Design Manual for Roads and Bridges

Highway Structures & Bridges
Design

CD 369
Surface protection for concrete highway structures

(formerly BA 85/04)

Revision 0

Summary
This document contains the requirements and supporting advice for the surface protection for concrete highway 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
0	Mar 2020	CD 369 replaces BA 85/04. This full document has been re-written to make it compliant with the new Highways England drafting rules.

Foreword

Publishing information

This document is published by Highways England.

This document supersedes BA 85/04 which is withdrawn.

Contractual and legal considerations

This document forms part of the work 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 incorporates technical updates due to progress in modern concrete construction since the publication of BA 85/04, and has also been developed for compliance with BS EN 1504-2 [Ref 6.N], and EC product harmonisation.

Assumptions made in the preparation of this document

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

Abbreviations

Abbreviations

Abbreviation	Definition
MCHW	Manual of Contract Documents for Highway Works
SHW	Specification for Highway Works

Terms and definitions

Terms

Term	Definition
Coating	Treatment to produce a continuous protective layer on the surface of the concrete in accordance with BS EN 1504-2 [Ref 6.N].
Historic structures	Term used in this document referring to structures requiring special permission for works to be undertaken to them.
Leachate	Where water has passed through concrete and left some of the constituent material on the surface.
Sensitive area	Sensitive area as defined by Section 105A of the Highways Act 1980 [Ref 2.N] (as amended).

1. Scope

Aspects covered

1.1 This document shall be used to define the requirements for the application of surface protection systems on concrete highway structures.

1.2 This document shall apply for the application of the following surface protection systems to concrete highway structures:

1) anti-graffiti coatings; and
2) anti-carbonation coatings.

Implementation

1.3 This document shall be implemented forthwith on all schemes involving the application of surface protection systems to concrete 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

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

2. Application of surface protection systems

General requirements

2.1 Surface protection systems used in combination with other surface protection systems shall be compatible with each other and specified in complementary combinations.

NOTE 1 *An example of surface protection systems being used in complementary combinations is an anti-graffiti coating applied on top of an anti-carbonation coating.*

NOTE 2 *An example of a poor choice would be an anti-carbonation coating on top of a sacrificial anti-graffiti product.*

2.2 Where surface protection systems are proposed for structures subject to the following situations an environmental impact assessment shall be carried out in accordance with LA 113 [Ref 8.N]:

1) structures located within water bodies;
2) structures located near water bodies;
3) where the surface protection system products could find their way into the water environment.

2.3 Consent for the application of surface protection systems shall be obtained from the relevant water authority.

2.3.1 The relevant water authority may be the Environment Agency or local authority depending on the watercourse.

2.4 Where surface protection systems are proposed for structures within or near sensitive areas, as defined by the Highways Act 1980 [Ref 2.N], consent for the application of surface protection systems shall be obtained from the relevant environmental regulator.

2.5 Where surface protection systems are proposed for historic structures, consent for the application of surface protection systems shall be obtained from the relevant planning and heritage authorities.

NOTE *Historic structures can include listed or scheduled structures.*

2.6 Where surface protection systems are proposed for structures on or near transport infrastructure, consent for the application of surface protection systems shall be obtained from the relevant authorities.

NOTE *Transport infrastructure can include railway and highway assets.*

2.7 The design drawings shall clearly state any constraints for the application of surface protection systems on concrete highway structures.

NOTE *The constraints for the application of surface protection systems can include:*

1) encapsulating the structure receiving surface protection systems;
2) masking of elements or components of the structure that could be adversely affected by the surface protection systems such as elastomeric bearings or joint sealants;
3) covering carriageway surfacing to prevent contamination;
4) protection measures to prevent contamination of the local environment;
5) any restrictions necessary at that location e.g.access, time intervals, noise, or surface preparation.

2.8 Surface protection systems shall be transparent and colourless following application to the concrete substrate.

NOTE *An opaque surface protection system can obscure defects and hinder inspections.*

2.9 Surface protection systems shall only be applied to concrete substrate surfaces that are free from defects.

NOTE *Defects are any flaws in the concrete surface that would:*

1) act as a barrier to the movement of the product through the substrate such as air gaps, cracks, delaminations or spalls;

2) possibly react adversely with the protection product.

2.10 Where defects are present on the existing concrete substrate, repairs shall be designed and executed in accordance with MCHW Series 5700 [Ref 4.N] prior to the application of surface protection systems.

Anti-graffiti coatings

2.11 The need for anti-graffiti coatings on new concrete structures or refurbishment of existing concrete structures shall be agreed with the Overseeing Organisation.

2.11.1 Anti-graffiti coatings may be applied to concrete highways structures which:

1) have proven or anticipated problem with offensive graffiti;
2) are located in sensitive areas as defined by the Highways Act 1980 [Ref 2.N] (as amended);
3) where there is an unacceptable safety risk in accordance with GG 104 [Ref 7.N] from vandal incursion onto the trunk road and motorway network to apply graffiti to a structure.

NOTE Offensive graffiti is any graffiti that in the opinion of the inspector would be likely to cause offence to members of the public or any graffiti that has been reported as offensive by a member of the public.

