Design Manual for Roads and Bridges

Drainage
Design

CD 534
Chamber tops and gully tops for road drainage and services

(formerly HA 104/09, IAN 196/17, IAN 197/17)

Version 0.1.0

Summary
This document contains the requirements for road chamber top and gully top installations on motorway and all-purpose trunk roads.

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 National Highways team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

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Latest release notes

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CD 534	0.**1**.0	May 2022	Core document, England NAA	Incremental change to requirements

Edits to requirements for the skid resistance test method and edits to the selection of frames. Clarification of required treatment of chamber tops becoming located in new carriageway and requirements for those already in the carriageway. Clarification around locating chambers in emergency areas. Decision tree redrawn. Other incremental changes to requirement clauses and editorial amendments.

Previous versions

Document code	Version number	Date of publication of relevant change	Changes made to	Type of change
CD 534	0.0.0	February 2020		

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Foreword

Publishing information

This document is published by National Highways.

This document supersedes HA 104/09, IAN 196/17 and IAN 197/17 which are withdrawn.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.

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Introduction

Background

This document sets out the requirements for chamber tops and gully tops on motorway and all-purpose trunk roads. This document can be read in conjunction with the RSTA Code of Practice for Ironwork Systems Installation and Refurbishment RSTA CoP Ironwork [Ref 1.I].

To reduce the risks to both road users and maintenance staff, chamber tops are no longer permitted within the carriageway of new construction and the need for existing chamber tops in the carriageway should be assessed. By removing or reducing the number of chamber tops in the carriageway, this reduces the need for lane closures and traffic management when carrying out routine inspection and maintenance tasks.

The premature failure of chamber top and gully top installations as well as the failure of the chamber itself and surrounding pavement surface can pose a risk to both maintenance operatives and road users.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 5.N] apply to this document.

Mutual Recognition

Where there is a requirement in this document for compliance with any part of a "British Standard", or other technical specification, that requirement may be met by compliance with GG 101 [Ref 5.N].

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Abbreviations

Abbreviation	Definition
AADT	Annual average daily traffic
DfS	Departure from standard
DSR	Design strategy record
LGV	Large goods vehicle
NMU	Non-motorised User
OO	Overseeing Organisation
SCRG	Safety Control Review Group
PSRV	Polished skid resistance value (or Polished stone value)
RSTA	The Road Surface Treatment Association
UKAS	United Kingdom Accreditation Service
USRV	Unpolished skid resistance value

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Terms and definitions

Term	Definition
Bedding material	mortar bound by cement or other synthetic materials
Carriageway	that area of the road surface that comprises the live running lanes, both temporary and permanent, the hard shoulder, or hard strip, and central reserve crossovers
Chamber top	comprises a removable cover, placed in a frame, as the access to the chamber from the surface
Failed installation	a structural failure or loosening of either the cover, the frame, or the supporting structure of the underlying chamber
Gully top	comprises a removable grating set in a frame that directs water into the gully
Weir depth	the distance from the top of the cover to the top of the fixed weir

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1. Scope

Aspects covered

1.1 The requirements contained in this document shall be applied to road chamber top and gully top installations on motorway and all-purpose trunk roads.

1.2 Chamber tops in carriageways including hardstrips, hard shoulders and central reserve crossovers of motorways and all-purpose trunk roads shall not be permitted.

1.3 Where existing (legacy) chambers are located in the running lanes then the decision tree, shown as Figure 1 of Appendix B, shall be used to resolve the presence of that chamber in the running lane.

Implementation

1.4 This document shall be implemented forthwith on all schemes involving the use of chamber tops and gully tops for road drainage on the Overseeing Organisation's motorway and all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 5.N].

Use of GG 101

1.5 The requirements contained in GG 101 [Ref 5.N] shall be followed in respect of activities covered by this document.

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2. Design for chamber tops and gully tops

General

2.1 New chamber tops shall not be installed in carriageways including hardstrips, hard shoulders and central reserve crossovers of motorways and all-purpose trunk roads.

2.2 Chamber tops and gully tops shall be specified in accordance with BS EN 124-1 1994 [Ref 4.N] and the requirements of this document.

