure.

C Tunnels

Usually it will be necessary for a Tunnel to be managed as a Major Structure. Tunnel specific management procedures are defined in **8.4**.

D Earthworks

The relevant requirements of **7**, **8** and **9** shall be applied to;

- 1 Network Rail owned or managed Earthworks equal to or greater than 3 metres high.
- 2 Network Rail owned or managed Earthworks (irrespective of their height) that have a history of instability, and/or whose stability is perceived to be at risk of flooding or water action (see **9.3**), and/or whose Failure could pose an unacceptable risk to the safe use or performance of railway infrastructure.
- 3 Outside Party Earthworks (irrespective of their height) whose Failure could pose an unacceptable risk to the safe use or performance of railway infrastructure.
- 4 Approach Embankments to an overline Bridge that are equal to or greater than 3 metres high, except those owned by a Highway Authority, Roads Authority, or other equally competent authority.

Except for **7.5** and **7.6**, the requirements of **7**, **8** and **9** need not be applied to Earthworks that do not meet any of the above criteria.

The height of a Cutting (and of a Natural Slope falling towards the track) shall be taken to be the difference in level of its crest and the lowest level of the cess (or invert of an adjoining open ditch). The

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height of an Embankment (and of a Natural Slope falling away from the track) shall be taken to be the difference in level of its toe (or invert of an adjoining open ditch) and the top of a sleeper.

E Building and Station structures

Where necessary, the management regime for a structure that lies within the lease area of a Station shall include procedures defined for other categories of structure.

F Coastal, Estuarine and River defences

Many structures within this category will need to be managed as a Major Structure.

River training walls (formed of Retaining Walls, Minor Retaining Walls and Wing Walls) might need to be managed as a Coastal, Estuarine and River defence.

A thorough evaluation of the site conditions and environment might be necessary when establishing the management regime for those parts of a defence that normally lie above water; for example, for training walls that might be subject to particularly harsh erosion conditions at times of flood.

G Ancillary structures

Except for **7.5** and **7.6**, the procedures defined in **7**, **8** and **9** need not be applied to Ancillary structures where, in the opinion of the Asset Manager, the probability of their Failure is unlikely or their Failure would not pose an unacceptable risk to the safe use or performance of railway infrastructure. However, such structures might fall within the scope of other Network Rail standards; for example, for Undertrack Crossings to [NR/L2/AMG/1040](#): *Buried Services Data Feedback*.

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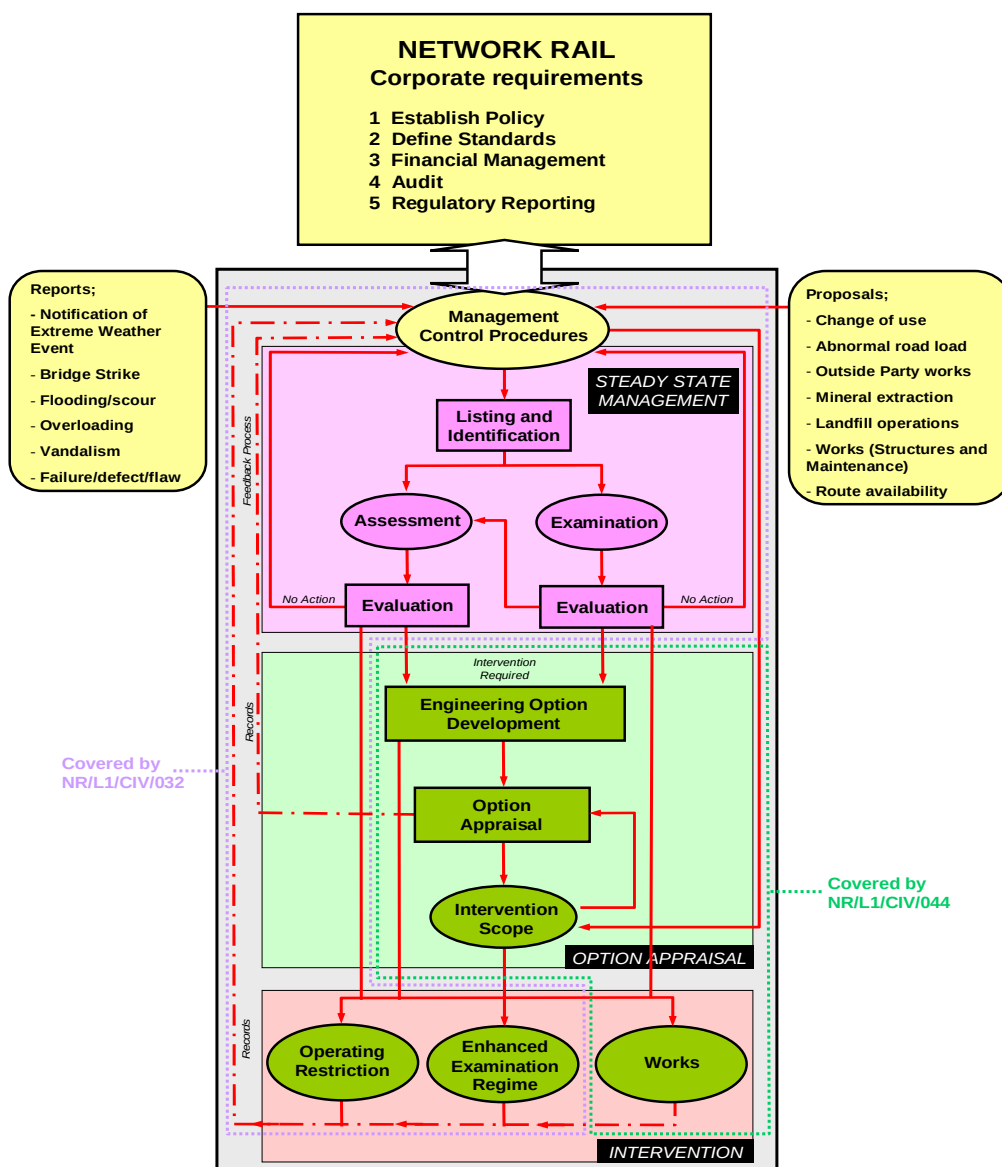


Figure 1: The management of structures

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7 Routine management procedures

7.1 Introduction

The routine management procedures are;

- 1 Listing and identification of structures.
- 2 Examination.
- 3 Assessment.
- 4 Evaluation.
- 5 Responding to reports (for example, of a Safety Related Event), and proposals (for example, relating to a change in use of a structure). Simply stated, these cover unplanned and planned/proposed changes in the stability, load-bearing capacity, condition or use of a structure.
- 6 Record keeping (of all the above procedures).

7.2 Listing and identification of structures

Details of the identity, location and any other data necessary for the effective and efficient management of a structure shall be recorded in a register. Registers may be devised for different categories and types of structure, and for managing particular risks or events - such as Bridge Strikes. However, it is unnecessary to develop a register of structures that are (a) only examined in sequence along their line of route, and/or (b) not subject to scheduled Examinations at regular (or reasonably so) intervals.

Hidden structures that are known to exist, or for which there is good evidence of their existence, shall be included in a register.

Consideration shall be given to including temporary structures and temporary Works in a register.

The data held in records of a structure shall allow its ready and unambiguous location and identification on site. In this regard, consideration shall be given to;

- 1 Marking individual elements of a complex or multi-element structure.
- 2 Locating structures using Global Positioning System (GPS) co-ordinates.
- 3 Providing markers along Major Structures, such as Tunnels, and Coastal, Estuarine and River Defences.