Geotechnics
Contract preparation

CP 601 Instructions for specifiers for CC 601 Earthworks

(formerly Series NG 600)

Version NI/LIVE_2025-02-19

Summary
MCHW Series 600: Earthworks has been rewritten to make it compliant with the new National Highways Standards drafting rules.

This document incorporates specific requirements for the Department for Infrastructure Northern Ireland. Alternative versions of this document are available for other Overseeing Organisations.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated team in the Department for Infrastructure, Northern Ireland. The email address for all enquiries and feedback is: dcu@infrastructure-ni.gov.uk

This is a controlled document.

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Latest release notes

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
CP 601	NI/ LIVE_2025-02-19	Not available	Core document	Change to policy, major revision, new document development
This document supersedes Series 600 and Series NG 600 which are withdrawn. It has been rewritten to be compliant with the latest drafting rules and extensively restructured.				

Previous versions

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change

Foreword

This document provides specifier instructions for the production of the works specific requirements for CC 601 Earthworks.

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. General earthworks requirements

Earthworks layout drawings or models

1.1 The earthworks details, including location, general arrangement, line, level, and dimensions, shall be as stated on the earthworks layout drawings or models.

1.2 Earthworks layout drawings or models shall be as stated in CC 601/WSR/001.

Earthworks layout drawings or models			
Unique reference of earthwork	**Earthwork type**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthworks or group of earthworks.

b) Enter text, to identify the type of the earthwork or group of earthworks.

c) Enter a unique reference, to identify the earthworks layout drawing(s) or model where the earthwork or group of earthworks is described.

d) Enter text, to identify the earthworks layout drawing(s) or model title(s) which describe the earthwork or group of earthworks.

Earthworks construction procedures documents for specific activities

1.3 The requirements on geometry, Contractor design, performance, activities, verification, documentation submission, and limitations of specific earthwork construction activities presented in earthworks construction procedures documents referenced within this document shall apply to the works.

1.4 Earthworks construction procedures documents for specific activities shall be as stated in CC 601/WSR/001.

Earthworks construction procedures documents for specific activities			
Unique reference of earthwork	**Earthwork type**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthworks or group of earthworks.

b) Enter text, to identify the type of the earthwork or group of earthworks.

c) Enter a unique reference, to identify the earthworks construction procedures document reference.

d) Enter text, to identify the earthworks construction procedures document title.

Technical approval of earthworks for Contractor designed items

1.5 The requirements of CD 601 [Ref 8.N]and CD 622 [Ref 22.N] shall be complied with for Contractor designed items.

1.6 The documentation required by CD 622 [Ref 22.N]and that required for departures from standard shall be prepared and submitted for Contractor designed items.

1.7 Departures from standard shall be approved prior to the submission of other technical approvals documentation.

1.8 Where documentation is to be submitted for the purposes of technical approval this shall be submitted at least ten working weeks prior to the programmed commencement of work on the aspect requiring technical approval.

1.9 The works detailed in the technical approval documentation shall not commence until at least four working weeks after acceptance by the Technical approval authority has been communicated in accordance with CD 622 [Ref 22.N].

Earthworks surface finished profile

1.10 Tolerances on earthworks surface finished profile shall be as stated in CC 601/WSR/001.

Tolerances on earthworks surface finished profile		
Unique reference for earthwork	**Surface level tolerance above design profile**	**Surface level tolerance below design profile**
(a)	(b)	(c)

a) Enter a unique reference, to identify the earthwork to which the tolerances apply.

b) Enter a number in units of mm, to identify the surface level tolerance for the earthwork above the design profile.

c) Enter a number in units of mm, to identify the surface level tolerance for the earthwork below the design profile.

Verification of earthworks surface finished profile

1.11 Verification of the earthworks surface finished profile shall be as stated in CC 601/WSR/001.

Verification of the earthworks surface finished profile			
Unique reference of earthwork	**Method of verification**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the method of verification of the earthworks surface finished profile.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for verification of the earthworks surface finished profile.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for verification of the earthworks surface finished profile.

1.12 The requirements for “Verification”in Section 14 of GC 101 [Ref 14.N] shall apply to the verification of the earthworks surface finished profile.

Documentation for earthworks surface finished profile

1.13 The Documentation for the earthworks surface finished level profile shall be as stated in the earthworks construction procedures document as stated in CC 601/WSR/001.

1.14 The requirements for “Documentation” in Section 2 of GC 101 [Ref 14.N] shall apply to the documentation for earthworks surface finished profile.

Restrictions on temporary works for earthworks

1.15 Restrictions on temporary works for earthworks resulting from the permanent works design shall be as stated in CC 601/WSR/001.

Restrictions on temporary works for earthworks resulting from the permanent works design	
Unique reference of earthwork	**Restrictions on temporary works for earthworks**
(a)	(b)

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

b) Enter text, to identify the restrictions on temporary works for earthworks resulting from the design of the earthworks.

Particular earthworks requirements in addition to those stated in this document

1.16 Particular earthworks requirements in addition to those stated in this document shall be stated in CC 601/WSR/001.

Particular earthworks requirements in addition to those stated in this document			
Unique reference of earthwork	**Particular earthworks requirement topic**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

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

b) Enter text, to to identify the topic of the particular earthworks requirements.

c) Enter a unique reference, to identify the earthworks construction procedures document that contains the particular earthworks requirements not specifically stated in this document.

d) Enter text, to identify the earthworks construction procedures document reference that contains the particular earthworks requirements not specifically stated in this document.

2. Earthworks materials

General classification of earthworks materials

2.1 Earthworks materials shall be either unacceptable or acceptable.

Unacceptable earthworks materials

2.2 Unacceptable earthworks materials shall be classified in accordance with Table 2.2.

Table 2.2 Classification of unacceptable earthworks materials	
Earthworks material class	General material description
Class U1A	1. materials not complying with any required class of acceptable earthworks material; and / or, 2. otherwise acceptable earthworks materials surplus to the works; and / or, 3. materials in a frozen condition.
Class U1B	1. materials classified by legislation as controlled waste; and / or, 2. materials whose level of contamination is outside the limits for contaminant concentrations for acceptable earthworks materials.
Class U2	materials classified by legislation as hazardous waste or radioactive waste

Acceptable earthwork materials

2.3 Acceptable earthwork materials classes shall be in accordance with "Acceptable earthwork material classes, properties, and frequency of testing" in Section 3 of this document.

2.4 Acceptable earthworks materials to be used in the works shall be as stated in CC 601/WSR/002.

Acceptable earthworks materials to be used in the works	
Unique reference of earthwork	**Acceptable earthworks materials class**
(a)	(b)

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

b) Enter text, to identify the acceptable earthworks material class to be used in the earthwork.

Processing of unacceptable earthworks materials to render the material acceptable

2.5 Unacceptable earthworks materials which have been processed to form acceptable earthwork materials shall meet the requirements of acceptable earthworks materials.

2.6 Processing requirements for unacceptable earthworks materials to render the material acceptable shall be as stated in CC 601/WSR/002.

Processing requirements for unacceptable earthworks materials to render the material acceptable			
Unique reference of earthworks material	**Processing methodology**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthworks material to be processed.

b) Enter text, to identify the methodology used to process the unacceptable earthworks material.

c) Enter text, to identify the earthworks construction procedures document reference that contains the processing requirements.

d) Enter text, to identify the earthworks construction procedures document title that contains the processing requirements.

3. Acceptable earthwork material classes, properties, and frequency of testing

Permitted constituents of acceptable earthworks materials

3.1 Permitted constituents of acceptable earthworks materials shall be in accordance with Table 3.3.

3.2 Permitted constituents of acceptable earthworks materials, except Class 4 and Class 5 earthworks materials, shall comprise natural or manufactured material of mineral origin or recycled inorganic or mineral material.

3.3 Acceptable earthworks materials, except Class 4 and Class 5 earthworks materials, shall not be composed of one or more of the constituents stated in Table 3.3.

Table 3.3 Non-permitted constituents of acceptable earthworks materials
Non-permitted constituents
Peat, materials from swamps, marshes, or bogs
Logs, stumps, or perishable material
Clay having a liquid limit exceeding 90% or plasticity index exceeding 65%
Material susceptible to spontaneous combustion

Classes of acceptable earthworks materials

3.4 Classes of acceptable earthworks materials shall be in accordance with Table 3.4 or as stated in "Additional classes of acceptable earthworks materials" in this Section.

Table 3.4 Classification of acceptable earthworks materials					
General material class	**General material end use description**	**Earthworks material class**	**Earthworks material description**	**Earthworks material end use**	**Permitted constituents**
Class 1	General granular earthworks fill	Class 1A	Well graded granular material	General earthworks fill	Any material or combination of materials other than material designated as Class 3.
		Class 1B	Uniformly graded	General earthworks	Any material, or combination of

Table 3.4 Classification of acceptable earthworks materials					
General material class	**General material end use description**	**Earthworks material class**	**Earthworks material description**	**Earthworks material end use**	**Permitted constituents**
			granular material	fill	materials, other than chalk.
		Class 1C	Coarse granular material	General earthworks fill	Any material, or combination of materials, other than material designated as Class 3.
Class 2	General cohesive earthworks fill	Class 2A	Wet cohesive material	General earthworks fill	Any material, or combination of materials, other than chalk.
		Class 2B	Dry cohesive material	General earthworks fill	Any material, or combination of materials, other than chalk.
		Class 2C	Stony cohesive material	General earthworks fill	Any material, or combination of materials, other than chalk.
		Class 2D	Silty cohesive material	General earthworks fill	Any material, or combination of materials, other than chalk.
		Class 2E	Reclaimed pulverised fuel ash cohesive material	General earthworks fill	Reclaimed material from lagoon or stockpile containing not more than 20% furnace bottom ash
Class 3	General chalk earthworks fill	Class 3	In accordance with "General description and permitted constituents of Class 3 and Class 7H5 earthworks materials" in this Section.	General earthworks fill	In accordance with "General description and permitted constituents of Class 3 and Class 7H5 earthworks materials" in this Section.
Class 4	Landscape earthworks	Class 4	In accordance with "General	Fill to landscape	In accordance with "General

	fill		description and permitted constituents of Class 4 earthworks materials" in this Section.	areas	description and permitted constituents of Class 4 earthworks materials" in this Section.
Class 5	Topsoil	Class 5A	Topsoil, or turf, existing on site	Topsoiling	Topsoil, or turf, existing on site
		Class 5B	Imported topsoil	Topsoiling	General purpose grade complying with BS 3882 [Ref 32.N]

Class 6	Selected granular earthworks fill	Class 6A	Selected well graded granular material	Fill below water	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk, well burnt colliery spoil or any combination thereof. Recycled aggregate.
		Class 6B	Selected coarse granular material	Starter layer	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, chalk, well burnt colliery spoil, slag or any combination thereof. Recycled aggregate.
		Class 6C	Selected uniformly graded granular material	Starter layer	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk, well burnt colliery spoil, slag or any combination thereof. Recycled aggregate.
		Class 6D	Selected uniformly graded granular material	Starter layer below pulverised fuel ash	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk, well burnt colliery spoil, slag or any combination thereof. Recycled aggregate.
		Class 6G	Selected granular material	Gabion fill	Natural gravel, crushed rock, crushed concrete or any combination thereof. None of these constituents

					shall include any argillaceous rock.
		Class 6H	Selected granular material	Drainage layer to reinforced soil and anchored earth structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, chalk, well burnt colliery spoil or any structures combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6I	Selected well graded granular material	Fill to reinforced soil and anchored earth structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof except that chalk shall not be combined with any other constituent. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6J	Selected uniformly graded granular material	Fill to reinforced soil and anchored earth	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof, except that chalk shall not be combined with any other constituent. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6K	Selected granular material	Lower bedding for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.

		Class 6L	Selected uniformly graded granular material	Upper bedding for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6M	Selected granular material	Surround to corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6N	Selected well graded granular material	Fill around structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6P	Selected granular material	Fill around to structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6Q1	Selected well graded granular material	Fill around structures Overlying fill for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate

					except recycled asphalt.
		Class 6Q2	Selected uniformly graded granular material	Fill around structures Overlying fill for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.
		Class 6Q3	Selected coarse graded granular material	Fill around structures Overlying fill for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt.