2.11.2 Anti-graffiti coatings should not be applied to concrete highway structures where the removal of graffiti or reapplication of anti-graffiti coating presents an unacceptable health and safety risk to operatives in accordance with GG 104 [Ref 7.N] and CS CA55 [Ref 1.I].

2.12 The need for the reapplication of anti-graffiti coatings on concrete highway structures shall be assessed and agreed with the Overseeing Organisation.

2.12.1 Anti-graffiti coatings should be reapplied in the following situations:

1) for sacrificial systems, after removal of graffiti;
2) after expiry of the system's expected life in accordance with the manufacturer's recommendations.

2.12.2 Anti-graffiti systems should not be reapplied if:

1) there is no evidence of recent graffiti; or
2) the health and safety risks to maintenance operatives are no longer acceptable.

Anti-carbonation coatings

2.13 The need for the application of anti-carbonation coatings on new concrete structures or refurbishment of existing concrete structures shall be assessed and agreed with the Overseeing Organisation.

NOTE New concrete structures subject to the following conditions can be vulnerable to carbonation:

1) high carbon dioxide concentrations;
2) relative humidity between 50% and 70% - CS CA55 [Ref 1.I].

2.13.1 Anti-carbonation coatings may be applied to existing concrete highway structures where:

1) specialised remedial work such as electrochemical chloride removal has been undertaken;
2) concrete carbonation has occurred.

2.14 The need for the reapplication of anti-carbonation coatings shall be assessed and agreed with the Overseeing Organisation.

2.14.1 Anti-carbonation coatings should be reapplied after expiry of the system's expected life in accordance with the manufacturer's recommendations.

3. Materials

Anti-graffiti coatings

3.1 Anti-graffiti coatings shall be specified to ensure that graffiti on treated areas of a concrete structure can be removed without damage to the concrete substrate.

3.1.1 Anti-graffiti coatings may consist of the following:

1) a system that forms a hard and chemical resistant film;
2) a sacrificial system where the coating is removed along with the graffiti.

NOTE 1 *Anti-graffiti coating systems that form a hard and chemical resistant film typically have a high sheen finish and alter the natural appearance of the concrete substrate.*

NOTE 2 *The natural appearance of the concrete substrate is altered less by sacrificial anti-graffiti coating systems compared to systems forming a hard and chemical resistant film.*

NOTE 3 *Cleaning and removal of graffiti on sacrificial anti-graffiti coating systems can partially or fully remove the anti-graffiti coating.*

3.2 The performance requirements for anti-graffiti coatings shall be specified in accordance with BS EN 1504-2 [Ref 6.N] and the minimum requirements given in Clause 1709 of MCHW Series 1700 [Ref 5.N].

3.3 The use of chemical cleaning agents to remove graffiti from anti-graffiti coating systems shall be assessed and agreed with the Overseeing Organisation.

Anti-carbonation coatings

3.4 Anti-carbonation coatings shall be specified to protect the concrete structure against carbon dioxide ingress and the consequential carbonation of the substrate.

3.5 The performance requirements for anti-carbonation coatings shall be specified in accordance with BS EN 1504-2 [Ref 6.N] and the minimum requirements given in Clause 1709 of MCHW Series 1700 [Ref 5.N].

4. Records and inspection

Construction and application records

4.1 A record of the application of the surface protection system shall be prepared in accordance with CG 302 [Ref 1.N] incorporating the following information:

1) as-built records showing extents of the surface protection systems application;
2) all technical literature including health and safety data sheets relating to the products used;
3) application method;
4) test findings;
5) amount of materials used;
6) number of applications;
7) coverage rate;
8) weather conditions;
9) maintenance requirements;
10) removal requirements.

Inspection

4.2 Structural elements where surface protection systems have been applied shall be inspected for signs of deterioration of the surface protection system, as part of the structural inspection regime in accordance with CS 450 [Ref 2.I].

NOTE *Signs of deterioration of the surface protection system can include the following:*

1) dirt build up;
2) graffiti;
3) peeling;
4) cracking;
5) leachates;
6) non-uniform patches within treated areas.

5. 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	The National Archives. legislation.gov.uk. Highways Act 1980, 'Highways Act 1980'
Ref 3.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 4.N	Highways England. MCHW Series 5700, 'Manual of Contract Documents for Highway Works Volume 1 Specification for Highway Works - Series 5700 Concrete Repairs'
Ref 5.N	Highways England. MCHW Series 1700, 'Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works - Series 1700 Structural Concrete'
Ref 6.N	BSI. BS EN 1504-2, 'Products and systems for the protection and repair of concrete structures. Definitions, requirements, quality control and evaluation of conformity. Surface protection systems for concrete'
Ref 7.N	Highways England. GG 104, 'Requirements for safety risk assessment'
Ref 8.N	Highways England. LA 113, 'Road drainage and the water environment'

6. Informative references

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

Ref 1.I	Concrete Society. O'Donoghue. CS CA55, 'Concrete Advice No. 55 - Carbonation'
Ref 2.I	Highways England. CS 450, 'Inspection of highway structures'