Design Manual for Roads and Bridges

Highway Structures & Bridges
Inspection & Assessment

CS 452
Inspection and records for road tunnel systems

(formerly BD 53/95)

Revision 0

Summary
This document describes the procedures for inspection and recording arrangements for road tunnels on the motorway and all-purpose trunk road network.

Application by Overseeing Organisations
Any specific requirements for Overseeing Organisations alternative or supplementary to those given in this document are given in National Application Annexes to this document.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Highways England team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

This is a controlled document.

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Release notes

Version	Date	Details of amendments
0	Mar 2020	CS 452 replaces BD 53/95 and has undergone an editorial revision with minor technical changes. Some requirements on inspection and records have been transferred from BA 72.

Foreword

Publishing information

This document is published by Highways England.

This document supersedes BD 53/95, which is withdrawn.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

Introduction

Background

This document provides requirements and advice covering the inspection and records for road tunnel systems. It supports good practice for the inspection and records for road tunnel systems, including M&E equipment, monitoring, service buildings, plant rooms and associated systems.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 6.N] apply to this document.

Abbreviations

Abbreviations

Abbreviation	Definition
OMM	Tunnel operation and maintenance manual
MA	Maintaining agent or service provider
M&E	Mechanical and electrical
TOA	Tunnel operating authority

Terms and definitions

Terms

Term	Definition
Maintaining agent or service provider	The organisation which is to be appointed by the Overseeing Organisation to execute maintenance and operational activities for the road network on the Overseeing Organisation's behalf. Under some tunnel operating regimes certain roles can be fulfilled by the Overseeing Organisation directly.
Tunnel operating authority	The organisation responsible for the day to day operation of the tunnel.

1. Scope

Aspects covered

1.1 This document shall be used for the inspection of tunnels and records to be kept for road tunnels systems.

NOTE *A road tunnel is defined to be an enclosed length of 150 metres or more, and consists of the tunnel fabric, associated service buildings and M&E equipment in the tunnel and service buildings.*

1.2 This document shall be read in conjunction with CG 302 [Ref 1.N] and CS 450 [Ref 5.N] which provide requirements and advice for the inspection and records of all structures. This includes the civil engineering tunnel structure.

NOTE *For new tunnels record inventory information requirements are contained in CD 352 [Ref 2.N] 'Design of road tunnels'.*

Implementation

1.3 This document shall be implemented forthwith on all inspections of road tunnels on the Overseeing Organisations' motorway and all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 6.N].

Use of GG 101

1.4 The requirements contained in GG 101 [Ref 6.N] shall be followed in respect of activities covered by this document.

2. Inspection requirements

2.1 All equipment and systems associated with tunnel plant monitoring and control, traffic, communications and safety shall be inspected.

NOTE *Equipment and systems associated with plant monitoring and control, traffic, communications and safety include the following:*

1) *ventilation;*
2) *tunnel and portal lighting, including photometers;*
3) *drainage and pumping plant;*
4) *fire safety, evacuation and emergency response systems and alarms;*
5) *firefighting systems;*
6) *communications and public address systems;*
7) *traffic control systems equipment, including remote controls for closures;*
8) *traffic monitoring, CCTV and incident detection systems;*
9) *tunnel operations and plant control systems;*
10) *environmental and plant monitoring and control systems;*
11) *power supply and distribution systems;*
12) *standby generation plant and uninterruptible power supply equipment;*
13) *service buildings, plant rooms and control rooms;*
14) *plant rooms;*
15) *plant monitoring;*
16) *overheight detection systems.*

3. Inspections

3.1 Tunnels are subject to a regime of planned closures, bore or lane closures. Inspections shall be coordinated with such closures.

3.2 For tunnel structures the categories of structural inspection for the tunnel fabric and ancillary service buildings and structures shall be in accordance with CS 450 [Ref 5.N].

3.3 Tunnel M&E equipment and systems, whether located in the tunnel or in the ancillary service buildings and other structures, where possible, shall be coordinated with inspections of the tunnel structural fabric.