Class 7	Selected cohesive earthworks fill	Class 7A	Selected cohesive material	Fill around structures	Any material or combination of materials, other than argillaceous rock and materials designated as Class 3 in the Contract. If chalk is used it shall form 100% of constituents.
		Class 7B	Selected conditioned pulverised fuel ash cohesive material	Fill around structures Fill to reinforced soil	Conditioned material direct from power station dust collection system and to which a controlled quantity of water has been added
		Class 7C	Selected wet cohesive material	Fill to reinforced soil	Any material, or combination of materials, other than unburnt colliery spoil, argillaceous rock and chalk.
		Clas	Selected stony	Fill to	Any material, or

		s 7D	cohesive material	reinforced soil	combination of materials, other than unburnt colliery spoil, argillaceous rock and chalk.
		Class 7H1	Selected wet cohesive material	Overlying fill for corrugated steel buried structures	Any material, or combination of materials, other than chalk, argillaceous rock, slag, and PFA.
		Class 7H2	Selected dry cohesive material	Overlying fill for corrugated steel buried structures	Any material, or combination of materials, other than chalk, argillaceous rock, slag, and PFA.
		Class 7H3	Selected stony cohesive material	Overlying fill for corrugated steel buried structures	Any material, or combination of materials, other than chalk, argillaceous rock, slag, and PFA.
		Class 7H4	Selected silty cohesive material	Overlying fill for corrugated steel buried structures	Any material, or combination of materials, other than chalk, argillaceous rock, slag, and PFA.
		Class 7H5	In accordance with "General description and permitted constituents of Class 3 and Class 7H5 earthworks materials" in this Section.	Overlying fill for corrugated steel buried structures	In accordance with "General description and permitted constituents of Class 3 and Class 7H5 earthworks materials" in this Section.
Class 8	Miscellaneous earthworks fill	Class 8	In accordance with "General description and permitted constituents of Class 8 earthworks materials" in this Section.	Lower trench fill	In accordance with "General description and permitted constituents of Class 8 earthworks materials" in this Section.

Additional classes of acceptable earthworks materials

3.5 Additional classes of acceptable earthworks materials shall be as stated in CC 601/WSR/003.

Additional classes of acceptable earthworks materials					
Unique reference of the earthworks material	**General material class**	**General material end use description**	**Earthworks material class**	**Earthworks material description**	**Earthworks material end use**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the earthworks material.

b) Enter text, to identify the general material class of the additional acceptable earthworks material.

c) Enter text, to identify the general material end use description of the additional acceptable earthworks material.

d) Enter a unique reference, to identify the additional acceptable earthworks material class.

e) Enter text, to identify the earthworks material description of the additional acceptable material class.

f) Enter text, to identify the earthworks material end use of the additional acceptable material class.

Additional classes of acceptable earthworks materials (continued)	
Unique reference of the earthworks material	**Permitted constituents**
(a)	(g)

g) Enter text, to identify the permitted constituents of the additional acceptable material class.

General description and permitted constituents of Class 3 and Class 7H5 earthworks materials

3.6 General material description and permitted constituents of Class 3 and Class 7H5 earthworks materials shall be as stated in CC 601/WSR/003.

General material description and permitted constituents of Class 3 and Class 7H5 earthworks materials			
Unique reference of the earthwork	**Earthworks materials class**	**General material description**	**Permitted constituents**
(a)	(b)	(c)	(d)

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

b) Enter a value, from options Class 3, Class 7H5, to identify the earthworks material class.

c) Enter text, to identify the general material description of the earthworks material class.

d) Enter text, to identify the permitted constituents of the earthworks material class.

General description and permitted constituents of Class 4 earthworks material

3.7 General material description and permitted constituents of Class 4 earthworks material shall be as stated in CC 601/WSR/003.

General material description and permitted constituents of Class 4 earthworks material		
Unique reference of the earthwork	**General material description**	**Permitted constituents**
(a)	(b)	(c)

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

b) Enter text, to identify the general material description of the earthworks material class.

c) Enter text, to identify the permitted constituents of the earthworks material class.

General description and permitted constituents of Class 8 earthworks material

3.8 Class 8 earthworks material shall be derived from Class 1, Class 2, or Class 3 earthworks materials.

3.9 Class 8 earthworks material shall have general material description and permitted constituents equivalent to the original Class 1, Class 2, or Class 3 earthworks material class.

Acceptable limits for grading of acceptable earthworks materials

3.10 Acceptable limits for grading of earthworks materials shall be as stated in Table 3.10a and Table 3.10b.

Table 3.10a Acceptable limits for grading of earthworks materials classes		
Earthworks material class	**Particle size (mm)**	**Percentage of material by mass smaller than the particle size (%)**
Class 1A	300	100
	125	95-100
	0.063	<15
Class 1B	125	100
	0.063	<15
Class 1C	500	100
	125	10-95
	0.6	0-25
	0.063	<15
Class 2A	125	100
	2	80-100
	0.063	15-100
Class 2B	125	100
	2	80-100
	0.063	15-100
Class 2C	125	100
	2	15-80
	0.063	15-80
Class 2D	125	100
	0.063	80-100
	0.02	0-20
Class 4	In accordance with "Grading of Class 4 earthworks material" in this Section.	
Class 5	In accordance with "Grading of Class 5 earthworks material" in this Section.	
Class 6B	500	100
	125	0-10
Class 6G	In accordance with "Grading of Class 6G earthworks material" in this Section.	
Class 6Q1	300	100
	125	95-100
	0.063	<15
Class 6Q2	125	100

Table 3.10a Acceptable limits for grading of earthworks materials classes		
Earthworks material class	**Particle size (mm)**	**Percentage of material by mass smaller than the particle size (%)**
	0.063	<15
Class 6Q3	500	100
	125	10-95
	0.6	0-25
	0.063	<15
Class 7A	75	100
	0.063	15-100
Class 7C	125	100
	75	85-100
	14	83-100
	2	80-100
	0.6	60-100
	0.063	15-45
	0.002	0-20
Class 7D	125	100
	75	85-100
	14	40-90
	2	15-79
	0.6	15-75
	0.063	15-45
	0.002	0-20
Class 7H1	125	100
	2	80-100
	0.063	15-100
Class 7H2	125	100
	2	80-100
	0.063	15-100
Class 7H3	125	100
	2	15-80
	0.063	15-80
Class 7H4	125	100
	0.063	80-100
	0.02	0-20
Class 8	In accordance with "Grading of Class 8 earthworks material" in this Section.	

Table 3.10b Acceptable limits for grading of earthworks materials (cont.)			
Earthworks material class	**Particle size (mm)**	**Percentage of material by mass smaller than the particle size (%)**	
		Non-aggregates	**Aggregates**
Class 6A	500	100	100
	10	0-100	0-100
	6.3	n/a	0-85
	5	0-85	n/a
	0.6	0-45	n/a
	0.5	n/a	0-45
	0.063	0-5	0-5
Class 6C	125	100	100
	40	n/a	0-100
	37.5	0-100	n/a
	6.3	0-100	0-100
	3.35	0-35	0-35
	2	0-10	0-10
	0.6	0-2	n/a
	0.5	n/a	0-2
Class 6D	10	100	100
	5	89-100	n/a
	4	n/a	85-100
	2	60-100	60-100
	1.18	30-100	n/a
	1	n/a	30-100
	0.6	15-80	n/a
	0.5	n/a	15-80
	0.3	5-48	n/a
	0.25	n/a	5-48
	0.15	0-15 except 0-20 for crushed rock	n/a
	0.125	n/a	0-15 except 0-20 for crushed rock
Class 6H	31.5	n/a	100
	20	100	n/a
	6.3	n/a	60-100
	5	60-100	n/a
	1.18	15-45	n/a
	1	n/a	15-45
	0.6	0.25	n/a
	0.5	n/a	0-25

Table 3.10b Acceptable limits for grading of earthworks materials (cont.)			
Earthworks material class	**Particle size (mm)**	**Percentage of material by mass smaller than the particle size (%)**	
		Non-aggregates	**Aggregates**
	0.15	0.5	n/a
	0.125	n/a	0-5
Class 6I	125	100	100
	80	n/a	85-100
	75	85-100	n/a
	16	n/a	25-100
	14	25-100	n/a
	2	15-100	15-100
	0.6	9-100	n/a
	0.5	n/a	9-100
	0.063	<15	<15
Class 6J	125	100	100
	80	n/a	85-100
	75	85-100	n/a
	16	n/a	25-100
	14	25-100	n/a
	2	15-100	15-100
	0.6	9-100	n/a
	0.5	n/a	9-100
	0.063	<15	<15
Class 6K	31.5	n/a	100
	20	100	n/a
	0.063	0-10	0-10
Class 6L	10	100	100
	5	89-100	n/a
	4	n/a	85-100
	2	60-100	60-100
	1.18	30-100	n/a
	1	n/a	30-100
	0.6	15-100	n/a
	0.5	n/a	15-100
	0.3	5-70	n/a
	0.25	n/a	5-70
	0.15	0-15 except 0-20 for crushed rock	n/a
	0.125	n/a	0-15 except 0-20 for crushed rock

Table 3.10b Acceptable limits for grading of earthworks materials (cont.)			
Earthworks material class	**Particle size (mm)**	**Percentage of material by mass smaller than the particle size (%)**	
		Non-aggregates	**Aggregates**
Class 6M	80	n/a	100
	75	100	n/a
	0.063	0-10	0-10
Class 6N	80	n/a	100
	75	100	n/a
	0.063	<15	<15
Class 6P	80	n/a	100
	75	100	n/a
	0.063	<15	<15

3.11 Acceptable limits for grading of earthworks materials presented as not applicable (n/a) in Table 3.10a and Table 3.10b shall not apply to the earthworks material class stated.

3.12 In addition to any grading requirements earthworks material to be placed beneath verges or central reserves and within 1.30 m of the finished surface shall not have a particle size greater than 150 mm.

Grading of Class 4 earthworks material

3.13 Grading of Class 4 earthworks material shall be as stated in CC 601/WSR/003.

Grading of Class 4 earthworks material	
Unique reference of the earthworks material	**Class 4 earthworks material grading requirements**
(a)	(b)

a) Enter a unique reference, to identify the earthwork material.

b) Enter text, to identify the grading requirements for the earthworks material class.

Grading of Class 5 earthworks material

3.14 Class 5 earthworks material shall have a maximum particle size of 100 mm equivalent diameter.

3.15 Class 5 earthworks material shall have a maximum particle size of 50 mm equivalent diameter when placed within 50 mm of the finished surface.

Grading of Class 6G earthworks material

3.16 The minimum particle size of Class 6G earthworks material fill shall be greater than the size of the mesh opening.

3.17 The maximum size of Class 6G earthworks material fill shall not exceed two thirds of the minimum dimension of the gabion compartment or 200mm, whichever is smaller.

Grading of Class 8 earthworks material

3.18 The grading of Class 8 earthworks material shall be equivalent to the original Class 1, Class 2, or Class 3 earthworks material class, with a maximum particle size of 40 mm.

Earthworks materials placed around cementitious materials and metallic structural elements

3.19 Earthworks materials to be placed within the minimum limiting distance to cementitious materials shall have limits on material properties as stated in Table 3.19a and at least one of the additional properties stated in Table 3.19b.

Table 3.19a Properties of earthworks materials placed within the minimum limiting distance of cementitious material

Property	Value
Water soluable sulfate	Maximum 1,500 mg of sulfate per litre (as SO_4)
Total sulfur	Maximum 1 % for aggregates other than air cooled blast furnace slag, or, maximum 2 % for air cooled blast furnace slag

Table 3.19b Additional properties of earthworks materials placed within the minimum limiting distance of cementitious material

Property	Description / Value
Constituents	Limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant.
Sulfide	Less than 0.5 % (as SO_4)

3.20 Earthworks materials to be placed within the minimum limiting distance to metallic structural elements shall have limits on material properties as stated in Table 3.20a and at least one of the additional properties stated in Table 3.20b.

Table 3.20a Properties of earthworks materials with elevated sulphur species placed within the minimum limiting distance of to metallic structural elements	
Property	**Value**
Water soluable sulfate	Maximum 300 mg of sulfate per litre (as SO_4)
Total sulfur	Maximum 1 % for aggregates other than air cooled blast furnace slag, or, maximum 2 % for air cooled blast furnace slag

Table 3.20b Additional properties of earthworks materials with elevated sulphur species placed within the minimum limiting distance to metallic structural elements	
Property	**Description / Value**
Constituents	Limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant.
Sulfide	Less than 0.06 % (as SO_4)

3.21 Earthworks materials not conforming to the requirements of earthworks materials placed within the minimum limiting distance of cementitious material or metallic structural elements shall be classified as earthworks materials with elevated sulphur species.

3.22 The minimum limiting distance for placement of earthworks materials with elevated sulfur species shall be as stated in “Placement of earthworks materials with elevated sulfur species” in Section 5 of this document.

Acceptable earthworks material properties, testing frequency, and acceptability limits

3.23 Acceptable earthworks material properties, testing frequency and acceptability limits shall be as stated in CC 601/WSR/003.

