Drainage
Contract preparation

CP 500 Instructions for specifiers for CC 500 Drainage

(formerly)

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Latest release notes

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
CP 500	LIVE_2025-02-17	Not available	Core document	Change to policy, major revision, new document development

This document replaces MCHW Volume 2 Series NG 500, which has been withdrawn. This document also replaces MCHW Volume 2 Series NG 2500 sections NG 2505 and NG 2506, which have been withdrawn. These documents have been revised in accordance with the Manual for Development of Documents and, as a result, have undergone significant restructuring and technical revisions.

Previous versions

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Foreword

This document provides specifier instructions for the production of the works specific requirements for CC 500 Drainage.

This document does not form part of the works specification.

The works specification is made up of both the Specification for Highway Works and the works specific requirements completed by the Specifier.

This document is applicable for contracts throughout the UK, complemented by the additional specification requirements and contractual changes of each Overseeing Organisation.

Users are responsible for applying all appropriate documents applicable to their contract.

Users are responsible for archiving contract documentation in accordance with the user's quality management system.

1. Drainage pipes

Product requirements for new drainage pipes

1.1 Drainage pipes up to and including 900mm internal diameter shall be as specified in CC 500/WSR/001.

Drainage pipes up to and including 900mm internal diameter								
Drainage pipe reference	**Drawing or model reference**	**Drainage pipe diameter**	**Upstream chamber/ headwall reference**	**Upstream invert level**	**Downstream chamber/ headwall reference**	**Downstream invert level**	**Drainage pipe length**	**Drainage pipe type**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter a unique reference.

b) Enter a number, to identify the drawing/ model where this is shown.

c) Enter a number in units of mm, to identify the internal pipe diameter.

d) Enter a unique reference.

e) Enter a number in units of m, to identify the upstream chamber or headwall invert level.

f) Enter a unique reference.

g) Enter a number in units of m, to identify the downstream chamber or headwall invert level.

h) Enter a number in units of m, to identify the pipe length between chambers.

i) Enter a value, from options carrier pipe, filter drain, culvert, to identify the drainage pipe type.

Drainage pipes up to and including 900mm internal diameter (continued)					
Drainage pipe reference	**Drainage pipe material**	**Drainage pipe roughness**	**Watercourse name**	**Drainage pipe class**	**Drainage pipe bedding**
(a)	(j)	(k)	(l)	(m)	(n)

j) Enter one or more values, from options vitrified clay, concrete, GRP, Thermoplastic solid wall, un-plasticised polyvinyl chloride (PVCu), polypropylene, polyethylene Thermoplastic structured wall, ductile iron, cast iron, corrugated steel, to identify the drainage pipe material.

k) Enter text, to identify the pipe roughness to ensure the drainage pipe selection adheres to the design criteria.

l) Enter text, to identify the name of the watercourse if this pipe is a culvert.

m) Enter text, to identify the drainage pipe class.

n) Enter text, to identify the drainage pipe bedding and trench detail.

Drainage pipes up to and including 900mm internal diameter (continued)							
Drainage pipe reference	**Drainage pipe group**	**Filter drain backfill material**	**Surface level detail of filter drains**	**Geotextile required between filter material and above layers**	**Waterproof geotextile required at the base of trench**	**Tensile strength of waterproof geotextile**	**Resistance to static puncture of waterproof geotextile**
(a)	(o)	(p)	(q)	(r)	(s)	(t)	(u)

o) Enter text, to identify the drainage pipe group number.

p) Enter one or more values, from options Type A, Type B, Type C, to identify the filter drain backfill material.

q) Enter one or more values, from options Type V, Type W, Type X, Type Y, to identify the surface level detail of filter drains.

r) Enter a value, from options Yes, No, to identify where a geotextile is required between the filter material and above layers.

s) Enter a value, from options Yes, No, to identify where a waterproof geotextile is required.

t) Enter a number in units of kN/m, to define the tensile strength of the waterproof geotextile.

u) Enter a number in units of N, to define the resistance to static puncture of the waterproof geotextile.

Drainage pipes up to and including 900mm internal diameter (continued)	
Drainage pipe reference	**Durability of waterproof geotextile**
(a)	(v)

v) Enter text, to define the durability requirement of the waterproof geotextile.

Contractor design of new culverts up to 900mm diameter

1.2 The design of culverts up to 900mm diameter shall be in accordance with CD 529 [Ref 20.N].

1.3 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 31.N] shall apply to culverts up to 900mm.

1.4 The new culvert pipes up to 900mm internal diameter that are to be Contractor design items shall be as stated in CC 500/WSR/001.

The new culvert pipes up to 900mm internal diameter that are to be Contractor design items						
Culvert pipe reference	**Culvert pipe flow**	**Culvert pipe length**	**Culvert pipe longitudinal fall**	**Number of culvert pipes**	**Culvert pipe roughness**	**Minimum culvert pipe load**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter a number in units of l/s, to identify the total flow through the pipe.

c) Enter a number in units of m, to identify the length of the pipe.

d) Enter a number in units of m, to identify the longitudinal fall along the full pipe length.

e) Enter a number, to identify the number of pipes needed.

f) Enter text, to identify the pipe roughness design input.

g) Enter a number in units of kN/m^2, to identify the minimum load the pipe must accommodate.

1.5 Pipes constructed in embankments or in other areas of fill, other than in a trench shall comply with 'Earthworks around pipes' in "Earthworks

around structures, foundations, and pipes" in Section 12 of CC 601 [Ref 25.N].

Product requirements for vitrified clay drainage pipes

1.6 Vitrified clay drainage pipes shall be compliant with BS EN 295-1 [Ref 73.N].

1.7 The vitrified clay drainage pipes shall meet the performance characteristics as stated in table 1.7

Table 1.7 Performance characteristics for vitrified clay pipes for drainage

Performance characteristic		Required value	
Reaction to fire		BS EN 295-1 [Ref 73.N] 7.1	A1
Crushing strength		BS EN 295-1 [Ref 73.N] 5.9 Tables 5, 6 and 7	Dependant on pipe diameter
Longitudinal bending strength as Bending moment resistance		BS EN 295-1 [Ref 73.N] 5.11 Table 8	Dependant on pipe diameter
Dimensional tolerances	Internal diameter	BS EN 295-1 [Ref 73.N] 5.2 Table 1	Pass
	Length	BS EN 295-1 [Ref 73.N] 5.3, Table 2	Pass
	Squareness of ends	BS EN 295-1 [Ref 73.N] 5.4	Pass
	Straightness	BS EN 295-1 [Ref 73.N] 5.5, Table 3	Pass
	Water seal of trapped fittings	BS EN 295-1 [Ref 73.N] 5.6	Pass
	Angle of curvature and radius of bends	BS EN 295-1 [Ref 73.N] 5.7, Table 4	Pass
	Branch angle of junctions	BS EN 295-1 [Ref 73.N] 5.8	Pass
	Continuity of invert	BS EN 295-1 [Ref 73.N] 6.3	Pass
	Joint inter-changeability	BS EN 295-1 [Ref 73.N] 6.4, Tables 13 and	Pass

		14	
Tightness: Gas and liquid and permeability	Watertightness of pipes or pipe sections and junctions	BS EN 295-1 [Ref 73.N] 5.14	Pass
	Airtightness of pipes, bends, junctions and pipe sections	BS EN 295-1 [Ref 73.N] 5.18, Tables 9 and 10	Pass
	Tightness of fittings	BS EN 295-1 [Ref 73.N] 5.19	Pass
Watertightness of joint assemblies	Angular deflection	BS EN 295-1 [Ref 73.N] 6.2.2, Table 12	Pass
	Shear resistance	BS EN 295-1 [Ref 73.N] Section 6.2.3	Pass
Release of dangerous substances		BS EN 295-1 [Ref 73.N] 7.3	
Durability of crushing strength and longitudinal bending strength, against:	Chemical resistance	BS EN 295-1 [Ref 73.N] 5.1 and 5.15	
	Resistance against high pressure water jetting	BS EN 295-1 [Ref 73.N] 5.1 and 5.20	Pass
Durability of watertightness, against	Chemical and physical resistance to effluent	BS EN 295-1 [Ref 73.N] 6.5	Pass
	Thermal cycling stability	BS EN 295-1 [Ref 73.N] 6.6	Pass
	Long term thermal stability	BS EN 295-1 [Ref 73.N] 6.7	Pass

1.8 The requirements for vitrified clay drainage pipes shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Product requirements for concrete drainage pipes

1.9 Concrete drainage pipes shall be as specified in CC 500/WSR/001.

Concrete drainage pipes				
Concrete drainage pipe reference	**Pipe material**	**Cement type**	**For concrete filter drains**	**Design chemical class of concrete**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference.

b) Enter a value, from options unreinforced concrete, reinforced concrete, to identify whether the concrete pipe requires reinforcement.

c) Enter text, to identify the cement type permitted.

d) Enter one or more values, from options Porous with ogee or rebated joints, unperforated not exceeding 2m in length with open joints, perforated with circular holes not greater than 10mm nor less than 3mm in diameter, to identify how concrete pipes are to be used as filter drains.

e) Enter text, to identify the DC-class of concrete in the concrete pipes for drainage.

1.10 Concrete drainage pipes shall be compliant with BS EN 1916 [Ref 11.N].

1.11 The concrete drainage pipes shall meet the performance characteristics as stated in table 1.11

Table 1.11 Performance characteristics for concrete pipes for drainage

Performance characteristic	Required value	
Dimensional tolerances relevant to joints	BS EN 1916 [Ref 11.N] 4.3.3.2, 4.3.4.1: BS 5911-1 [Ref 10.N] tables 2, 3, 4 and 5	Pass
Crushing strength	BS EN 1916 [Ref 11.N]4.3.5, 5.3.2, 5.3.4 BS 5911-1 [Ref 10.N] tables 6, 7 and 8	Dependant on pipe diameter
Longitudinal bending strength	BS EN 1916 [Ref 11.N] 4.3.6	Dependant on pipe diameter
Watertightness	BS EN 1916 [Ref 11.N] 4.3.7 Not applicable for filter drains	No leakage
Durability	BS EN 1916 [Ref 11.N] 4.3.9	Relevant to specified serviceability conditions

1.12 The requirements for concrete drainage pipes shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

1.13 Supersulfated cement shall not be used for concrete pipes.

Product requirements for glass reinforced plastic (GRP) drainage pipes

1.14 GRP drainage pipes shall be as specified in CC 500/WSR/001.

GRP drainage pipes	
GRP drainage pipe reference	**Pipe classification for GRP pipes nominal stiffness**
(a)	(b)

a) Enter a unique reference.

b) Enter text, to identify the nominal stiffness of GRP pipes for drainage.

1.15 GRP drainage pipes shall be compliant with BS EN ISO 23856 [Ref 55.N].

1.16 The GRP drainage pipes shall meet the performance characteristics as stated in table 1.16

Table 1.16 Performance characteristics of glass reinforced plastics (GRP) pipes for drainage			
Performance characteristic		Required value	
Classification	nominal size	BS EN ISO 23856 [Ref 55.N] 4.1.2	Refer to the WSR
	nominal pressure	BS EN ISO 23856 [Ref 55.N] 4.1.4	
	nominal stiffness	BS EN ISO 23856 [Ref 55.N] 4.1.3	Refer to the WSR

1.17 The requirements for GPR drainage pipes shall be in accordance with "Product certification schemes" in Section 11 of GC 101 [Ref 31.N].

Product requirements for cast and ductile iron drainage pipes

1.18 Cast iron drainage pipes shall be compliant with BS 437 [Ref 59.N].

1.19 The cast iron drainage pipes shall meet the performance characteristics as stated in table 1.19

Table 1.19 Performance characteristics for cast iron pipes for drainage			
Performance characteristic	Test Standard	Required value	
Nominal Size		BS 437 [Ref 59.N]	Pas

			4.3.1	s
Dimensional tolerances of external diameter		BS 437 [Ref 59.N] Annex A.2	BS 437 [Ref 59.N] 4.3.2 and Table 1	Pas s
Dimensional tolerances of internal diameter		BS 437 [Ref 59.N]Annex A.3	BS 437 [Ref 59.N] 4.3.3	Pas s
Wall thickness		BS 437 [Ref 59.N] Annex A.4	BS 437 [Ref 59.N] 4.3.4, and Table 1	Pas s
Socket dimensions for rigid joints		BS 437 [Ref 59.N] Annex A.5	BS 437 [Ref 59.N] 4.3.5 and Table 2	Pas s
Straightness of pipes		BS 437 [Ref 59.N] Annex A.6	BS 437 [Ref 59.N] 4.3.6	Pas s
End faces		BS 437 [Ref 59.N] Annex A.7	BS 437 [Ref 59.N] 4.3.7	Pas s
Length of pipes		BS 437 [Ref 59.N] Annex A.8	BS 437 [Ref 59.N] 4.3.8	Pas s
Length of fittings and sealing zones/socket depths			BS 437 [Ref 59.N] 4.3.9 and Table 3	Pas s
Angle of fittings			BS 437 [Ref 59.N]4.3.10	Pas s
Access components and traps			BS 437 [Ref 59.N] 4.3.11	Pas s
Mass		BS 437 [Ref 59.N] Annex A.9	BS 437 [Ref 59.N] 4.4	Pas s
Material characteristics of pipes and fittings	Crushing Test	BS 437 [Ref 59.N]Annex A.10	BS 437 [Ref 59.N] 4.5 and Table 4	Pas s
Coatings for pipes, fittings and couplings			BS 437 [Ref 59.N] 4.6	
Joints			BS 437 [Ref 59.N] 4.7	
Marking			BS 437 [Ref 59.N] 4.8	
Flexible Joints		BS 437 [Ref 59.N] 5.2	BS 437 [Ref 59.N] 5	

1.20 The requirements for cast iron drainage pipes shall be in accordance with "Product certification schemes" in Section 11 of GC 101 [Ref 31.N].

1.21 Ductile iron drainage pipes shall be compliant with BS EN 598 [Ref 24.N].

1.22 The ductile iron pipes shall meet the performance characteristics as stated in table 1.22

Table 1.22 Performance characteristics for ductile iron pipes for drainage

Performance characteristic	Required value	
Dimension tolerances (on external diameter DE for	BS EN 598 [Ref	Pass

compatibility purposes)		24.N] 4.2.2.1	
Internal pressure strength (tensile strength)		BS EN 598 [Ref 24.N] 4.3 and Table 3	
Impact resistance	Tensile properties	BS EN 598 [Ref 24.N] 4.3.1 and Table 3	
	Hardness	BS EN 598 [Ref 24.N] 4.3.2	
Longitudinal bending strength	Longitudinal bending of pipes	BS EN 598 [Ref 24.N] 5.2	Pass
Maximum load for admissible deformation	Diametrical Stiffness of pipes	BS EN 598 [Ref 24.N] 5.3	Pass
Tightness : gas and liquid	Leaktightness of joints	BS EN 598 [Ref 24.N] 5.5	
	Internal Pressure		
	Vacuum		
	External pressure		
	Cyclic pressure		
Durability	External coating for pipes - Zinc Coating	BS EN 598 [Ref 24.N] 4.4.1, 4.4.2	
	External coating for pipes - Alternative coating	BS EN 598 [Ref 24.N] 4.4.1, Annex B, B.1	
	External coatings for fittings - Epoxy	BS EN 598 [Ref 24.N]4.5.1, 4.5.2	
	Internal lining for pipes and fittings - Chemical resistance to effluents	BS EN 598 [Ref 24.N] 5.8	Pass
	Internal lining for pipes and fittings - Abrasion resistance	BS EN 598 [Ref 24.N] 5.9	Pass

1.23 The requirements for ductile iron drainage pipes shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Product requirements for thermoplastic drainage pipes

1.24 Thermoplastic drainage pipes shall be as specified in CC 500/WSR/001.

Thermoplastic drainage pipes					
Thermoplastic drainage pipe reference	**Drainage pipe stiffness class**	**Thermoplastic structured wall drainage pipe type**	**Creep ratio**	**Drainage pipe impact resistance**	**Thermoplastic structured wall pipe material**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter a number in units of kN/m^2, to identify the thermoplastic structured wall pipe stiffness class.

c) Enter a value, from options Type A, Type B, to identify the thermoplastic structured wall pipe type.

d) Enter text, to identify the creep ratio of thermoplastic pipes for drainage.

e) Enter a number in units of kN, to identify the thermoplastic pipe impact resistance.

f) Enter a value, from options PVC-U, PP, PE, to identify the thermoplastic structured wall pipe material.

1.25 Thermoplastic pipes for drainage shall be made from unplasticised polyvinyl-chloride (PVC-U), polypropylene or polyethylene.

Product requirements for thermoplastic solid wall drainage pipes

1.26 Thermoplastic solid wall PVC-U drainage pipes shall be compliant with BS EN 1401-1 [Ref 48.N].

1.27 The PVC-U drainage pipes shall meet the following performance characteristics: The grade appropriate for use without structural calculations SN4 (SDR 41).

1.28 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to PVC-U drainage pipes.

1.29 Thermoplastic solid wall polypropylene drainage pipes shall be compliant with BS EN 1852-1 [Ref 51.N].

1.30 The polypropylene drainage pipes shall meet the following performance characteristics: The grade appropriate for use without structural calculations SN8.

1.31 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to polypropylene drainage pipes.

1.32 Thermoplastic solid wall polyethylene drainage pipes shall be compliant with BS EN 12666-1 [Ref 50.N].

1.33 The polyethylene drainage pipes shall meet the following performance characteristics: The grade appropriate for use without structural calculations SN8.

1.34 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to polyethylene drainage pipes.

Product requirements for thermoplastic structured wall drainage pipes

1.35 Thermoplastics structured wall drainage pipes and fittings shall be compliant with BS EN 13476-1 [Ref 52.N].

1.36 The thermoplastics structured wall drainage pipes and fittings shall meet the performance characteristics as stated in table 1.36a and 1.36b.

Table 1.36a Performance characteristics for thermoplastic structured wall pipes

Performance characteristic	Test standard	Required value
Diameter tolerance		BS EN 13476-2 [Ref 53.N] BS EN 13476-3 [Ref 54.N]7.2
Ring stiffness		Minimum of 6 kN/m^2. Lower ring ring stiffness values are permitted if calculations in accordance with BS EN 1295-1 [Ref 69.N] (UK National Annex) demonstrate achievement of required performance level.
Ring flexibility		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14
Resistance to water jetting	WRc Jetting Test Method	Minimum acceptable failure pressure of 137 bar
Longitudinal bending	CD 533 [Ref 21.N]	Pipes with nominal diameters ≤ 350mm to have a difference in dimensions when measured in the vertical axis of less than 5% of the pipe length and no local permanent deformation occurs during the test.
Impact resistance at 0°C		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14
Impact		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref

resistance at 23°C		53.N]Table 14
Rodding resistance	CD 533 [Ref 21.N]	Rodding resistance for pipes less than 350mm diameter to achieve an average failure energy greater than 3 joules.
Tensile strength of a seam		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14

Table 1.36b Performance characteristics for thermoplastic structured wall pipe fittings

Performance characteristic	Test standard	Required value
Diameter tolerance		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]7.2
Ring stiffness (excluding couplers)		Minimum of 6 kN/m^2
Rodding resistance	CD 533 [Ref 21.N]	Fittings with nominal diameters ≤ 350 mm to have an average failure energy >3 joules
Strength and flexibility of fabricated fixings		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N] (Table 16 requirements)
Watertightness of fabricated fittings		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]BS EN 13476 (Table 17 requirements)

1.37 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to thermoplastic structured wall pipes and fittings.

1.38 The external layer of the thermoplastic structured wall pipes and fitting for drainage shall be coloured either terracotta or black throughout.

Product requirements for thermoplastic land drains

1.39 Thermoplastic pipe and fittings for land drains shall be compliant with BS 4962 [Ref 62.N].

1.40 The thermoplastic pipe and fittings for land drains shall meet the performance characteristics as stated in table 1.40

Table 1.40 Performance characteristics for thermoplastic pipe and fittings for land drains

Performance characteristic	Required value	
Dimensional tolerance	BS 4962 [Ref 62.N] 4	Pass
Specific tangential end stiffness	BS 4962 [Ref 62.N] 5.1	Pass

Ring stiffness	BS 4962 [Ref 62.N] 5.2	Pass
Impact resistance	BS 4962 [Ref 62.N] 6	Pass
Flexibility of coilable pipe and associated joints	BS 4962 [Ref 62.N] 7	Pass
Extensibility of coilable pipe and associated joints	BS 4962 [Ref 62.N] 8	Pass
Fittings for joints and junctions	BS 4962 [Ref 62.N] 9	Pass

1.41 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to thermoplastic pipe and fittings for land drains.

Product requirements for thermoplastic filter drains

1.42 Filter drains made from PVC-U, polypropylene and polyethylene shall be perforated with not less than 1000mm^2 of holes per metre length of pipe.

1.43 The perforations in filter drains made from PVC-U, polypropylene and polyethylene shall not reduce the pipe stiffness by more than 5%.

1.44 The perforations in filter drains made from PVC-U, polypropylene and polyethylene shall be circular not greater than 10mm nor less than 3mm in diameter or rectangular slots not greater than 4mm nor less than 0.6mm in width.

1.45 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to thermoplastic pipes for filter drains.

Product requirements for corrugated steel drainage pipes

1.46 Where corrugated steel pipes are manufactured from galvanised steel sheet for lock seam fabrication, they shall be compliant with BS EN 10346 [Ref 15.N].

1.47 The corrugated steel pipes are manufactured from galvanised steel sheet shall meet the following performance characteristics: grade DX51D + Z600, minimum thickness 1.25mm.

1.48 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to the corrugated steel pipes are manufactured from galvanised steel sheet.

1.49 Where corrugated steel pipes are manufactured from aluminium coated steel sheet, they shall be compliant with AASHTO M274 [Ref 66.N].