2.3 Chamber tops with clear opening of greater than 1 m shall be in accordance with BS 9124 [Ref 10.N] and the requirements of this document.

2.4 The minimum classification for all chamber tops and gully tops installed in areas of motorways and all-purpose trunk roads that are at risk from trafficking, either directly or indirectly, shall be of grade D400 in accordance with BS EN 124-1 1994 [Ref 4.N].

2.5 Where the AADT LGV for a carriageway exceeds 1500 in each direction, grade E600 chamber tops shall be specified.

2.6 Chamber tops shall be specified with a minimum polished skid resistance value (PSRV) dependent on the risk specific to their location as shown in Table 2.6.

Table 2.6 Minimum PSRV

	Pendulum test	WRc test
Low risk	>45	>0.62 kN
High risk	>60	>0.83 kN

NOTE 1 *Low-risk sites are those where the predominant use is by non-motorised users (NMU), such as footways. High-risk sites are those where the predominant use is vehicular.*

NOTE 2 *Skid risk is defined in DMRB CS 228 [Ref 4.I].*

NOTE 3 *The pendulum test method to determine the skid resistance of the pavement surface or of plain frictional covers (where no vertical or near vertical edges exceeding 1.5 mm are present) is to accord with BS EN 13036-4 2011 [Ref 8.N].*

2.6.1 Where the skid resistance of profiled covers (where vertical or near vertical edges exceeding 1.5 mm are present) is measured in accordance with the WRc Skid Resistance Method (see UC 12974 [Ref 1.N]), the test should be undertaken by a UKAS-accredited test house.

NOTE 1 *The PSRV value is derived from a comparison of the values of skid resistance of surface materials tested using both the pendulum method and the WRc fixed-wheel method when inserted in the equation in Appendix A.*

NOTE 2 *Appendix A contains a brief description of the trials undertaken to establish a comparison between the two methods and an equation for determining the comparative PSRV.*

2.7 The unpolished skid resistance value (USRV) is unrepresentative of the service condition and shall not be used in the assessment of skid risk.

Chamber tops

2.8 A chamber top permitting access shall conform to the following minimum clear opening requirements:

1) the minimum clear opening for a frame with a rectangular opening is not less than 600 mm with a diagonal measurement of not less than 700 mm;
2) the minimum clear opening for a frame with a circular opening is a diametric measurement of not less than 700 mm.

NOTE *The minimum cover dimensions where personnel access is not required are stated in BS EN 752 [Ref 2.N].*

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2.9 The frame of a chamber top shall be a minimum of 150 mm deep for installations in motorways and all-purpose trunk roads.

2.10 Frames shall be selected in accordance with Table 2.10a and Table 2.10b.

Table 2.10a Minimum weight of iron frames

Shape	Nominal opening size and depth (mm)	Minimum frame weight (kg)
Square	600x600x150 deep	27
Square	600x600x100 deep	21
Square	675x675x150 deep	33
Square	675x675x100 deep	26

Table 2.10b Minimum flange area of frames

Cover duty	Minimum flange area (mm^2)
D400	190,000
E600	285,000

NOTE *Failure of bedding materials due to concentrated loads from poor frame/bedding is a common cause of premature failure of ironwork and a source of danger to road users. Such failures are caused by inadequate distribution of loads from frames onto and through the bedding materials. This load distribution is a complex issue and depends on the frame configuration at the supports, the frame flange geometry and extent, the bedding material elastic modulus and the frame stiffness.*

2.11 The depth of the insertion of the chamber top cover within the frame shall be no less than 50 mm, or no less than 80 mm if the design relies upon the depth of insertion for security.

2.12 Types of loose couplings, other than those specified in MCHW Series 0500 [Ref 6.N] shall be specified as having a minimum cross-sectional area of 140 mm^2.

Gully tops

2.13 Gully tops (frame and grating) shall be specified as grade D400 in accordance with BS EN 124-1 1994 [Ref 4.N].

2.13.1 Hinged gratings may be either kerb-hinged or side-hinged appropriate to the direction of traffic.

2.13.2 Kerb-type gully gratings and frames should provide a kerbside water intake and an access which, if hinged, opens away from the carriageway, that is, towards the kerb.