Acceptable earthworks material properties, testing frequency and acceptability limits					
Earthworks material class	**Earthworks material property**	**Minimum acceptable limit**	**Maximum acceptable limit**	**Frequency of suitability testing**	**Frequency of acceptability testing**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter text, to identify the earthworks material class.

b) Enter text, to identify the earthworks material property.

c) Enter text, to identify the minimum acceptable limit for the earthworks material property.

d) Enter text, to identify the maximum acceptable limit for the earthworks material property.

e) Enter text, to identify the frequency of suitability testing for the earthworks material property.

f) Enter text, to identify the frequency of acceptability testing for the earthworks material property.

3.24 Acceptable limits presented as not applicable (n/a) in CC 601/WSR/003 shall not apply to the earthworks material class stated.

Contaminants in acceptable earthworks materials

3.25 Contaminant concentrations limits in acceptable earthworks materials, testing method, and frequency of suitability and acceptability testing shall be as stated in CC 601/WSR/003.

Contaminant concentrations limits in acceptable earthworks materials, testing method, and frequency of suitability and acceptability testing					
Unique reference of earthworks material	**Contaminant reference**	**Contaminant limits**	**Test method**	**Test standard**	**Frequency of suitability testing**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the earthwork material.

b) Enter text, to identify the contaminant.

c) Enter text, to identify the limit of concentration of contaminant in a material, expressed as minimum or maximum acceptable values.

d) Enter text, to identify the method of contaminant testing required to determine the contamination concentration in the earthwork material.

e) Enter text, to identify the testing standard that the test is to be undertaken in accordance with.

f) Enter text, to identify the frequency of of suitability testing required, expressed as number per source.

Contaminant concentrations limits in acceptable earthworks materials, testing method, and frequency of suitability and acceptability testing (continued)	
Unique reference of earthworks material	**Frequency of acceptability testing**
(a)	(g)

g) Enter text, to identify the frequency of acceptability testing required, expressed as number per m^3.

Verification of acceptable earthworks materials

3.26 Verification of acceptable earthworks materials shall be undertaken by suitability testing and acceptability testing of material properties and contaminant concentrations.

3.27 Verification for acceptable earthwork materials by suitability testing and acceptability testing shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 14.N].

Verification of acceptable earthworks materials properties

3.28 Verification shall be undertaken for the required classes of acceptable earthworks materials properties by suitability testing using the test methods as stated in "Sampling and testing methods for earthworks materials" in Section 15 of this document.

3.29 The frequency of suitability testing of proposed acceptable earthworks materials properties shall be as stated in CC 601/WSR/003 for each earthwork material class per material source.

3.30 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the suitability testing of acceptable earthworks materials properties.

3.31 Verification shall be undertaken for the required classes of acceptable earthworks materials properties by acceptability testing using the test methods as stated in "Sampling and testing methods for earthworks materials" in Section 15 of this document.

3.32 The frequency of acceptability testing of proposed earthworks materials shall be as stated in CC 601/WSR/003 for each earthwork material class per material source.

3.33 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the acceptability testing of each earthworks materials class.

Verification of contaminant concentrations in acceptable earthworks materials

3.34 Verification shall be undertaken for contaminant concentrations in acceptable earthworks materials by suitability testing using the test methods as stated in CC 601/WSR/003.

3.35 The frequency of suitability testing for contaminant concentrations of acceptable earthworks materials shall be as stated in CC 601/WSR/003 for each earthwork material class per material source.

3.36 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to suitability testing for contaminant concentrations of acceptable earthworks materials.

3.37 Verification shall be undertaken for contaminant concentrations in acceptable earthworks materials by acceptability testing using the test methods as stated in CC 601/WSR/003.

3.38 The frequency of acceptability testing for contaminant concentrations of acceptable earthworks materials shall be as stated in CC 601/WSR/003 for each earthwork material class per material source.

3.39 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to acceptability testing for contaminant concentrations of acceptable earthworks materials.

Documentation for acceptable earthworks materials

3.40 The following Documentation shall be submitted for earthwork materials suitability testing prior to the commencement of earthwork material installation: for each test, a certificate stating the acceptable earthworks material class to which the test applies, the date of the test, the source of the material tested, test criteria and test results, demonstrating test results are within acceptable limits; and, documentation in accordance with the testing standards.

3.41 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the certification for earthwork materials suitability testing.

3.42 The date of any suitability test shall not be greater than 12 months prior to the commencement of earthwork material installation.

3.43 The following Documentation for earthwork materials acceptability testing shall be submitted as continuous records: for each test, a certificate stating the acceptable earthworks material class to which the test applies, the date of the test, the source of the material tested, test

criteria and test results, demonstrating test results are within acceptable limits; and, documentation in accordance with the testing standards.

3.44 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to the certification and documentation for earthwork materials acceptability testing.

4. Aggregates, concrete, and geotextiles and geotextile-related products used in earthworks

Aggregates used in earthworks

4.1 Aggregates used in earthworks shall be compliant with BS EN 13242 [Ref 1.N].

4.2 The aggregates shall meet the following performance characteristics: acceptable material property limits as stated in "Acceptable earthwork material classes, properties, and testing" in Section 3 of this document.

4.3 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 14.N] shall apply to aggregates used in earthworks.

Concrete used in earthworks

4.4 Concrete used in earthworks shall be in accordance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 27.N].

Geotextiles and geotextile-related products used in earthworks

4.5 Geotextiles and geotextile-related products used in earthworks shall compliant with the standards stated in Table 4.5, as defined by BS EN 13249 [Ref 18.N].

Table 4.5 Standards for geotextiles and geotextile-related products used in earthworks

Use of geotextile or geotextile-related product	Harmonised standard
Roads and other trafficked areas	BS EN 13249 [Ref 18.N]
Earthworks, foundations, and retaining structures	BS EN 13251 [Ref 19.N]
Erosion control systems	BS EN 13253 [Ref 20.N]

4.6 Geotextiles and geotextile-related products used in earthworks shall meet the performance characteristics stated in CC 601/WSR/004.

4.7 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 14.N] shall apply to geotextiles and geotextile-related products used in earthworks.

4.8 Performance characteristics for function-related characteristics of geotextiles and geotextile-related products used in earthworks, relevant to all conditions of use, shall be as stated in CC 601/WSR/004.

Performance characteristics for function-related characteristics of geotextil and geotextile-related products used in earthworks, relevant to all condition use,								
Unique reference of the geotextile or geotextile-related product	**Applicable harmonised standard**	**Tensile strength**	**Elongation at maximum load**	**Static puncture resistance**	**Dynamic perforation resistance**	**Characteristic opening size**	**Water permeability normal to the plane**	**Durity**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter a unique reference, to identify the geotextile or geotextile-related product.

b) Enter text, to identify the applicable harmonised standard.

c) Enter a number in units of kN/m, to identify the tensile strength.

d) Enter a number in units of %, to identify the elongation at maximum load.

e) Enter a number in units of mm, to identify the static puncture resistance.

f) Enter a number in units of mm, to dynamic perforation resistance.

g) Enter a number in units of um, to identify the characteristic opening size.

h) Enter a number in units of l/(m^2.s), to identify the water permeability normal to the plane.

i) Enter a number in units of year, to identify the durability.

4.9 Performance characteristics for function-related characteristics for geotextiles and geotextile-related products used in earthworks, relevant to specific conditions of use, shall be as stated in CC 601/WSR/004.

Performance characteristics for function-related characteristics for geotextiles and geotextile-related products used in earthworks, relevant to specific conditions of use,								
Unique reference of the geotextile or geotextile-related product	**Stiffness at 2 %**	**Stiffness at 5 %**	**Stiffness at 10 %**	**Tensile strength of seams**	**Tensile strength of joints**	**Friction characteristics**	**Tensile creep**	**Resistance to damage during installation under repeated loading**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter a unique reference, to identify the geotextile or geotextile-related product.

b) Enter a number in units of kN/m, to identify the stiffness at 2 %.

c) Enter a number in units of kN/m, to identify the stiffness at 5 %.

d) Enter a number in units of kN/m, to identify the stiffness at 10 %.

e) Enter a number in units of kN/m, to identify the tensile strength of seams.

f) Enter a number in units of kN/m, to identify the tensile strength of joints.

g) Enter a number in units of °, to identify the friction characteristics.

h) Enter a number in units of %/min, to identify tensile creep.

i) Enter a number in units of %, to identify resistance to damage during installation.

Installation of geotextiles and geotextile-related products used in earthworks

4.10 Geotextiles and geotextile-related products shall be installed in accordance with manufacturers instructions for installation and in accordance with CC 601/WSR/004.

4.11 Installation of geotextiles and geotextile-related products shall be as stated in CC 601/WSR/004.

Installation of geotextiles and geotextile-related products			
Unique reference of the geotextile or geotextile-related product	**Installation requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the geotextile or geotextile-related product.

b) Enter text, to identify the requirements for installation of geotextiles and geotextile-related products.

c) Enter text, to identify the unique drawing or model reference that contains the construction details for geotextiles and geotextile-related products.

d) Enter text, to identify the drawing or model title that contains the construction details for geotextiles and geotextile-related products.

Documentation for installation of geotextiles and geotextile-related products used in earthworks

4.12 The following Documentation shall be submitted for installation of geotextiles and geotextile-related products used in earthworks prior to the commencement of installation of geotextiles and geotextile-related products used in earthworks: Manufacturer's instructions for installation.

4.13 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the manufacturer's instructions for installation of geotextiles and geotextile-related products used in earthworks.

5. General earthworks construction

Handling of acceptable earthworks materials

5.1 Acceptable earthworks materials shall be handled such that the earthwork material class is maintained when placed and at the point of compaction.

5.2 Acceptable earthworks materials shall not be removed from site, unless otherwise stated in CC 601/WSR/005.

SI.5.2 The requirements for the removal of acceptable earthworks materials from site shall be [enter free text].

5.3 To maintain determined material properties, earthworks materials of different sources shall not be mixed during placement or compaction.

5.4 To maintain determined material properties, earthworks materials of different classes shall not be mixed during placement or compaction.

Excavation, handling, and disposal of known unacceptable earthworks materials

5.5 Requirements for excavation, handling, and disposal of known unacceptable earthworks materials shall be as stated in CC 601/WSR/005.

Requirements for excavation, handling, and disposal of known unacceptable earthworks materials					
Unique reference of earthwork	**Earthworks material class**	**Excavation requirements**	**Handling requirements**	**Disposal requirements**	**Requirements for the control of leachate and contaminated water**
(a)	(b)	(c)	(d)	(e)	(f)

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

b) Enter a value, from options Class U1A, Class U1B, Class U2, to identify the class of the unacceptable earthworks materials.

c) Enter text, to identify the excavation requirements of the unacceptable earthworks materials.

d) Enter text, to identify the handling requirements of the unacceptable earthworks materials.

e) Enter text, to identify the disposal requirements of the unacceptable materials.

f) Enter text, to identify requirements for control of leachate and contaminated water associated with unacceptable earthworks materials.

Requirements for excavation, handling, and disposal of known unacceptable earthworks materials (continued)	
Unique reference of earthwork	**Requirements for drainage and for sealing exposed surfaces**
(a)	(g)

g) Enter text, to identify requirement for drainage and for sealing exposed surfaces associated with unacceptable earthworks materials.

Frozen earthworks material

5.6 Material which is unacceptable only by reason of being frozen shall be retained on site when in that condition to minimise potential degradation of the material.

5.7 Upon thawing, previously frozen material shall be demonstrated to be acceptable material through verification of acceptable earthworks materials properties in accordance with this section, prior to use in works.

Preparation for earthworks

5.8 Preparation of the ground prior to earthworks shall be as stated in CC 601/WSR/005.

Preparation of the ground prior to earthworks			
Unique reference of ground to be prepared	**Ground preparation methodology**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the area to be prepared for earthwork.

b) Enter text, to identify the methodology for preparation of the ground prior to earthworks.

c) Enter text, to identify the earthworks construction procedures document reference that contains the requirements for preparation of the ground prior to earthworks.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for preparation of the ground prior to earthworks.

Staged construction of earthworks

5.9 Staged construction of earthworks shall be as stated in CC 601/WSR/005.

Staged construction of earthworks			
Unique reference of earthwork	**Staged construction requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the requirements for staged construction of earthworks.

c) Enter text, to identify the unique drawing or model reference that contains the staged construction of earthworks requirements.

d) Enter text, to identify the drawing or model title that contains the staged construction of earthworks requirements.

Earthworks protection

5.10 Earthworks, including any temporary works, formation, or earthworks protection layers, shall be maintained during the works to avoid damage or degradation of the earthworks.

5.11 Temporarily exposed earthworks shall be protected from damage and degradation from plant, environmental hazards including weather and intrusive vegetation growth, and other hazards including flow of surface water and groundwater, by one or more of the following methods.