Contractor design requirements for corrugated steel drainage pipes

1.50 Corrugated steel drainage pipes shall be contractor design items.

1.51 The corrugated steel drainage pipes to be contractor design shall be as specified in CC 500/WSR/001.

The corrugated steel drainage pipes to be contractor design			
Corrugated steel drainage pipe reference	**Design life**	**Shape**	**maximum design load**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the pipe number.

b) Enter a number in units of year, to identify the design life of the corrugated steel pipe.

c) Enter text, to identify the shape of the corrugated steel pipe.

d) Enter a number in units of kN/m^2, to identify the load necessary for the corrugated steel pipe to accommodate.

1.52 The design of corrugated steel drainage pipes shall be in accordance with CG 501 [Ref 19.N].

1.53 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 31.N] shall apply to corrugated steel pipes.

1.54 Corrugated steel pipes shall be installed accordance with the manufacturer's requirements.

Product requirements for excavation for drainage pipes

1.55 Backfill material to replace unsuitable material shall be either Type 1 unbound subbase, pipe bedding material or concrete.

1.56 Where the backfill material to replace the unsuitable material is Type 1 unbound subbase material, it shall comply with "Unbound mixtures for pavement subbase" in Section 8 of CC 201 [Ref 47.N].

1.57 Where the backfill material to replace the unsuitable material is pipe bedding material, it shall comply with 'Product requirements for bedding and surround material for drainage pipes'.

1.58 Where the backfill material to replace the unsuitable material is concrete, it shall be GEN 1 concrete in compliance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

Product requirements for bedding and surround material for drainage pipes

1.59 For bedding type A, the concrete shall be GEN 3 in compliance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

1.60 For bedding types Z, G, J and L, the concrete shall be GEN 2 in compliance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

1.61 Materials for backfilling trenches and filter drains placed within 500mm of concrete, cement bound materials, other cementitious mixtures or stabilised capping shall comply with the requirements stated in Section 3 of CC 601 [Ref 25.N], unless otherwise stated in CC 500/WSR/001.

SI.1.61 The maximum separation distance of the materials for backfilling trenches and filter drains from concrete, cement bound materials, other cementitious mixtures or stabilised capping where the backfill material is to comply with Section 3 of CC 601 [Ref 25.N] shall be [enter a number] .

1.62 Materials for backfilling trenches and filter drains placed within 500mm of metallic structural elements shall comply with the requirements in Section 3 of CC 601 [Ref 25.N], unless otherwise stated in CC 500/WSR/001.

SI.1.62 The maximum separation distance of the materials for backfilling trenches and filter drains from metallic structural elements where the backfill material is to comply with Section 3 of CC 601 [Ref 25.N] shall be [enter a number] .

Product requirements for bedding and surround material for carrier pipes

1.63 Aggregate for pipe bedding, haunching and surrounding material shall be compliant with BS EN 13242 [Ref 2.N].

1.64 The aggregate for pipe bedding, haunching and surround material shall meet the performance characteristics as stated in table 1.64

Table 1.64 Aggregate for pipe bedding, haunching and surrounding material

	Coarse Aggregate	Fine Aggregate	All-in Aggregate
Water-soluble sulfate content	Less than 0.2% category $SS_{0.2}$		
Classification of coarse recycled aggregates	Table 12		

Resistance to fragmentation	Category LA_{50}			
Category for general grading requirements	G_c 80-20		G_F 80-20	G_A 80-20
Category for maximum values of fines content	Natural aggregate - f_2 Manufactured/recycled aggregate - f_4		Natural aggregate - f_3 Manufactured/recycled aggregate - f_4	
Nominal pipe diameter, mm	Aggregate size, mm			
	Graded	Single	Fine	All-in
Not exceeding 140	-	4/10	0/10, 0/20 or 0/40	0/10
Exceeding 140 but not exceeding 400	2/14 or 4/20	4/10, 6/14 or 10/20		0/10 or 0/20
Exceeding 400	2/14, 4/20 or 4/40	4/10, 6/14, 10/20 or 20/40		0/10, 0/20 or 0/40

1.65 The aggregate requirements for pipe bedding, haunching and surrounding material shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

1.66 Coarse aggregate shall be used for pipe bedding types F, B and S.

1.67 Fine and all-in aggregate shall be used for pipe bedding types N and T.

1.68 The Class 8 lower trench fill material placed 300mm above the pipe or bedding shall comply with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

Product requirements for bedding and surround material for filter drains

1.69 Filter drain bedding and surround product requirements shall be in accordance with 'Product requirements for backfill material for filter drains'.

Product requirements for backfill material for drainage pipes

Product requirements for backfill material for carrier pipes

1.70 The backfilling of trenches in this section shall refer to the placement of material which is additional to the pipe bedding, haunching and surround.

1.71 The backfill to pipework except for filter drains shall be with Class 1, 2 or 3 general fill material complying with "Acceptable earthwork material

classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

1.72 Where recycled coarse aggregate is used in accordance with this section it shall not contain more than 1% ‘other’ materials (Class X) having been tested in accordance with "Unbound mixtures for pavement subbase" in Section 8 of CC 201 [Ref 47.N].

Product requirements for backfill material for filter drains

1.73 Type A and type C filter material for backfill shall be compliant with BS EN 13285 [Ref 72.N].

1.74 The Type A and C filter material for backfill shall meet the performance characteristics as stated in table 1.78.

1.75 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to Type A and Type C filter material.

1.76 Type C filter material for backfill shall be as specified in CC 500/WSR/001.

Type C filter material for backfill					
Drainage pipe reference	**Size**	**Grading**	**Oversize category**	**Category for tolerances at mid-size sieves**	**Category for maximum fines**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the location of the filter drain.

b) Enter a number in units of mm, to define allowable size or sizes of material.

c) Enter text, to define requirement.

d) Enter text, to define requirement.

e) Enter text, to define requirement.

f) Enter text, to define requirement.

1.77 Type B filter material for backfill of filter drains shall be compliant with BS EN 13242 [Ref 2.N].

1.78 The Type B filter material for backfill of filter drains shall meet the performance characteristics as stated in table 1.78.

Table 1.78 Performance characteristics for filter drain material

	Type A	Type B	Type C
Standard	BS EN 13285 [Ref 72.N]	BS EN 13242 [Ref 2.N]	BS EN 13285 [Ref 72.N]
Size, mm	0/20	20/40	Refer to the WSR
Grading	G_e (with an additional sieve)	G_c 80/20	
Oversize Category	OC_{80}	-	
Category for tolerances at mid-size sieves	-	GT_{NR}	
Category for maximum fines	UF_3	F_{NR} (no requirement)	
Resistance to fragmentation	BS EN 13242 [Ref 2.N] Category LA_{50}		
Water soluble sulfate content	BS EN 13242 [Ref 2.N] Less than 0.2% Category $SS_{0.2}$		
Summary grading requirements			
Sieve size, mm	Percentage by mass passing		
80	-	100	Refer to the WSR
63	-	99 - 100	
40	100	80 - 99	
20	80 - 99	0 - 20	
10	50 - 90	0 - 5	
4	30 - 75		
2	15 - 60		
0.500	0 - 35		
0.125	0 - 4		
0.063	0 - 3		
% in size fraction			
4/10	5 - 35	-	
2/4	5 - 35	-	

1.79 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N] shall apply to the Type B filter material for backfill of filter drains.

1.80 Lightweight aggregate for filter material shall be compliant with BS EN 13055 [Ref 44.N].

1.81 The performance characteristics for lightweight aggregate for filter material shall be as specified in CC 500/WSR/001.

The performance characteristics for lightweight aggregate for filter material					
Drainage pipe reference	**Particle shape, size and density**	**Water absorption/ suction**	**Percentage of crushed particles**	**Volume stability**	**Durability against freeze/ thaw/ weathering**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to define the requirement.

c) Enter text, to define the requirement.

d) Enter text, to define the requirement.

e) Enter text, to define the requirement.

f) Enter text, to define the requirement.

The performance characteristics for lightweight aggregate for filter material (continued)			
Drainage pipe reference	**Resistance to fragmentation**	**Chloride and sulphur content**	**Cleanliness**
(a)	(g)	(h)	(i)

g) Enter text, to define the requirement.

h) Enter text, to define the requirement.

i) Enter text, to define the requirement.

1.82 The lightweight aggregate requirements for filter material shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

1.83 Subbase material used for the upper layer of filter drains shall be Type 1 in accordance with "Unbound mixtures for pavement subbase" in Section 8 of CC 201 [Ref 47.N].

Product requirements for geotextiles used within backfill for drainage pipes

1.84 The filtration/ separation geotextile used in backfill for drainage pipes shall be compliant with BS EN 13252 [Ref 32.N].

1.85 The performance characteristics for the filtration/ separation geotextile used in backfill for drainage pipes shall be as specified in CC 500/WSR/001.

The performance characteristics for the filtration/ separation geotextile used in backfill for drainage pipes							
Drainage pipe reference	**Tensile strength**	**Elongation at maximum load**	**Resistance to static puncture**	**Dynamic perforation resistance**	**Characteristic maximum pore opening size**	**Water permeability normal to the plane**	**Durability**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.

b) Enter a number in units of kN/m, to define the tensile strength of the geotextile.

c) Enter a number in units of %, to define the elongation at maximum load of the geotextile.

d) Enter a number in units of N, to define the resistance to static puncture of the geotextile.

e) Enter a number in units of mm, to define the requirement for dynamic perforation resistance.

f) Enter a number in units of um, to define the requirement for the characteristic maximum pore opening size of the geotextile.

g) Enter text, to define the requirement for water permeability normal to the plane.

h) Enter text, to define the durability requirement.

The performance characteristics for the filtration/ separation geotextile used in backfill for drainage pipes (continued)	
Drainage pipe reference	**Dangerous substances**
(a)	(i)

i) Enter text, to define the requirement.

1.86 The requirements for the filtration/ separation geotextile shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Product requirements for the connection to existing drainage assets

1.87 The existing drains to be extended, connected and jointed to new drains and channels shall be as set out in CC 500/WSR/001.

The existing drains to be extended, connected and jointed to new drains and channels					
Connection Reference	**Drawing or model reference**	**Connection Type**	**Special Connecting Pipe**	**Responsible Authority**	**Notice Period**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter one or more values, from options pipe, channel, chamber, to identify the type of works.

d) Enter text, to identify where one is required.

e) Enter text, to identify whose drainage system to which the connection is to be made.

f) Enter a number in units of d, to advise the notice period required by the Responsible Authority.

Product requirements for drainage pipes to be abandoned

1.88 Drainage pipes /drains to be abandoned shall be as described in CC 500/WSR/001.

Drainage pipes /drains to be abandoned			
Asset reference of drainage pipes/ drains	**Drawing or model reference**	**Asset type**	**Type of Abandonment**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter text, to identify the asset type.

d) Enter a value, from options seal with concrete, remove and replace with general fill material, seal with grout or other material of equivalent performance, to identify type of abandonment required.

1.89 Concrete used to seal abandoned assets shall be GEN 2 concrete in compliance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

1.90 General fill material used to seal abandoned assets shall comply with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

1.91 Grout used to seal abandoned assets shall be a 1:10 cement: fly ash mix, unless otherwise stated in CC 500/WSR/001.

SI.1.91 The alternative grout material used to seal abandoned assets shall be [enter free text].

1.92 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to the alternative grout material used to seal abandoned assets.

1.93 The sealing grout shall be installed in accordance with the manufacturer’s instructions.

1.94 The cement in the sealing grout shall be compliant with BS EN 197-1 [Ref 3.N].

1.95 The cement in the sealing grout shall meet the following performance characteristics: cement type, standard strength class,sulfate resistance.

SI.1.95a The cement type of the cement in the sealing grout shall be [select one from: CEM I, CEM II, CEM III, CEM IV, CEM V].

SI.1.95b The standard strength class of the cement in the sealing grout shall be [select one from: 32.5, 42.5, 52.5].

SI.1.95c The sulfate resistance of the cement in the sealing grout shall be [select one or more from: CEM I-SR 0,CEM I-SR 3,CEM I-SR 5,CEM III/B-SR,CEM III/C-SR,CEM IV/A-SR,CEM IV/B-SR] where sulfate resistance is required.

1.96 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N] shall apply to the cement.

1.97 The fly ash in the sealing grout shall be compliant with BS EN 450-1 [Ref 28.N].

1.98 The fly ash shall meet the following performance characteristics: fineness to be Zone B, sulfate content not exceeding 1.5%.

1.99 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N] shall apply to the fly ash.

Product verification for the bedding, surround and backfill material for drainage pipes

1.100 Verification shall be undertaken for characteristics of pipe bedding, surround and filter drain backfill material by sampling and undertaking compliance testing detailed in table 1.103.

1.101 The frequency of sampling and testing for characteristics of pipe bedding, surround and filter drain backfill material shall be as detailed in table 1.103.

1.102 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to sampling and testing for characteristics of pipe bedding, surround and filter drain backfill material.

1.103 Verification for characteristics of pipe bedding, surround and filter drain backfill material as detailed in table 1.103 shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 31.N].

Table 1.103 Compliance testing required for characteristics of pipe bedding, surround and filter drain backfill material

Characteristic of material	Material	Testing criteria	Frequency of testing	Further requirements
Grading	pipe bedding, surround and filter drain backfill	test method as stated in BS EN 13285 [Ref 72.N]	1 per 100 tonnes	laboratory certificate required
Plastic index	filter drain backfill	test method as stated in BS EN 13242 [Ref 2.N]	1 per source	
Resistance to fragmentation	pipe bedding, surround and filter drain backfill	test method as stated in BS EN 13242 [Ref 2.N]	1 per source	
Water-soluble sulfate content	pipe bedding, surround and filter drain	test method as stated in BS EN 13242 [Ref 2.N]	5 per source	

	backfill			
Oxidisable sulfides content and total potential sulfate content	pipe bedding, surround and filter drain backfill	test method as stated in BS EN 13242 [Ref 2.N]	5 per source	
Permeability	filter drain backfill	test method as stated in BS EN 13285 [Ref 72.N]	1 per source	
Classification of coarse recycled aggregates	pipe bedding, surround and filter drain backfill	test method as stated in BS EN 933-11 [Ref 71.N]	’1 per source	
		test method in accordance with the ‘Quality Protocol for the production of aggregates from inert waste’ and the ‘Producers’ compliance checklist’ published by Waste and Resources Action Programme (WRAP)	As required by the ‘Quality Protocol for the production of aggregates from inert waste'	

Installation requirements for the excavation for drainage pipes

1.104 Excavation for pipes for drainage shall comply with "General earthworks construction" in Section 5 of CC 601 [Ref 25.N].

1.105 Pockets of soft soil, with an undrained shear strength of less than 50kPa, or loose rock at the bottom of all excavations shall be removed.

1.106 Where pockets of soft soil with an undrained shear strength of less than 50kPa are present, this unsuitable material shall be excavated and replaced with backfill material as stated in 'Product requirements for excavation for drainage pipes'.

Installation requirements for drainage pipes

1.107 The deviation in the pipe invert levels from those specified at any point shall not exceed 20mm.

1.108 The algebraic difference of the deviation in level at any two points on each pipe shall not exceed 30mm.

1.109 Drainage pipes shall be installed in accordance with the manufacturer's instructions.

1.110 Drainage pipes shall be laid to the levels shown on the drainage drawings and schedules.

1.111 Subsoil field drainage pipes which are corrugated coilable perforated pipes shall be laid only by automatic single pass drain laying machines.

1.112 Joints in PVC-U drainage pipes shall not be made with plastic solvent.

1.113 Jointing for drainage pipes up to and including 900mm internal diameter shall be as specified in CC 500/WSR/001.

Jointing for drainage pipes up to and including 900mm internal diameter					
drainage pipe reference	**drawing or model reference**	**jointing requirement**	**air test**	**partly watertight joint test**	**rigid joint permitted**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter a value, from options watertight, partly watertight, not watertight, to identify the jointing requirements for the pipes for drainage.

d) Enter a value, from options yes, no, to identify if the pipe requires an air test.

e) Enter a value, from options yes, no, to identify if the pipe requires a partly watertight joint test.

f) Enter a value, from options yes, no, to identify if a rigid joint is permitted.

1.114 Where the watertight joints are unable to pass the air test, the pipeline shall be tested by a water test.

1.115 Push fit joints shall have a register to ensure that the pipe is fully pushed into the joint.

1.116 The use of flexible joints and the maximum length of pipe between flexible joints shall be as stated in CC 500/WSR/001.

SI.1.116 The maximum length of pipes between flexible joints shall be [enter a number] .

1.117 All drainage pipes on bridge structures shall be watertight and have sealed joints.

1.118 Non thermoplastic perforated pipes shall be jointed as unperforated pipes of the same material.

1.119 Rigid joints shall mean joints made solid by caulking the sockets, or bolting together flanges integral with the pipes.

1.120 Flexible joints shall mean joints made with deformable rings or gaskets held between pipe spigots and sockets, sleeves or collars.

1.121 Spigots and sockets of rigid joints shall be jointed in line with the manufacturer's requirements and the socket caulked with mortar.

1.122 The caulking mortar placed around the socket extending for a length of not less than 50mm from the face of the socket shall comply with "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

1.123 Joint filler board shall be used with rigid pipes at flexible joints where there is a concrete bed, cradle, arch or surround.

1.124 The joint filler board to be used at flexible joints where there is a concrete bed, cradle, arch or surround shall comply with "Filler board for concrete pavements" in Section 14 of CC 203 [Ref 57.N].

1.125 Filter drains shall be laid with slots or perforations upwards where a concrete bed is used.

1.126 The orientation of the slots or perforations for filter drains on non-concrete beds shall be as stated in CC 500/WSR/001.

SI.1.126 The orientation of the slots or perforations shall be [enter free text].

1.127 Corrugated steel pipes of lock seam fabrication, not exceeding 900mm internal diameter shall be joined in accordance with the manufacturer’s instructions.

1.128 Bolted segmental plate pipe arches or circular pipes, not exceeding 900mm internal diameter shall be joined in accordance with the manufacturer’s instructions.

Installation requirements for the backfill for drainage pipes

1.129 The topsoil thickness on the line of the backfilled trench shall be as stated in CC 500/WSR/001.

SI.1.129 The thickness of the topsoil on the line of the trench shall be [enter free text].

1.130 The top of the backfill at areas where the trenches are in carriageways or other paved areas shall be to formation level or sub-formation level where capping is required.

Installation requirements for the connection to existing drainage assets

1.131 Before entering or breaking into an existing drainage asset, the authority responsible for the drainage system shall be informed.

1.132 Connections made to existing drainage assets shall be made during the construction of the new drainage asset.

1.133 Where pipe connections are made to existing brick concrete or stone drains, chambers or channels, the pipes shall be placed as to discharge at an angle not greater than 60° to the direction of flow.

Verification requirements for the installation of drainage pipes

Air test for drainage pipes

1.134 Verification shall be undertaken for watertight joints on a pipeline using an air test.

1.135 The frequency of using an air test shall be once for each pipe run excluding filter drains.

1.136 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to using an air test.

1.137 A pipeline shall be deemed to have passed the air test if the head of water does not drop from 100mm to less than 75mm in a 5 minute period.

1.138 A pipeline with traps shall be deemed to have passed the air test if the head of water does not drop from 50mm to less than 37mm in a 5 minute period.

1.139 Air testing in pipes shall be compliant with BS EN 1610 [Ref 14.N].

Water test for drainage pipes

1.140 Verification shall be undertaken for watertight joints on a pipeline where the air test has failed using a water test.

1.141 The frequency of using a water test shall be once for each pipe run that has failed an air test.

1.142 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to using a water test.

1.143 A pipeline shall be deemed to have passed the water test if the water added to maintain the 1.2m head of water above the crown of the upper end of the pipeline for 30 minutes does not exceed 1 litre per hour per linear metre of drain per metre of nominal internal diameter, (e.g. 27 l/hr for a 90m long pipeline of 0.3m diameter).

1.144 The difference in level between the upper and lower ends of the pipeline being tested shall not exceed 6m.

1.145 Water tests for drainage pipes shall be compliant with BS EN 1610 [Ref 14.N].

Partly watertight joints for drainage pipes

1.146 Verification shall be undertaken for partly watertight joints on a pipeline using a partly watertight joint test.

1.147 The frequency of using a partly watertight joint test shall be once for each pipe run.

1.148 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to using a partly watertight joint test.

1.149 Partly watertight joints for pipelines up to and including 900mm diameter shall be tested with a head of water kept level with the crown of the pipe.

1.150 The joint shall not be accepted if the flow through the joint in litres per minute exceeds 20 times the square of the nominal internal diameter of the pipe in metres.

1.151 The test for partly watertight joints shall be carried out before the pipe is laid because the water escaping from the joint has to be measured.

Testing of drainage pipes

1.152 The testing of pipelines shall be as described in CC 500/WSR/001.

The testing of pipelines			
Asset reference for drainage pipes	**Drawing or model reference**	**Asset type**	**Testing requirement**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter a value, from options carrier drain, filter drain, to define the asset type.

d) Enter one or more values, from options CCTV survey, mandrel, none, to define the testing requirements.

1.153 The Closed Circuit Television (CCTV) survey shall be compliant with CS 551 [Ref 23.N].

Documentation requirements for drainage pipe products

Product documentation for the bedding, surround and backfill for drainage pipes

1.154 The following Documentation shall be submitted for pipe bedding, surround and backfill material test results prior to the commencement of installation: test results certificates.

1.155 The requirements for "Documentation" in Section 2 of GC 101 [Ref 31.N] shall apply to pipe bedding, surround backfill material test results.

Documentation requirements for installation of drainage pipes

Documentation for the cleaning of drainage pipes

1.156 On completion of the whole of the works, all chambers, catchpits, gullies and drains including verge/surface water drains and filter drains but excluding all fin and narrow filter drains shall be flushed from end to end with water and left free from obstructions and silt.

1.157 The following Documentation shall be submitted for the cleaning of drainage pipes prior to the commencement of scheme handover: cleaning records.

Documentation for the air testing and water testing

1.158 The following Documentation shall be submitted for air testing and water testing prior to the commencement of scheme handover: test results certificates.

Documentation for the connection to existing drains

1.159 The following Documentation shall be submitted for the connection to an existing drainage system prior to the commencement of scheme handover: Schedule showing a record of connections.