3.4 Intervals for specialist inspection, checks and adjustment of M&E equipment shall fulfil the requirements of CM 430 [Ref 7.N].

3.4.1 The frequency of tunnel M&E systems inspections may be influenced by a number of other factors:

1) a risk based assessment;
2) environmental conditions;
3) operating conditions within the road tunnel;
4) tunnel location and configuration;
5) tunnel planned closures;
6) tunnel operating and maintenance manual requirements;
7) service life of M&E equipment and systems.

3.5 M&E inspections and checks shall be arranged, undertaken and reported by the Tunnel Operating Authority (TOA).

3.6 Where an inspection reveals a hazard to the travelling public or a serious defect or damage to the road tunnel is found, then the TOA shall implement measures to safeguard the public and maintain functionality.

3.7 The TOA shall inform the Overseeing Organisation, immediately of any serious defects.

Periodic inspections

3.8 Periodic inspections shall be carried out at the intervals as prescribed in the 'Tunnel operation and maintenance manual' (OMM).

3.9 Periodic inspections carried out at regular intervals shall be categorised into the four following types:

1) superficial;
2) general;
3) principal;
4) special;
5) safety (Section 5).

NOTE 1 Superficial inspections are regular, informal visual inspections to identify deficiencies and defects which can lead to accidents or unnecessarily high maintenance costs.

NOTE 2 General inspections are visual inspections of all accessible parts of the road tunnel and its M&E equipment.

NOTE 3 Principal inspections consist of a review of all relevant as-built drawings, wiring diagrams, operation manuals for maintenance and inspection for the road tunnel, followed by close and detailed examinations of all accessible parts of the tunnel and can involve removal of cladding, casings, mountings to fans etc. in order to gain access.

NOTE 4 Special inspections consist of close examination and investigations (including testing) of a particular area of a defect which is of structural or operational concern.

Superficial inspections

3.10 Superficial inspections shall be carried out on an ongoing basis.

NOTE *Superficial inspections are typically undertaken by the TOA whenever they are in the vicinity of a tunnel, such as during periods of routine maintenance and tunnel closure.*

3.11 The TOA shall report any safety issues to the Overseeing Organisation which require a safety or special inspection or urgent attention.

NOTE 1 *Common examples include collision damage, road settlement, water seepage, ice, stalactite formation, oil seepage, loose joint bolts, joint failure, spalling of concrete, displacement or cracking of the tunnel lining and portal walls or defective equipment, signals and controls.*

NOTE 2 *Drainage systems can exhibit blockages, leakages or excessive accumulation of debris.*

3.12 Records of superficial inspections shall be kept by the TOA.

General Inspections

3.13 General inspections shall be undertaken no later than one year after the due date of the last general or principal inspection for M&E equipment and associated systems.

3.13.1 An emergency drill together with all relevant emergency services may be undertaken as part of the general M&E inspection as per guidance in CM 430 [Ref 7.N].

NOTE *The purpose of the drill is to demonstrate the correct operation of all safety and emergency equipment for the road tunnel as well as demonstrate the adequacy of response by the emergency services.*

Principal inspections

3.14 Principal inspections of the tunnel M&E equipment and associated systems shall be carried out at intervals agreed with the Overseeing Organisation and not exceeding three years from the last principal inspection due date.

3.15 Where a principal inspection coincides with a general inspection in a given year, the principal inspection shall be undertaken in lieu of the general inspection.

3.16 Principal inspections shall comprise a close and detailed examination of all accessible parts of the tunnel and M&E systems and equipment, and can include removal of cladding, casings etc.

3.17 Principal inspection and testing of electrical installations shall be undertaken in accordance with BS 7671 [Ref 8.N].

3.17.1 Inspection and testing of M&E equipment may be undertaken in conjunction with the principal inspection of the structure.

3.18 The principal inspection report shall include recommendations for any remedial or refurbishment works, with estimated costs.