1. sealing of earthworks surfaces;

2. restricting plant movements over the exposed earthwork; and / or,

3. an earthwork protection layer.

5.12 Earthworks protection layers shall be formed by leaving any excavation high of the excavation base or by placement and compaction of a thickness of earthworks material.

5.13 In areas of earthworks fill, earthworks protection layers shall be formed of the same earthworks material class, placed and compacted in the same way, as the earthworks material being protected.

5.14 Earthworks protection layers shall be sacrificial and removed prior to works to the earthwork recommencing.

Benching and shaping of slopes prior to placement of earthworks fill

5.15 Benching and shaping of slopes prior to placement of earthworks fill shall be as stated in CC 601/WSR/005.

Benching and shaping of slopes prior to placement of earthworks fill			
Unique reference of earthwork	**Benching and shaping requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the requirements for benching and shaping of slopes prior to placement of earthworks fill.

c) Enter text, to identify the unique drawing or model reference that contains the benching or shaping requirements..

d) Enter text, to identify the drawing or model title that contains the benching or shaping requirement.

Excavation by blasting

5.16 Excavation by blasting shall not be permitted, unless otherwise stated in CC 601/WSR/005.

5.17 Earthworks where excavation by blasting is permitted shall be as stated in CC 601/WSR/005.

Earthworks where excavation by blasting is permitted	
Unique reference of excavation	**Restrictions on permitted blasting**
(a)	(b)

a) Enter a unique reference, to identify the earthwork where excavation by blasting is permitted.

b) Enter text, to identify restrictions on the permitted blasting.

5.18 Excavation by blasting shall be a Contractor design item.

5.19 Contractor design of excavation by blasting shall be in accordance with CD 601 [Ref 8.N]and CD 622 [Ref 22.N].

5.20 The requirements for "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to Contractor designed excavation by blasting.

5.21 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 14.N] shall apply to Contractor designed excavation by blasting.

5.22 The following Documentation shall be submitted for excavation by blasting prior to the commencement of any blasting: A programme of blasting activities, written notice of each blasting event.

5.23 Documentation for the written notice of each blasting event shall be submitted at least 12 hours prior to the blasting event.

5.24 The requirements for “Documentation” in Section 2 of GC 101 [Ref 14.N] shall apply to the programme of blasting activities and written notice of each blasting event.

Earthworks around known obstructions

5.25 Known obstructions shall be dealt with in accordance with "Site clearance" in Section 1 of GC 109 [Ref 30.N].

5.26 Earthworks around known obstructions to be left in place shall be as stated in CC 601/WSR/005.

Earthworks around known obstructions to be left in place			
Unique reference of obstruction	**Requirements for earthworks around known obstructions**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the known obstruction.

b) Enter text, to identify the requirements for earthworks around known obstructions to be left in place.

c) Enter text, to identify the unique drawing or model reference that contains the requirements for earthworks around the obstruction.

d) Enter text, to identify the drawing or model title that contains the requirements for earthworks around the obstruction.

Earthworks for watercourses

5.27 Earthworks protection for new watercourses shall be as stated in CC 601/WSR/005.

Earthworks protection for new watercourses			
Unique reference of watercourse	**Protection requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the new watercourse earthworks.

b) Enter text, to identify the requirements for earthworks protection for new watercourses.

c) Enter a unique reference, to identify the unique drawing or model reference that contains the protection requirements for new watercourses.

d) Enter text, to identify the unique drawing or model title that contains the protection requirements for new watercourses.

5.28 Earthworks protection for existing watercourses shall be as stated in CC 601/WSR/005.

Earthworks protection for existing watercourses			
Unique reference of watercourse	**Protection requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the existing watercourse earthworks.

b) Enter text, to identify the requirements for earthworks protection for existing watercourses.

c) Enter a unique reference, to identify the unique drawing or model reference that contains the protection requirements for existing watercourses included in the works.

d) Enter text, to identify the unique drawing or model title that contains the protection requirements for existing watercourses included in the works.

5.29 Earthworks treatment of exposed surfaces of redundant watercourses shall be as stated in CC 601/WSR/005.

Earthworks treatment of exposed surfaces of redundant watercourses			
Unique reference of watercourse	**Treatment requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the redundant watercourse earthworks.

b) Enter text, to identify the requirements for earthworks treatment of exposed surfaces of redundant watercourses.

c) Enter a unique reference, to identify the unique drawing or model reference that contains the requirements for treatment of exposed surface of redundant watercourses.

d) Enter text, to identify the unique drawing or model title that contains the requirements for treatment of exposed surface of redundant watercourses.

Placement of earthworks materials with elevated sulfur species

5.30 Earthworks materials with elevated sulfur species shall not be placed within a minimum limiting distance from cementitious material or metallic structural elements.

5.31 The minimum limiting distance for the placement of material with elevated sulfur species from cementitious material or metallic structural elements shall be as stated in CC 601/WSR/005.

The minimum limiting distance for the placement of material with elevated sulfur species from cementitious material or metallic structural elements		
Unique reference of earthwork	**Minimum limiting distance from cementitious material**	**Minimum limiting distance from metallic structural elements**
(a)	(b)	(c)

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

b) Enter a number in units of mm, to identify the minimum distance that earthworks materials with elevated sulfur species can be placed from cementitious material.

c) Enter a number in units of mm, to identify the minimum distance that earthworks materials with elevated sulfur species can be placed from metallic structural elements.

Verification requirements for placement of earthworks materials with elevated sulfur species

5.32 Verification shall be undertaken for placement of earthworks material with elevated sulfur species by measurement of the minimum distance between the placed earthworks material and any cementitious material and metallic structural elements and checking against the minimum limiting distance stated in CC 601 WSR/005.

5.33 The frequency of verification of the placement of earthworks material with elevated sulfur species shall be once per day during the earthworks activity.

5.34 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the verification measurement of the minimum distance between the placed earthworks material and any cementitious material and metallic structural elements.

Placement of earthworks materials comprising pulverised fuel ash

5.35 Earthworks materials comprising pulverised fuel ash shall not be placed within a minimum limiting distance from the formation.

5.36 The minimum limiting distance for the placement of material comprising pulverised fuel ash from the formation shall be as stated in CC 601/WSR/005.

The minimum limiting distance for the placement of material comprising pulverised fuel ash from the formation	
Unique reference of earthwork	**Minimum limiting distance from the formation**
(a)	(b)

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

b) Enter a number in units of mm, to identify the minimum distance for the placement of material comprising pulverised fuel ash from the formation.

Verification requirements for placement of material comprising pulverised fuel ash

5.37 Verification shall be undertaken for placement of material comprising pulverised fuel ash by measurement of the minimum distance between the placed earthworks material and the formation and checking against the minimum limiting distance stated in CC 601/WSR/005.

5.38 The frequency of verification of the placement of material comprising pulverised fuel ash shall be once per day during the earthworks activity.

5.39 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the verification measurement of the minimum distance between the placed earthworks material and the formation and checking against the minimum limiting distance.

6. Compaction of earthworks fill

General requirements for the compaction of earthworks fill

6.1 Excavation and haulage plant shall not be used as compaction plant.

6.2 The use of a lighter category of compaction plant to regulate the surface of any fill prior to the use of heavier plant shall not be taken into account when assessing the amount of compaction required for any placed layer.

6.3 Compaction shall be undertaken immediately following placement of earthworks materials.

Earthworks fill compaction control

6.4 Earthworks fill compaction control shall be in accordance with Table 6.4 or, where Method compaction is stated in Table 6.4, an alternative compaction control in accordance with “Alternative earthworks fill compaction control” in this Section.

Table 6.4 Control for the compaction of earthworks fill

Earthworks material class	Compaction control	Method of earthworks compaction
Class 1A	Method compaction	Method 2
Class 1B	Method compaction	Method 3
Class 1C	Method compaction	Method 5
Class 2A	Method compaction	Method 1
Class 2B	Method compaction	Method 2
Class 2C	Method compaction	Method 2
Class 2D	Method compaction	Method 3
Class 2E	End-product compaction	-
Class 3	Method compaction	Method 4
Class 4	No compaction	-
Class 5A	No compaction	-
Class 5B	No compaction	-
Class 6A	No compaction	-
Class 6B	Method compaction	Method 5
Class 6C	Method compaction	Method 3
Class 6D	Method compaction	Method 4
Class 6G	No compaction	-
Class 6H	Method compaction	Method 3
Class 6I	Method compaction	Method 2
Class 6J	Method compaction	Method 3

Table 6.4 Control for the compaction of earthworks fill		
Earthworks material class	**Compaction control**	**Method of earthworks compaction**
Class 6K	End-product compaction	-
Class 6L	No compaction	-
Class 6M	End-product compaction	-
Class 6N	End-product compaction	-
Class 6P	End-product compaction	-
Class 6Q1	End-product compaction	-
Class 6Q2	End-product compaction	-
Class 6Q3	End-product compaction	-
Class 7A	End-product compaction	-
Class 7B	End-product compaction	-
Class 7C	Method compaction	Method 1
Class 7D	Method compaction	Method 2
Class 7H1	Method compaction	Method 1
Class 7H2	Method compaction	Method 2
Class 7H3	Method compaction	Method 2
Class 7H4	Method compaction	Method 3
Class 7H5	Method compaction	Method 4
Class 8	Equivalent to the original earthworks material class	

Method compaction of earthworks fill

6.5 The type and category of compaction plant, maximum thickness of the compacted layer D, and minimum number of passes N for method compaction of earthworks fill shall be in accordance with Table 6.5 for the relevant stated method.

Table 6.5 Method compaction of earthworks materials													
Type of compaction plant	**Compaction plant category**	**Method 1**		**Method 2**		**Method 3**		**Method 4**		**Method 5**		**Pavement formation compaction**	
												A	**B**
		D	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**N**	**N**
Rollers													

Table 6.5 Method compaction of earthworks materials													
Type of compaction plant	**Compaction plant category**	**Method 1**		**Method 2**		**Method 3**		**Method 4**		**Method 5**		**Pavement formation compaction**	
												A	**B**
		D	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**N**	**N**
	Mass per metre width of roll:												
Smooth wheeled roller (without vibration)	over 2,100 kg up to 2,700 kg	125	8	125	10	125	10	175	4	-		-	-
	over 2,700 kg up to 5,400 kg	125	6	125	8	125	8	200	4	-		-	-
	over 5,400 kg	150	4	150	8	-		300	4	-		-	4
Smooth wheeled roller (with vibration)	over 270 kg up to 450 kg	-		75	16	150	16	-		-		-	-
	over 450 kg up to 700 kg	-		75	12	150	12	-		-		-	-
	over 700 kg up to 1,300 kg	100	12	125	10	150	6	125	10	-		-	-
	over 1,300 kg up to 1,800 kg	125	8	150	8	200	10*	175	4	-		-	-
	over 1,800 kg up to 2,300 kg	150	4	150	4	225	12*	-		-		-	-
	over 2,300 kg up to 2,900 kg	175	4	175	4	250	10*	-		400	5	-	-
	over 2,900 kg up to 3,600 kg	200	4	200	4	275	8*	-		500	6	-	-
	over 3,600 kg up to 4,300 kg	225	4	225	4	300	8*	-		600	6	-	-
	over 4,300 kg up to 5,000 kg	250	4	250	4	300	6*	-		700	6	12	-
	over 5,000 kg	275	4	275	4	300	4*	-		800	6	10	-
Tamping	over 4,000	225	8	150	24	25	8	350	8	-		-	8

Table 6.5 Method compaction of earthworks materials														
Type of compaction plant	**Compaction plant category**	**Method 1**		**Method 2**		**Method 3**		**Method 4**		**Method 5**		**Pavement formation compaction**		
												A	**B**	
		D	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**N**	**N**	
roller (without vibration)	kg up to 6,000 kg					0								
	over 6,000 kg	300	10	200	24	300	6	400	8	-		20	8	
Tamping roller (with vibration)	over 700 kg up to 1,300 kg	100	12	100	12	150	12	100	10	-		-	-	
	over 1,300 kg up to 1,800 kg	125	12	125	12	175	12*	175	8	-		-	-	
	over 1,800 kg up to 2,300 kg	150	12	150	12	200	12*	-		-		-	-	
	over 2,300 kg up to 2,900 kg	150	9	150	9	250	12*	-		400	5	-	-	
	over 2,900 kg up to 3,600 kg	200	9	200	9	275	12*	-		500	6	-	-	
	over 3,600 kg up to 4,300 kg	225	9	225	9	300	12*	-		600	6	-	-	
	over 4,300 kg up to 5,000 kg	250	9	250	9	300	9*	-		700	6	12	-	
	over 5,000 kg	275	9	275	9	300	7*	-		800	6	10	-	
Grid roller	over 2,700 kg up to 5,400 kg	150	10	-		150	10	250	4	-		-	4	
	over 5,400 kg up to 8,000 kg	150	8	125	12	-		325	4	-		-	4	
	over 8,000 kg	150	4	125	12	-		400	4	-		-	4	
Pneumatic-tyred roller	Mass per wheel:													
	over 1,000 kg up to	125	6	-		150	10*	240	4	-		-	-	