2. Service ducts

Product requirements for service ducts

2.1 Service ducts shall be as specified in CC 500/WSR/002.

Service ducts							
Service duct reference	**Drawing or model reference**	**Service duct colour**	**Service duct internal diameter**	**Chamber number start**	**Chamber number end**	**Service duct length**	**Service duct cover depth start**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.

b) Enter a number, to identify the drawing/ model where this is shown.

c) Enter text, to identify the colour of the service duct.

d) Enter a number in units of mm, to identify the internal service duct pipe diameter (usually this is 100mm).

e) Enter text, to identify the chamber number at the start of the service duct run (for increasing road chainage).

f) Enter text, to identify the chamber number at the end of the service duct run (for increasing road chainage).

g) Enter a number in units of m, to identify the service duct length between the start and end chambers for that specific duct run.

h) Enter a number in units of mm, to identify the depth of the service duct at the start chamber for the specific duct run (for increasing road chainage).

Service ducts (continued)			
Service duct reference	**Service duct cover depth end**	**Service duct material**	**Water tight joints**
(a)	(i)	(j)	(k)

i) Enter a number in units of mm, to identify the depth of the service duct at the end chamber for the specific duct run (for increasing road chainage).

j) Enter one or more values, from options vitrified clay, ductile iron, GRP, thermoplastic solid wall, thermoplastic single wall, thermoplastic structured wall, other, to identify the service duct pipe material.

k) Enter a value, from options water tight, not water tight, to identify if the service duct needs to be water tight.

2.2 Service ducts shall be terminated within a chamber.

Product requirements for vitrified clay service ducts

2.3 Vitrified clay pipes used for service ducts shall be compliant with BS EN 295-1 [Ref 73.N].

2.4 The vitrified clay pipes used for service ducts shall meet the performance characteristics as stated in table 1.7.

2.5 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N] shall apply to vitrified clay pipes used for service ducts.

2.6 Vitrified clay pipes used for service ducts shall be plain-ended, self aligning flexible sleeve jointed with internal ends a radius of 3mm minimum.

Product requirements for ductile iron service ducts

2.7 Ductile iron service ducts shall be compliant with BS EN 598 [Ref 24.N].

2.8 The ductile iron service ducts shall meet the performance characteristics as stated in table 1.22.

2.9 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N] shall apply to ductile iron service ducts.

Product requirements for glass reinforced plastic (GRP) service ducts

2.10 GRP service ducts shall be as specified in CC 500/WSR/002.

GRP service ducts	
Service duct number	**Pipe classification for GRP service ducts nominal stiffness**
(a)	(b)

a) Enter a unique reference.

b) Enter a value, from options 1250 N/m^2, 2500 N/m^2, 5000 N/m^2, 10000 N/m^2, to identify the nominal stiffness of GRP service ducts.

2.11 GRP service ducts shall be compliant with BS EN ISO 23856 [Ref 55.N].

2.12 The GRP service ducts shall meet the performance characteristics as stated in table 1.16.

2.13 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to GRP service ducts.

Product requirements for thermoplastic service ducts

2.14 Thermoplastic service ducts shall be as specified in CC 500/WSR/002.

Thermoplastic service ducts	
Service duct number	**Resistance to bending requirements**
(a)	(b)

a) Enter a unique reference.

b) Enter text, to identify the resistance to bending requirements.

2.15 Thermoplastic service ducts joints shall be compliant with BS EN 13598-1 [Ref 49.N].

2.16 The watertightness of the joints shall meet the following performance characteristics: no leakage.

Product requirements for thermoplastic solid wall service ducts

2.17 Thermoplastic solid wall pipes for ducts shall be made from unplasticised polyvinyl-chloride (PVC-U), polypropylene or polyethylene.

2.18 PVC-U solid wall service ducts shall be compliant with BS EN 1401-1 [Ref 48.N]or BS 3506 [Ref 64.N].

2.19 The PVC-U solid wall service ducts shall meet the following performance characteristics: For BS EN 1401-1 [Ref 48.N] Grade SN4 (SDR 41); for BS 3506 [Ref 64.N] Class C.

2.20 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to PVC-U solid wall service ducts.

2.21 Polypropylene solid wall service ducts shall be compliant with BS EN 1852-1 [Ref 51.N].

2.22 The polypropylene solid wall service ducts shall meet the following performance characteristics: The grade for use without structural calculations SN8.

2.23 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to polypropylene solid wall service ducts.

2.24 Polyethylene solid wall service ducts shall be compliant with BS EN 12666-1 [Ref 50.N].

2.25 The polyethylene solid wall service ducts shall meet the following performance characteristics: The grade for use without structural calculations SN8.

2.26 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to polyethylene solid wall service ducts.

Product requirements for thermoplastic single wall service ducts

2.27 Thermoplastic single wall service ducts shall be compliant with BS EN 61386-24 [Ref 13.N].

2.28 The thermoplastic single wall service ducts shall meet the following performance characteristics: classified as normal duty, corrugated, have a degree of protection against ingress of foreign objects classification rating of 3 or 4 and a degree of protection against ingress of water classification rating of 7.

2.29 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to thermoplastic single wall service ducts.

2.30 Thermoplastic single wall service ducts shall be restricted to ducts buried a minimum of 600mm below the surface.

Product requirements for thermoplastic structured wall service ducts

2.31 Thermoplastic structured wall pipes for service ducts shall be compliant with BS EN 61386-24 [Ref 13.N].

2.32 The thermoplastic structured wall pipes for service ducts shall meet the following performance characteristics: classified as normal duty, corrugated, have a degree of protection against ingress of foreign objects classification rating of 3 or 4 and a degree of protection against ingress of water classification rating of 7.

2.33 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to thermoplastic structured wall pipes for service ducts.

Product requirements for other materials used for service ducts

2.34 Other materials used for service ducts shall be permitted provided they hold current Product Acceptance Scheme Certification stating that they are a suitable alternative.

2.35 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to other materials used for service ducts.

Product requirements for the bedding, surround and backfill for service ducts

2.36 Service ducts bedding and surround shall be as specified in CC 500/WSR/002.

Service ducts bedding and surround						
Service duct number	**Drawing or model reference**	**Service duct bedding and surround material**	**Service duct bedding thickness**	**Service duct surround and cover thickness**	**Service duct backfill material**	**Service duct trench surfacing material**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter a number, to identify the drawing/ model where this is shown.

c) Enter text, to identify the granular bedding material around the pipe.

d) Enter a number in units of mm, to identify the thickness of the granular bedding material (from bottom of trench to the underside of the pipe).

e) Enter a number in units of mm, to identify the material to surround and cover the pipe.

f) Enter text, to identify the pipe backfill material within the trench.

g) Enter text, to identify the surfacing material to the trench.

2.37 Service ducts bedding, surround, backfill and surfacing material shall comply with 'Communication cable duct trenches' in "Ducts for roadside technology and communications" in Section 15 of TC 131 [Ref 58.N].

Installation requirements for service ducts

2.38 The end of service ducts shall have no sharp edges.

2.39 Pipes for ducts shall be jointed so that no silt, grit, grout or concrete surround is able to enter the duct.

2.40 Pipes for ducts with push-fit joints shall have a register to ensure that the pipe is fully pushed into the joint.

2.41 The internal bore of pipes for service ducts shall be smooth.

2.42 Each service duct shall be fitted with a pigmented, rot-proof material draw rope of 5kN breaking load.

2.43 The draw rope fitted to each service duct shall have a minimum design life of 60 years.

Installation verification for service ducts

2.44 Testing for service ducts shall be in accordance with 'Testing of communication cable ducts' "Ducts for roadside technology and communications" in Section 15 of TC 131 [Ref 58.N].

Installation documentation for service ducts

2.45 Documentation for the testing of service ducts shall be in accordance with 'Test documentation for communications cable ducts' in "Ducts for roadside technology and communications" in Section 15 of TC 131 [Ref 58.N].

3. Chambers for drainage pipes

Product requirements for new chambers for drainage pipes

3.1 General requirements for new chambers for drainage pipes shall be as specified in CC 500/WSR/003.

General requirements for new chambers for drainage pipes						
Chamber reference	**Drawing/ model number of chamber**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**Chamber cover level**	**Incoming pipe(s)**	**Incoming pipe(s) diameter**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter text, to identify the drawing reference for the chamber.

c) Enter text, to identify the location of the chamber.

d) Enter text, to identify the location of the chamber.

e) Enter a number in units of m, to identify the chamber cover level.

f) Enter text, to identify the unique reference of incoming pipe(s) connecting to the chamber.

g) Enter a number in units of mm, to identify the internal diameter of all incoming pipes connecting to the chamber.

General requirements for new chambers for drainage pipes (continued)				
Chamber reference	**Incoming pipe(s) invert level**	**Outgoing pipe(s)**	**Outgoing pipe(s) diameter**	**Outgoing pipe(s) invert level**
(a)	(h)	(i)	(j)	(k)

h) Enter a number in units of m, to identify the invert level of the incoming pipe(s).

i) Enter text, to identify the unique reference of out going pipe(s) connecting to the chamber.

j) Enter a number in units of mm, to identify the internal diameter of all outgoing pipes connecting to the chamber.

k) Enter a number in units of m, to identify the invert level of the outgoing pipe(s).

3.2 New chamber for drainage pipe type and size shall be as specified in CC 500/WSR/003.

New chamber for drainage pipe type and size					
New chamber number	**Chamber type**	**Chamber material**	**Chamber dimensions**	**Chamber opening size**	**Landing width**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the chamber type.

c) Enter text, to identify the chamber material.

d) Enter text, to identify the internal chamber length and width (if rectangular) or the internal chamber diameter (if circular).

e) Enter text, to identify the chamber opening size.

f) Enter a number in units of mm, to identify the landing with as defined in CD 536 [Ref 4.N].

New chamber for drainage pipe type and size (continued)			
New chamber number	**Reinforcement for in-situ concrete cover slab**	**Particular requirements**	**Design chemical class of concrete**
(a)	(g)	(h)	(i)

g) Enter text, to identify the chamber reinforcement for in-situ types 1, 9 and 10 chambers only.

h) Enter text, to identify any particular requirements, for example flow controls.

i) Enter text, to identify the DC-class of concrete in the concrete chambers for drainage pipes.

3.3 All GEN concrete referred to in this Section shall be designated GEN concrete complying with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

3.4 Chambers for use in highway communications installations shall comply with "Chambers for roadside technology and communications" in Section 14 of TC 131 [Ref 58.N].

3.5 Cast in-situ concrete chambers shall be constructed of minimum strength GEN 3 concrete.

3.6 Cast in-situ concrete cover slabs shall be constructed of minimum strength C32/40 concrete complying with "Pavement quality concrete" in Section 7 of CC 203 [Ref 57.N].

3.7 Precast concrete chambers shall be compliant with BS EN 1917 [Ref 7.N].

3.8 The precast concrete chambers shall meet the performance characteristics as stated in table 3.8

Table 3.8 Performance characteristics for precast concrete chambers

Performance characteristic	Required value	
Opening size	BS EN 1917 [Ref 7.N], 4.3.3.5 and the WSR	
Mechanical resistance	BS EN 1917 [Ref 7.N], 4.2.2, 4.3.5, 4.3.6, 5.2.4 and 5.2.6; BS 5911-3 [Ref 9.N], 5.5 and 6.2	
Load bearing capacity of any installed steps	BS EN 1917 [Ref 7.N], 4.3.7	
Watertightness	BS EN 1917 [Ref 7.N], 4.3.8; BS 5911-3 [Ref 9.N], 5.6	No leakage
Durability	BS EN 1917 [Ref 7.N], 4.3.10	Relevant to specified serviceability conditions

3.9 The requirements for precast concrete chambers shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

3.10 Corrugated galvanized steel chambers shall comply with 'Product requirements for corrugated steel pipes' in "Drainage pipes" in Section 1 of this document.

3.11 The inverts for corrugated galvanized steel chambers shall be in-situ GEN 3 concrete.

3.12 Corrugated galvanized steel chambers shall have precast concrete cover slabs.

3.13 Reinforcement within chambers shall have a minimum of 40mm cover.

3.14 Reinforcement within chambers shall comply with "Steel reinforcement for structural concrete" in Section 4 of CC 482 [Ref 68.N].

3.15 Type 1, Type 9 and Type 10 chamber walls shall be as specified in CC 500/WSR/003.

Type 1, Type 9 and Type 10 chamber walls	
Chamber number	**Chamber walls**
(a)	(b)

a) Enter a unique reference.

b) Enter one or more values, from options Class B clay engineering bricks with mortar, in-situ concrete, to identify the chamber wall construction type.

3.16 The concrete apron for the Type 7 chamber shall be cast in-situ with GEN 3 concrete.

3.17 The Type 8 chamber base shall be as specified in CC 500/WSR/003.

The Type 8 chamber base	
Chamber number	**Chamber base type**
(a)	(b)

a) Enter a unique reference.

b) Enter a value, from options 100mm thick precast concrete base unit, 150mm in-situ concrete, purpose made plastic, to identify the chamber base type.

3.18 Pipe material for Type 8 chambers shall be as specified in CC 500/WSR/003.

Pipe material for Type 8 chambers	
Chamber number	**Pipe material**
(a)	(b)

a) Enter a unique reference.

b) Enter one or more values, from options vitrified clay, precast concrete, PVC-U, purpose made plastic with pre-fitted gully top, to identify the pipe material used for the shaft of a Type 8 chamber.

3.19 The pipe material used for the shaft of a Type 8 chamber shall comply with the material requirements in "Drainage pipes" in Section 1 of this document.

3.20 Where purpose made plastics upper shaft sections are used, they shall be surrounded with GEN 3 concrete to the extents of the cover slab above.

3.21 Purpose made plastic material used in Type 8 chambers shall comply with 'Thermoplastic pipes for drainage product requirements' in "Drainage pipes" in Section 1 of this document.

3.22 The outgoing pipe(s) within a Type 8 chamber shall have a sealed joint between the outside of the pipe and the chamber wall.

3.23 The geotextile barrier around the underside of the Type 8 chamber cover slab shall be compliant with BS EN 13252 [Ref 32.N].

3.24 The performance characteristics for the geotextile barrier used around the underside of the Type 8 chamber cover slab shall be as specified in CC 500/WSR/003.

The performance characteristics for the geotextile barrier used around the underside of the Type 8 chamber cover slab							
Chamber reference	**Tensile strength**	**Elongation at maximum load**	**Resistance to static puncture**	**Dynamic perforation resistance**	**Characteristic maximum pore opening size**	**Water permeability normal to the plane**	**Durability**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference, to identify the chamber reference.

b) Enter a number in units of kN/m, to define the tensile strength of the geotextile.

c) Enter a number in units of %, to define the elongation at maximum load of the geotextile.

d) Enter a number in units of N, to define the resistance to static puncture of the geotextile.

e) Enter a number in units of mm, to define the requirement for dynamic perforation resistance.

f) Enter a number in units of um, to define the requirement for the characteristic maximum pore opening size of the geotextile.

g) Enter text, to define the requirement for water permeability normal to the plane.

h) Enter text, to define the durability requirement.

The performance characteristics for the geotextile barrier used around the underside of the Type 8 chamber cover slab (continued)	
Chamber reference	**Dangerous substances**
(a)	(i)

i) Enter text, to define the requirement.

3.25 The requirements for the geotextile barrier around the underside of the Type 8 chamber cover slab shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

3.26 For Type 11 chambers, steel cruciform comprising 2 No. 76mm x 51mm x 6mm angle components 700mm long shall be built into the brickwork across the centre of the access to prevent person entry.

Product requirements for connecting to existing chambers

3.27 Connections to existing chambers shall be set out in 'Connecting to existing drains, chambers and channels' in ' "Drainage pipes" in Section 1 of this document.

Product requirements for brickwork and mortar for chambers

3.28 Brickwork and joints of brickwork shall comply with "Brickwork and blockwork" in Section 13 of CC 491 [Ref 45.N].

3.29 The mortar for brickwork shall comply with mortar designation (i) (or proprietary mortar of equivalent strength) in "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

3.30 The mortar bed for precast concrete cover slabs shall be designation (i) to "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

3.31 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to any alternative mortar used to ensure the equivalent strength is achieved to mortar designation (i).

3.32 Where brickwork is used for chamber construction, the ends of the pipework within the chambers shall be finished flush against the brickwork with mortar designation (i) in "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

3.33 Lime shall not be permitted within the mortar used for chambers.

Product requirements for the chamber frame supporting structure

3.34 The chamber frame supporting structure shall be as specified in CC 500/WSR/003.

The chamber frame supporting structure		
Chamber number	**Chamber frame supporting structure type**	**New chamber or chamber reinstatement**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter one or more values, from options engineering bricks, precast concrete adjusting units, to identify the chamber frame supporting structure type.

c) Enter a value, from options new chamber, chamber reinstatement, to identify whether the supporting structure is for a new chamber or a chamber reinstatement.

3.35 Where rebuilding involves more than one course of brickwork or precast concrete cover frame seating ring, a course of adjusting units shall be used to meet the finished surface level.

3.36 The bedding mortar for reinstatement of frames for chamber covers shall be Class Md with a compressive strength exceeding 20 N/mm^2.

3.37 The bedding mortar used for the reinstatement of frames for chamber covers shall comply with "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

Product requirements for the excavation for chambers

3.38 Backfill to replace unsuitable material shall be either unbound subbase, pipe bedding material or concrete.

3.39 Where the backfill material to replace the unsuitable material is Type 1 unbound subbase, it shall comply with "Pavement foundation construction" in Section 1 of CC 201 [Ref 47.N].

3.40 Where the backfill material to replace the unsuitable material is pipe bedding material, it shall comply with "Drainage pipes" in Section 1 of this document.

3.41 Where the backfill material to replace the unsuitable material is concrete, it shall be GEN 2 concrete in accordance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

Product requirements for the chamber foundation

3.42 Foundations and base slabs for chambers shall be GEN 3 concrete, unless otherwise stated in CC 500/WSR/003.

SI.3.42 The type of concrete for foundations and base slabs for chambers shall be [enter free text].

3.43 The foundation for chamber types 2, 3, 4, 5 and 11 shall be as specified in CC 500/WSR/003.

The foundation for chamber types 2, 3, 4, 5 and 11	
Chamber number	**Chamber foundation detail**
(a)	(b)

a) Enter a unique reference.

b) Enter one or more values, from options in-situ concrete base slab integral with base walls and benching which extends 50mm beyond outer face of chamber ring above, precast concrete chamber rings bedded in mortar on top of an in-situ concrete base slab which is 300mm greater in diameter than the internal diameter of the chamber rings above, to identify the chamber foundation detail for chamber types 2, 3, 4, 5 and 11.

3.44 The channel within the chamber foundation (excluding catchpits) shall be as specified in CC 500/WSR/003.

The channel within the chamber foundation (excluding catchpits)	
Chamber number	**Channel type**
(a)	(b)

a) Enter a unique reference.

b) Enter one or more values, from options formed within the foundation concrete, constructed on preformed half circle channels, constructed on complete plastic units, to identify the detail of how a channel is incorporated into the chamber foundation.

3.45 Where channels for chambers are formed within the foundation concrete, there shall be a maximum vertical protrusion length of 2mm.

3.46 The sides of preformed half circle channels shall be benched in GEN 3 concrete or mortar complying with 'Product requirements for brickwork and mortar for chambers'.

3.47 For inspection chambers not exceeding 1.3m in depth to invert where complete plastic units are used, they shall comply with 'Product requirements for thermoplastic drainage pipes' in "Drainage pipes" in Section 1 of this document.

3.48 Complete plastic units used for chambers shall be surrounded by 150mm GEN 3 concrete.

3.49 Where there is an integral in-situ concrete base walls, benching and base slab, the concrete shall be GEN 3 concrete.

3.50 Where precast concrete chamber rings are used for the chamber base walls, these shall be bedded on mortar complying with 'Product requirements for brickwork and mortar for chambers' on an in-situ GEN 3 concrete base slab.

Product requirements for the chamber benching

3.51 Benching for chambers shall be GEN 3 concrete.

Product requirements for the chamber steps

3.52 Chamber steps shall be compliant with BS EN 13101 [Ref 67.N].

3.53 The chamber steps shall meet the performance characteristics as stated in table 3.53

Table 3.53 Performance characteristics of chamber steps

Performance characteristic	Required value
Width of tread	BS EN 13101, 4.3.2.2 c
Stand-off distance	BS EN 13101, 4.3.2.2 e
Vertical loading	BS EN 13101, 4.3.7
Pull-out/ anchorage	BS EN 13101, 4.3.9
Proof load (Grey cast iron)	BS EN 13101, 4.3.8
Impact (where applicable)	BS EN 13101, 4.3.10
Twist	BS EN 13101, 4.3.6
Durability	BS EN 13101, 4.1, 4.3.5, 4.3.2.2 b

3.54 The requirements for chamber steps shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

3.55 Chamber access shall be as specified in CC 500/WSR/003.

Chamber access	
Chamber number	**Chamber steps**
(a)	(b)

a) Enter a unique reference.

b) Enter one or more values, from options not required, single steps at 250mm or 300mm centre to centre vertically, double steps at 250mm or 300mm centre to centre vertically, ladder, to identify the type of chamber steps needed.

3.56 Threaded components for steps shall be galvanised in compliance with "Surfaces in contact with concrete for protection of steelwork against corrosion" in Section 9 of CC 486 [Ref 56.N].

Product requirements for the chamber steelwork

3.57 Steelwork for ladders, handholds, guardrails, posts, safety chains, hooks, gratings, brackets, steel cruciform and other steel fittings shall be compliant with BS 970-1 1996 [Ref 30.N].

3.58 All steelwork for chamber guardrails, posts, safety chains and hooks, gratings, brackets and steel cruciform shall be hot dip galvanised in compliance with "Surfaces in contact with concrete for protection of steelwork against corrosion" in Section 9 of CC 486 [Ref 56.N].

3.59 The stainless steel studs and nuts used for fixing the chamber guardrail shall be compliant with BS EN 10088-1 [Ref 65.N].

3.60 The stainless steel studs and nuts for fixing the chamber guardrail shall meet the following performance characteristics: designation 1.4401.