3.19 An emergency exercise with relevant emergency services shall be undertaken as part of the M&E inspection.

NOTE *The purpose of the exercise is to demonstrate the correct operation of all safety and emergency equipment for the road tunnel as well as demonstrate the adequacy of response by the emergency services.*

3.20 A debriefing meeting shall be held with the emergency services, TOA and the Overseeing Organisation after the drill.

3.21 Minutes of the debriefing meeting shall be recorded.

Special inspections

3.22 A special inspection of M&E equipment shall be carried out to investigate specific problems found during other inspections or during the operation of the equipment.

3.23 The special inspection report shall include recommendations for remedial or refurbishment works with estimated costs.

3.24 Special inspections shall be undertaken where an unplanned incident, closure or accident has occurred that has affected the tunnel systems.

Conclusions and recommendations from inspections

3.25 Any changes to the tunnel operation, maintenance and safety procedures in response to the findings of inspections and emergency exercises shall be developed, costed and recorded, and held on the Overseeing Organisation's asset management system.

3.26 Significant changes to the tunnel operation, maintenance and safety procedures in response to the findings of inspections and emergency exercises shall be brought to the attention of the Overseeing Organisation.

4. Acceptance inspections

4.1 Acceptance inspections shall be carried out at handover of a new or existing road tunnel.

4.2 The acceptance inspection shall be undertaken to the same requirements as for a principal inspection.

NOTE *Acceptance inspections would be expected at the following stages:*

1) pre-opening;

2) completion date;

3) end of defects liability;

4) transfer/handover of the tunnel from one party to another.

New and refurbished road tunnels

4.3 A joint acceptance inspection shall take place on a date agreed with the Overseeing Organisation and the company responsible for the tunnel construction, before the issue of a certificate of completion or opening of the road tunnel.

NOTE *The joint acceptance inspection is usually undertaken by the TOA, and representatives of the Overseeing Organisation.*

4.4 The acceptance inspection shall include any service buildings, plant rooms, associated structures and equipment, and emergency exercises.

NOTE *The purpose of the inspection is to identify and record any work still to be completed under the contract and any other items required to enable the TOA to take over maintenance and operational responsibilities.*

4.5 Any permanent access provisions and features affecting general safety and security of the tunnel shall be agreed by the TOA prior to handover of the maintenance and operational responsibilities, and recorded in the Overseeing Organisation's asset information system.

4.6 The records, maintenance and operating manuals related to the tunnel shall be supplied to the TOA prior to the handover of the maintenance and operational responsibilities.

4.7 The date on which the TOA takes over maintenance responsibility shall be recorded in the Overseeing Organisation's asset management system.

4.8 During the defects liability period of the contract (construction or refurbishment), the TOA shall report any defects to the Overseeing Organisation.

4.9 A further joint acceptance inspection shall be undertaken on a date agreed with the Overseeing Organisation prior to the end of the defects liability period to ensure that all work outstanding under the contract has been completed.

4.10 New or refurbished tunnels shall have an initial principal inspection immediately after opening.

4.11 A further principal inspection shall be undertaken three to four years after the issuing of the maintenance certificate to ensure that any defects are recorded and appropriate action is taken prior to the end of the contract liability period.

Existing tunnels

4.12 A principal inspection shall be undertaken when a new TOA takes over responsibility for a road tunnel already in service.

4.13 The incumbent TOA shall hand over records, maintenance and operating manuals related to the tunnel to the new TOA prior to the handover of maintenance and operational responsibilities.

4.14 Where any documentation is omitted or not available, documents for the continued safe use of the road tunnel shall be prepared as a part of the principal inspection report.

4.15 Any permanent access provisions and features affecting general safety and security of the tunnel shall be agreed by the TOA prior to handover of the maintenance and operational responsibilities.

4.16 The date on which the new TOA takes over maintenance responsibility shall be recorded in the Overseeing Organisation's asset information system.

