Design Manual for Roads and Bridges

Drainage
Design

CD 529
Design of outfall and culvert details

(formerly HA 107/04)

Revision 1

Summary
This document contains the requirements for the design of outfall and culvert details.

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.

Contents

Release notes

Version	Date	Details of amendments
1	Mar 2020	Revision 1 (March 2020) Revision to update references only. Revision 0 (December 2019) CD 529 replaces HA 107/04. 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This document supersedes HA 107/04, which is withdrawn.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 gives the requirements and advice for the design of outfalls and culverts. It supplements the guidance given in the CIRIA C786 [Ref 1.N] and explains how the guidance in that document applies to motorways and all purpose trunk roads.

Assumptions made in the preparation of this document

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

Terms and definitions

Terms

Term	Definition
Culvert	A covered channel or pipe designed to prevent the obstruction of a watercourse or drainage path by an artificial construction.
Environmental Protection Agency	The legislative body responsible for managing the quality of water bodies and flood risk in public watercourses.
Groundwater	All water below the surface of the ground and in direct contact with the ground or subsoil.
Outfall	The point where the road drainage discharges into a public watercourse, tidal waters or a sewer.
Outlet	The point at which water flows from a sub-surface continuous asset (such as a pipe) to an open surface asset (such as a ditch or a pond).
Screen	A screen at the inlet of a culvert designed to prevent debris from entering the culvert and causing a blockage. A screen on an outfall or the outlet of a culvert designed to prevent unauthorised access.
Surface water	A watercourse, lake, pond, reservoir, canal or stretch of coastal water.
Water body	A body of surface water or groundwater.

1. Scope

Aspects covered

1.1 The requirements and advice in this document shall apply to the design of outfalls and culverts.

NOTE 1 *The design of outlets from edge of pavement runoff is not covered in this document and is given in CD 521 [Ref 3.I].*

NOTE 2 *Culverts and outfalls having a diameter or clear span greater than 900mm are defined as structures and guidance on their structural design is not given in this document.*

NOTE 3 *The requirements and advice for the structural design of concrete box structures is given in BS 5911-1 [Ref 1.I].*

NOTE 4 *The requirements and advice for the structural design of corrugated steel buried structures is given in CD 375 [Ref 2.I].*

NOTE 5 *The requirements and advice for the structural design of concrete pipe structures is given in BS 5911-1 [Ref 1.I].*

NOTE 6 *The requirements and advice for the structural design of clay pipe structures is given in BS EN 295 [Ref 5.I].*

Implementation

1.2 This document shall be implemented forthwith on all schemes involving culverts or outfalls on the Overseeing Organisations' motorway and all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 2.N].

Use of GG 101

1.3 The requirements contained in GG 101 [Ref 2.N] shall be followed in respect of activities covered by this document.

2. Design of outfalls

2.1 Where an outfall is to a public watercourse, the design shall be determined in consultation with the Environmental Protection Agency.

2.2 The guidance on the hydraulic design of outfalls, as given in Chapter 12 of CIRIA C786 [Ref 1.N], shall be used in the design of outfalls.

2.3 The design of screens on outfalls shall follow the guidance in Chapter 4 of CIRIA C786 [Ref 1.N].

3. Design of culverts

3.1 The presence and probable size of culverts shall be determined early in the design process.

NOTE 1 *Culverts beneath highways have to accommodate restrictions imposed by carriageway alignment and road construction, as these affect the cover to the top of the culvert.*

NOTE 2 *Culverts can be designed to facilitate crossings of highway ditches or channels.*

NOTE 3 *Culverts can be designed to transfer the drainage run from one side of the carriageway to the other.*

3.2 Where a culvert conveys a public watercourse, the design shall be determined in consultation with the Environmental Protection Agency.

NOTE *Where a culvert conveys a highway drain that is not a public watercourse, no consultation is required.*

3.3 The guidance on the hydraulic design of culverts, as given in Chapter 12 of CIRIA C786 [Ref 1.N], shall be used in the design of culverts.

NOTE 1 *Culverts with a diameter or clear span of 900mm or less are not structures and are considered to have a design life of 60 years.*

NOTE 2 *Culverts with a diameter or clear span greater than 900mm are structures and the design life for such structures is given in CD 350 [Ref 4.I].*

3.4 Where a circular culvert is longer than 12 metres it shall be at least 1.2 metres in diameter to facilitate access for maintenance.

3.5 Where a box culvert is longer than 12 metres it shall have both span and height at least 1.2 metres to facilitate access for maintenance.

3.5.1 The minimum culvert diameter should be 450mm as smaller sizes are prone to blockage.

3.6 The design of screens to culverts shall follow the guidance in Chapter 4 of CIRIA C786 [Ref 1.N].

3.7 Where a safety risk assessment identifies a need for a screen, this shall be provided.

3.8 The provision of screens to culverted public watercourses shall be discussed and agreed with the Environmental Protection Agency.

3.9 Where a culvert conveys a public watercourse, its invert shall be depressed below the natural bed level as described in Chapter 9 of CIRIA C786 [Ref 1.N].

3.10 Where a culvert conveys a highway drain that is not a public watercourse, the invert shall be at least 75mm below the bed of the drain.

3.11 Where a culvert conveys a highway drain that is not a public watercourse, the sides of the drain shall be higher than the culvert soffit.

3.12 Where a culvert conveys a highway drain that is not a public watercourse, the headwall of the culvert shall extend into the banks of the drain over the full depth.

3.12.1 The headwall of a culvert which conveys a highway drain that is not a public watercourse may be a simple brick structure, cast in-situ concrete reinforced concrete or concrete bagwork.

3.13 Where a culvert conveys a highway drain that is not a public watercourse, a concrete apron shall be designed in front of the headwall to suppress vegetation growth immediately upstream of the inlet and downstream of the outlet.

3.14 Where a culvert conveys a carriageway channel, it shall be designed to carry the design flow without surcharging.

3.14.1 Where a culvert conveys a carriageway channel, it may be designed to carry more than the design flow to allow for sediment deposition within the culvert.

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 1.N	CIRIA. Benn J, Kitchen A, Fosbeary C, Faulkner D, Hemsworth M, Latham D. CIRIA C786, 'Culvert, screen and outfall manual'
Ref 2.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'

5. Informative references

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

Ref 1.I	BSI. BS 5911-1, 'Concrete pipes and ancillary concrete products. Specification for unreinforced and reinforced concrete pipes (including jacking pipes) and fittings with flexible joints (complementary to BS EN 1916:2002)'
Ref 2.I	Highways England. CD 375, 'Design of corrugated steel buried structures'
Ref 3.I	Highways England. CD 521, 'Hydraulic design of road edge surface water channels and outlets'
Ref 4.I	Highways England. CD 350, 'The design of highway structures'
Ref 5.I	BSI. BS EN 295, 'Vitrified clay pipe systems for drains and sewers Part 1: Requirements for pipes, fittings and joints'