Table 6.5 Method compaction of earthworks materials													
Type of compaction plant	**Compaction plant category**	**Method 1**		**Method 2**		**Method 3**		**Method 4**		**Method 5**		**Pavement formation compaction**	
												A	**B**
		D	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**N**	**N**
	1,500 kg												
	over 1,500 kg up to 2,000 kg	150	5	-		-		300	4	-		-	4
	over 2,000 kg up to 2,500 kg	175	4	125	12	-		350	4	-		-	4
	over 2,500 kg up to 4,000 kg	225	4	125	10	-		400	4	-		-	4
	over 4,000 kg up to 6,000 kg	300	4	125	10	-		-		-		-	-
	over 6,000 kg up to 8,000 kg	350	4	150	8	-		-		-		-	-
	over 8,000 kg up to 12,000 kg	400	4	150	8	-		-		-		-	-
	over 12,000 kg	450	4	175	6	-		-		-		-	-
Compactors													
Vibrating plate compactor	Mass per m^2 of base plate:												
	over 880 kg up to 1,100 kg	-		-		75	6	-		-		-	-
	over 1,100 kg up to 1,100 kg	-		75	10	100	6	75	10	-		-	-
	over 1,200 kg up to 1,400 kg	-		75	6	150	6	150	8	-		-	-
	over 1,400 kg up to 1,800 kg	100	6	125	6	150	4	-		-		-	-
	over 1,800 kg up to	150	6	150	5	200	4	-		-		-	-

Table 6.5 Method compaction of earthworks materials													
Type of compaction plant	**Compaction plant category**	**Method 1**		**Method 2**		**Method 3**		**Method 4**		**Method 5**		**Pavement formation compaction**	
												A	**B**
		D	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**D**	**N**	**N**	**N**
	2,100 kg												
	over 2,100 kg	200	6	200	5	250	4	-		-		12	-
Vibro-tamper	Mass:												
	over 50 kg up to 65 kg	100	3	100	3	125	3	125	3	-		-	-
	over 65 kg up to 75 kg	125	3	125	3	150	3	150	3	-		12	-
	over 75 kg up to 100 kg	150	3	150	3	175	3	175	3	-		10	-
	over 100 kg	225	3	200	3	250	3	250	3	-		10	3
Power rammer	Mass:												
	100 kg up to 500 kg	150	4	150	6	-		200	4	-		-	-
	over 500 kg	275	8	275	12	-		400	4	-		14	4
Dropping-weight compactor	Mass of rammer over 500 kg:												
	over 1 m up to 2 m weight drop	600	4	600	8	450	8	-		-		-	-
	over 2 m weight drop	600	2	600	8	-		-		-		-	-

Additional requirements for method compaction of earthworks fill

6.6 The compaction plant referenced in Table 6.5 shall be as described in BS EN 16907-3 [Ref 10.N]and Nowak & Gilbert (2015) [Ref 11.N].

6.7 The finishing of earthworks fill shall be as stated in "Finishing and topsoiling of earthworks" in Section 8 of this document.

6.8 The category of compaction plant stated in Table 6.5 shall be selected in terms of static mass with the exception of vibrating plate compactors which are in terms of working mass.

6.9 The compaction plant identified by having a '-' against the layer thickness and / or minimum number of passes stated in Table 6.5 shall not be used for the relevant method.

6.10 The compaction plant identified by having an '*' against the minimum number of passes stated in Table 6.5 shall be towed track-laying tractors only for the relevant method.

6.11 The minimum number of passes stated in Table 6.5 shall be the minimum number of passes that each point on the surface of the layer being compacted is traversed by the individual compaction element of the compaction plant in its operating mode, or a single strike by power rammers or dropping weight compactors.

6.12 Where combinations of different types or categories of compaction plant, or plant with multiple differing sized compacting elements, are used, the method of compaction of earthworks fill shall be based on the lower layer thickness and greater number of passes required by the plant used.

6.13 Class 2A earthworks material with liquid limit greater than 50 % shall only be compacted with tamping rollers or grid rollers.

6.14 Class 3 earthworks material shall not be compacted using vibratory compaction rollers with static weight over 1,800 kg mass per meter width of roll.

6.15 Class 7H1 earthworks material with liquid limit greater than 50 % shall only be compacted with tamping rollers or grid rollers.

6.16 Class 7H5 earthworks material shall not be compacted using vibratory compaction plant with static weight over 1,800 kg.

6.17 The feet of tamping rollers shall have a projected end area of each foot exceeding 0.01 m^2 and the sum of the areas of the feet exceeding 15% of the area of the cylinder swept by the ends of the feet.

6.18 Vibrating rollers for Method 5 compaction shall be single roll types.

6.19 Vibrating rollers shall use the lowest gear on a self-propelled machine with mechanical transmission and a speed of 1.5 to 2.5 km/h for a towed machine, or a self-propelled machine with hydrostatic transmission.

6.20 Vibrating rollers shall be operated at the maximum amplitude setting recommended by the manufacturer and at the maximum frequency recommended by the manufacturer for that setting.

6.21 Vibrating rollers shall be equipped or provided with devices recording the frequency at which the mechanism is operating and the speed of travel.

6.22 Vibrating plate compactors shall be operated at travelling speeds of less than 1 km/h.

6.23 The compacted layer thickness of any earthworks fill shall be not less than 1.5 times the maximum particle size of the placed earthworks fill.

6.24 Compaction of the finishing earthworks fill layer beneath pavements shall be as stated in CC 601/WSR/006.

Compaction of the finishing earthworks fill layer beneath pavements	
Unique reference of the finishing earthworks layer	**Compaction requirements of the finishing earthworks fill layer beneath pavements**
(a)	(b)

a) Enter a unique reference, to identify the finishing earthworks layer.

b) Enter text, to identify the compaction requirements of the finishing earthworks fill layer beneath pavements.

Confirmatory testing of method compaction of earthworks fill

6.25 Confirmatory testing of method compaction of earthworks fill shall be undertaken as stated in CC 601/WSR/006.

Confirmatory testing of method compaction of earthworks fill		
Unique reference of the earthworks fill	**Confirmatory testing method**	**Frequency of confirmatory testing**
(a)	(b)	(c)

a) Enter a unique reference, to identify the earthworks fill.

b) Enter text, to identify the test method for confirmatory testing of method compaction of earthworks fill.

c) Enter text, to identify the frequency of confirmatory testing of method compaction of earthworks fill.

Verification of method compaction of earthworks fill

6.26 Verification shall be undertaken for the method compaction of earthworks fill for each material source and class by compaction compliance testing, recording type and category of plant used, measured

compacted layer thicknesses, recorded number of passes made and demonstrating compliance with the method used.

6.27 Frequency of compaction compliance testing for method compaction of earthworks fill shall be as stated in CC 601/WSR/006.

Frequency of compaction compliance testing for method compaction of earthworks fill	
Unique reference of the earthworks fill	**Frequency of compaction compliance testing**
(a)	(b)

a) Enter a unique reference, to identify the earthworks fill.

b) Enter text, to identify the frequency of compaction compliance testing required for method compaction of earthworks fill.

6.28 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to compaction compliance testing for method compaction of earthwork fill.

Documentation for confirmatory and compliance testing of method compaction of earthworks fills

6.29 The following documentation for confirmatory testing of method compaction of earthworks fills shall be submitted as continuous records: a certificate stating the unique reference for the earthworks fill to which the certificate applies, the date of the tests undertaken, and the source of the material tested; and a test report for each test in accordance with the testing standards as stated in "Sampling and testing methods for earthworks materials" in Section 15 of this document.

6.30 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to confirmatory testing of method compaction of earthwork fill.

6.31 The following Documentation for compaction compliance testing for method compaction of earthwork fill shall be submitted as continuous records: Record of type and category of plant used, measured compacted layer thicknesses, recorded number of passes made.

6.32 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to compaction compliance testing for method compaction of earthwork fill.

End-product compaction of earthworks fill

6.33 End-product compaction of earthworks fill shall achieve the acceptability limits for the degree of earthworks material compaction in accordance with Table 6.33.

Table 6.33 Acceptability limits for end-product compaction of earthworks fill

Earthworks material class	Degree of compaction acceptability limits
Class 2E	Dry density equivalent to minimum 95 % of maximum dry density
Class 6K	Dry density equivalent to minimum 90 % of maximum dry density
Class 6M	Dry density equivalent to minimum 90 % of maximum dry density
Class 6N	Dry density equivalent to minimum 95 % of maximum dry density
Class 6P	Dry density equivalent to minimum 95 % of maximum dry density
Class 6Q1	Dry density equivalent to minimum 95 % of maximum dry density
Class 6Q2	Dry density equivalent to minimum 95 % of maximum dry density
Class 6Q3	Dry density equivalent to minimum 95 % of maximum dry density
Class 7A	The lower of the maximum dry density and the dry density corresponding to 5% air voids at field water content
Class 7B	Dry density equivalent to minimum 95 % of maximum dry density

Additional requirements for end-product compaction of earthworks fill

6.34 The compacted layer thickness of any earthworks fill shall be not less than 1.5 times the maximum particle size of the placed earthworks fill.

6.35 Earthworks fill material requiring end-product compaction shall be placed in layers not exceeding 250 mm uncompacted thickness.

Determination of acceptability limits for end-product compaction of earthworks fill

6.36 The determination of acceptability limits for end-product compaction of earthworks fill shall be by relationship testing to determine the dry density / water content relationship for each source and class of earthworks material.

6.37 The frequency of end-product compaction relationship testing shall be as stated in CC 601/WSR/006.

The frequency of end-product compaction relationship testing	
Unique reference of the earthworks material	**Frequency of relationship testing**
(a)	(b)

a) Enter a unique reference, to identify the earthworks material.

b) Enter text, to identify the frequency of end-product compaction relationship testing for the earthworks material.

6.38 Relationship testing to determine the dry density / water content relationship shall be as stated in "Sampling and testing methods for earthworks materials" in Section 15 of this document.

6.39 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the determination of acceptability limits for end-product compaction of earthworks fill.

Documentation for the determination of end-product compaction acceptability limits for earthworks materials

6.40 The following Documentation shall be submitted for end-product relationship testing for earthworks materials prior to the commencement of end-product compaction of earthworks fill: for each earthworks material source and class, a Certificate for determination of end-product compaction, stating the determined end-product compaction acceptability limits based on all tests undertaken, the earthworks material class to which the certificate applies, the date of the tests undertaken, and the source of the material tested, and a test report for each test.

6.41 Documentation for end-product relationship testing for earthworks materials shall be submitted at least one working week prior to the commencement of end-product compaction of earthworks materials.

6.42 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the certificate for determination of end-product compaction.

Documentation for confirmatory recording of the construction procedures for end-product compaction of earthworks fill

6.43 The following Documentation for confirmatory recording of the construction procedures for end-product compaction of earthworks fill shall be submitted as continuous records: Record of type and category of

plant used, measured compacted layer thicknesses, recorded number of passes made for each material source and class used.

6.44 Confirmatory recording of the construction procedures for end-product compaction of earthworks fill shall be undertaken as stated in CC 601/WSR/006.

Confirmatory recording of the construction procedures for end-product compaction of earthworks fill		
Unique reference of the earthworks fill	**Confirmatory recording method**	**Frequency of confirmatory recording**
(a)	(b)	(c)

a) Enter a unique reference, to identify the earthworks fill.

b) Enter text, to identify recording method for confirmatory recording of the construction procedures of end-product compaction of earthworks fill.

c) Enter text, to identify the frequency of confirmatory recording of the construction procedures of end-product compaction of earthworks fill.

6.45 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to confirmatory recording of the construction procedures for end-product compaction of earthworks fill.

Verification of end-product compaction of earthworks fill

6.46 Verification of end-product compaction of earthworks fill shall be by compliance point testing, unless otherwise stated in CC 601/WSR/006.

6.47 Verification of end-product compaction of earthworks fill by compliance point testing shall be through in situ density and water content testing of the compacted earthworks fill to demonstrate compliance with the determined end-product compaction acceptability limits.

6.48 The frequency of compliance end-product point testing shall be as stated in CC 601/WSR/006.

The frequency of compliance end-product point testing	
Unique reference of the earthworks fill	**Frequency of compliance testing**
(a)	(b)

a) Enter a unique reference, to identify the earthworks fill.

b) Enter text, to identify the frequency of the compliance end-product point testing required for end-product compaction of earthworks fill.