3.61 Isolating washers shall be used between stainless steel fixing stud and galvanised guardrail.

Product requirements for the chamber backfill material

3.62 The backfill material for all chambers except corrugated galvanised steel chambers shall be general fill in accordance with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

3.63 The backfill material for corrugated galvanised steel chambers shall be Class 6M in accordance with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

3.64 Where mechanical compaction of unbound backfill material is impracticable, the backfill material shall be GEN 2 concrete.

Installation requirements for chambers

3.65 Excavation for chambers shall be comply with "General earthworks construction" in Section 5 of CC 601 [Ref 25.N].

3.66 Pockets of soft soil, with an undrained shear strength of less than 50kPa, or loose rock at the bottom of all excavations shall be removed.

3.67 Where pockets of soft soil with an undrained shear strength of less than 50kPa are removed, the unsuitable material shall be excavated and replaced with backfill material as stated in 'Product requirements for the excavation of chambers'.

3.68 The backfill material for all chambers shall comply with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

Verification requirements of installation for chambers

Watertightness testing for chambers

3.69 Testing for watertightness in chambers shall be as specified in CC 500/WSR/003.

Testing for watertightness in chambers		
Chamber number	**Drawing/model number**	**watertightness test**
(a)	(b)	(c)

a) Enter a unique reference, to identify the chamber number reference.

b) Enter text, to identify the location reference.

c) Enter text, to identify the test required to establish the chamber is watertight.

3.70 Testing for watertightness in chambers shall be compliant with BS EN 1610 [Ref 14.N].

CCTV Surveys for chambers

3.71 Testing of chambers by CCTV survey shall be as specified in CC 500/WSR/003.

Testing of chambers by CCTV survey	
Chamber reference	**CCTV survey required**
(a)	(b)

a) Enter a unique reference.

b) Enter a value, from options yes, no, to identify if a CCTV survey is required.

3.72 The CCTV survey shall be compliant with CS 551 [Ref 23.N].

Cleaning of chambers

3.73 Cleaning of chambers shall comply with 'Cleaning of drainage pipes' in "Drainage pipes" in Section 1 of this document.

4. Chambers for service ducts

Product requirements for chambers for service ducts

4.1 The chambers for service ducts shall be as specified in CC 500/WSR/004.

The chambers for service ducts						
Chamber for service duct number	**Drawing/ model reference**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**New/ Existing/ Modified**	**Chamber type**	**Chamber cover type**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter text, to identify the drawing reference for the chamber.

c) Enter text, to identify the location of each chamber.

d) Enter text, to identify the location of each chamber.

e) Enter a value, from options New, Existing, Modified, to identify if the chamber is new, existing or modified.

f) Enter text, to identify the chamber type.

g) Enter a value, from options E600, D400, to identify the chamber cover type.

4.2 Chambers for service ducts shall comply with "Chambers for roadside technology and communications" in Section 14 of TC 131 [Ref 58.N].

Installation requirements for chambers for service ducts

4.3 The installation of chambers for service ducts shall comply with "Chambers for roadside technology and communications" in Section 14 of TC 131 [Ref 58.N].

Verification requirements of chambers for service ducts

4.4 Chambers for service ducts installation verification shall comply with 'Testing of communication cable ducts' in "Chambers for roadside technology and communications" in Section 14 of TC 131 [Ref 58.N].

Documentation requirements of chambers for service ducts

4.5 Chambers for service ducts documentation shall comply with 'Test documentation for communications cable ducts' in "Chambers for roadside technology and communications" in Section 14 of TC 131 [Ref 58.N].

5. Gullies and pipe junctions

Product requirements for gullies

5.1 Gullies shall be as specified in CC 500/WSR/005.

Gullies							
Gully reference	**Drawing/ model reference**	**X' (Easting) coordinate**	**X' (Northing) coordinate**	**Gully type**	**Gully construction**	**Gully minimum internal diameter**	**Gully outlet diameter**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.

b) Enter text, to identify the drawing reference for the gully.

c) Enter text, to identify location of gully.

d) Enter text, to identify location of gully.

e) Enter a value, from options trapped, untrapped, sumpless, to specify gully type.

f) Enter a value, from options precast, in-situ, to specify construction type.

g) Enter a number in units of mm, to specify size of gully pot.

h) Enter a number in units of mm, to specify size of gully outlet.

Gullies (continued)			
Gully reference	**Gully cover slab nominal size**	**Gully cover slab thickness**	**Saddle to pipe junction permitted**
(a)	(i)	(j)	(k)

i) Enter a number in units of mm, to specify gully cover slab dimensions.

j) Enter a number in units of mm, to specify the minimum gully cover slab thickness.

k) Enter a value, from options Yes, No, to identify if saddles are permitted.

Product requirements for precast gullies with sump

5.2 Precast concrete gullies and cover slabs shall be compliant with the requirements of BS 5911-6 [Ref 8.N].

5.3 The precast concrete gullies and cover slabs shall meet the performance characteristics as stated in table 5.3.

Table 5.3 Precast concrete gullies and cover slabs product requirements

Performance characteristic	Reference in standard	Required value
dimensional tolerances	BS 5911-6 [Ref 8.N] Annex A	pass
water-tightness	BS 5911-6 [Ref 8.N] Annex B	pass
concrete class	BS 5911-6 [Ref 8.N] 4.2	pass

5.4 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to precast concrete gullies and cover slabs.

5.5 Precast vitrified clay gullies shall be compliant with BS EN 295-1 [Ref 73.N].

5.6 The precast vitrified clay gullies shall meet the performance characteristics as stated in table 5.6.

Table 5.6 Precast vitrified clay gully product requirement

Performance characteristic	Reference in standard	Required value
dimensional tolerances	BS EN 295-1 [Ref 73.N] 5.2	pass
water-tightness	BS EN 295-1 [Ref 73.N] 5.6	pass
reaction to fire	BS EN 295-1 [Ref 73.N] 7.1	Class A1
minimum bond strength	BS EN 295-1 [Ref 73.N] 5.12	5 N/mm^2

5.7 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to precast vitrified clay gullies.

Product requirements for in-situ cast gullies with sump

5.8 The concrete bed and surround to the in-situ cast gullies shall be constructed of GEN3 concrete, 150mm thick, complying with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

5.9 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to permanent shuttering used to construct an in-situ concrete gully with sump.

Product requirements for in-situ cast sumpless gullies

5.10 The concrete bed and surround to the in-situ sumpless gully shall be made of GEN3 concrete complying with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

5.11 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to permanent shuttering used to construct an in-situ concrete sumpless gully.

Product requirements for a gully connection pipe

5.12 Pipes for gully connections shall be specified in accordance with the requirements of "Drainage pipes" in Section 1 of this document.

Product requirements for a junction pipe

5.13 Junction pipes for gully connections shall be specified in accordance with the requirements of "Drainage pipes" in Section 1 of this document.

Product requirements for brickwork and mortar for a gully

5.14 Brickwork for gullies shall comply with the requirements of "Brickwork and blockwork" in Section 13 of CC 491 [Ref 45.N].

5.15 Brickwork for gullies shall comply with the requirements of "Chambers for drainage pipes" in Section 3 of this document.

Product requirements for a precast concrete adjusting unit for a gully

5.16 Precast concrete adjusting units shall comply with the requirements of "Chambers for drainage pipes" in Section 3 of this document.

Installation requirements for a precast gully with sump

5.17 The concrete base for the precast gully pot shall be formed from GEN3 concrete complying with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

5.18 Backfilling to precast gullies shall be carried out to sub-formation level with general fill material Class 1 as described in "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

5.19 Backfill to precast gullies shall be compacted in compliance with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

5.20 Where mechanical compaction of unbound backfill is not achievable, the backfiling of precast gullies shall be in GEN2 concrete complying with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

Installation requirements for a in-situ cast gully

5.21 Permanent shuttering used to construct an in-situ cast gully shall be installed in accordance with the manufacturers recommendation.

Installation requirements for a gully outlet connection pipe and junction pipe

5.22 When entering chambers, gully connections shall be in accordance with "Chambers for drainage pipes" in Section 3 of this document.

5.23 Junction pipes which are laid but not immediately connected shall be fitted with temporary stoppers or seals.

5.24 Junctions for gully outlet connections which are temporarily stopped up or sealed shall be identified and recorded.

5.25 Saddle junctions shall not include internal projections greater than 5mm.

5.26 Saddles for plastic pipes shall be installed in accordance with the manufacturers recommendations.

5.27 Saddles with clay pipes shall be jointed with mortar designation (i), excluding lime, complying with "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

Documentation requirements for junction pipes

5.28 The following Documentation shall be submitted for locations of pipe junctions temporarily stopped up or sealed prior to the commencement of temporary backfilling: Drawings showing the location of stopped up or sealed pipe junctions.

6. Chamber tops and gully tops for drainage

Product requirements for chamber covers, gratings and cover frames

6.1 Chamber covers, gratings and frames with a clear opening up to 1m shall be compliant with BS EN 124-1 [Ref 36.N].

6.2 The chamber covers, gratings and frames with a clear opening up to 1m shall meet the performance characteristics as stated in table 6.2

Table 6.2 Performance characteristics for chamber covers, gratings and frames with a clear opening up to 1m

Performance characteristic		Testing standard	Required value
Reaction to fire			Cast iron: BS EN 124-2 [Ref 37.N]5.3.1 Steel/ aluminium: BS EN 124-3 [Ref 38.N] 5.3.1 Steel reinforced concrete: BS EN 124-4 [Ref 39.N] 5.3.1
Load bearing capacity	Frame bearing area		$P_b \leq 2.1$ N/mm^2
	Load bearing capacity	BS EN 124-1 [Ref 36.N] 8.3	BS EN 124-1 [Ref 36.N] 7.2, 8.3 — Refer to WSR
	Permanent set	BS EN 124-1 [Ref 36.N] 8.2, Annex A	BS EN 124-1 [Ref 36.N] 7.3, 8.2
Securing of covers/ gratings	by securing feature	BS EN 124-1 [Ref 36.N] 8.4.6, Annex E	BS EN 124-1 [Ref 36.N] 6.6a
	by mass per unit area		BS EN 124-1 [Ref 36.N] 6.6b
	by other method		BS EN 124-1 [Ref 36.N] 6.6c
Child safety	by mass of the individual cover/ grating	BS EN 124-1 [Ref 36.N] Annex E	BS EN 124-1 [Ref 36.N] 7.5, 8.5
	by securing feature/ locking accessory		
Skid resistance	of concrete surfaces		BS EN 124-1 [Ref 36.N] 7.4.2a
	of raised pattern		BS EN 124-1 [Ref 36.N] 7.4.2b
	of other surface	BS EN 124-1	BS EN 124-1 [Ref

		[Ref 36.N] Annex C	36.N] 7.4.2c
	of gratings		BS EN 124-1 [Ref 36.N] 7.4.3
	of frames		BS EN 124-1 [Ref 36.N] 7.4.4
Durability	of load bearing capacity against mechanical failure		Cast Iron BS EN 124-2 [Ref 37.N] 5.3.2 Steel/ aluminium BS EN 124-3 [Ref 38.N] 5.3.2 Steel reinforced BS EN 124-4 [Ref 39.N] 5.2.5
	of securing against mechanical failure		
	of skid resistance against loss of grip		
	of effectiveness of child safety		
Dangerous substances			Cast Iron BS EN 124-2 [Ref 37.N] 5.3.3 Steel/ aluminium BS EN 124-3 [Ref 38.N] 5.3.3 Steel reinforced BS EN 124-4 [Ref 39.N] 5.2.6

6.3 The requirements for chamber covers, gratings and frames up to 1m clear opening shall be in accordance with "Product certification schemes" in Section 11 of GC 101 [Ref 31.N].

6.4 Chamber covers, gratings and frames with a clear opening greater than 1m shall be compliant with BS 9124 [Ref 63.N].

6.5 The chamber covers, gratings and frames with a clear opening greater than 1m shall meet the performance characteristics in table 6.5

Table 6.5 Performance characteristics for chamber covers, gratings and frames with a clear opening greater than 1m

Performance characteristic	Required value	
Loading classification	BS 9124 [Ref 63.N] 6.2	Refer to the WSR
Nominal bearing Pressure P_b (In relation to the cover frame bearing area)	$P_b \leq 2.1$ N/mm^2	
Securing of covers/ gratings	BS 9124 [Ref 63.N] 5.10	Refer to the WSR
Skid Resistance	BS 9124 [Ref 63.N] 5.8	
Whether corrosion protection is required	BS 9124 [Ref	

	63.N] 4.6.1	

6.6 The requirements for chamber covers, gratings and frames with a clear opening greater than 1m shall be in accordance with "Product certification schemes" in Section 11 of GC 101 [Ref 31.N].

6.7 The general requirements of each chamber cover, grating and frame shall be as specified in CC 500/WSR/006.

The general requirements of each chamber cover, grating and frame							
Chamber reference	**Drawing/ model reference**	**Type of chamber cover, grating and frame**	**chamber cover design life**	**Minimum clear opening requirements for chamber covers**	**Clear opening**	**Vents for chamber covers**	**Seating of cover within frame**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.

b) Enter text, to identify the drawing reference for the chamber.

c) Enter a value, from options new, existing to be reinstated, to identify whether it is new or existing to be reinstated.

d) Enter a number in units of year, to identify the chamber cover design life.

e) Enter a value, from options a 600mm rectangular frame with a minimum diagonal measurement of 700mm, a circular frame with minimum diameter 700mm, greater than 1m, to identify the minimum clear opening requirements of chamber covers.

f) Enter text, to identify the clear opening requirements for covers greater than 1m.

g) Enter a value, from options vent, no vent, to identify which chamber covers need vents.

h) Enter a value, from options yes, no, to identify if there is a requirement to seat the chamber in the cover frame.

6.8 The loading requirements of each chamber cover, grating and frame shall be as specified in CC 500/WSR/006.

The loading requirements of each chamber cover, grating and frame		
Chamber reference	**Chamber loading class**	**The permanent non-rock feature**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a value, from options D400, E600, to identify the loading class of each chamber cover.

c) Enter one or more values, from options triangular point suspension, machined faces, to identify the permanent non-rock feature.

6.9 The coating requirements of each chamber cover, grating and frame shall be as specified in CC 500/WSR/006.

The coating requirements of each chamber cover, grating and frame			
Chamber reference	**chamber cover polished skid resistance value**	**Coating of chamber cover, grating or frame**	**Coating type**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter a value, from options >45, >60, to identify the polished skid resistance value of each chamber cover.

c) Enter a value, from options fine cast (uncoated), coated, to identify which chamber cover, and associated grating and frame, need a coating.

d) Enter text, to identify what type of coating is required.

6.10 The grating requirements of each chamber cover, grating and frame shall be as specified in CC 500/WSR/006.

The grating requirements of each chamber cover, grating and frame		
Chamber reference	**Grating requirement**	**Minimum waterway area for chamber gratings**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a value, from options no grating required, grating required, to identify where a chamber grating is required.

c) Enter a number in units of m^2, to identify the minimum waterway area for chamber gratings where applicable.

6.11 The sealing requirements of each chamber cover, grating and frame shall be as specified in CC 500/WSR/006.

The sealing requirements of each chamber cover, grating and frame		
Chamber reference	**Sealing of chamber covers**	**Sealing method**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a value, from options sealed, not sealed, to identify which chamber covers need to be sealed.

c) Enter text, to identify the method of chamber sealing where applicable.

6.12 The securing requirements of each chamber cover, grating and frame shall be as specified in CC 500/WSR/006.

The securing requirements of each chamber cover, grating and frame		
Chamber reference	**Method of securing cover or grating**	**The method of loosening the chamber cover from the frame**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a value, from options securing feature, mass per unit area, other method, to identify how the cover or grating is secured.

c) Enter text, to identify the method of loosening the chamber cover from the frame (usually a recess to accommodate a prising bar).

6.13 All covers with loading class D400 and above shall incorporate a permanent non-rock feature.

6.14 Where a chamber cover is required to be seated in a frame the design life of the seating shall match that of the frame.

6.15 The surface of any coating specified on covers, grating or frames shall be free from rust, debris and dry before application of the coating.

6.16 Bolts, screws and nuts supplied for loosely coupling separate sections of covers and gratings shall be steel hexagon headed.

6.17 The steel hexagon headed bolts for loosely coupling separate sections of covers and gratings shall be compliant with BS EN ISO 4016 [Ref 40.N].

6.18 The steel hexagon headed bolts shall meet the following performance characteristics: minimum size M16.

6.19 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to the steel hexagon headed bolts.

6.20 The steel hexagon headed screws for loosely coupling separate sections of covers and gratings shall be compliant with BS EN ISO 4018 [Ref 41.N].

6.21 The steel hexagon headed screws shall meet the following performance characteristics: minimum size M16.

6.22 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to steel hexagon headed screws.

6.23 The steel hexagon nuts for loosely coupling separate sections of covers and gratings shall be compliant with BS EN ISO 4034 [Ref 42.N].

6.24 The steel hexagon nuts shall meet the following performance characteristics: minimum size M16.

6.25 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 31.N] shall apply to steel hexagon nuts.

6.26 The bolts supplied for loosely coupling separate sections of covers and gratings shall be provided with means to prevent undue tightening of unit sections.

6.27 Bolts, screws and nuts supplied for loosely coupling separate sections of covers and gratings shall be galvanized in compliance with "Surfaces in contact with concrete for protection of steelwork against corrosion" in Section 9 of CC 486 [Ref 56.N].

6.28 Pins or circlips used as part of the chamber cover securing device shall be of equal cross sectional area.

Product requirements for chamber and gully cover frame bedding

6.29 Mortar used for the bedding material for the chamber and gully cover frame, shall comply with mortar designation (i) (or proprietary mortar of

equivalent strength) in "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

6.30 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to any alternative mortar used to ensure the equivalent strength is achieved to mortar designation (i).

6.31 Chamber and gully covers shall be bedded upon material which is non-shrinkable.

6.32 Chamber and gully covers shall be bedded upon material which has a minimum workable life of 15 minutes.

6.33 Chamber and gully covers shall be bedded upon material which has a minimum compression strength of 30N/mm^2 within 3 hours of placing.

6.34 Chamber and gully covers shall be bedded upon material which has a tensile strength that exceeds 5N/mm^2 within 3 hours of placing.

6.35 The bedding beneath the chamber cover or gully cover frame shall be free of voids.

6.36 Packing materials shall not be used in the bedding of chamber and gully covers.

Product requirements for chamber cover frame bearing area

6.37 The chamber cover frame requirements shall be as specified in CC 500/WSR/006.

The chamber cover frame requirements		
Chamber reference	**The external corners of the frame**	**The shape of the external corners of the frame**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter one or more values, from options solid, can include holes, to identify the requirements of the external corners of the frame.

c) Enter one or more values, from options square, curved or chamfered, to identify the shape of the external corners of the frame.

6.38 For openings with corners the width of the external corners of the chamber cover frame shall not be less than the minimum bedding width.

6.39 The nominal bearing pressure of the cover frame bearing area shall not exceed 2.1 N/mm^2.

6.40 The chamber cover frame bearing area shall have a minimum bedding width of 50mm of metal.

6.41 The chamber cover frame bearing area shall have a maximum bedding width of 120mm of metal.

6.42 The bedding flange for the chamber cover frame shall have a minimum thickness of 5mm.

6.43 Where vertical frame stiffening webs or gussets are provided, they shall be located adjacent to seatings.

6.44 The tops of triangular webs/ gussets shall be compliant with BS 7903 [Ref 34.N].

6.45 There shall be no holes within the seating areas of the bedding flanges for chamber cover frames beneath the cover seatings.

6.46 Any holes within the flanges for the chamber cover frame within the bedding area of the frame shall not reduce the specified bearing area of the frame.

Product requirements for chamber cover keyway

6.47 Chamber keys and keyways shall be in accordance with the manufacturer's instructions.

Product requirements for gully grating and frame

6.48 Gully gratings, kerb type gully covers and frames shall be compliant with the requirements of BS EN 124:1994 [Ref 35.N].

6.49 Gully gratings, kerb type gully covers and frames shall be as specified in CC 500/WSR/006.

Gully gratings, kerb type gully covers and frames							
Gully reference	**Drawing / model reference**	**Type of gully grating and frame**	**Classification of gully grating and frame**	**Diameter of gully grating and frame**	**Minimum waterway area of gully grating**	**Kerb inlet profile**	**Coating of gully grating or frame**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.

b) Enter text, to identify the drawing reference for the gully.

c) Enter a value, from options gully, kerb inlet, to determine grating, frame and cover type.

d) Enter a value, from options D400, E600, to determine loading classification.

e) Enter a number in units of mm, to specify minimum size of frame, grating and cover.

f) Enter a number in units of mm, to to specify minimum inlet requirement.

g) Enter a unique reference, to identify the shape profile of the kerb inlet unit.

h) Enter a value, from options fine cast (uncoated), coated, to identify which gully grating and frame, need a coating.

6.50 The requirements for gully gratings, kerb type gully covers and frames shall be in accordance with "Product certification schemes" in Section 11 of GC 101 [Ref 31.N].

Product requirements for adjustment of existing chamber covers, gratings, cover frames, gully gratings and gully frames

6.51 Adjustment or replacement of existing chamber covers, frames or gratings shall be as specified in CC 500/WSR/006.

Adjustment or replacement of existing chamber covers, frames or gratings			
Chamber or gully reference	**Chamber cover, frame and grating method of adjustment**	**Cover level of adjusted or replaced chamber cover, frame or grating**	**Adjustment of level method**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter a value, from options taken-up and refixed, taken-up removed and replaced with new units in compliance with 'Chamber covers, gratings and frames', to identify the method of adjustment of existing chamber covers, frames and gratings.

c) Enter a number in units of mm, to identify the level of adjusted or replaced chamber, cover and frame.

d) Enter a value, from options not applicable (ie no adjustment of level), modifying the brickwork, modifying the adjusting unit, using a frame of the depth necessary for the adjustment, to identify the method of adjusting the level of the chamber cover, frame and grating.

Installation requirements for new chamber covers, gratings and cover frames

6.52 The frames of chamber and gully covers shall be placed on the bedding mortar so that all webs of the frame are fully supported by the frame supporting structure.