2.13.3 Weir depth, if any, should be 115 mm (Type 1) or 165 mm (Type 2) as defined by BS 7903 [Ref 3.N].

2.13.4 Kerb-type gully gratings and frames should be provided with a Type HB (half batter) profile in accordance with BS 7263-1 [Ref 7.N] unless otherwise specified.

2.14 The critical dimensions of kerb-type gully gratings and frames shall be specified in accordance with BS 7903 [Ref 3.N].

2.15 Nominal widths of gratings and minimum areas of waterway shall be specified in accordance with BS EN 124-1 1994 [Ref 4.N] and BS 7903 [Ref 3.N].

2.15.1 The minimum area of waterway should be 900 cm^2.

2.15.2 There should be a minimum waterway area of 45 cm^2 between the kerb face of the frame and a parallel line 50 mm distant.

2.15.3 There should be a minimum waterway area of 65 cm^2 between the kerb face of the frame and a parallel line 90 mm distant.

2.16 The gully top frame shall be at least 100 mm deep.

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2.17 Kerb type gully covers and frames shall be specified with:

1) a metal retaining bar, of minimum cross section 35 mm x 25 mm for use during construction;
2) a cover with either open keyway(s) or a locking mechanism;
3) an opening unit with a minimum rectangular clear opening of 400 mm x 250 mm;
4) a locking mechanism where a cover can be readily raised without the use of the key or tool;
5) hinges at the rear edge of the cover, as viewed from the road, where used;
6) a raised pattern conforming with BS EN 124-1 1994 [Ref 4.N] and be self-draining; and,
7) a grid with horizontal bars of a minimum of 12 mm galvanised in accordance with BS EN ISO 1461 [Ref 9.N] or a minimum of two integrally cast vertical fins to act as a debris trap across the open mouth of the unit.

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3. Chamber tops in the carriageway

Existing chamber tops becoming located in new carriageway

3.1 Where existing chamber tops will become located in the carriageway, the treatment shall be determined in accordance with the decision tree shown as Figure 1 in Appendix B.

NOTE *Examples of where chamber tops become located in the carriageway include:*

1) smart motorways;

2) schemes currently in design or under construction and future schemes where hard shoulders are to be converted to running lanes; and,

3) temporary road works where the hard shoulder is to be utilised as a running lane.

Existing chamber tops already located in the carriageway

3.2 Existing chamber tops positioned within the carriageway shall be removed.

3.3 The treatment of an existing chamber top that is already located in the carriageway shall be:

1) determined in accordance with the decision tree shown as Figure 1 in Appendix B; and,

2) recorded in the project file.

NOTE *There have been a number of failures of chamber top covers where the hard shoulder has been converted to, or utilised as, a running lane. Similar failures have occurred where the hard shoulder is utilised as a running lane in roadworks.*

3.4 Chambers that have been plated over shall be recorded in accordance with the Overseeing Organisation's data requirements, including details of the method and depth of the plating.

3.5 Where any realignment is undertaken or chambers in the verge introduced, the connecting piping shall be the same diameter as that of the main drain with an invert-to-invert connection that will facilitate CCTV access.

3.6 Where any realignment is undertaken or chambers in the verge introduced, the chambers shall be benched to the invert level of the connecting pipe.

Assessment of locations and programme of upgrading works

3.7 Locations affected by positioning a chamber access in the carriageway shall be identified and recorded.

Decision tree for treatment of existing chambers that are or may become located in the carriageway

3.8 Where an existing chamber in the carriageway is to be retained and/or modified by a scheme then the decision tree, in Appendix B, shall be followed.

NOTE *E600 chamber tops are not an alternative to addressing the location of chamber tops in running lanes.*

3.9 Chamber tops shall not be permitted within the wheel track zone.

3.9.1 Chambers should not be located in Emergency Areas.

3.9.2 Where a chamber is identified as existing in the carriageway pavement, the local network should be surveyed for the presence of similarly located chambers.

3.10 All drainage details shall be recorded in accordance with the Overseeing Organisation's data requirements, including chamber realignments, treatments of plating over, piping through, side chambers.

