



Highway Structures & Bridges
Maintenance & Operation

CM 432

Maintenance of buried concrete box structures

(formerly BA 88/04)

Revision 1

Summary

This document details the maintenance requirements for buried concrete box structures.

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
1	Mar 2020	Revision 1 (March 2020) Update to references only. Revision 0 (December 2019) CM 432 replaces part of BA 88/04. This full document has been rewritten to make it compliant with the new Highways England drafting rules.

Foreword

Publishing information

This document is published by Highways England.

This document supersedes the maintenance content of BA 88/04, which is withdrawn.

Content on assessment has been moved to CS 459 [Ref 5.N].

Content on inspection has been moved into CS 432 [Ref 1.N].

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 details the maintenance requirements for buried concrete box structures.

Buried concrete box structures are often used as culverts and underpasses through highway embankments in the UK. Most buried concrete box structures are performing well and have required little in the way of maintenance. However, where defects are identified, and without proper maintenance, the service life of the structure is likely to be reduced.

A number of documents for the assessment, inspection and maintenance of concrete structures have been written for concrete bridge decks such as CS 459 [Ref 5.N], CS 455 [Ref 6.N], CS 450 [Ref 2.N] and CS 470 [Ref 4.N]. Much of this information also applies to buried concrete box structures.

Assumptions made in the preparation of the document

The assumptions made in GG 101 [Ref 3.N] apply to this document.

Terms and definitions

Term	Definition
Immediate risk structure	As defined in CS 470 [Ref 4.N]

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1. Scope

Aspects covered

1.1 This document shall be used to determine the appropriate maintenance and repair work for buried concrete box structures.

1.1.1 This document may also be used for buried concrete portal frame structures.

Implementation

1.2 This document shall be implemented forthwith on all schemes involving buried concrete box structures on the Overseeing Organisations' motorway and all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 3.N].

Use of GG 101

1.3 The requirements contained in GG 101 [Ref 3.N] shall be followed in respect of activities covered by this document.

2. Maintenance

Routine maintenance

2.1 Routine maintenance shall be undertaken to maintain and prolong the working life of buried concrete box structures.

2.2 The condition and cause of deterioration identified through an inspection of buried concrete box structures (Ref. CS 432 [Ref 1.N]) shall be used to plan, cost and undertake effective maintenance work.

NOTE *Regular maintenance can be more cost-effective than early replacement of a structure as the costs of regular maintenance are usually significantly lower than the capital cost for replacement.*

2.3 The following shall be addressed during routine maintenance:

- 1) invert silting;
- 2) blocked drainage, including pipes, weep holes and internal gullies;
- 3) vandalism;
- 4) cracking of mortar joints; and,
- 5) perished joint seals.

2.4 Clearance of silt, debris or vegetation shall be carried out without damaging the structure.

NOTE 1 *Clearance of silt, debris and other vegetation can be necessary in order to inspect the invert of the structure.*

NOTE 2 *Silting of an invert commonly occurs in culverts built on waterlogged ground or where flow rates are low.*

NOTE 3 *Drains can become blocked leading to a build up of hydrostatic pressure and possible breakdown of the structure's waterproofing.*

2.5 Damage due to vandalism shall be repaired where it is detrimental to the structure.

NOTE 1 *Vandalism is usually a local hazard confined to structures with pedestrian access.*

NOTE 2 *Superficial damage to lights, fittings, and drainage and by fire are in most cases not structurally significant but their early repair can prevent further deterioration.*

2.5.1 Graffiti should be removed from concrete surfaces where:

- 1) it is detrimental to the structure;
- 2) it is deemed an aesthetic issue.

NOTE *The effects of graffiti on unprotected concrete is commonly limited to being an aesthetic issue.*

2.6 The method of removal of graffiti shall not cause damage to the concrete.

2.7 Mortar joints and joint seals which have cracked or perished shall be repaired or replaced.

NOTE *Deteriorated and damaged mortar joints and joints seals can lead to the ingress and egress of water or effluent.*

Remedial maintenance due to critical defects

2.8 Strengthening or replacement of a structure where critical defects have been identified shall be undertaken where the adequacy cannot be demonstrated through an assessment.

NOTE 1 *Critical defects are defects which raise concerns over the stability and safety of the structure.*

NOTE 2 *Carrying out a more detailed method of analysis of the structure can sometimes prevent unnecessary expenditure on the strengthening or replacement of serviceable structures when the initial assessment by calculation has shown the buried concrete box structure to have a critical defect.*

- 2.9 Site constraints shall be evaluated to determine whether replacement is more cost effective than undertaking extensive remedial works including:
- 1) for culverts, the cost of temporarily diverting the watercourse;
 - 2) for underpasses and subways, the availability of alternative routes for vehicular and pedestrian traffic;
 - 3) the potential traffic management requirements and resultant traffic delays.

NOTE 1 Extensive remedial works can involve the renewal of the soffit or waterproofing system, or strengthening using a reinforced concrete saddle.

NOTE 2 Extensive remedial works can be necessary, particularly for older structures designed and constructed to less onerous standards. Some of these older structures were constructed without contiguous waterproofing systems.

NOTE 3 Traffic management and traffic delays can be substantial for structures on the trunk road and motorway network. Relining the structure with, for example, a glass reinforced plastic liner can avoid significant traffic management and statutory undertaker's costs.

- 2.10 Where critical defects are observed which results in the buried concrete box structure being classed as an immediate risk structure, the structure shall be managed in accordance with CS 470 [Ref 4.N].

NOTE Tilting of a buried concrete box structure supporting a highway can be an indication of an immediate risk structure.

Environmental considerations

- 2.11 Where maintenance works are proposed, the environmental impacts of the works shall also be assessed and managed.

- 2.11.1 Where remedial maintenance works are proposed, the potential for improvements to the structure with respect to the environment should be considered.

NOTE Improvements to the structure can include the provision of aids to fish migration and mammal ledges.

- 2.11.2 Sacrificial linings should be provided where the integrity of structural concrete could be adversely affected by deleterious environmental liquids.

NOTE Deleterious environmental liquids can include urea, animal slurry and petrol and diesel fuels.

3. 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 432, 'Inspection of buried concrete box structures'
Ref 2.N	Highways England. CS 450, 'Inspection of highway structures'
Ref 3.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 4.N	Highways England. CS 470, 'Management of sub-standard highway structures'
Ref 5.N	Highways England. CS 459, 'The assessment of bridge substructures and retaining structures and buried structures'
Ref 6.N	Highways England. CS 455, 'The assessment of concrete highway bridges and structures'

4. Informative references

The following documents are informative references for this document and provide supporting information.

Ref 1.I	BRE. BRE SD-1 2005, 'Special Digest 1:2005, Third edition, Concrete in aggressive ground.'
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