6.53 The webs of the frame shall not overhang the internal faces of the frame supporting structure.

6.54 Any holes within the chamber cover frame shall be infilled with bedding mortar.

6.55 Where holes in the chamber cover frame have been infilled with bedding mortar, the flanges of that frame shall be enveloped by a minimum thickness of 10mm of the bedding mortar.

6.56 Exposed surfaces of the bedding mortar around the outside of the chamber or gully cover frame shall be floated to fill any voids and remove loose fragments.

6.57 The exposed surface of the bedding mortar inside the chamber shall be pointed such that any protrusions to the surface are less than 2mm.

6.58 Surround material for the chamber cover frame shall only be placed in contact with the frame once the bedding material has set.

6.59 Where a self-setting surround material is used for chamber covers this shall be placed no higher than 40mm below the finished surface level.

6.60 Mixing and placing of proprietary bedding materials shall be in accordance with the manufacturer’s instructions.

6.61 Bedding layers greater than 50mm thick shall be placed in two layers; the second layer placed after the first layer has set.

6.62 Where more than one layer of bedding mortar is needed, the first layer shall be no thicker than 40mm.

6.63 Any compaction device for the carriageway reinstatement operation shall not be in contact at any stage with the chamber cover, frame or grating.

6.64 The joint between the reinstated and existing materials shall be sealed with bituminous material in compliance with "Constituents for bituminous mixtures" in Section 7 of CC 202 [Ref 27.N].

Installation requirements for new gully grating and frame

6.65 The upper surface of the gully grating shall be laid flat, unless otherwise stated in CC 500/WSR/006.

6.66 The upper surface of the gully grating shall be laid as specified in CC 500/WSR/006.

The upper surface of the gully grating		
Gully reference	**Flat level**	**Alternative level specification**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a value, from options yes, no, to identify if the upper surface of the gully grating is flat.

c) Enter text, to identify the alternative installation requirement.

6.67 The upper surface of the gully grating shall be recessed by 3mm to 6mm from the finished road level.

6.68 Slots in gratings and frames shall not be orientated parallel to the direct of traffic except where the slots are less than 150mm long or less than 20mm wide.

6.69 Gratings and frames shall be supplied in a fine cast (uncoated) condition, unless otherwise stated in CC 500/WSR/006.

6.70 Hinged gratings shall be orientated to close in the direction of traffic flow.

6.71 The finished thickness of the mortar bed shall be between 10mm and 25mm.

6.72 On completion of the works, each gully grating shall be lifted and the frame and seating cleaned such that there is no debris and the grating sits correctly in the frame.

Installation requirements for adjustment of existing chamber covers, gratings, cover frames, gully grating and gully frames

6.73 On taking up or removal of the chamber cover, frame or grating, any concrete or mortar bedding shall be broken out and the surface prepared such that there are no vertical protrusions greater than 3mm.

6.74 Where existing chamber covers, frames and gratings are to be re-used, they shall be cleaned such that they are free from existing mortar, concrete, debris, rust and moisture before re-use.

6.75 The finished thickness of mortar bed for the adjusted or replaced chamber cover, frame and grating shall be between 10mm and 25mm.

6.76 On completion of the adjustment or replacement of the existing chamber cover, frame and grating, the cover shall be lifted and the frame and seating cleaned such that there is no debris.

7. Surface water channels and precast drainage channel blocks

Product requirements for surface water channels and precast drainage channel blocks

7.1 In-situ surface water channels and pre-cast drainage channel blocks shall comply with "Kerb unit construction" in Section 8 of CC 207 [Ref 29.N].

7.2 In-situ surface water channels and pre-cast drainage channel blocks shall be compliant with CD 524 [Ref 26.N].

7.3 Surface water channels shall be as specified in CC 500/WSR/007.

Surface water channels					
Asset reference of surface water channel	**Drawing or model reference**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter text, to identify location of start of the surface water channel.

d) Enter text, to identify location of start of the surface water channel.

e) Enter text, to identify location of end of the surface water channel.

f) Enter text, to identify location of end of the surface water channel.

Surface water channels (continued)									
Asset reference of surface water channel	**Channel shape**	**Channel location**	**Dimension T**	**Dimension l_1**	**Dimension V**	**Dimension W**	**Dimension l_2**	**Dimension Y**	**Dimension h_1**
(a)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)

g) Enter a value, from options triangular, rectangular, trapezoidal, to identify channel shape.

h) Enter a value, from options verge, central reserve, to identify the location of the channel.

i) Enter a number in units of mm, to define width of base of trapezoidal channel.

j) Enter a number in units of mm, to define the back edge of channel width.

k) Enter a number in units of mm, to define the right side slope.

l) Enter a number in units of mm, to define the left side slope.

m) Enter a number in units of mm, to define the channel width.

n) Enter a number in units of mm, to define the difference in level between the back edge of the channel and the level of the carriageway, hardshoulder or hardstrip adjacent to the channel.

o) Enter a number in units of mm, to define the depth of concrete below the channel invert level.

7.4 Precast drainage channel blocks shall be as specified in CC 500/WSR/007.

Precast drainage channel blocks					
Asset reference of precast drainage channel blocks	**Drawing or model reference**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter text, to identify location of start of the surface water channel block.

d) Enter text, to identify location of start of the surface water channel block.

e) Enter text, to identify location of end of the surface water channel block.

f) Enter text, to identify location of end of the surface water channel block.

Precast drainage channel blocks (continued)						
Asset reference of precast drainage channel blocks	**Channel block location**	**Channel block type**	**Radius r_1**	**Dimension l_3**	**Dimension l_1**	**Dimension l_2**
(a)	(g)	(h)	(i)	(j)	(k)	(l)

g) Enter a value, from options verge, central reserve, to identify the location of the channel block.

h) Enter a value, from options A, B, C, D, E, F, to define channel block type.

i) Enter a number in units of mm, to define the channel block size.

j) Enter a number in units of mm, to define the channel block length.

k) Enter a number in units of mm, to define the offset from the carriageway edge to the channel block centre.

l) Enter a number in units of mm, to define the offset from the carriageway edge to the fin drain or narrow filter drain adjacent to the channel block.

7.5 Precast concrete blocks shall be compliant with BS EN 1340 [Ref 6.N].

7.6 The precast concrete blocks shall meet the performance characteristics as stated in table 7.6

Table 7.6 Performance characteristics for pre-cast concrete blocks	
Performance characteristic	Required value
Emission of asbestos	BS EN 1340 [Ref 6.N] 4.2
Breaking strength	BS EN 1340 [Ref 6.N] 5.3.3.1
Slip/skid resistance	BS EN 1340 [Ref 6.N] 5.3.5.1 BS EN 1340 [Ref 6.N] 5.3.5.2
Durability*	BS EN 1340 [Ref 6.N] 5.3.3.3 BS EN 1340 [Ref 6.N] 5.3.5.3

7.7 The requirements for precast concrete blocks shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

7.8 Where a surface water channel is positioned adjacent to rigid carriageway construction, the sealing strip between the channel and the carriageway shall comply with "Joint sealing of concrete pavements" in Section 15 of CC 203 [Ref 57.N].

7.9 Type A surface water channels shall be a designed mix with strength class C23/35 to BS 8500-2 [Ref 12.N].

7.10 The concrete for Type A surface water channels shall be air-entrained in accordance with BS 5931 [Ref 5.N].

Installation requirements for surface water channels and drainage channel blocks

7.11 Contraction joints in Type A surface water channels shall be sawn or wet formed.

7.12 Sawn contraction joints in Type A surface water channels shall be cut to a minimum depth of 25mm below the channel invert or to a minimum depth of one quarter of the channel section, whichever is the greater.

7.13 Wet formed contraction joints in surface water channel Type A shall be cut into the concrete whilst it is still plastic over not less than two thirds of the cross sectional area.

7.14 Wet formed contraction joints in Type A surface water channels shall be finished to form a tapered sealing groove not less than 13mm wide at the surface tapering to not less than 5mm at a depth of 25mm.

7.15 The spacing of contraction joints in Type A surface water channels shall be 5m.

7.16 Expansion joints in Type A surface water channels shall be formed at spacings not exceeding 40m in accordance with "Transverse joints in jointed concrete pavements" in Section 9 of CC 203 [Ref 57.N].

7.17 Type B surface water channels shall be used when the carriageway and channel are slipformed simultaneously.

7.18 Type B surface water channels shall be deemed a continuation of the carriageway and be reinforced accordingly.

7.19 Type B surface water channels shall have transverse joints of the same type and spacing as in the carriageway slab.

7.20 The transverse joints for surface water channels shall be sealed in accordance with "Joint sealing of concrete pavements" in Section 15 of CC 203 [Ref 57.N].

7.21 Drainage channel blocks shall be installed in accordance with the manufacturer's requirements.

8. Land drains

Product requirements for new land drains

8.1 New land drains shall be as described in CC 500/WSR/008.

New land drains		
Land drain reference	**Drawing/ model reference**	**Type**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter text, to to identify the location of the new land drain.

c) Enter a value, from options filter drain or carrier pipe, ditch, to identify the type of land drain.

Product requirements for new filter drain or carrier pipe for land drains

8.2 New filter drains or carrier pipes for land drains shall be specified in accordance with the requirements of "Drainage pipes" in Section 1 of this document.

Product requirements for new ditch for land drains

8.3 New ditches for land drains shall be as specified in CC 500/WSR/008.

New ditches for land drains						
Land drain ditch reference	**X (Easting) coordinate**	**Y (Northing) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**Upstream invert level**	**Downstream invert level**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter text, to identify location of start of ditch.

c) Enter text, to to identify location of start of ditch.

d) Enter text, to to identify end of ditch.

e) Enter text, to to identify end of ditch.

f) Enter a number in units of m, to identify invert level of ditch.

g) Enter a number in units of m, to identify invert level of the ditch.

New ditches for land drains (continued)							
Land drain ditch reference	**Width of base**	**Ditch side slope**	**Subsoil**	**Impermeable membrane**	**Tensile strength**	**Resistance to static puncture**	**Durability**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)

h) Enter a number in units of mm, to specify the base width of the the ditch.

i) Enter text, to specify the side slope of the ditch.

j) Enter a value, from options yes, no, to to identify if subsoil is required.

k) Enter a value, from options yes, no, to identify where impermeable membrane is required.

l) Enter a number in units of kN/m, to define the tensile strength of the impermeable membrane.

m) Enter a number in units of N, to define the resistance to static puncture of the impermeable membrane.

n) Enter text, to define the durability requirement of the impermeable membrane.

8.4 The grass mix for seeding of ditches for land drains shall be as stated in CC 500/WSR/008.

SI.8.4a Grass mix for seeding of ditches (specific to location) [enter free text].

SI.8.4b The steps for seedbed preparation of the ditch shall be [enter free text].

8.5 The surface material of the ditch shall be topsoil Class 5B in accordance with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

8.6 The subsoil of the ditch shall be free of stones larger than 50mm.

Product requirements for existing land drains

8.7 Existing land drains which are identified during construction and are permanently severed by the works shall be marked and recorded.

8.8 Existing land drains which are blocked when first exposed shall be marked and recorded.

8.9 The lengths of existing land drain shall be cleaned in accordance with the requirements of "The cleaning of existing drainage systems" in Section 16 of this document.

8.10 Existing land drains which are damaged shall be replaced with a new land drain.

8.11 Where an existing land drain is exposed and severed by temporary works, the position of the land drain shall be marked and recorded.

8.12 Where an existing land drain is exposed and severed by temporary works, the land drain shall be diverted into an existing pipe, drain, ditch or watercourse.

8.13 The lengths of existing land drain remaining within the works shall be recorded.

Installation requirements for new filter drains or carrier pipes for land drains

8.14 New filter drains or carrier pipes for land drains shall be constructed in accordance with the requirements of "Drainage pipes" in Section 1 of this document.

Installation requirements for new ditches for land drains

8.15 Subsoil for new ditches for land drains shall be placed in layers, not exceeding 100mm depth.

8.16 Subsoil for new ditches for land drains shall be compacted using a vibrating plate compactor to Method 1 requirements if using 1400kg to 1800kg plant or Method 3 requirements if using 1100kg to 1200kg plant in accordance with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

8.17 The topsoil for new ditches for land drains shall be between 35mm and 50mm thick following compaction.

8.18 The topsoil for new ditches for land drains shall be compacted by two passes of a vibrating plate compactor to Method 1 depth requirements if using 1400kg to 1800kg plant or Method 3 depth requirements if using 1100kg to 1200kg plant in accordance with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

8.19 Runoff from adjacent areas shall be prevented from entering the ditch during construction.

Installation requirements for existing land drains

8.20 Disused ends of intercepted existing land drains shall be sealed with GEN3 concrete in compliance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

8.21 Any existing land drain disturbed by the works shall be relaid to ensure a free discharge into the new pipe, drain or ditch.

Documentation for existing land drains

8.22 The following Documentation shall be submitted for existing land drains prior to the commencement of land drainage works in that locality: Schedule showing the locations of existing land drains identified during construction and are permanently severed by the works, locations of existing land drains blocked, location of existing land drains impacted by temporary works, locations of existing land drains remaining.

9. Backfilling to pipe bays and verges on bridges

Product requirements for backfill to pipe bays and verges on bridges

9.1 The backfill material to pipe bays and verges on bridges shall be as specified in CC 500/WSR/009.

The backfill material to pipe bays and verges on bridges		
Pipe bay/ bridge verge location reference	**Drawing/ model reference**	**Backfill material to pipe bays and verges on bridges**
(a)	(b)	(c)

a) Enter a unique reference, to identify the location reference of the pipe bay or bridge verge.

b) Enter a number, to identify the drawing/ model reference.

c) Enter text, to identify the backfill material to be used.

9.2 Where granular material is used for the backfill material to pipe bays and verges on bridges, it shall be well graded granular material not exceeding 20mm size and contain not more than 3% of material passing through the 0.063mm sieve and with a uniformity coefficient of more than 5.

9.3 The backfill material to pipe bays and verges on bridges placed within 500mm of concrete, cement bound materials, other cementitious mixtures or stabilised capping shall comply with the sulfate requirements described in Section 3 of CC 601 [Ref 25.N], unless otherwise stated in CC 500/WSR/009.

SI.9.3 The maximum separation distance of the backfill material to pipe bays and verges on bridges from concrete, cement bound materials, other cementitious mixtures or stabilised capping where the backfill material is to comply with the sulfate requirements described in Section 3 of CC 601 [Ref 25.N] shall be [enter a number] .

9.4 The backfill material to pipe bays and verges on bridges placed within 500mm of metallic structural elements shall comply with the sulfate requirements described in Section 3 of CC 601 [Ref 25.N], unless otherwise stated in CC 500/WSR/009.

SI.9.4 The maximum separation distance of the backfill material to pipe bays and verges on bridges from metallic structural elements where the

backfill material is to comply with the sulfate requirements described in Section 3 of CC 601 [Ref 25.N] shall be [enter a number] .

Product verification for backfill to pipe bays and verges on bridges

9.5 Verification shall be undertaken for granular backfill material to pipe bays and verges on bridges by sampling and undertaking the contractor compliance testing detailed in table 9.8.

9.6 The frequency of sampling and testing for characteristics of granular backfill material to pipe bays and verges on bridges shall be as detailed in table 9.8.

9.7 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to sampling and testing for characteristics of granular backfill material to pipe bays and verges on bridges.

9.8 Verification for characteristics of granular backfill material to pipe bays and verges on bridges as detailed in table 9.8 shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 31.N].

Table 9.8 Compliance testing required for characteristics of granular backfill material to pipe bay and verges on bridges

Characteristic of material	Testing criteria	Frequency of testing	Further requirements
Grading	test method as stated in BS EN 13285 [Ref 72.N]	1 per 50 tonnes (minimum of 3)	laboratory certificate required
Water-soluble sulfate content	test method as stated in BS EN 13242 [Ref 2.N]	5 per source	laboratory certificate required
Oxidisable sulfides content and total potential sulfate content	test method as stated in BS EN 13242 [Ref 2.N]	5 per source	laboratory certificate required

Installation requirements for backfill to pipe bays and verges on bridges

9.9 The backfill material to pipe bays and verges on bridges shall be laid and compacted in compliance with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

Product documentation for backfill to pipe bays and verges on bridges

9.10 The following Documentation shall be submitted for Results of the tests for the granular backfill material to pipe bays and verges on bridges prior to the commencement of installation: test results certificates.

9.11 The requirements for "Documentation" in Section 2 of GC 101 [Ref 31.N] shall apply to Results of the tests for the granular backfill material to pipe bays and verges on bridges.

10. Permeable backing to earth retaining structures

Product requirements for permeable backing to earth-retaining structures

10.1 Permeable backing to earth retaining structures shall be as specified in CC 500/WSR/010.

Permeable backing to earth retaining structures			
earth retaining structure reference	**Drawing/ model reference**	**permeable backing material**	**Alternative permeable backing material**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter text, to identify the drawing reference for the earth retaining structure.

c) Enter a value, from options granular material, porous cast in-situ no fines concrete, precast hollow concrete blocks, sand (where fill adjacent to the structure is Class 7A Class 7B or Chalk), to identify the permeable backing material to each earth retaining wall, other.

d) Enter text, to identify an alternative permitted material.

Product requirements for granular backfill to earth retaining structures

10.2 Granular material used for permeable backing to earth retaining structures shall be a minimum thickness of 300mm.

10.3 Where granular material is used for permeable backing to earth retaining structures, it shall comply with the requirements of Type A or Type C of 'Product requirements for backfill material for drainage pipes' "Drainage pipes" in Section 1 of this document.

10.4 Granular material used for permanent backing to earth retaining structures shall satisfy the criteria below where the percentage size of a material is the size of particle corresponding to the given percentage ordinate of the particle size distribution graph.

Equation 10.4a Piping ratio, defined as

Equation 10.4a Piping ratio, defined as

$$\frac{15\% \text{ size of the material}}{85\% \text{ size of the backfill material}} < 5$$

Equation 10.4b Permeability ratio, defined as

Equation 10.4b Permeability ratio, defined as

$$\frac{15\% \text{ size of the material}}{15\% \text{ size of the backfill material}} > 5$$

Product requirements for porous no-fines concrete backfill to earth retaining structures

10.5 Porous cast in-situ no fines concrete used for permeable backing to earth retaining structures shall be a minimum thickness of 225mm.

10.6 Porous cast in-situ no fines concrete used for permeable backing to earth retaining structures shall comply with "Porous No Fines Concrete" in Section 3 of CC 495 [Ref 46.N].

Product requirements for precast hollow concrete block backfill to earth retaining structures

10.7 Precast hollow concrete blocks used for permeable backing to earth retaining structures shall be laid in a stretcher bond with dry joints in 225mm thick walling with holes vertical.

10.8 Precast hollow concrete blocks used for permeable backing to earth retaining structures shall be compliant with BS EN 771-3 [Ref 61.N].

10.9 The precast hollow concrete blocks used for permeable backing to earth retaining structures shall meet the performance characteristics as stated in table 10.9

Table 10.9 Performance characteristics for precast concrete hollow blocks

Performance characteristic	Required value	
Dimensions and dimensional tolerances	BS EN 771-3 [Ref 61.N] 5.2.1, 5.2.2	Refer to the WSR
Configuration	BS EN 771-3 [Ref 61.N] 5.3.1	
Compressive strength	BS EN 771-3 [Ref 61.N] 5.5.1	

Dimensional stability	BS EN 771-3 [Ref 61.N] 5.9	
Bond strength	BS EN 771-3 [Ref 61.N] 5.12, 5.13	
Reaction to fire	BS EN 771-3 [Ref 61.N] 5.11	
Water absorption	BS EN 771-3 [Ref 61.N] 5.8	
Water vapour permeability	BS EN 771-3 [Ref 61.N] 5.10	
Direct airborne sound insulation, density and configuration	BS EN 771-3 [Ref 61.N] 5.4.1	
Thermal resistance	BS EN 771-3 [Ref 61.N] 5.6	
Durability against freeze/thaw	BS EN 771-3 [Ref 61.N] 5.7	
Dangerous substances	BS EN 771-3 [Ref 61.N] 5.14	

10.10 The performance characteristics for precast hollow concrete blocks used for permeable backing to earth retaining structures shall be as specified in CC 500/WSR/010.

The performance characteristics for precast hollow concrete blocks used for permeable backing to earth retaining structures						
earth retaining structure reference	**drawing / model reference**	**concrete block dimensions**	**Configuration**	**Compressive strength**	**Dimensional stability**	**Bond strength**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the earth retaining structure for where the precast hollow concrete blocks are used.

b) Enter a number, to identify the drawing model reference.

c) Enter text, to identify the concrete block dimensions.

d) Enter text, to identify the configuration of the blocks.

e) Enter a number in units of N/mm^2, to identify the compressive strength of the blocks.

f) Enter text, to identify the dimensional stability requirement.

g) Enter a number in units of N/mm^2, to identify the bond strength requirement.

The performance characteristics for precast hollow concrete blocks used for permeable backing to earth retaining structures (continued)					
earth retaining structure reference	**Reaction to fire**	**Water absorption**	**Water vapour permeability**	**Direct airborne sound insulation**	**Thermal resistance**
(a)	(h)	(i)	(j)	(k)	(l)

h) Enter text, to identify the reaction to fire requirement.

i) Enter text, to identify the water absorption requirement.

j) Enter text, to the water vapour permeability requirement.

k) Enter text, to identify the direct airborne sound insulation requirement.

l) Enter text, to identify the thermal resistance requirement.

The performance characteristics for precast hollow concrete blocks used for permeable backing to earth retaining structures (continued)	
earth retaining structure reference	**Durability against freeze/ thaw**
(a)	(m)

m) Enter text, to identify the durability against freeze/ thaw requirement.

10.11 The requirements for the precast hollow concrete blocks used for permeable backing to earth retaining structures shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Product requirements for Class 7A, Class 7B and chalk backfill material to earth retaining structures

10.12 Class 7A and Class 7B material shall comply with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

10.13 When the fill adjacent to a structure is selective cohesive material (Class 7A), selected conditioned pulverised-fuel ash (Class 7B) or chalk, the permeable backing shall be a minimum thickness of 300mm of 0/4 or 0/2, CP or MP, sand.