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4. 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.	Document
Ref 1.N	WRc. UC 12974, 'Comparison of Skid Resistance Test Methods for Manhole Covers'
Ref 2.N	BSI. BS EN 752, 'Drain and sewer systems outside buildings - sewer system management.'
Ref 3.N	BSI. BS 7903, 'Guide to selection and use of gully tops and manhole covers for installation within the highway'
Ref 4.N	BSI. BS EN 124-1, 'Gully tops and manhole tops for vehicular and pedestrian areas. Definitions, classification, general principles of design, performance requirements and test methods' , 1994
Ref 5.N	National Highways. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 6.N	Highways England. MCHW Series 0500, 'Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works. Series 500 Drainage and service ducts.'
Ref 7.N	BSI. BS 7263-1, 'Precast concrete flags, kerbs, channels, edgings and quadrants'
Ref 8.N	BSI. BS EN 13036-4, 'Road and airfield surface characteristics. Test methods. Part 4- Method for measurement of slip/skid resistance of a surface: The pendulum test' , 2011
Ref 9.N	BSI. BS EN ISO 1461, 'Specification for hot dip galvanized coatings on iron and steel articles'
Ref 10.N	BSI. BS 9124, 'Specification for Steel and Aluminium Access Covers Systems with 1m Clear Opening'

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5. Informative references

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

Ref.	Document
Ref 1.I	The Road Surface Treatments Association. RSTA CoP Ironwork, 'Code of practice for ironwork systems installation and refurbishment'
Ref 2.I	Highways England. MCHW Series 0900, 'Manual of Contract Documents for Highway Works. Volume 1 Specification for Highway Works. Series 900 Road Pavements – Bituminous Bound Materials.'
Ref 3.I	BSI. DD ENV 12633, 'Method of determination of unpolished and polished slip/skid resistance value'
Ref 4.I	Highways England. CS 228, 'Skidding resistance'
Ref 5.I	American Society for Testing Materials. ASTM E1884, 'Standard specification for A size 10x4-5 smooth tread friction test tire'

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Appendix A. WRc skid test

A1 Test procedure

The skid resistance of pavement surface materials is measured using the Pendulum Test in accordance with Annex B of DD ENV 12633 [Ref 3.I]. This is inappropriate for adequately assessing the skid resistance of profiled surfaces such as those formed on chamber top covers.

WRc were commissioned in 2016 to devise a more appropriate test method for these raised surface profiles and developed the locked wheel test described in their final report UC 12974 [Ref 1.N] of February 2018 and summarised below.

The test is undertaken using a rig comprising of a support frame with a top to support the test sample. A fixed wheel with a specific smooth tread tyre ASTM E1884 [Ref 5.I], and inflated to 40 psi, is mounted in a free moving frame. The tyre is placed on the test sample and a load of 70 kg is applied to the wheel. The tyre is then drawn across the sample surface by means of a hand crank. The link between the handle and the wheel contains a load cell that measures the peak force (in kN) which is displayed on a force meter.

The test sample is thoroughly wetted prior to carrying out each test.

A2 Verification

A range of materials and chamber tops were subject to skid resistance tests using both the pendulum test and the fixed wheel test.

The values obtained by each method were then compared to derive a formula that would enable a direct comparison to be made.

The comparative formula is:

$$y = 2 + 70x$$

where x is the skid wheel peak force (in kN) and y is the polished skid resistance value measured using the pendulum test.