6.49 The requirements for “Verification” in Section 14 of GC 101 [Ref 14.N] shall apply to the compliance end-product point testing.

6.50 Verification for the compliance end-product point testing shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 14.N].

6.51 In situ density and water content testing shall be as stated in "Sampling and testing methods for earthworks materials" in Section 15 of this document.

6.52 Alternative verification of end-product compaction of earthworks fill shall be as stated in CC 601/WSR/006.

Alternative verification of end-product compaction of earthworks fill			
Unique reference of the earthworks fill	**Method of verification**	**Earthworks construction procedures document references**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthworks fill.

b) Enter text, to identify the alternative method of verification of end-product compaction of earthworks fill.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for the alternative method of verification of end-product compaction of earthworks fill.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for the alternative method of verification of end-product compaction of earthworks fill.

Alternative earthworks fill compaction control

6.53 Alternative earthworks fill compaction control shall achieve an end-product degree of compaction of maximum 10% air voids and a minimum dry density of 95% of maximum dry density.

6.54 The verification and documentation requirements for alternative earthworks fill compaction control shall be as stated in "End-product

compaction of earthworks fill” in this Section and with the addition of an earthworks compaction trial in accordance with "Earthworks compaction trials" in this Section.

Earthworks compaction trials

6.55 Earthworks compaction trials shall be as stated in CC 601/WSR/006.

Earthworks compaction trials			
Unique reference of the earthworks fill	**Purpose of earthworks compaction trial**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthworks fill.

b) Enter text, to identify the purpose of the earthworks compaction trial.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for earthworks compaction trials.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for earthworks compaction trials.

Verification of earthworks compaction trials

6.56 Verification shall be undertaken for earthworks compaction trials by compaction trial testing, demonstrating compliance with the defined end-product compaction acceptability limits through in situ testing of field dry density and water content of the trial-compacted earthworks fill.

6.57 The frequency of compaction trial testing shall be as stated in the earthworks construction procedures document as stated in CC 601/WSR/006.

6.58 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to compaction trial testing.

Documentation for earthworks compaction trials

6.59 The following Documentation shall be submitted for earthworks compaction trials prior to the commencement of permanent compaction of the relevant earthworks fill: for each source and class, a Report for

earthworks compaction trials, recording the alternative control of compaction of earthworks materials, the defined acceptability limits, plant, layer thickness, number of passes, test results demonstrating compliance.

6.60 Documentation for the earthworks compaction trial shall be submitted minimum one working week prior to the commencement of permanent compaction of the relevant earthworks fill.

6.61 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the report for earthworks compaction trials.

Compaction of earthworks formations

6.62 Earthworks formations shall be prepared in accordance with "Earthworks formations" in Section 7 of this document.

Compaction of formations beneath structural foundations

6.63 Compaction of formations beneath structural foundations shall be as stated in CC 601/WSR/006.

Compaction of formations beneath structural foundations	
Unique reference of the formation	**Compaction requirements**
(a)	(b)

a) Enter a unique reference, to identify the formation beneath the structural foundation.

b) Enter text, to identify the compaction requirements for formations beneath structural foundations.

Compaction of formations beneath corrugated steel buried structures

6.64 Compaction of earthworks formations below corrugated steel buried structures shall be as stated in CC 601/WSR/006.

Compaction of earthworks formations below corrugated steel buried structures	
Unique reference of the formation	**Compaction requirements**
(a)	(b)

a) Enter a unique reference, to identify the formation beneath the corrugated steel buried structure.

b) Enter text, to identify the compaction requirements for formations beneath corrugated steel buried structures.

Compaction of formations beneath pavements

6.65 Preparation compaction of formations beneath pavements where no capping is to be placed shall be as stated in Table 6.69.

Table 6.65 Preperation compaction of formations beneath pavements where no capping is to be placed	
Earthworks formation material	**Compaction requirements**
All materials except Class 3 and Class 7H5 earthworks material	Table 6.5 Column A
Class 3 and Class 7H5 earthworks material	Table 6.5 Column B

6.66 Preparation compaction of formations beneath pavements where capping is to be subsequently placed shall be not undertaken, unless otherwise stated in CC 601/WSR/006.

Preparation compaction of formations beneath pavements where capping is to be subsequently placed	
Unique reference of the formation	**Preparation compaction requirements**
(a)	(b)

a) Enter a unique reference, to identify the formation beneath the pavement.

b) Enter text, to identify the preparation compaction requirements for formations beneath pavements.

6.67 On completion of all preparation compaction and final trimming, in all materials except Class 3 and Class 7H5 earthworks materials, formations beneath pavements shall be compacted with one pass of a smooth-wheeled roller having a mass per metre width of roll not less than 2,100 kg or a vibratory roller having a mass per metre width of vibrating roll of not less than 700 kg or a vibrating plate compactor having a mass per m^2 under the base plate of not less than 1,400 kg.

6.68 On completion of all preparation compaction and final trimming in Class 3 and Class 7H5 earthworks materials, formation beneath pavements shall be compacted with one pass of a smooth-wheeled roller having a mass per metre width of roll not less than 2,100 kg.

7. Earthworks formations

General requirements for earthworks formations

7.1 Formations shall be free from visible defects including material damaged by construction plant and loose fragments.

7.2 Earthworks formations strength requirements shall be as stated in CC 601/WSR/007.

Earthworks formations strength requirements				
Unique reference of the formation	**Formation type**	**Minimum required formation strength**	**Formation testing requirements**	**Frequency of formation strength testing**
(a)	(b)	(c)	(d)	(e)

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

b) Enter a value, from options Natural soil, Earthworks fill, Rock, to identify the anticipated formation material.

c) Enter text, to identify the minimum formation strength.

d) Enter text, to identify the formation testing requirements.

e) Enter text, to identify the frequency of formation strength testing.

7.3 Formation material not meeting the formation strength requirements stated in CC 601/WSR/007 or damaged by construction plant shall be replaced with formation rectification material.

7.4 Formation rectification material shall be as stated in CC 601/WSR/007.

Formation rectification material	
Unique reference of the formation	**Formation rectification material**
(a)	(b)

a) Enter a unique reference, to Identify the formation.

b) Enter text, to identify the rectification material for replacement of material not meeting the formation strength requirements or damaged by construction plant.

Formations in natural soils and earthwork fills

7.5 Natural soils and earthworks fill formations shall be constructed to level and compacted as stated in "Compaction of earthworks fill" in Section 6 of this document.

7.6 Following formation compaction, if the surface level of the earthworks formation is higher than tolerance then the surface shall be trimmed and compaction repeated.

7.7 Following formation compaction, if the surface level of the earthworks formation is lower than tolerance then the surface shall be raised by the placement and compaction of acceptable earthworks material having the same properties as the formation material.

7.8 Where a formation comprises Class 2 or Class 7 earthworks materials and the surface level of the formation is lower than tolerance, the formation material shall be removed to a depth of at least 150 mm below the formation before being raised by the placement and compaction of acceptable earthworks material having the same material properties as the formation material.

Formations in rock

7.9 Preparation of formations in rock shall consist of one of the following activities.

1. excavation, processing and compaction of excavated material; or,

2. regulation of the formation surface.

7.10 Excavation, processing, and compaction of excavated material to form formations in rock shall be as stated in CC 601/WSR/007.

Excavation, processing, and compaction of excavated material to form formations in rock			
Unique reference of the formation	**Depth of excavation below the formation**	**Material processing requirements**	**Material compaction requirements**
(a)	(b)	(c)	(d)

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

b) Enter a number in units of mm, to identify the depth of the excavation of rock below the formation.

c) Enter text, to identify the processing requirements for excavated rock material.

d) Enter text, to identify the compaction requirements for the processed rock material.

7.11 Regulation of the formation in rock shall be as stated in CC 601/WSR/007.

Regulation of the formation in rock				
Unique reference of the formation	**Regulating material**	**Compaction of regulating material**	**Minimum thickness of regulating material**	**Maximum thickness of regulating material**
(a)	(b)	(c)	(d)	(e)

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

b) Enter text, to specify the material used for regulating the formation.

c) Enter text, to identify the method of compacting the regulating material.

d) Enter a number in units of mm, to identify the minimum thickness of the regulating material.

e) Enter a number in units of mm, to identify the maximum thickness of the regulating material.

Verification requirements for earthworks formations

7.12 Verification to confirm absence of damaged formation material and loose fragments from the formation shall be undertaken by visual inspection of the formation as stated in CC 601/WSR/007.

Verification to confirm absence of damaged formation material and loose fragments from the formation		
Unique reference of the formation	**Description of visual inspection**	**Frequency of visual inspection**
(a)	(b)	(c)

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

b) Enter text, to identify the description of the visual inspection to confirm absence of damaged formation material and loose fragments.

c) Enter text, to identify the frequency of the visual inspection to confirm absence of damaged formation material and loose fragments.

7.13 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the visual inspection of the formations.

7.14 Verification shall be undertaken for the formation strength through testing of the formation as stated in CC 601/WSR/007.

7.15 The frequency of verification of the formation strength shall be as stated in CC 601/WSR/007.

7.16 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the formation strength testing.

Documentation requirements for earthworks formations

7.17 The following Documentation for visual inspection of formations shall be submitted as continuous records: Formation inspection record, including confirmation of formation type and photographs demonstrating absence of material damaged by construction plant and loose fragments.

7.18 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to the formation inspection record.

7.19 The format of photographs shall be still images in accordance with "Still images and video format" in Section 5 of GC 105 [Ref 2.N].

7.20 The following Documentation for strength testing of formations shall be submitted as continuous records: Formation testing record, including formation strength test certificates confirming acceptable formation strength.

7.21 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to the formation testing record.

Earthworks formations for pavement construction

7.22 Earthworks formations for pavement construction shall be in accordance with CC 201 [Ref 28.N].

7.23 Subgrade assessment of the formation beneath pavements prior to pavement foundation construction shall be in accordance with "Subgrade assessment prior to foundation construction" in Section 4 of CC 201 [Ref 28.N].

Earthworks formations for structural foundations

7.24 Where blinding concrete is placed on the formation of any structural foundation, earthworks shall not be undertaken in the vicinity of the blinding concrete for at least 24 hours.

7.25 Blinding of the earthworks formation beneath structural foundations, excluding pile foundations shall be as stated in CC 601/WSR/007.

Blinding of the earthworks formation beneath structural foundations, excluding pile foundations				
Unique reference of the formation	**Unique reference of the structural foundation**	**Blinding requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)	(e)

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

b) Enter a unique reference, to identify the structural foundation.

c) Enter text, to identify the requirements for blinding of the earthworks formation beneath structural foundations, excluding pile foundations.

d) Enter a unique reference, to identify the earthworks layout drawing(s) of model where the earthworks formations for structural foundations are described.

e) Enter text, to identify the earthworks layout drawing(s) or model which describe the earthworks formations for structural foundations.

8. Finishing and topsoiling of earthworks

Finishing earthworks fill layer beneath pavements

8.1 Earthworks fill within the finishing earthworks fill layer below pavement formations shall be placed and compacted in a single operation to create a consistent layer in preparation for placement of pavement materials.

8.2 Finishing earthworks fill layers beneath pavements shall be as stated in CC 601/WSR/008.

Finishing earthworks fill layers beneath pavements		
Unique reference of earthwork	**Minimum thickness of finishing earthworks fill layer**	**Minimum lateral extents of finishing earthworks fill layer**
(a)	(b)	(c)

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

b) Enter a number in units of mm, to identify the minimum thickness of the finishing earthworks fill beneath pavements.

c) Enter text, to identify the minimum lateral extents of the finishing earthworks fill beneath pavements.

Exposed earthwork faces in their final condition

8.3 Exposed earthwork faces in their final condition and, where not covered by subsequent works, shall be left in a stable condition.

8.4 Requirements for making stable exposed earthwork faces prior to placement of topsoil or where topsoil is not to be placed shall be as stated in CC 601/WSR/008.

Requirements for making stable exposed earthwork faces prior to placement of topsoil or where topsoil is not to be placed			
Unique reference of earthwork	**Method of making exposed earthwork faces stable**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the method of making exposed earthwork faces stable prior to placement of topsoil or where topsoil is not to be placed.

c) Enter text, to identify the unique drawing or model reference that contains the requirements for making exposed earthwork faces stable prior to placement of topsoil or where topsoil is not to be placed.

d) Enter text, to identify the drawing or model title that contains the requirements for making exposed earthwork faces stable where topsoil is not to be placed.

8.5 Requirements for preparation of exposed earthwork faces for topsoil shall be as stated in CC 601/WSR/008.

Requirements for preparation of exposed earthwork faces for topsoil			
Unique reference of earthwork	**Method of preparation of earthwork faces prior to placement of topsoil**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the method of preparation of earthworks faces prior to placement of topsoil.

c) Enter a unique reference, to identify the unique drawing or model reference that contains the requirements for preparation of earthworks faces prior to placement of topsoil.

d) Enter text, to identify the drawing or model title that contains the requirements for preparation of earthworks faces prior to placement of topsoil.