10.14 The sand used for permeable backing shall be compliant with BS EN 12620 [Ref 1.N].

10.15 The sand used for permeable backing shall meet the performance characteristics as stated in table 10.15

Table 10.15 Performance characteristics for sand used for permeable backing			
Performance characteristic		Reference in standard	Required value
Particle shape, size and density	Aggregate size	BS EN 12620 [Ref 1.N] 4.2	0/2, 0/4
	Grading	BS EN 12620 [Ref 1.N] 4.3	
	Shape of coarse aggregate	BS EN 12620 [Ref 1.N] 4.4	FI_{NR} SI_{NR}
	Particle density	BS EN 12620 [Ref 1.N] 5.5	
Cleanliness	Shell Content	BS EN 12620 [Ref 1.N] 4.5	SC_{NR}
Cleanliness	Fines content	BS EN 12620 [Ref 1.N] 4.6	Refer to the WSR
Resistance to fragmentation/ crushing		BS EN 12620 [Ref 1.N] 5.2	LA_{50}
Resistance to polishing/ abrasion/ wear	To wear of coarse aggregate	BS EN 12620 [Ref 1.N] 5.3	$M_{DE}NR$
	To polishing	BS EN 12620 [Ref 1.N] 5.4.1	PSV_{NR}
	To surface abrasion	BS EN 12620 [Ref 1.N] 5.4.2	AAV_{NR}
	To abrasion from studded tyres	BS EN 12620 [Ref 1.N] 5.4.3	$A_N NR$
Composition/ content	Constituents of coarse recycled aggregates	BS EN 12620 [Ref 1.N] 5.8	Rcu_{NR}
	Chlorides	BS EN 12620 [Ref 1.N] 6.2	
	Acid soluble sulfates	BS EN 12620 [Ref 1.N] 6.3.1	Refer to the WSR
	Total sulphur	BS EN 12620 [Ref 1.N] 6.3.2	
	Water-soluble sulfate content of recycled aggregates	BS EN 12620 [Ref 1.N] 6.3.3	
	Constituents of natural aggregates which alter the rate of setting and hardening of concrete	BS EN 12620 [Ref 1.N] 6.4.1	A_{NR}
	Influence on initial setting time of cement (recycled	BS EN 12620 [Ref 1.N] 6.4.1	A_{NR}

	aggregates)		
	Carbonate content of fine aggregate for concrete pavement surface courses	BS EN 12620 [Ref 1.N] 6.5	N/A
Volume stability	Volume stability - drying shrinkage	BS EN 12620 [Ref 1.N] 5.7.2	N/A
Volume stability	Constituents which affect the volume stability of air-cooled blast furnace slag	BS EN 12620 [Ref 1.N] 6.4.2	
Water absorption	Particle density and water absorption	BS EN 12620 [Ref 1.N] 5.5	
Dangerous substances:		BS EN 12620 [Ref 1.N] Annex H.3.3, H.4	None Permitted
Durability against freeze-thaw		BS EN 12620 [Ref 1.N] 5.7.1	Refer to the WSR
Durability against alkali-silica reactivity		BS EN 12620 [Ref 1.N] 5.7.3	

10.16 The performance characteristics of the sand used for permeable backing to Class 7A, Class 7B or Chalk backfill shall be as specified in CC 500/WSR/010.

The performance characteristics of the sand used for permeable backing to Class 7A, Class 7B or Chalk backfill					
Location of earth retaining structure	**Grading**	**Fines content**	**Acid soluble sulfates**	**Total sulfur**	**Water-soluble sulfate content of recycled aggregates**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the grading requirements.

c) Enter text, to identify the fines content.

d) Enter text, to identify the acid soluble sulfates.

e) Enter text, to identify the total sulfur.

f) Enter text, to identify the water-soluble sulfate content of recycled aggregates.

The performance characteristics of the sand used for permeable backing to Class 7A, Class 7B or Chalk backfill (continued)	
Location of earth retaining structure	**Freeze/thaw resistance of coarse aggregate**
(a)	(g)

g) Enter text, to identify the freeze/thaw resistance of coarse aggregate.

10.17 The requirements for the sand used for permeable backing shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Product verification for permeable backing to earth-retaining structures

10.18 Where granular material is used for permeable backing to earth retaining structures, it shall be verified in accordance with 'Product verification for the bedding, surround and backfill material for drainage pipes' in "Drainage pipes" in Section 1 of this document.

Product documentation for permeable backing to earth-retaining structures

10.19 Where granular material is used for permeable backing to earth retaining structures, documentation shall be provided in accordance with 'Product documentation for the bedding, surround and backfill for drainage pipes' in "Drainage pipes" in Section 1 of this document.

11. Fin drains

Product requirements for fin drains

11.1 Fin Drains shall be as described in CC 500/WSR/011.

Fin Drains								
Fin drain reference	**Drawing/ model reference**	**Offset distance from the edge of carriage way**	**Fin drain thickness**	**Upstream chamber/ headwall reference**	**Downstream chamber/ headwall reference**	**Upstream invert level**	**Downstream invert level**	**Fin drain type**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter a unique reference.

b) Enter text, to identify the drawing where the Fin Drain is located.

c) Enter a number in units of mm, to identify the offset distance from the edge of carriageway to the centre of the fin drain where it is not used in conjunction with a concrete channel or channel block.

d) Enter a number in units of mm, to identify the thickness of the composite drain (ie the combined thickness of the core and geotextile).

e) Enter a unique reference, to identify the upstream chamber or headwall reference.

f) Enter a unique reference, to identify the downstream chamber or headwall reference.

g) Enter a number in units of m, to identify the invert level of the bottom of the trench at the upstream chamber of length of fin drain.

h) Enter a number in units of m, to identify the invert level of the bottom of the trench at the downstream chamber of length of fin drain.

i) Enter one or more values, from options type 5, type 6, type 7, type 10, to identify the fin drain type (multiple options can be selected to allow constructor to choose).

Fin Drains (continued)					
Fin drain reference	**Maximum drain slope angle to the vertical**	**The long term in plane flow for fin drains (the near vertical downward flow)**	**The long term in plane flow for fin drains along the drain parallel to the road edge**	**Pipe surround material**	**Fin drain internal pipe diameter**
(a)	(j)	(k)	(l)	(m)	(n)

j) Enter text, to identify the maximum slope angle.

k) Enter text, to identify the long term in plane flow for fin drains which includes fin drain joints transverse to the direction of flow.

l) Enter text, to identify the long term in plane flow for fin drains which includes fin drain joints transverse to the direction of flow.

m) Enter text, to identify the pipe surround material within the fin drain.

n) Enter a number in units of mm, to identify the Fin drain internal pipe diameter.

Fin Drains (continued)	
Fin drain reference	**Trench backfill material**
(a)	(o)

o) Enter text, to identify the trench backfill material where fin drains are installed in a trench (usually as dug material).

11.2 Fin drains shall be compliant with the requirements in CD 524 [Ref 26.N].

11.3 The fin drains shall meet the performance characteristics as stated in table 11.3

Table 11.3 Performance characteristics of fin drains		
Performance characteristic	Relevant Testing Standard/ Method	Required value
Percentage Contact Area of Drainage Core	CD 524 [Ref 26.N]	100%
Thickness of Fin drains under	CD 524 [Ref 26.N]	Refer to the WSR. No

specified normal and shear stress		reduction in thickness from what is stated
In-plane flow under compressive loading	BS EN ISO 12958 [Ref 33.N] CD 524 [Ref 26.N]	Refer to the WSR. No impact on flow from what is stated.
Flow rate through each face of the drain	Direct measurement of the composite drain using BS EN ISO 12958 [Ref 33.N] or by calculation based on the flow rate obtained by the standard test in BS EN ISO 12958 [Ref 33.N]and the percentage contact area of the drainage core.	More than 75% of the value of the geotextile on the sides where in flow occurs

11.4 Pipes within fin drains type 6 shall be perforated or porous.

11.5 Pipes and pipe joints within fin drains type 6 shall comply with 'Product requirements for new drainage pipes' in "Drainage pipes" in Section 1 of this document.

11.6 Pipes within fin drains type 7 shall be unperforated thermoplastic structured wall pipes.

11.7 Pipes and pipe joints within type 7 fin drains shall comply with 'Product requirements for thermoplastic drainage pipes' in "Drainage pipes" in Section 1 of this document.

11.8 Pipes within type 7 fin drains shall be slotted longitudinally along the top surface of the pipe with the slots no more than 60 degrees from the crown of the pipe.

11.9 The bedding material for pipes in fin drains shall comply with 'Product requirements for bedding and surround material for drainage pipes' in "Drainage pipes" in Section 1 of this document.

11.10 The surround material for pipes in fin drains shall comply with Types A and C in 'Product requirements for backfill material for drainage pipes' "Drainage pipes" in Section 1 of this document.

11.11 The geotextile section of the fin drain shall be compliant with BS EN 13252 [Ref 32.N].

11.12 The geotextile section of the fin drain shall meet the performance characteristics as stated in table 11.12.

Table 11.12 Geotextile section performance characteristics	
Essential characteristic	Required value

Minimal tensile strength at breaking point in both machine and cross machine directions	minimum 5 kN/m
Elongation at maximum load	minimum 10%
Resistance to static puncture	minimum 1200 N
Dynamic perforation resistance	mean hole diameter <40mm
Characteristic maximum opening size (O_{90})	Refer to the WSR
Water permeability normal to the plane	minimum 10 l/m^2/sec
Durability	BS EN 13252 [Ref 32.N] Annex B, Clause 4.1, 5.1 and Table 1 (15)
Dangerous substances	None permitted

11.13 The performance characteristics for the geotextile section of the fin drain shall be as specified in CC 500/WSR/011.

The performance characteristics for the geotextile section of the fin drain	
Fin drain reference	**Characteristic maximum opening size (O_{90})**
(a)	(b)

a) Enter a unique reference.

b) Enter a number in units of um, to identify the characteristic maximum opening size (O_{90}).

11.14 The requirements for the geotextile section of the fin drain shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Installation requirements for fin drains in new drainage systems

11.15 Fin drains shall be installed in accordance with the manufacturer's instructions.

11.16 Compaction of the backfill material shall comply with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

11.17 The bottom of the fin drain trench shall be free from irregularities.

11.18 The trench shall be backfilled and compacted such that the fin drain is touching the trench walls.

11.19 The marker tape laid above the fin drain shall be green self-coloured PVC or polythene plastic not less than 0.1mm thick and 150mm wide.

11.20 All joints shall be formed so as to prevent the ingress of soil particles or other extraneous material into the drain.

11.21 Geotextile shall be wrapped around fin drain joints parallel to the direction of flow and any other exposed edges with 150mm overlap.

Installation requirements for fin drains in existing drainage systems

11.22 Where a composite drain is installed in an existing drain, it shall be in accordance with the manufacturer's instructions.

11.23 The material used for the sub-soil shall be Class 4 non-cohesive material in compliance with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

11.24 Where a composite drain is installed in an existing drain, the maximum depth from the top of the topsoil to the channel invert shall be 200mm.

11.25 The subsoil above composite drains shall be non-cohesive.

11.26 The subsoil above fin drains shall have a permeability greater than 10^{-4} m/s.

Installation verification requirements for fin drains

11.27 Verification shall be undertaken for the permeability of the sub-soil above fin drains in accordance with Appendix C of CD 225 [Ref 17.N].

11.28 The frequency of permeability test shall be 1 per source.

11.29 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to the permeability testing of the sub-soil used above fin drains.

Product documentation requirements for fin drains

11.30 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to fin drains.

11.31 The Product Acceptance Scheme certification for fin drains shall demonstrate that the requirements of CD 524 [Ref 26.N] are met.

Installation documentation requirements for fin drains

11.32 The following Documentation shall be submitted for the permeability testing results prior to the commencement of backfill of topsoil: test result certificates.

12. Narrow filter drains

Product requirements for narrow filter drains

12.1 Narrow filter drains shall be as described in CC 500/WSR/012.

Narrow filter drains							
Narrow filter drain number	**Narrow filter drain drawing/ model reference**	**Offset distance from the edge of carriage way**	**Upstream chamber/ headwall reference**	**Downstream chamber/ headwall reference**	**Upstream invert level**	**Downstream invert level**	**Narrow filter drain type**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.

b) Enter text, to identify where the narrow filter drain is located.

c) Enter a number in units of mm, to identify the offset distance from the edge of carriageway to the centre of the narrow filter drain where it is not used in conjunction with a concrete channel or channel block.

d) Enter a unique reference, to identify chamber/headwall.

e) Enter a unique reference, to identify chamber/headwall.

f) Enter a number in units of m, to identify the invert level of the bottom of the trench at the upstream chamber.

g) Enter a number in units of m, to identify the invert level of the bottom of the trench at the downstream chamber.

h) Enter one or more values, from options type 8, type 9, to identify the narrow filter drain type (multiple options can be selected to allow constructor to choose).

Narrow filter drains (continued)				
Narrow filter drain number	**Maximum drain slope angle to the vertical**	**Narrow filter drain pipe diameter**	**Category for tolerances at mid-size sieves**	**Minimum permeability of granular material within the narrow filter drain**
(a)	(i)	(j)	(k)	(l)

i) Enter text, to identify the maximum slope angle (usually 15% maximum).

j) Enter a number in units of mm, to identify the narrow filter drain internal pipe diameter.

k) Enter text, to identify the category for tolerances at mid-size sieves for the type 8 and type 9 narrow filter drain granular material.

l) Enter a number in units of m/s, to identify the minimum permeability of granular material within the narrow filter drain (typically this is 1×10^{-4} m/s).

12.2 Pipes within narrow filter drains shall be perforated or porous.

12.3 Pipes and pipe joints within narrow filter drains shall comply with 'Product requirements for drainage pipes' in "Drainage pipes" in Section 1 of this document.

12.4 The geotextile used in narrow filter drains shall comply with the requirements within 'Product requirements for fin drains' in "Fin drains" in Section 11 of this document.

12.5 The granular material used for pipe surround and trench infill shall be compliant with BS EN 13242 [Ref 2.N].

12.6 The granular material used for pipe surround and trench infill shall meet the performance characteristics as stated in table 1.78 for LA category and sulfate content; and table 12.6 for grading requirements.

Table 12.6 Narrow Filter Drain: pipe surround and trench Infill grading requirement		
Drain type	Type 8	Type 9
Standard	BS EN 13242 [Ref 2.N]	
Size, mm	1/20	10/40
Grading	G_C 80-20	G_C 85-15
Aggregate	Coarse	
Category for tolerances at mid-size	Refer to the WSR	

sieves		
Category for maximum fines	f_2	
Additional requirements	d/8 0-3% passing by mass	d/80 0-3% passing by mass

12.7 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N] shall apply to the granular material used for pipe surround and trench infill.

Product verification for narrow filter drains

12.8 Product verification for the narrow filter drain pipe surround and backfill material shall comply with 'Product verification for the bedding, surround and backfill material for drainage pipes' in "Drainage pipes" in Section 1 of this document.

Installation requirements for narrow filter drains

12.9 Narrow filter drains shall be installed in accordance with the manufacturer's instructions.

12.10 The narrow filter drain trench bottom shall be free from irregularities.

12.11 Where coilable pipes are used, they shall be capable of being straightened so as to lie flat without restraint in the trench bottom before backfilling.

12.12 The deposition and compaction of infill material shall comply with 'Installation requirements for the backfill for drainage pipes' in "Drainage pipes" in Section 1 of this document.

12.13 Narrow filter drains shall be backfilled and compacted such that the narrow filter drain is touching the trench walls.

12.14 Narrow filter drains installed as part of the works shall not be used for the disposal of surface water run-off during construction.

12.15 The marker tape laid above the narrow filter drain shall be green self-coloured PVC or polythene plastic not less than 0.1mm thick and 150mm wide.

Product documentation for narrow filter drains

12.16 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to narrow filter drains.

12.17 Documentation for the narrow filter drain pipe surround and backfill material shall comply with 'Product documentation for the bedding, surround and backfill for drainage pipes' in "Drainage pipes" in Section 1 of this document.

13. Combined kerb and drainage systems

Product requirements for combined kerb and drainage systems

13.1 Combined kerb and drainage systems shall be Contractor design items.

13.2 The design of combined kerb and drainage systems shall be in accordance with CD 524 [Ref 26.N].

13.3 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 31.N] shall apply to combined kerb and drainage systems.

13.4 The combined kerb and drainage systems shall be as specified in CC 500/WSR/013.

The combined kerb and drainage systems						
Drawing or model reference for combined kerb drainage system	**X (Easting) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**Y (Northing) coordinate**	**Design flow**	**Maximum width**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter text, to identify the drawing or model where this is shown.

b) Enter text, to identify location of start of the combined kerb and drainage system.

c) Enter text, to identify location of start of the combined kerb and drainage system.

d) Enter text, to identify location of end of the combined kerb and drainage system.

e) Enter text, to identify location of end of the combined kerb and drainage system.

f) Enter a number in units of l/s, to define required capacity.

g) Enter a number in units of mm, to define design requirement.

The combined kerb and drainage systems (continued)						
Drawing or model reference for combined kerb drainage system	**Maximum depth**	**Kerb upstand**	**Side entry unit dimensions**	**Kerb profile**	**Strength classification**	**Special fitting requirements**
(a)	(h)	(i)	(j)	(k)	(l)	(m)

h) Enter a number in units of mm, to define design requirement.

i) Enter a number in units of mm, to define design requirement.

j) Enter a number in units of mm, to define the dimensions of the side entry units to be used in or adjacent to porous asphalt.

k) Enter a value, from options splay, half batter, to define design requirement.

l) Enter a value, from options C250, D400, E600, to define design requirement.

m) Enter text, to identify any fittings including junctions, connecting pipes and other fittings comprising the combined drainage and kerb system.

13.5 The combined kerb and drainage systems shall be compliant with BS EN 1433 [Ref 22.N].

13.6 The combined kerb and drainage systems shall meet the performance characteristics as stated in table 13.6.

Table 13.6 Performance characteristics for combined kerb and drainage systems		
Performance characteristic	Required value	
Watertightness	BS EN 1433 [Ref 22.N] 7.5.1	No leakage
Load bearing capacity, deflection under load - maximum load - Permanent set	BS EN 1433 [Ref 22.N] 7.15 BS EN 1433 [Ref 22.N] 7.16	Refer to WSR
Weathering resistance - durability	BS EN 1433 [Ref 22.N] 6	+R

13.7 The requirements of the combined kerb and drainage systems shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

13.8 The side-entry inlets to the combined kerb and drainage system shall be used to drain the adjacent pervious surfacing material.

13.9 The combined kerb and drainage systems shall be able to accommodate the design flows without surcharge, with the top water level below the inlet apertures.

13.10 Junctions, connecting pipes and other fittings comprising the combined drainage and kerb systems shall comply with "Drainage pipes" in Section 1 of this document.

13.11 The combined kerb and drainage system shall incorporate measures to enable rodding of the outfall pipework and provide access for jetting by water jetting equipment into the system.

13.12 Joints between units comprising the system and between the system and adjacent construction shall be watertight to avoid leakage of surface water.

13.13 Joints between bridge deck waterproofing and component parts passing through the waterproofing shall be watertight.

13.14 For rigid carriageway construction, the sealing strip between the combined kerb and drainage system and the carriageway shall comply with "Joint sealing of concrete pavements" in Section 15 of CC 203 [Ref 57.N].

Installation requirements for combined kerb and drainage systems

13.15 Combined kerb and drainage systems shall be installed in accordance with the manufacturer's requirements.

13.16 The combined kerb and drainage systems shall be left clean and free from all obstructions.

14. Linear drainage channel systems

Product requirements for linear drainage channel systems

14.1 Linear drainage channel systems shall be Contractor design items.

14.2 The design of linear drainage channel systems shall be in accordance with CD 524 [Ref 26.N].

14.3 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 31.N] shall apply to linear drainage channel systems.

14.4 Linear drainage channel systems shall be as specified in CC 500/WSR/014.

Linear drainage channel systems					
Drawing or model reference of the linear drainage channel system	**X (Easting) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**Y (Northing) coordinate**	**Channel type**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter text, to identify the drawing or model where this is shown.

b) Enter text, to identify location of start of the linear drainage channel system.

c) Enter text, to identify location of start of the linear drainage channel system.

d) Enter text, to identify location of end of the linear drainage channel system.

e) Enter text, to identify location of end of the linear drainage channel system.

f) Enter a value, from options I, M, to define how the loads in service are to be accommodated.

Linear drainage channel systems (continued)							
Drawing or model reference of the linear drainage channel system	**Design Flow**	**Maximum width**	**Maximum depth**	**Side entry unit dimensions**	**Strength Classification**	**Weathering resistance**	**Minimum inlet area**
(a)	(g)	(h)	(i)	(j)	(k)	(l)	(m)

g) Enter a number in units of l/s, to state required capacity.

h) Enter a number in units of mm, to define maximum width.

i) Enter a number in units of mm, to define maximum depth.

j) Enter a number in units of mm, to define the dimensions of the side entry units to be used in or adjacent to porous asphalt.

k) Enter a value, from options C250, D400, E600, to define strength requirement.

l) Enter a value, from options N/A, N, W, +R, to define the durability requirements.

m) Enter text, to set the minimum inlet area through the slots.

Linear drainage channel systems (continued)				
Drawing or model reference of the linear drainage channel system	**Special fitting requirements**	**Concrete mix**	**Concrete air content**	**Concrete dry density**
(a)	(n)	(o)	(p)	(q)

n) Enter text, to identify any fittings including junctions, connecting pipes and other fittings comprising the linear drainage channel system.

o) Enter text, to identify the mix of concrete if an in-situ channel is used.

p) Enter text, to identify the concrete air content if an in-situ channel is used.

q) Enter text, to identify the concrete dry density if an in-situ channel is used.

14.5 When linear drainage channel systems are used adjacent to porous asphalt surfacing materials, the linear drainage channel units shall incorporate side entry inlets to permit drainage of water held within the porous asphalt.

14.6 Junctions, connecting pipes and other fittings comprising the linear drainage channel system shall comply with "Drainage pipes" in Section 1 of this document.