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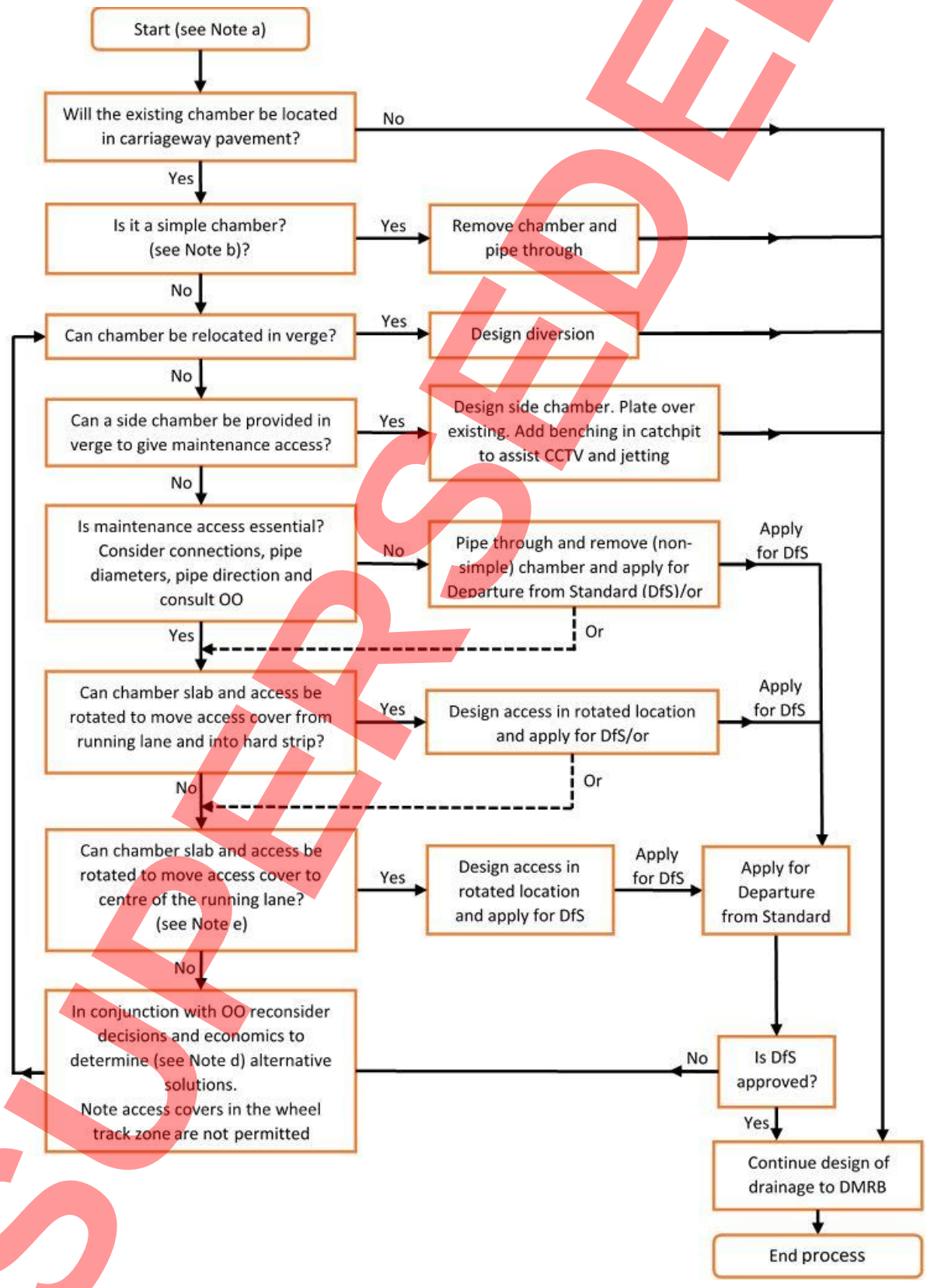
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Appendix B. Decision tree

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Figure B.1 Decision tree



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a) The decision tree process applies to all access covers (whole or part) located in the carriageway pavement including its hard shoulder and hardstrip(s) as defined in terms and definitions.

b) A 'simple chamber' is one that meets all the following criteria:

1) no side connections, that is one incoming pipe and one outgoing pipe only;
2) On removal of the chamber in question the resulting gap between adjacent remaining chambers on the same drainage run is no greater than 200 m;
3) difference in incoming and outgoing pipe diameter are no greater than 150 mm; and,
4) The change in pipe direction is no greater than 22.5°.

c) In central reserves the full area of emergency crossover points are included even where a reduced pavement structure is provided. Other hardened central reserve areas that do not have the full depth pavement construction of the adjacent carriageway are excluded.

d) The Overseeing Organisation will discuss alternative solutions to achieve a consensus prior to the submission of a DfS. The alternatives include:

1) a plated & buried chamber retained under the pavement around bridge piers where existing changes of direction provide pipe angles >22.5 degrees; and,
2) a retained buried benched chamber within the central reserve, but with rodding eye for jetting purposes.

e) Where reference is made to a location wholly between the wheel track zones within a running lane, additionally the area between the wheel track zone and the carriageway edge line and its hard strip is an equivalent area. For the purposes of this decision tree, the wheel track zone is a 900 mm-wide zone (and not 600 mm-wide zone). If retaining an access cover within the entry and exit areas of junctions (both main line and slip road) as the combined, and individually wider, wheel track zones are not as simple as that described in MCHW Series 0900 [Ref 2.I].