8.6 Exposed earthwork faces shall be left without scars or damage from construction plant, loose material that can be moved by hand or airline hose removed, and uneven appearance.

Topsoiling using Class 5 earthworks material

8.7 Class 5 earthworks material for topsoiling shall not be stored in stockpiles of heights exceeding 2 m, unless otherwise stated in CC 601/WSR/008.

SI.8.7 The maximum height of stockpiles of Class 5 earthworks material shall be [enter free text].

8.8 Class 5 earthworks material which has been stockpiled for more than 2 years shall not be used in the works, unless otherwise stated in CC 601/WSR/008.

SI.8.8 The maximum period of time for which Class 5 earthworks material is permitted to be stockpiled prior to use in the works shall be [enter a number] .

8.9 Class 5 earthworks material stockpiles shall not be surcharged or otherwise loaded.

8.10 Class 5 earthworks material shall not be excavated from stockpiles that have been exposed to more than 100 mm of cumulative rainfall measured at the specific location over the preceding 28 days prior to excavation, unless otherwise stated in CC 601/WSR/008.

SI.8.10 The maximum cumulative measurement of rainfall, measured at the contract specific location, over the preceding 28 days shall be [enter a number] .

8.11 Class 5 earthworks material shall not be excavated from stockpiles during heavy rainfall.

8.12 Class 5 earthworks material shall not be excavated from stockpiles older than 6 months, unless the stockpile has been treated.

8.13 Treatment of Class 5 earthworks material, which has been stockpiled for more than 6 months shall comply with "Pesticide use on landscape and ecological work" in Section 3 of LC 120 [Ref 21.N].

8.14 Screening of Class 5A earthworks material to achieve grading requirements shall be undertaken by mechanical means such as hand-picking or screening plant.

8.15 Class 5 earthworks material shall be placed to smooth contours, eliminating mounds and depressions where water can collect.

8.16 Class 5 earthworks material shall be placed in layers not exceeding 150 mm.

8.17 Class 5 earthworks materials shall be firmed without formal compaction after placement.

8.18 Class 5 earthworks material shall not have particles protruding above the surface by more than 30 mm.

9. Specific installation requirements for specific earthwork material classes

Specific installation requirements for earthworks using Class 1C and Class 6B earthworks material

9.1 Class 1C and Class 6B earthworks materials shall , before compaction, be spread in layers by a crawler tractor of not less than 15 tonnes total mass.

9.2 If voids remain in the compacted surface of Class 1C and Class 6B earthworks material, each layer shall be blinded with blinding material.

9.3 Blinding material for Class 1C and Class 6B earthworks material shall be as stated in CC 601/WSR/009.

Blinding material for Class 1C and Class 6B earthworks material	
Unique reference of earthwork	**Blinding material for Class 1C and Class 6B earthworks material**
(a)	(b)

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

b) Enter text, to identify the acceptable earthworks material class of blinding material for Class 1C and Class 6B earthworks material.

Specific installation requirements for earthworks using Class 3 and Class 7H5 earthworks material

9.4 Acceptable excavation, haulage, and earth-moving plant, and operating restrictions for working Class 3 and Class 7H5 earthworks materials shall be as stated in CC 601/WSR/009.

Acceptable excavation, haulage, and earth-moving plant, and operating restrictions for working Class 3 and Class 7H5 earthworks materials		
Unique reference of earthwork	**Acceptable plant**	**Operating restrictions**
(a)	(b)	(c)

a) Enter a unique reference, to identify earthworks using Class 3 or Class 7H5 earthworks materials.

b) Enter text, to identify the acceptable plant to work Class 3 or Class 7H5 earthworks material.

c) Enter text, to identify operating restrictions on the acceptable plant to work Class 3 or Class 7H5 earthworks material.

9.5 The maximum capacity of vehicles permitted to traffic Class 3 and Class 7H5 earthworks materials, when at struck volume, shall be as stated in CC 601/WSR/009.

SI.9.5 The maximum capacity of vehicles permitted to traffic Class 3 and Class 7H5 earthworks materials, when at struck volume, shall be [enter a number] .

9.6 The working face of Class 3 or Class 7H5 earthworks material excavations shall be at least 3 m in height, unless the total height of the excavation is less than 3 m.

9.7 The methodology for excavating Class 3 and Class 7H5 earthworks materials shall be as stated in CC 601/WSR/009.

SI.9.7a The methodology for excavation of Class 3 and Class 7H5 earthworks material faces less than 3m in height shall be [enter free text].

SI.9.7b The methodology for excavation of Class 3 and Class 7H5 earthworks material faces equal to or greater than 3m in height shall be [enter free text].

9.8 No earthworks involving Class 3 or Class 7H5 earthworks materials shall be undertaken outside the acceptable working time period.

9.9 The acceptable working time period for undertaking earthworks using Class 3 and Class 7H5 earthworks materials shall be as stated in CC 601/WSR/009.

SI.9.9 The acceptable working time period of undertaking earthworks using Class 3 and Class 7H5 earthworks materials shall be [enter free text].

9.10 No trafficking of areas which consist of Class 3 or Class 7H5 earthworks materials, shall be undertaken outside the acceptable working time period, unless the Class 3 or Class 7H5 earthworks materials are covered with an earthworks protection layer.

9.11 Earthworks protection layers shall be as stated in "General earthworks construction" in Section 5 of this document.

9.12 Class 3 and Class 7H5 earthworks materials shall not be stockpiled.

9.13 Class 3 and Class 7H5 earthworks materials shall not be subjected to multiple handling.

9.14 Class 3 and Class 7H5 earthworks materials shall be sealed at the end of each day, unless otherwise stated in CC 601/WSR/009.

SI.9.14 The requirement for sealing of Class 3 and Class 7H5 earthworks materials at the end of each day shall be [enter free text].

9.15 The method for sealing of exposed Class 3 and Class 7H5 earthworks materials at the end of each day shall be as stated in CC 601/WSR/009.

SI.9.15 The method for sealing of exposed Class 3 and Class 7H5 earthworks materials at the end of each day shall be [enter free text].

9.16 Class 3 and Class 7H5 earthworks materials shall not be interlayered with other materials, unless otherwise stated in CC 601/WSR/009.

SI.9.16 The requirements for the interlayering of Class3 and Class 7H5 earthworks materials with other materials shall be [enter free text].

Resting of Class 3 and Class 7H5 earthworks materials

9.17 Prior to completion of earthworks activities in Class 3 and Class 7H5 earthworks materials, the earthworks shall be installed to a resting level.

9.18 The resting level for Class 3 and Class 7H5 earthworks materials shall be at formation plus an earthworks protection layer or 600 mm below formation where capping is required.

9.19 Following installation to the resting level, Class 3 and Class 7H5 earthworks materials shall be left for a minimum resting time period to allow re-cementation of the material following placement and compaction.

9.20 The minimum resting time period of Class 3 and Class 7H5 earthworks materials shall be as stated in CC 601/WSR/009.

SI.9.20 The minimum resting time period of Class 3 and Class 7H5 earthworks materials shall be [enter a number] .

Areas of temporary instability of Class 3 and Class 7H5 earthworks materials

9.21 Where temporary instability of Class 3 or Class 7H5 earthworks materials occurs during the works, further works in the areas of the instability shall be delayed until the material has recovered sufficient strength for work to proceed.

9.22 The required recovered strength, method of measurement, and frequency of measurement of Class 3 and Class 7H5 earthworks materials following temporary instability shall be as stated in CC 601/WSR/009.

SI.9.22a The required recovered strength of Class 3 and Class 7H5 earthworks material following temporary instability shall be [enter free text].

SI.9.22b The method of measurement of the recovered strength of Class 3 and Class 7H5 earthworks materials following temporary instability shall be [enter free text].

SI.9.22c The frequency of measurement of the recovered strength of Class 3 and Class 7H5 earthworks materials following temporary instability shall be [enter free text].

Verification for recovered strength of areas of temporary instability of Class 3 and Class 7H5 earthworks materials

9.23 Verification shall be undertaken for the recovered strength of Class 3 and Class 7H5 earthworks materials following temporary instability by strength measurement of recovered strength using the method as stated in CC 601/WSR/009.

9.24 The frequency of measurement of the recovered strength of Class 3 and Class 7H5 earthworks materials following temporary instability shall be as stated in CC 601/WSR/009.

9.25 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the measurement of the recovered strength of Class 3 and Class 7H5 earthworks materials following temporary instability.

Documentation for areas of instability of Class 3 and Class 7H5 earthworks material

9.26 The following Documentation shall be submitted for areas of temporary instability of Class 3 and Class 7H5 earthworks materials prior to the commencement of further works in the area: A Report for areas of instability of Class 3 and Class 7H5 earthworks materials, presenting an assessment of the reasons for instability, amendments to construction procedure, method of measurement of the recovered strength of Class 3 and Class 7H5 earthworks materials, and a record of the verification of the recovered strength.

9.27 Documentation for areas of temporary instability of Class 3 and Class 7H5 earthworks materials shall be submitted at least one working day prior to commencement of further works in the area.

9.28 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the report for areas of instability of Class 3 and Class 7H5 earthworks materials.

Specific installation requirements for earthworks using Class 4 earthworks material

9.29 Areas of Class 4 earthworks material fill shall be constructed at a different time from adjacent earthworks fills to prevent mixing.

9.30 Class 4 earthworks materials shall be placed in such a manner as to remove large voids and to produce a coherent mass whilst preventing over-compaction and any build-up of excess pore pressures.

10. Earthworks treatment of natural voids and abandoned mine workings

Earthworks treatment of natural voids and areas of natural void infill

10.1 The pre-treatment investigation of natural voids and areas of natural void infill shall be as stated in CC 601/WSR/010.

The pre-treatment investigation of natural voids and areas of natural void infill			
Unique reference of natural void and / or natural void infill	**Method of pre-treatment investigation**	**Earthworks construction procedure document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the natural voids and areas of natural void infill to be investigated.

b) Enter text, to identify the method of pre-treatment investigation of natural voids and areas of natural void infill.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for pre-treatment investigation of natural voids and areas of natural void infill.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for pre-treatment investigation of natural voids and areas of natural void infill.

10.2 Treatment of natural voids and areas of natural void infill shall be as stated in CC 601/WSR/010.

Treatment of natural voids and areas of natural void infill			
Unique reference of natural void and / or natural void infill	**Method of treatment**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the natural void and / or area of natural void infill to be treated.

b) Enter text, to identify the method of treatment of natural voids and / or area of natural void infill.

c) Enter text, to identify the earthworks construction procedures document reference that contains the requirements for the treatment of natural voids and / or area of natural void fill.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for the treatment of natural voids and / or area of natural void fill.

10.3 Capping of natural voids and areas of natural void infill shall be as stated in CC 601/WSR/010.

Capping of natural voids and areas of natural void infill			
Unique reference of natural void and / or natural void infill	**Method of capping**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the natural void or area of natural void infill to be capped.

b) Enter text, to identify the method of capping of natural voids and areas of natural void infill.

c) Enter text, to identify the earthworks construction procedures document reference that contains the requirements for capping of natural voids and / or area of natural void fill.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for capping of natural voids and / or area of natural void fill.

Earthworks treatment of abandoned mine workings

10.4 Pre-treatment investigation of abandoned mine workings shall be as stated in CC 601/WSR/010.

Pre-treatment investigation of abandoned mine workings			
Unique reference of abandoned mine workings	**Method of pre-treatment investigation**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the abandoned mine workings to be investigated.

b) Enter text, to identify the method of pre-treatment investigation of abandoned mine workings.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for pre-treatment investigation of abandoned mine workings.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for pre-treatment investigation of abandoned mine workings.

10.5 Treatment of abandoned mine workings shall be as stated in CC 601/WSR/010.

Treatment of abandoned mine workings			
Unique reference of abandoned mine workings	**Method of treatment**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthwork for the abandoned mine workings to be treated.

b) Enter text, to identify the method of treatment of abandoned mine workings.

c) Enter text, to identify the earthworks construction procedures document reference that contains the requirements for the treatment of abandoned mine workings.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for the treatment of abandoned mine workings.

10.6 Treatment of abandoned mine entries shall be as stated in CC 601/WSR/010.

Treatment of abandoned mine entries			
Unique reference of abandoned mine entry	**Method of treatment**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the earthworks for the abandoned mine entries to be treated.

b) Enter text, to identify the method of treatment of the abandoned mine entries.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for the treatment of the abandoned mine entries.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for the treatment of the abandoned mine entries.