14.7 The linear drainage channel system shall incorporate measures to enable rodding of the outfall pipework and provide access for jetting by water jetting equipment into the system.

14.8 Joints between bridge deck waterproofing and component parts passing through the waterproofing shall be watertight.

14.9 The sealing strip between the prefabricated linear drainage system and the either the rigid carriageway or concrete safety barrier shall comply with "Joint sealing of concrete pavements" in Section 15 of CC 203 [Ref 57.N].

Product requirements for prefabricated linear drainage channel systems

14.10 Prefabricated linear drainage channel systems shall be compliant with BS EN 1433 [Ref 22.N].

14.11 The prefabricated linear drainage channel systems shall meet the performance characteristics as stated in table 14.12

Table 14.11 Performance characteristics for prefabricated linear drainage channel systems

Performance characteristic	Required value	
Water-tightness- jointing of drainage channels	BS EN 1433 [Ref 22.N] 7.5.1	No leakage
Load bearing capacity, deflection under load - maximum load - Permanent set	 BS EN 1433 [Ref 22.N] 7.15 BS EN 1433 [Ref 22.N] 7.16	Refer to the WSR
Durability	BS EN 1433 [Ref 22.N] 6	

14.12 The requirements for prefabricated linear drainage channel systems shall be in accordance with "Designated standards" in Section 10 of GC 101 [Ref 31.N].

14.13 The concrete between the prefabricated linear drainage channel system and the rigid carriageway construction shall be strength class C28/35 to a depth of not less than the thickness of the rigid carriageway slab.

Product requirements for in-situ linear drainage channel systems

14.14 In situ linear drainage channel systems shall comply with "Kerb unit construction" in Section 8 of CC 207 [Ref 29.N].

14.15 The concrete used for the in-situ linear drainage channel systems, shall be plain concrete irrespective of the inclusion of reinforcement.

14.16 The concrete used for the in-situ linear drainage channel systems, shall comply with "Kerb unit construction" in Section 8 of CC 207 [Ref 29.N].

14.17 In-situ linear drainage channel systems shall be slipformed.

14.18 Gully sections for linear drainage channel systems shall be handformed.

14.19 The survey of the central void of the linear drainage channel shall comply with "Drainage pipes" in Section 1 of this document.

14.20 Filler board 25mm thick between adjacent concrete pours of the linear drainage channel shall comply with "Filler board for concrete pavements" in Section 14 of CC 203 [Ref 57.N].

14.21 Full depth joints seals of the linear drainage channel shall comply with "Joint sealing of concrete pavements" in Section 15 of CC 203 [Ref 57.N].

14.22 Reinforcement of the linear drainage channel shall comply with "Steel reinforcement for structural concrete" in Section 4 of CC 482 [Ref 68.N].

14.23 Minimum cover to reinforcement of the linear drainage channel shall be 75mm.

Installation requirements for linear drainage channel systems

14.24 Prefabricated linear drainage channel systems shall be installed in accordance with the manufacturer's requirements.

14.25 Prefabricated linear drainage channel systems shall be isolated from the adjacent concrete construction by a sealed expansion joint in accordance with "Transverse joints in jointed concrete pavements" in Section 9 of CC 203 [Ref 57.N].

14.26 Linear drainage channel systems shall be left clean and free from all obstructions.

Installation verification for linear drainage channel systems

14.27 The trial lengths and testing of in-situ linear drainage channel systems shall be compliant with BS 5931 [Ref 5.N].

14.28 Verification shall be undertaken for in-situ linear drainage channel systems by undertaking trial lengths and testing.

14.29 The frequency of the trial lengths shall be 10m lengths for each concrete mix design unless otherwise stated in CC 500/WSR/014.

SI.14.29a The frequency of the trial length of the insitu linear drainage channel systems shall be [enter free text].

SI.14.29b The selected mix of the concrete shall be [enter free text].

SI.14.29c The air content of the concrete shall be [enter free text].

SI.14.29d The dry density of the concrete shall be [enter free text].

14.30 The requirements for "Verification" in Section 14 of GC 101 [Ref 31.N] shall apply to the trial length testing.

Installation documentation for linear drainage channel systems

14.31 The following Documentation shall be submitted for in-situ linear drainage channels prior to the commencement of their construction: the results of the trial length testing.

14.32 The requirements for "Documentation" in Section 2 of GC 101 [Ref 31.N] shall apply to the results of the trial length testing.

15. Concrete bagwork

Product requirements for concrete bagwork

15.1 The locations of the concrete bagwork shall be as described in CC 500/WSR/015.

The locations of the concrete bagwork			
Bagwork Reference	**Drawing or model reference**	**Start Coordinate**	**End Coordinate**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter a number in units of m, to identify the location on the National Grid coordinate system.

d) Enter a number in units of m, to identify the location on the National Grid coordinate system.

15.2 Concrete bagwork shall be constructed from bags when filled of dimensions 450mm x 300mm x 150mm.

15.3 The concrete for the bagwork shall be GEN 3 with a consistence class S1.

15.4 The GEN3 concrete for the bagwork shall comply with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 46.N].

15.5 The bags shall be hessian sand bags compliant with BS 1214 [Ref 60.N].

15.6 The performance characteristics of the hessian sand bags shall be as specified in CC 500/WSR/015.

The performance characteristics of the hessian sand bags	
Bagwork Reference	**Fabric of the hessian sand bags**
(a)	(b)

a) Enter a unique reference.

b) Enter a value, from options Type A, Type B, Type C, to identify the fabric of the hessian sand bags.

15.7 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to the hessian sand bag fabric.

Installation requirements for concrete bagwork

15.8 Concrete bagwork courses shall be horizontal and all vertical joints staggered in alternate courses.

15.9 Headers shall be placed at every third concrete bag in alternate courses.

15.10 The finished exposed faces of the concrete bagwork shall not be punctured or torn and no tucked ends visible.

15.11 The finished exposed faces of the concrete bagwork shall be flat with square edges.

15.12 Each concrete bag shall be spiked to the one below and the bottom row spiked to the foundation with 10mm x 200mm mild steel dowel bars.

15.13 Where the concrete bagwork has a concrete backing, alternate rows of bags shall be spiked to the backing concrete with 10mm x 200mm mild steel dowel bars at 45 degrees to the horizontal with one dowel per bag in the row.

15.14 Where concrete bagwork forms a headwall, the headwall foundations shall be cast against the excavated face and any overdig filled with GEN3 concrete.

15.15 Formed concrete surfaces shall comply with F1 in "Precast structural concrete" in Section 7 of CC 482 [Ref 68.N].

15.16 Unformed concrete surfaces shall comply with U1 in "Precast structural concrete" in Section 7 of CC 482 [Ref 68.N].

15.17 Where concrete bagwork is provided to protect watercourses, before placing the bags, the banks shall be cut into horizontal steps to provide a suitable foundation.

15.18 Where concrete bagwork is provided to protect watercourses, the foundation shall be covered with geotextile in accordance with "Earthworks for special geotechnical works" in Section 13 of CC 601 [Ref 25.N].

15.19 Where concrete bagwork is constructed in watercourses, the bottom course of the bags shall be at least 450mm below the bed.

15.20 The concrete bagwork shall be thoroughly soaked with water upon completion of the construction to saturate the hessian bags.

16. The cleaning of existing drainage systems

Installation requirements for the cleaning of existing drainage systems

16.1 The cleaning of existing drainage systems shall be in accordance with CS 551 [Ref 23.N] at the locations specified in CC 500/WSR/016.

The cleaning of existing drainage systems				
Asset Reference	**Drawing or model reference**	**Asset Type**	**Method of cleaning**	**Time of cleaning**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter a value, from options Gully, Catchpit, Soakaway, Separator/interceptor, Piped Drainage System, Subway Drainage Channels, Kerb Offlet Pipe, Channel Offlet Pipe, Bridge Drainage System, Chamber, Linear drainage channel system, Combined kerb and drainage system, Apron, Culvert, Outfall, Pond, Ditch, to clean.

d) Enter text, to identify the method of cleaning for each existing drainage system.

e) Enter text, to identify when the existing drainage system shall be cleaned.

16.2 The requirement for jetting shall comply with the procedures in "Low pressure high volume jetting of drainage systems" in Section 17 of this document.

Installation requirements for the cleaning of bridge drainage systems

16.3 Cleaning of bridge drainage systems shall be in accordance with CS 551 [Ref 23.N] at the locations specified in CC 500/WSR/016.

Cleaning of bridge drainage systems		
Bridge name	**Bridge asset**	**Cleaning method**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a value, from options bridge bearing shelves, subway sumps, grit chambers, other bridge drainage systems, to define asset.

c) Enter a value, from options sweeping, vacuum/air suction, low pressure high volume jetting, to define appropriate cleaning method.

17. Low pressure high volume jetting of drainage systems

Installation requirements for low pressure high volume jetting of drainage systems

17.1 Low pressure high volume jetting shall be in accordance with CS 551 [Ref 23.N] to the pipes specified in CC 500/WSR/017.

Low pressure high volume jetting						
Asset Reference	**Drawing/ model reference**	**Asset Type**	**Length of asset**	**Pipe diameter/Nominal channel size**	**Asset material**	**Particular requirements for pipes**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter a value, from options Pipe, Linear Drainage Channels, Combined Kerb Drainage, to clean.

d) Enter a number in units of m, to clean.

e) Enter a number in units of mm, to clean.

f) Enter a value, from options Brick/Masonry, Plastics - Structural Wall, Plastics - Solid Wall, Concrete, Clay, Other, to select pump pressures.

g) Enter a value, from options pitch fibre, porous concrete, or perforated pipes, to identify if any pitch fibre pipe, porous concrete pipe, perforated pipes are present.

18. Vortex Separators

Product requirements for vortex separators

18.1 Vortex separators shall be as specified in CC 500/WSR/018.

Vortex separators						
Vortex separator reference	**Drawing/ model reference**	**Easting**	**Northing**	**Maximum discharge rate into the vortex separator**	**Minimum discharge rate into the vortex separator**	**Routine maintenance period**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter text, to identify the location of the centre of the access chamber.

d) Enter text, to identify the location of the centre of the access chamber.

e) Enter a number in units of l/s, to identify the maximum discharge rate into the vortex separator.

f) Enter a number in units of l/s, to identify the minimum discharge rate into the vortex separator.

g) Enter text, to identify the routine maintenance period of the vortex separator.

Vortex separators (continued)	
Vortex separator reference	**Additional information from the manufacturer**
(a)	(h)

h) Enter text, to identify additional manufacturer information in relation to the vortex separator, for example the treatment capacity.

18.2 Vortex separators shall have no moving parts.

18.3 Internal components of the vortex separator shall be constructed from stainless steel and/or polyethylene.

18.4 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to vortex separators.

Installation requirements for vortex separators

18.5 Vortex separators shall be installed in accordance with the manufacturer’s requirements.

18.6 The formation level of the vortex separator shall be blinded with GEN 1 concrete in accordance with "Bedding Mortar" in Section 1 of CC 495 [Ref 46.N].

19. Grassed surface water channels

Product requirements for grassed surface water channels

19.1 Grassed surface water channels shall be as described in CC 500/WSR/019.

Grassed surface water channels					
Grassed surface water channel reference	**Drawing/ model reference**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where the grassed surface water channel is shown.

c) Enter text, to identify location of start of grassed surface water channel.

d) Enter text, to identify location of start of grassed surface water channel.

e) Enter text, to identify location of end of grassed surface water channel.

f) Enter text, to identify location of end of grassed surface water channel.

Grassed surface water channels (continued)								
Grassed surface water channel reference	**Channel length**	**Channel profile**	**Channel width B**	**Channel base width**	**Channel depth**	**Findrain type**	**Biodegradable reinforcement**	**Duration of protection of biodegradable reinforcement**
(a)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)

g) Enter a number in units of m, to identify length of grassed surface water channel.

h) Enter a value, from options triangular, trapezoidal, to specify grassed surface water channel profile.

i) Enter a number in units of m, to define the width of the grassed surface water channel.

j) Enter a number in units of m, to define base width of the trapezoidal channel.

k) Enter a number in units of m, to define maximum depth of channel.

l) Enter a value, from options Type 5, Type 6, Not included, to define subsurface drainage type.

m) Enter a value, from options yes, no, to identify biodegradable reinforcement between subsoil and topsoil layers locations.

n) Enter text, to confirm the duration of protection required from the biodegradable reinforcement.

Grassed surface water channels (continued)						
Grassed surface water channel reference	**Tensile strength of biodegradable reinforcement**	**Characteristic opening size of biodegradable reinforcement**	**Impermeable membrane**	**Tensile strength of impermeable membrane**	**Resistance to static puncture of impermeable membrane**	**Durability of impermeable membrane**
(a)	(o)	(p)	(q)	(r)	(s)	(t)

o) Enter a number in units of kN/m^2, to define the requirement for tensile strength of the biodegradable reinforcement.

p) Enter text, to define the characteristic opening size of the biodegradable reinforcement.

q) Enter a value, from options yes, no, to identify where impermeable membrane is required.

r) Enter a number in units of kN/m, to define the tensile strength of the impermeable membrane.

s) Enter a number in units of N, to define the resistance to static puncture of the impermeable membrane.

t) Enter text, to define the durability requirement of the impermeable membrane.

19.2 The grass mix for seeding or turfing of the grassed surface water channel shall be as stated in CC 500/WSR/019.

SI.19.2a Grass mix, specific to location [enter free text].

SI.19.2b The steps for seedbed/turfbed preparation of the grassed surface water channel shall be [enter free text].

19.3 Fin drains included within the grass surface water channel shall comply with the requirements of "Fin drains" in Section 11 of this document.

19.4 The fin drains double cuspated central core shall be made from polyethylene or polypropylene and be in accordance with the requirements within "Fin drains" in Section 11 of this document.

19.5 The surface material of the grassed surface water channel shall be topsoil Class 5B in accordance with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of CC 601 [Ref 25.N].

19.6 The subsoil of the grassed surface water channels shall be non cohesive material.

19.7 The subsoil for grassed surface water channels shall be free of stones larger than 50mm.

Installation requirements for grassed surface water channels

19.8 Prior to placing subsoil for the grassed surface water channel, the formation shall be ripped to a depth not exceeding 150mm.

19.9 Fixings used to hold a impermeable membrane for the grassed surface water channel in place shall not pierce the material.

19.10 Subsoil for grassed surface water channels shall be placed in layers, not exceeding 100mm depth.

19.11 The subsoil for grassed surface water channels shall be compacted using a vibrating plate compactor to Method 1 requirements if using 1400kg to 1800kg plant or Method 3 requirements if using 1100kg to 1200kg plant in accordance "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

19.12 Biodegradable reinforcement for grassed surface water channels shall be placed between the subsoil and topsoil layers.

19.13 The topsoil depth of the grassed surface water channel shall be between 35mm and 50mm following compaction.

19.14 The topsoil for grassed surface water channels shall be compacted by two passes of a vibrating plate compactor to Method 1 depth requirements if using 1400kg to 1800kg plant or Method 3 depth requirements if using 1100kg to 1200kg plant in accordance "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

19.15 Runoff from the pavement or verge shall be prevented from entering the grassed surface water channel or surcharging the fin drain during construction.

19.16 Where turf is used for grassed surface water channels, it shall be placed within 4 hours after compaction of the topsoil to minimise the risk of washout of the soil.

20. Combined concrete surface water channel and pipe

Product requirements for combined concrete surface water channel and pipe

20.1 The combined concrete surface water channel and pipe sections shall comply with the WSR relevant to "Kerb unit construction" in Section 8 of CC 207 [Ref 29.N].

20.2 Combined concrete surface water channel and pipes shall be as specified in CC 500/WSR/020.

Combined concrete surface water channel and pipes					
Combined concrete surface water channel and pipe reference	**Drawing or model reference**	**X (Easting) coordinate**	**Y (Northing) coordinate**	**X (Easting) coordinate**	**Y (Northing) coordinate**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.

b) Enter text, to identify the drawing or model where this is shown.

c) Enter text, to identify location of start of the combined surface water channel and pipe system.

d) Enter text, to identify location of start of the combined surface water channel and pipe system.

e) Enter text, to identify location of end of the combined surface water channel and pipe system.

f) Enter text, to identify location of end of the combined surface water channel and pipe system.

Combined concrete surface water channel and pipes (continued)		
Combined concrete surface water channel and pipe reference	**Overall channel width**	**Internal pipe diameter**
(a)	(g)	(h)

g) Enter a number in units of mm, to define width of channel.

h) Enter a number in units of mm, to define size of pipe.

Installation requirements for combined concrete surface water channel and pipe

20.3 The installation of the combined concrete surface water channel and pipe sections shall comply with "Kerb unit construction" in Section 8 of CC 207 [Ref 29.N].

Product documentation Combined concrete surface water channel and pipe product documentation

20.4 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to combined concrete surface water channel and pipe products.

21. Reservoir pavements

Product requirements of reservoir pavements

21.1 The reservoir pavements shall be as specified in CC 500/WSR/021.

The reservoir pavements	
Reservoir pavement	**Reservoir pavement specification**
(a)	(b)

a) Enter a unique reference, to identify the reservoir pavement.

b) Enter text, to detail the reservoir pavement specification.

Installation requirements for reservoir pavements

21.2 Reservoir pavements shall be installed in accordance with the manufacturer's requirements and instructions.

22. Drainage Structures

Product requirements for drainage structures

22.1 All piped culverts, box culverts, sewers and drainage structures, other than bridges, that have a diameter or clear span exceeding 900mm shall comply with this section of the document.

22.2 The piped and boxed culverts, sewers and drainage structures that have a diameter or clear span exceeding 900mm shall be constructor design items.

22.3 The design of piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter shall be in accordance with CC 500/WSR/022.

22.4 The requirements for "Technical approval of highway structures" in Section 18 of GC 101 [Ref 31.N] shall apply to piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter.

22.5 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 31.N] shall apply to piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter.

22.6 Piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter shall be as specified in CC 500/WSR/022.

Piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter						
Piped and boxed culverts, sewers and drainage structure reference	**Drawings or model reference**	**Design flow**	**Design roughness coefficient (ks)**	**Hydraulic requirements**	**X (Easting) coordinate**	**Y (Northing) coordinate**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter a number, to identify the drawing/model where this information is shown.

c) Enter a number in units of l/s, to specify the required design capacity of the drainage structure.

d) Enter a number in units of mm, to specify hydraulic criteria.

e) Enter text, to specify any further hydraulic requirements.

f) Enter text, to specify start of drainage structure.

g) Enter text, to specify start of drainage structure.

Piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter (continued)				
Piped and boxed culverts, sewers and drainage structure reference	**X (Easting) coordinate**	**Y (Northing) coordinate**	**Minimum loading**	**Site specific constraints**
(a)	(h)	(i)	(j)	(k)

h) Enter text, to specify end of drainage structure.

i) Enter text, to specify end of drainage structure.

j) Enter a number in units of kN/m^2, to identify the minimum loading the piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter must accommodate.

k) Enter text, to identify site specific constraints.

22.7 The design of piped and boxed culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of DMRB CG 300 [Ref 70.N].

Product requirements for pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

22.8 The design of piped and boxed culverts exceeding 900mm diameter shall be compliant with the requirements of CD 529 [Ref 20.N].

22.9 Pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be selected from vitrified clay, concrete, ductile iron, corrugated steel and thermoplastic structured wall pipes.

22.10 Only one type of pipe for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be used between consecutive chambers.

Product requirements for vitrified clay pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

22.11 Vitrified clay pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of BS EN 295-1 [Ref 73.N].

22.12 The vitrified clay pipes diameter for piped culverts, sewers and drainage structures exceeding 900mm diameter shall meet the performance characteristics as stated in table 22.12.

Table 22.12 Performance characteristics for vitrified clay pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

Performance Characteristic		Required value	
Reaction to fire		BS EN 295-1 [Ref 73.N] 7.1	A1
Crushing strength		BS EN 295-1 [Ref 73.N] 5.9	Dependant on pipe diameter
Longitudinal bending strength as Bending moment resistance		BS EN 295-1 [Ref 73.N] 5.11 Table 8	Dependant on pipe diameter
Dimensional tolerances	Internal diameter	BS EN 295-1 [Ref 73.N] 5.2 Table 1	Pass
	Length	BS EN 295-1 [Ref 73.N] 5.3, Table 2	Pass
	Squareness of ends	BS EN 295-1 [Ref 73.N]5.4	Pass
	Straightness	BS EN 295-1 [Ref 73.N] 5.5, Table 3	Pass
	Water seal of trapped fittings	BS EN 295-1 [Ref 73.N] 5.6	Pass
	Angle of curvature and radius of bends	BS EN 295-1 [Ref 73.N] 5.7, Table 4	Pass
	Branch angle of junctions	BS EN 295-1 [Ref 73.N] 5.8	Pass
	Continuity of invert	BS EN 295-1 [Ref 73.N] 6.3	Pass
	Joint inter-changeability	BS EN 295-1 [Ref 73.N] 6.4, Tables 13 and 14	Pass
Tightness: Gas and liquid and permeability	Watertightness of pipes or pipe	BS EN 295-1 [Ref 73.N] 5.14	Pass

	sections and junctions		
	Airtightness of pipes, bends, junctions and pipe sections	BS EN 295-1 [Ref 73.N] 5.18, Tables 9 and 10	Pass
	Tightness of fittings	BS EN 295-1 [Ref 73.N] 5.19	Pass
Watertightness of joint assemblies	Angular deflection	BS EN 295-1 [Ref 73.N]6.2.2, Table 12	Pass
	Shear resistance	BS EN 295-1 [Ref 73.N] Section 6.2.3	Pass
Release of dangerous substances		BS EN 295-1 [Ref 73.N] 7.3	
Durability of crushing strength and longitudinal bending strength, against:	Chemical resistance	BS EN 295-1 [Ref 73.N]5.1 and 5.15	Pass
	Resistance against high pressure water jetting	BS EN 295-1 [Ref 73.N]5.1 and 5.20	Pass
Durability of watertightness, against	Chemical and physical resistance to effluent	BS EN 295-1 [Ref 73.N]6.5	Pass
	Thermal cycling stability	BS EN 295-1 [Ref 73.N] 6.6	Pass
	Long term thermal stability	BS EN 295-1 [Ref 73.N]6.7	Pass

22.13 Vitrified clay pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N].

22.14 Vitrified clay pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter" in Section 23 of this document.

Product requirements for concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

22.15 Concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of BS EN 1916 [Ref 11.N].

22.16 The concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall meet the performance characteristics as stated in table 22.16.