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Notification

This document was notified in draft to the European Commission in accordance with Technical Standards and Regulations Directive 2015/1535/EU.

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Drainage
Design

CD 534
England National Application Annex to CD 534 Chamber tops and gully tops for road drainage and services

(formerly HA 104/09, IAN 196/17, IAN 197/17)

Version 0.0.1

Summary
This National Application Annex sets out the National Highways-specific requirements relating to chamber tops and gully tops.

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 National Highways team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

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Latest release notes

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CD 534	0.0.**1**	May 2022	England NAA	Incremental change to notes and editorial updates

England National Application Annex to CD 534. Minor editorial amendments to section E/2 to improve clarity of wording.

Previous versions

Document code	Version number	Date of publication of relevant change	Changes made to	Type of change
CD 534	0.0.0	February 2020		

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Foreword

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Introduction

Background

This National Application Annex gives the National Highways-specific requirements relating to chamber tops and gully tops.

Assumptions made in the preparation of this document

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Terms and definitions

Term	Definition
All lane running	a smart motorway which includes the permanent conversion of a hard shoulder to a running lane
Smart motorways	motorways that use variable mandatory speed limits to increase capacity and smooth the flow of traffic

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E/1. Existing chamber access covers becoming located in the carriageway

E/1.1 The requirements of CD 534 section 3 shall be applied to all smart motorways.

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E/2. Assessment/Upgrading works for chamber tops located in a running lane

E/2.1 The requirements of CD 534 section 3 shall be applied retrospectively to all existing chamber accesses in live running lanes in operational smart motorways (all lane running or part-time (dynamic hard shoulder running) schemes), and any other motorways that are managed by National Highways.

E/2.2 Where a requirement in CD 534 cannot be followed, the departure process outlined in GG 101 [Ref 1.N] shall be followed before an application can be made to certify a design under the certification of drainage design process in CG 502 [Ref 1.I].

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E/3. Normative references

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Ref.	Document
Ref 1.N	National Highways. GG 101, 'Introduction to the Design Manual for Roads and Bridges'

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E/4. Informative references

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

Ref.	Document
Ref 1.I	Highways England. CG 502, 'The certification of drainage design'

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Drainage
Design

CD 534
Northern Ireland National Application Annex to CD 534 Chamber tops and gully tops for road drainage and services

(formerly HA 104/09, IAN 196/17, IAN 197/17)

Revision 0

Summary
There are no specific requirements for Department for Infrastructure, Northern Ireland supplementary or alternative to those given in CD 534.

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**

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Release notes

Version	Date	Details of amendments
0	Feb 2020	Department for Infrastructure Northern Ireland National Application Annex to CD 534.

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Drainage
Design

CD 534
Scotland National Application Annex to CD 534 Chamber tops and gully tops for road drainage and services

(formerly HA 104/09, IAN 196/17, IAN 197/17)

Revision 0

Summary
There are no specific requirements for Transport Scotland supplementary or alternative to those given in CD 534.

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	Feb 2020	Transport Scotland National Application Annex to CD 534.

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Llywodraeth Cymru
Welsh Government

Drainage
Design

CD 534
Wales National Application Annex to CD 534 Chamber tops and gully tops for road drainage and services

(formerly HA 104/09, IAN 196/17, IAN 197/17)

Revision 0

Summary
There are no specific requirements for Welsh Government supplementary or alternative to those given in CD 534.

Feedback and Enquiries
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Release notes

Version	Date	Details of amendments
0	Feb 2020	Welsh Government National Application Annex to CD 534.

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