5. Safety inspections

5.1 Safety inspections shall be undertaken in accordance with the tunnel operation and maintenance manual and CS 450 [Ref 5.N].

5.2 A safety inspection shall be carried out at intervals determined following risk assessments, but not less frequent than weekly.

NOTE 1 Safety inspections are frequent periodic visual inspections to identify or investigate potential defects that can endanger the public or staff or lead to significant maintenance costs or disruption to traffic.

NOTE 2 The frequency of the safety inspections can be based on a risk assessment of the system being considered.

NOTE 3 Safety inspections can be triggered as a result of third party notifications of defects.

NOTE 4 Such defects can include:

1) collision damage and debris;
2) water seepage;
3) ice formation;
4) spalling concrete;
5) loose, missing or defective equipment, panels, signals and controls;
6) oil spill or accumulation of dripped oil and/or debris posing a fire risk;
7) blockages in drainage and ducted ventilation systems;
8) cross passage doors not closing/opening;
9) failed M&E equipment.

NOTE 5 The scope of safety inspections depends on whether the tunnel is manned or unmanned, the equipment associated with the tunnel, the tunnel information systems and how they are monitored.

NOTE 6 A safety inspection can be undertaken from a slow-moving vehicle, on foot, or other means such that defects can be identified.

5.3 Where monitoring systems installed for safety critical items do not provide complete system coverage, safety inspections of the safety critical items shall be undertaken on a daily basis.

NOTE Complete coverage refers to the ability of the monitoring system to provide identification and notification of issues over the extents of the safety critical item.

6. Health and safety

Introduction

6.1 The management of inspections and testing of road tunnels must comply with current relevant health and safety legislation and The Road Tunnel Safety Regulations SI 2007/1520 [Ref 4.N] and The Road Tunnel Safety (Amendment) Regulations SI 2009/64 [Ref 3.N] .

NOTE 1 Guidance on appropriate safety measures for undertaking inspections within areas where mould growth is suspected or encountered is provided in CS 450 [Ref 5.N].

NOTE 2 Industry good practice guidance can also be followed for other similar hazards, such as the presence of bird droppings, soot and asbestos for example.

7. Records and forms

7.1 Record documents and forms related to the road tunnel shall be developed, kept, maintained and updated by the TOA, and recorded in the Overseeing Organisation's asset information system.

NOTE 1 The forms for road tunnels are defined by the Overseeing Organisation's asset information system and can include the following:

1) tunnels register;
2) inspection reports;
3) tunnel events;
4) operation summary and costs.

NOTE 2 The asset information system is the system used by the Overseeing Organisation to record inventory, construction, condition and maintenance data.

7.1.1 Record documents for road tunnels should be retained locally at the tunnel service buildings and on the Overseeing Organisation's asset information system. Typical records are:-

1) design documents;
2) design reports;
3) design calculations;
4) technical approval documents;
5) as-built drawings;
6) H&S files;
7) manufacturer's information;
8) legal documents;
9) inspection reports;
10) tunnel operation and safety documents;
11) maintenance and operation manuals;
12) incident records;
13) accident records;
14) maintenance records;
15) equipment logs;
16) closure records;
17) expenditure records;
18) inventory records.
19) reported condition through inspections;
20) traffic incident information;
21) maintenance information;
22) performance information;
23) operational feedback;
24) changes to inventory in service;
25) record of outcome of emergency exercises.

NOTE 1 The record documents above can be used to assist the formulation and review of policy and criteria for the safe and economic operation of existing and future tunnels.

NOTE 2 These records can also form the basis for any upgrading or refurbishment requirements.

NOTE 3 The information on accidents, incidents, power consumption and costs forms a valuable feedback from computerised monitoring, control and data gathering.

7.2 All forms and other information for road tunnels shall be updated regularly and uploaded to the Overseeing Organisation's asset information system within three months.

8. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	Highways England. CG 302, 'As-built, operational and maintenance records for highway structures'
Ref 2.N	Highways England. CD 352, 'Design of road tunnels'
Ref 3.N	The National Archives. legislation.gov.uk. SI 2009/64, 'Highways - Tunnels - Road Tunnel Safety (Amendment) Regulations 2009'
Ref 4.N	The National Archives. legislation.gov.uk. SI 2007/1520, 'Highways - Tunnels - The Road Tunnel Safety Regulations 2007'
Ref 5.N	Highways England. CS 450, 'Inspection of highway structures'
Ref 6.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 7.N	Highways England. CM 430, 'Maintenance of road tunnels'
Ref 8.N	BSI. BS 7671, 'Requirements for Electrical Installations, IET Regulations'

Highway Structures & Bridges
Inspection & Assessment

CS 452
England National Application Annex to CS 452 Inspection and records for road tunnel systems

(formerly BD 53/95)

Revision 0

Summary
There are no specific requirements for Highways England supplementary or alternative to those given in CS 452.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Highways England team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

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Release notes **2**

Release notes

Version	Date	Details of amendments
0	Mar 2020	Highways England National Application Annex to CS 452.

Department for Infrastructure
An Roinn Bonneagair

Highway Structures & Bridges
Inspection & Assessment

CS 452
Northern Ireland National Application Annex to CS 452 Inspection and records for road tunnel systems

(formerly BD 53/95)

Revision 0

Summary
There are no specific requirements for Department for Infrastructure Northern Ireland supplementary or alternative to those given in CS 452.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated team in the Department for Infrastructure, Northern Ireland. The email address for all enquiries and feedback is: dcu@infrastructure-ni.gov.uk

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Release notes **2**

Release notes

Version	Date	Details of amendments
0	Mar 2020	Department for Infrastructure Northern Ireland National Application Annex to CS 452.

Highway Structures & Bridges
Inspection & Assessment

CS 452
Scotland National Application Annex to CS 452 Inspections and records for road tunnel systems

(formerly BD 53/95)

Revision 0

Summary
This National Application Annex sets out the Transport Scotland specific requirements in relation to inspections and records for road tunnel systems.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Transport Scotland team. The email address for all enquiries and feedback is: TSStandardsBranch@transport.gov.scot

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Release notes

Version	Date	Details of amendments
0	Mar 2020	Transport Scotland National Application Annex to CS 452.

Foreword

Publishing information

This document is published by Highways England on behalf of Transport Scotland.

This document supersedes BD 53/95, which is withdrawn.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

Introduction

Background

This National Application Annex sets out Scotland's specific requirements and guidance covering the inspection and records for road tunnels.It outlines an underlying approach to encourage best practice, establish intended outcomes tho support the quality of inspection and required records for road tunnels.

Assumptions made in the preparation of the document

The assumptions made in GG 101 [Ref 2.N] apply to this document.

S/1. Acceptance inspections

New and refurbished road tunnels (additional to CS 452, clause 4.3)

S/1.1 For road tunnels in Scotland, at the end of the maintenance period, the joint acceptance inspection shall be replaced by an initial principal inspection in accordance with CS 452 [Ref 1.N].

NOTE *The joint acceptance inspection is described in CS 452 [Ref 1.N].*

S/1.2 Further principal inspections in accordance with CS 452 [Ref 1.N] shall be undertaken within the prescriptive period.

S/2. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	Highways England. CS 452, 'Inspection and records for road tunnel systems'
Ref 2.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'

Llywodraeth Cymru
Welsh Government

Highway Structures & Bridges
Inspection & Assessment

CS 452
Wales National Application Annex to CS 452 Inspection and records for road tunnel systems

(formerly BD 53/95)

Revision 0

Summary
There are no specific requirements for Welsh Government supplementary or alternative to those given in CS 452.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Welsh Government team. The email address for all enquiries and feedback is: Standards_Feedback_and_Enquiries@gov.wales

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Release notes

Version	Date	Details of amendments
0	Mar 2020	Welsh Government National Application Annex to CS 452.