Table 22.16 Performance characteristics for concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

Performance Characteristic	Required value	
Dimensional tolerances relevant to joints	BS EN 1916 [Ref 11.N] 4.3.3.2, 4.3.4.1	Pass
Crushing strength	BS EN 1916 [Ref 11.N] 4.3.5, 5.3.2, 5.3.4	Dependant on pipe diameter
Longitudinal bending strength (M)	BS EN 1916 [Ref 11.N] 4.3.6	Dependant on pipe diameter
Watertightness	BS EN 1916 [Ref 11.N] 4.3.7	No leakage
Durability	BS EN 1916 [Ref 11.N]4.3.9	Relevant to specified serviceability conditions

22.17 Concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N].

22.18 Concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of BS 5911-1 [Ref 10.N].

22.19 CEMI and SPRC concrete for concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of Table 1 of BS 8500-2 [Ref 12.N].

22.20 Supersulfated cement shall not be used for concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter.

22.21 Concrete pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter" in Section 23 of this document.

Product requirements for ductile Iron pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

22.22 Ductile iron pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with BS EN 598 [Ref 24.N].

22.23 The ductile iron pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall meet the performance characteristics as stated in table 22.23.

Table 22.23 Performance characteristics for ductile iron pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

Performance Characteristic		Required value	
Dimension tolerances (on external diameter DE for compatibility purposes)		BS EN 598 [Ref 24.N] 4.2.2.1	Pass
Internal pressure strength (tensile strength)		BS EN 598 [Ref 24.N] 4.3 and Table 3	
Impact resistance	Tensile properties	BS EN 598 [Ref 24.N] 4.3.1,	
	Hardness	BS EN 598 [Ref 24.N] 4.3.2	
Longitudinal bending strength	Longitudinal bending of pipes	BS EN 598 [Ref 24.N] 5.2	Pass
Maximum load for admissible deformation	Diametrical Stiffness of pipes	BS EN 598 [Ref 24.N] 5.3	Pass
Tightness : gas and liquid	Internal Pressure	BS EN 598 [Ref 24.N] 5.5	
	Vacuum	BS EN 598 [Ref 24.N]5.5	
	External pressure	BS EN 598 [Ref 24.N] 5.5	
	Cyclic pressure	BS EN 598 [Ref 24.N] 5.5	
Durability	External coating for pipes - Zinc Coating	BS EN 598 [Ref 24.N] 4.4.1, 4.4.2	
	External coating for pipes - Alternative coating	BS EN 598 [Ref 24.N] 4.4.1 Annex B, B.1	
	External coatings for fittings - Epoxy	BS EN 598 [Ref 24.N]4.5.1, 4.5.2	
	Internal lining for pipes and	BS EN 598	Pass

	fittings - Chemical resistance to effluents	[Ref 24.N] 5.8	
	Internal lining for pipes and fittings - Abrasion resistance	BS EN 598 [Ref 24.N] 5.9	Pass

22.24 Ductile iron pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Designated standards" in Section 10 of GC 101 [Ref 31.N].

Product requirements for corrugated steel pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

22.25 Corrugated steel pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of CD 375 [Ref 18.N].

22.26 Corrugated steel pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Corrugated steel buried structures" in Section 1 of CC 605 [Ref 16.N].

22.27 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to Corrugated steel pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter.

Product requirements for thermoplastic structured wall pipe for piped culverts, sewers and drainage structures exceeding 900mm diameter

22.28 Thermoplastic structured wall pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with BS EN 13476-1 [Ref 52.N].

22.29 Thermoplastic structured wall pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall meet the performance requirements as stated in table 22.29a and 2.29b.

Table 22.29a Performance characteristics for thermoplastic structured wall pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

Performance Characteristic	Test standard	Required value
Diameter tolerance		BS EN 13476-2 [Ref 53.N] BS EN 13476-3 [Ref 54.N]7.2
Ring stiffness		Minimum of 6 kN/m^2. Lower ring ring stiffness values are permitted if calculations in

		accordance with BS EN 1295-1 [Ref 69.N] (UK National Annex) demonstrate achievement of required performance level.
Ring flexibility		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14
Resistance to water jetting	WRc Jetting Test Method	Minimum acceptable failure pressure of 137 bar
Impact resistance at 0°C		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14
Impact resistance at 23°C		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14
Tensile strength of a seam		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]Table 14

Table 22.29b Performance characteristics for thermoplastic structured wall pipe fittings

Performance Characteristic	Test standard	Required value
Diameter tolerance		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]7.2
Ring stiffness (excluding couplers)		Minimum of 6 kN/m^2
Strength and flexibility of fabricated fixings		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N] (Table 16 requirements)
Watertightness of fabricated fittings		BS EN 13476-3 [Ref 54.N] BS EN 13476-2 [Ref 53.N]BS EN 13476 (Table 17 requirements)

22.30 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 31.N] shall apply to thermoplastic structured wall pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter.

23. Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

Product requirements for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.1 Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall include vitrified clay pipes and concrete pipes as set out in "Drainage Structures" in Section 22 of this document.

23.2 Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be as specified in CC 500/WSR/023.

Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter								
Piped culverts, sewers and drainage structure reference	**Pipe diameter**	**Pipe material**	**Pipe class**	**Trench type**	**Cement type**	**Joint type**	**Maximum rigid pipe length**	**Saddle to pipe junction permitted**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter a unique reference.

b) Enter a number in units of mm, to identify the diameter of the buried rigid pipe for piped culverts, sewers and drainage structures exceeding 900mm diameter.

c) Enter a value, from options vitrified clay, concrete, to specify the pipe material for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter.

d) Enter a number, to identify the pipe class number for concrete pipes.

e) Enter a value, from options trench, trenchless, to identify the location of pipes constructed without a trench.

f) Enter text, to specify required cement type for concrete pipes.

g) Enter a value, from options flexible, rigid, to specify joint type for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter.

h) Enter a number in units of m, to specify the maximum length of rigid pipe between joints for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter.

i) Enter a value, from options Yes, No, to identify if saddle connections are permitted.

Product requirements for excavation for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.3 Excavations for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of 'Excavation for pipes for drainage product requirements "Drainage pipes" in Section 1 of this document.

23.4 The trench dimensions for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be as described in CC 500/WSR/023.

The trench dimensions for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter		
Drainage structure reference	**maximum trench width**	**minimum trench width**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a number in units of mm, to specify maximum trench width for the buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm.

c) Enter a number in units of mm, to specify the minimum trench for the buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm width.

Product requirements for bedding material, surround and backfill for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.5 The bedding and surround material for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of 'Pipes for drainage bedding and surround product requirements' "Drainage pipes" in Section 1 of this document.

23.6 The backfill material for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of 'Pipes for drainage backfill product requirements' "Drainage pipes" in Section 1 of this document.

Product requirements for jointing for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.7 Rigid joints for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall mean joints made solid by caulking sockets, or bolting together flanges integral with the pipe.

23.8 Flexible joints for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall mean joints made with deformable rings or gaskets held between pipe spigots and sockets, sleeves or collars.

23.9 Joints for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be watertight.

23.10 The spigots and sockets of rigid joints shall be jointed in accordance with the manufacturers instructions and the socket caulked with mortar.

23.11 The caulking mortar for the rigid joint shall extend for a minimum length of 50mm from the socket.

23.12 The jointing mortar for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be mortar designation (i), excluding lime, complying with the requirements of "Masonry mortar" in Section 5 of CC 491 [Ref 45.N].

23.13 Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter under embankment shall have flexible joints.

23.14 Joint filler board for jointing of buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Filler board for concrete pavements" in Section 14 of CC 203 [Ref 57.N].

Product requirements for connection to existing drainage assets

23.15 Connections to existing drainage assets shall comply with the requirements of 'Connection to existing drainage assets product requirements' in "Drainage pipes" in Section 1 of this document.

Product requirements for chambers for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.16 The chambers for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be constructor design items.

23.17 The design of chambers for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be in accordance with CC 500/WSR/023.

23.18 The requirements for "Technical approval of highway structures" in Section 18 of GC 101 [Ref 31.N] shall apply to chambers for drainage structures.

23.19 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 31.N] shall apply to chambers for drainage structures.

23.20 Chambers for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be one of the types specified in CC 500/WSR/023.

Chambers for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter		
Chamber reference	**Drawing or model reference**	**Chamber type**
(a)	(b)	(c)

a) Enter a unique reference.

b) Enter a number, to identify the drawing/model where this is shown.

c) Enter text, to identify the type of chamber construction.

23.21 Chambers for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with CD 536 [Ref 4.N].

23.22 Chambers for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter product requirements shall be compliant with the requirements of "Chambers for drainage pipes" in Section 3 of this document.

Product requirements for chamber covers, gratings and frames for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.23 Chamber covers, gratings and frames for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter product requirements shall be as described in CC 500/WSR/023.

Chamber covers, gratings and frames for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter product requirements			
Chamber reference	**Chamber cover type**	**loading classification**	**dimensions**
(a)	(b)	(c)	(d)

a) Enter a unique reference.

b) Enter a value, from options solid cover, grating, to determine type of chamber cover.

c) Enter a value, from options D400, E600, to determine loading classification.

d) Enter a number in units of mm, to determine size of cover or grating.

23.24 Chamber covers, gratings and frames for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the product requirements of "Chamber tops and gully tops for drainage" in Section 6 of this document.

Product requirements for pipe junctions for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.25 Junctions for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the product requirements of 'Junction pipe product requirement's' in "Gullies and pipe junctions" in Section 5 of this document.

Installation requirements for excavation for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.26 Excavations for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of 'Excavation for pipes for drainage installation requirements "Drainage pipes" in Section 1 of this document.

23.27 Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm in embankments or in other areas of fill constructed

other than in a trench shall comply with "Earthworks around structures, foundations, and pipes" in Section 12 of CC 601 [Ref 25.N].

Installation requirements for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.28 The deviation in invert levels of the buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter from those specified shall not exceed 20mm.

23.29 Buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be installed in accordance with the manufacturers instructions.

23.30 Pipe bedding and surround combinations for buried rigid pipes for for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be selected from the alternatives in CC 500/WSR/023.

Pipe bedding and surround combinations for buried rigid pipes for for piped culverts, sewers and drainage structures exceeding 900mm diameter						
drainage structure reference	**pipe diameter**	**cover to pipe**	**pipe material**	**permitted bedding combination for rigid buried pipes for drainage structures**	**Limestone aggregate allowable**	**measures to minimise water flows through the granular bedding surround**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter a number in units of mm, to identify the buried rigid pipe internal diameter.

c) Enter a number in units of m, to identify the cover to the buried rigid pipe.

d) Enter one or more values, from options vitrified clay, concrete, reinforced concrete, prestressed concrete, to determine allowable pipe material.

e) Enter one or more values, from options A,B,F,NS,Z, to identify permitted bedding options.

f) Enter a value, from options yes, no, to determine locations where limestone aggregate is allowable.

g) Enter text, to identify required measures to minimise water flow through the granular material.

Installation requirements for jointing of buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.31 Joints for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be installed in accordance with the manufacturers instructions.

23.32 Where a concrete bed, cradle, arch or surround is used with buried rigid pipes exceeding 900mm diameter having flexible joints, joint filler board exceeding 900mm diameter having flexible joints, joint filler board shall be placed in contact with the end of the socket at all pipe joints.

23.33 Joint filler board used at pipe joints shall extend through the full thickness of the concrete bed, haunch and surround in contact with the pipe.

Installation requirements for backfilling of buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.34 The material used for backfilling buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter shall be deposited and compacted in compliance with "Compaction of earthworks fill" in Section 6 of CC 601 [Ref 25.N].

23.35 Backfilling to trenches in carriageways or other paved areas shall be brought up to formation level, or sub-formation level where capping is required.

23.36 The areas where topsoil at the surface is on the line of the trench, the backfill topsoil thickness shall be as stated in CC 500/WSR/023.

SI.23.36 The backfill thickness of topsoil shall be [enter free text].

23.37 Sheeting and other excavation supports shall be removed as the filling proceeds, unless otherwise stated in CC 500/WSR/023.

SI.23.37 The method of removal of sheeting and excavation supports shall be [enter free text].

Installation requirements for connecting to existing drains, chambers and channels

23.38 Connections to existing drainage assets shall comply with the installation requirements of 'Connection to existing drainage assets installation requirements' in "Drainage pipes" in Section 1 of this document.

Installation requirements for chambers for buried rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.39 The installation of chambers for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall be compliant with the requirements of "Chambers for drainage pipes" in Section 3 of this document.

Installation requirements for chamber covers, gratings and frames for rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.40 The installation of chamber covers, gratings and frames for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the requirements of "Chamber tops and gully tops for drainage" in Section 6 of this document.

Installation requirements for pipe junctions for rigid pipes for piped culverts, sewers and drainage structures exceeding 900mm diameter

23.41 The installation of pipe junctions for rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall comply with the product requirements of 'Junction pipe installation requirements' "Gullies and pipe junctions" in Section 5 of this document.

23.42 On completion of the whole of the works, all pipes and chambers for buried rigid pipe culverts, sewers and drainage structures exceeding 900mm diameter shall be flushed from end to end with water and left free from obstruction.

24. 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	BSI. BS EN 12620, 'Aggregates for concrete (Designated Standard - CPR)'
Ref 2.N	BSI. BS EN 13242, 'Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction (Designated Standard - CPR)'
Ref 3.N	BSI. BS EN 197-1, 'Cement. Composition, specifications and conformity criteria for common cements. (Designated Standard - CPR)'
Ref 4.N	National Highways. CD 536, 'Chambers for drainage pipes'
Ref 5.N	BSI. BS 5931, 'Code of practice for machine laid in-situ edge details for paved areas'
Ref 6.N	BSI. BS EN 1340, 'Concrete kerb units. Requirements and test methods. (Designated Standard - CPR)'
Ref 7.N	BSI. BS EN 1917, 'Concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced (Designated Standard - CPR)'
Ref 8.N	BSI. BS 5911-6, 'Concrete pipes and ancillary concrete products - Specification for road gullies and gully cover slabs'
Ref 9.N	BSI. BS 5911-3, 'Concrete pipes and ancillary concrete products - Specification for unreinforced and reinforced concrete, manholes and soakaways'
Ref 10.N	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 11.N	BSI. BS EN 1916, 'Concrete pipes and fittings, unreinforced, steel fibre and reinforced (Designated Standard - CPR)'
Ref 12.N	BSI. BS 8500-2, 'Concrete. Complementary British Standard to BS EN 206. Specification for constituent materials and concrete.'
Ref 13.N	BSI. BS EN 61386-24, 'Conduit systems for cable management. Particular requirements. Conduit systems

	buried underground (Designated Standard - LVD)'
Ref 14.N	BSI. BS EN 1610, 'Construction and testing of drains and sewers'
Ref 15.N	BSI. BS EN 10346, 'Continuously hot-dip coated steel flat products. Technical delivery conditions'
Ref 16.N	National Highways. CC 605 'Corrugated Steel Buried Structures (formerly Series 2500 Cl.2501)'
Ref 17.N	National Highways. CD 225, 'Design for new pavement foundations'
Ref 18.N	National Highways. CD 375, 'Design of corrugated steel buried structures'
Ref 19.N	National Highways. CG 501, 'Design of highway drainage systems'
Ref 20.N	National Highways. CD 529, 'Design of outfall and culvert details'
Ref 21.N	National Highways. CD 533, 'Determination of pipe and bedding combinations for drainage works'
Ref 22.N	BSI. BS EN 1433, 'Drainage channels for vehicular and pedestrian areas. Classification, design and testing requirements, marking and evaluation of conformity [Designated Standard - CPR]'
Ref 23.N	National Highways. CS 551, 'Drainage surveys'
Ref 24.N	BSI. BS EN 598, 'Ductile Iron Pipes & Fittings for Sewerage Applications. (Designated Standard - CPR)'
Ref 25.N	National Highways. CC 601, 'Earthworks'
Ref 26.N	National Highways. CD 524, 'Edge of pavement details'
Ref 27.N	National Highways. CC 202 'Flexible pavement construction'
Ref 28.N	BSI. BS EN 450-1, 'Fly ash for concrete - Definitions, specifications and conformity criteria (Designated Standard - CPR)'
Ref 29.N	National Highways. CC 207 'Footway, cycle track, paved area, kerb unit and access step construction'
Ref 30.N	BSI. BS 970-1, 'General inspection and testing procedures and specific, requirements for carbon, carbon manganese, alloy and stainless steels' , 1996
Ref 31.N	National Highways. GC 101 'General requirements for the

	Specification for Highway Works'
Ref 32.N	BSI. BS EN 13252, 'Geotextiles and geotextile-related products. Characteristics required for use in drainage systems (Designated Standard - CPR)'
Ref 33.N	BSI. BS EN ISO 12958, 'Geotextiles and geotextile-related products. Determination of water flow capacity in their plane'
Ref 34.N	BSI. BS 7903, 'Guide to selection and use of gully tops and manhole covers for installation within the highway'
Ref 35.N	BS EN 124:1994, 'Gully tops and manhole tops for vehicular and pedestrian areas — Design requirements, type testing, marking, quality control'
Ref 36.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'
Ref 37.N	BSI. BS EN 124-2, 'Gully tops and manhole tops for vehicular and pedestrian areas. Gully tops and manhole tops made of cast iron'
Ref 38.N	BSI. BS EN 124-3, 'Gully tops and manhole tops for vehicular and pedestrian areas. Gully tops and manhole tops made of steel or aluminium alloys'
Ref 39.N	BSI. BS EN 124-4, 'Gully tops and manhole tops for vehicular and pedestrian areas. Gully tops and manhole tops made of steel reinforced concrete'
Ref 40.N	BSI. BS EN ISO 4016, 'Hexagon head bolts. Product grade C '
Ref 41.N	BSI. BS EN ISO 4018, 'Hexagon head screws. Product grade C'
Ref 42.N	BSI. BS EN ISO 4034, 'Hexagon regular nuts (style 1). Product grade C'
Ref 43.N	National Highways. GC 100, 'Introduction to the specification for highway works'
Ref 44.N	BSI. BS EN 13055, 'Lightweight aggregates '
Ref 45.N	National Highways. CC 491 'Masonry [Series 2400]'
Ref 46.N	National Highways. CC 495 'Miscellaneous'
Ref 47.N	National Highways. CC 201 'Pavement foundation construction'
Ref 48.N	BSI. BS EN 1401-1 , 'Plastic piping systems for non-pressure

	underground drainage and sewerage. (PVC-U)'
Ref 49.N	BSI. BS EN 13598-1, 'Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) - Specifications for ancillary fittings and shallow chambers'
Ref 50.N	BSI. BS EN 12666-1, 'Plastics piping systems for non-pressure underground drainage and sewerage. Polyethylene (PE). Specifications for pipes, fittings and the system'
Ref 51.N	BSI. BS EN 1852-1, 'Plastics piping systems for non-pressure underground drainage and sewerage. Polypropylene (PP). Specifications for pipes, fittings and the system'
Ref 52.N	BSI. BS EN 13476-1, 'Plastics piping systems for non-pressure underground drainage and sewerage. Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). General requirements and performance characteristics'
Ref 53.N	BSI. BS EN 13476-2, 'Plastics piping systems for non-pressure underground drainage and sewerage. Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). Specifications for pipes and fittings with smooth internal and external surface and the system, Type A'
Ref 54.N	BSI. BS EN 13476-3, 'Plastics piping systems for non-pressure underground drainage and sewerage. Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B '
Ref 55.N	BSI. BS EN ISO 23856, 'Plastics piping systems for pressure and non-pressure water supply, drainage or sewerage. Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin'
Ref 56.N	National Highways. CC 486 'Protection of steelwork against corrosion [Series 1900]'
Ref 57.N	National Highways. CC 203 'Rigid pavement construction'
Ref 58.N	National Highways. TC 131 'Roadside technology and communications'
Ref 59.N	BSI. BS 437, 'Specification for cast iron drain pipes, fittings and their joints for socketed and socketless systems'
Ref 60.N	BSI. BS 1214, 'Specification for hessian sandbags and rot-

	proofed hessian '
Ref 61.N	BSI. BS EN 771-3, 'Specification for masonry units. Aggregate concrete masonry units (Dense and lightweight aggregates) (Designated Standard - CPR)'
Ref 62.N	BSI. BS 4962, 'Specification for Plastics pipes and fittings for use as subsoil field drains'
Ref 63.N	BSI. BS 9124, 'Specification for Steel and Aluminium Access Covers Systems with 1m Clear Opening'
Ref 64.N	BSI. BS 3506, 'Specification for unplasticized PVC pipe for industrial uses'
Ref 65.N	BSI. BS EN 10088-1, 'Stainless steels. List of stainless steels'
Ref 66.N	AASHTO. AASHTO M274, 'Standard Specification for Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe'
Ref 67.N	BSI. BS EN 13101, 'Steps for underground man entry chambers. Requirements, marking, testing and evaluation of conformity (Designated Standard - CPR)'
Ref 68.N	National Highways. CC 482 'Structural concrete'
Ref 69.N	BSI. BS EN 1295-1, 'Structural design of buried pipelines under various conditions of loading. General requirements'
Ref 70.N	National Highways. CG 300, 'Technical approval of highway structures'
Ref 71.N	BSI. BS EN 933-11, 'Tests for geometrical properties of aggregates. Classification test for the constituents of coarse recycled aggregate'
Ref 72.N	BSI. BS EN 13285, 'Unbound mixtures. Specifications'
Ref 73.N	BSI. BS EN 295-1, 'Vitrified clay pipe systems for drains and sewers: Requirements for pipes, fittings and joints (Designated Standard - CPR)'