10.7 Capping of abandoned mine shafts shall be as stated in CC 601/WSR/010.

Capping of abandoned mine shafts			
Unique reference of abandoned mine shaft	**Method of capping**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the abandoned mine shaft to be capped.

b) Enter text, to identify the method of abandoned mine shafts.

c) Enter text, to identify the earthworks construction procedures document reference that contains the requirements for capping of abandoned mine shafts.

d) Enter a unique reference, to identify the earthworks construction procedures document title that contains the requirements for capping of abandoned mine shafts.

11. Ground improvement

Method controlled ground improvement

11.1 Method controlled ground improvement shall achieve the performance characteristics stated in CC 601/WSR/011.

11.2 Method controlled ground improvement shall be as stated in CC 601/WSR/011.

Method controlled ground improvement				
Unique reference of area of ground improvement	**Ground improvement method**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**	**Site trial requirement**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the area of method controlled ground improvement.

b) Enter text, to identify the method of ground improvement to be used.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for the method controlled ground improvement.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for the method controlled ground improvement.

e) Enter a value, from options Required, Not required, to identify whether a site trial of the method controlled ground improvement is required.

End-product controlled ground improvement

11.3 End-product controlled ground improvement shall achieve the performance characteristics stated in CC 601/WSR/011.

11.4 The ground improvement method and construction procedures used in end-product ground improvement shall be Contractor design items.

11.5 End-product controlled ground improvement shall be in accordance with CD 601 [Ref 8.N] and CD 622 [Ref 22.N].

11.6 End-product controlled ground improvement shall be be as stated in CC 601/WSR/011.

End-product controlled ground improvement					
Unique reference of area of ground improvement	**Performance characteristic**	**Performance criteria acceptable value**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**	**Site trial requirement**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the ground improvement activity.

b) Enter text, to identify the performance characteristic to be measured.

c) Enter text, to identify the performance criteria acceptable value to be met by the ground improvement, expressed as minimum or maximum acceptable values.

d) Enter text, to identify the earthworks construction procedures document reference that contains the requirements for the end-product controlled ground improvement.

e) Enter text, to identify the earthworks construction procedures document title that contains the requirements for the end-product controlled ground improvement.

f) Enter a value, from options Required, Not required, to identify whether a site trial of the method controlled ground improvement is required.

11.7 The requirements for "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to the design of the ground improvement method and construction procedures used in end-product ground improvement.

11.8 The requirements of “Contractor design” in Section 17 of GC 101 [Ref 14.N] shall apply to the design of the ground improvement method and construction procedures used in end-product ground improvement.

Documentation for the determination of ground improvement method and construction procedures used in end-product ground improvement

11.9 The following Documentation shall be submitted for the determination of ground improvement method and construction procedures used in end-product ground improvement: for each area of ground improvement, a Geotechnical Design Report in accordance with CD 622 [Ref 22.N]and CD 601 [Ref 8.N].

11.10 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the Geotechnical Design Report for the determination of ground improvement method and construction procedures used in end-product ground improvement.

12. Earthworks around structures, foundations, and pipes

Earthworks around structures and foundations except corrugated steel buried structures

12.1 Earthwork fill to be placed around structures and foundations except corrugated steel buried structures shall be as stated in CC 601/WSR/012.

Earthwork fill to be placed around structures and foundations except corrugated steel buried structures				
Unique reference of the earthwork	**Unique reference of the structure or foundation**	**Earthworks fill requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)	(e)

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

b) Enter a unique reference, to identify the structure or foundation except corrugated steel buried structures.

c) Enter text, to identify the requirements for earthwork fill to be placed around structures and foundations except corrugated steel buried structures.

d) Enter a unique reference, to identify the earthworks layout drawing(s) of model where the earthworks around structures and foundations except corrugated steel buried structures are described.

e) Enter text, to identify the earthworks layout drawing(s) or model which describe the earthworks around structures and foundations except corrugated steel buried structures.

12.2 Where earthworks fill within 2 m of a structure except corrugated steel buried structures is required to the same level on more than one side of the structure, the fill around structures shall be maintained at heights not differing by more than 250 mm after compaction on opposing sides of the structural element.

12.3 Compaction plant used within 2 m of a structure for earthworks fill around structures except corrugated steel buried structures shall be one of the following.

1. vibratory roller having a mass per metre width of roll, not exceeding 1,300 kg with a total mass not exceeding 1,000 kg;

2. vibrating plate compactor having a mass not exceeding 1,000 kg; or,

3. vibro-tamper having a mass not exceeding 75 kg.

12.4 The compacted level of the fill within 2 m of a structure except corrugated steel buried structures shall not differ during construction from the compacted level of the remainder of the adjoining fill to structures by more than 250 mm.

Earthworks around corrugated steel buried structures

12.5 Corrugated steel buried structures shall be in accordance with CC 605 [Ref 7.N].

12.6 Earthwork fill to be placed around corrugated steel buried structures shall be stated in CC 601/WSR/012.

Earthwork fill to be placed around corrugated steel buried structures				
Unique reference of the earthwork	**Unique reference of the structure**	**Earthworks fill requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)	(e)

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

b) Enter a unique reference, to identify the corrugated steel buried structure.

c) Enter text, to identify the requirements for earthwork fill to be placed around corrugated steel buried structures.

d) Enter a unique reference, to identify the earthworks layout drawing(s) of model where the earthwork fill around the corrugated steel buried structure described.

e) Enter text, to identify the earthworks layout drawing(s) or model which describe the earthwork fill around the corrugated steel buried structure.

12.7 Earthworks material placed around corrugated steel buried structures shall not exceed 150 mm compacted layer thickness.

12.8 Compaction plant used within 1 m of either side of corrugated steel buried structures and up to a height of 1 m, or one fifth of the span if greater, above the crown of corrugated steel buried structures, shall be one of the following types.

1. vibratory rollers having a mass per metre width of roll not exceeding 750 kg;

2. vibrating plate compactors having mass not exceeding 750 kg; or,

3. vibro-tampers.

12.9 Maximum surcharge pressure allowed on corrugated steel buried structures shall be as stated in CC 601/WSR/012.

Maximum surcharge pressure allowed on corrugated steel buried structures	
Unique reference of the structure	**Maximum allowable surcharge pressure**
(a)	(b)

a) Enter a unique reference, to identify the corrugated steel buried structure.

b) Enter a number in units of kN/m^2, to identify the maximum surcharge pressure allowed on the corrugated steel buried structure.

12.10 Earthworks materials or other materials shall not be tipped either onto or stored above the corrugated steel buried structure.

12.11 Earthworks materials or other materials shall not be tipped or stored within a distance of 2 m or half the span of the structure, whichever is the greatest, from the corrugated steel buried structure.

Deflection of corrugated steel buried structures during construction

12.12 Corrugated steel buried structures shall be monitored for deflection during operations of earthworks fill placement and compaction, road pavement construction, and of any other traffic movements within influence of the structure.

12.13 Limits for deflection of corrugated steel buried structures during construction shall be as stated in CC 601/WSR/012.

Limits for deflection of corrugated steel buried structures during construction					
Unique reference of the structure	**Deflection limit from nominal span for circular structures**	**Deflection limit from nominal span for non-circular structures**	**Method of verification of deflection**	**Frequency of verification of deflection**	**Deflection documentation requirements**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the corrugated steel buried structures.

b) Enter a number in units of mm, to identify the limit on deflection from nominal span for circular corrugated steel buried structures.

c) Enter a number in units of mm, to identify the limit on deflection from nominal span for non-circular corrugated steel buried structures.

d) Enter text, to identify the method of verification of deflection of corrugated steel buried structures.

e) Enter text, to identify the frequency of verification of deflection of corrugated steel buried structures.

f) Enter text, to identify the documentation requirements for deflection of corrugated steel buried structures.

12.14 Limits for construction tolerance of corrugated steel buried structures shall be as stated in Table 12.14.

Table 12.14 Limits for construction tolerance of corrugated steel buried structures	
Condition	**Construction tolerance**
Longitudinal straightness over any 10 m length	Maximum 25 mm
Rotational displacement in any 10 m length	Maximum 25 mm

Verification of deflection of corrugated steel buried structures during construction

12.15 Verification shall be undertaken for deflection of corrugated steel buried structures during construction by the method of verification as stated in CC 601/WSR/012.

12.16 The frequency of verification of deflection of corrugated steel buried structures during construction shall be as stated in CC 601/WSR/012.

12.17 The requirements of "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to the verification of deflection of corrugated steel buried structures during construction.

Documentation for deflection of corrugated steel buried structures during construction

12.18 Documentation for deflection of corrugated steel buried structures during construction shall be as stated in CC 601/WSR/012.

12.19 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to documentation for deflection of corrugated steel buried structures during construction.

Earthworks around pipes

12.20 Earthworks fill around pipes other than those in a trench shall be brought up to and over the pipe equally on both sides.

12.21 Earthworks fill above pipes other than those in a trench shall be placed in even layers and not be heaped above the pipe.

12.22 Earthworks fill around pipes other than those in a trench shall be placed and compacted without dislodging, distorting, or damaging the pipe.

12.23 Earthworks fill around pipes in trenches shall comply with "Backfilling to pipe bays and verges on bridges" in Section 9 of CC 500 [Ref 9.N].

13. Earthworks for special geotechnical works

Gabion units used in earthworks

13.1 Gabion units used in earthworks shall be as stated in CC 601/WSR/013.

Gabion units used in earthworks					
Unique reference of the gabion units	**Unique reference of the structure**	**Gabion unit requirements**	**Drawing or model reference**	**Drawing or model title**	**Minimum working life**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the gabion units used in earthworks.

b) Enter a unique reference, to identify the structure where gabion units are to be installed.

c) Enter text, to identify the requirements for gabion units used in earthworks.

d) Enter a unique reference, to identify the earthworks layout drawing(s) or model where the gabion units are described.

e) Enter text, to identify the earthworks layout drawing(s) or model title(s) which describe the gabion units.

f) Enter a number in units of year, to identify the minimum working life of the gabion units.

13.2 Gabions units used in earthworks shall be compliant with BS 8002 [Ref 5.N].

13.3 Double twisted wire mesh gabion units shall be compliant with BS EN 10223-3 [Ref 33.N].

13.4 Welded mesh gabion units shall be compliant with BS EN 10223-8 [Ref 34.N].

Contractor designed gabion units used in earthworks

13.5 Gabion units used in earthworks that are Contractor designed items shall be as stated in CC 601/WSR/013.

Gabion units used in earthworks that are Contractor designed items	
Unique reference of the gabion units	**Restrictions on Contractor designed gabion units used in earthworks**
(a)	(b)

a) Enter a unique reference, to identify the gabion units used in earthworks.

b) Enter text, to identify restrictions on Contractor designed gabion units used in earthworks.

13.6 Contractor designed gabion units used in earthworks shall be in accordance with CD 601 [Ref 8.N]and CD 622 [Ref 22.N].

13.7 The requirements of "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to Contractor designed gabion units.

13.8 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 14.N] shall apply to Contractor designed gabion units.

Non-Contractor designed gabion units used in earthworks

13.9 The performance characteristics for non-Contractor designed double twisted wire mesh gabion units shall be as stated in CC 601/WSR/013.

The performance characteristics for non-Contractor designed double twisted wire mesh gabion units					
Unique reference of the gabion units	**Mesh designation**	**Minimum wire diameter**	**Wire coating type**	**Wire coating class**	**Characteristics of the eventual organic coating**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the gabion units to be used in earthworks.

b) Enter one or more values, from options 6x8, 8x10, to identify the mesh designation.

c) Enter a number in units of mm, to identify the minimum wire diameter.

d) Enter text, to identify the wire coating type.

e) Enter text, to identify the wire coating class.

f) Enter text, to identify the characteristics of the eventual organic coating.

13.10 The performance characteristics for non-Contractor designed welded mesh gabion units shall be as stated in CC 601/WSR/013.

The performance characteristics for non-Contractor designed welded mesh gabion units				
Unique reference of the gabion units	**Mesh size**	**Wire diameter**	**Wire type**	**Characteristics of the eventual PVC coating**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the gabion units used in earthworks.

b) Enter text, to identify the mesh size.

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

d) Enter a value, from options Stainless steel wire, Steel wire including metallic coating, to identify the wire type.

e) Enter text, to identify the characteristics of the eventual PVC coating.

Product acceptance schemes for gabions used in earthworks

13.11 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 14.N] shall apply to gabions used in earthworks.

Documentation for gabion units used in earthworks

13.12 The following Documentation shall be submitted for each batch of gabion units to be used in earthworks prior to the commencement of earthworks using gabion units: Product acceptance scheme certificate, Certificate of Origin in accordance with BS EN 10223-3 [Ref 33.N]and BS EN 10223-8 [Ref 34.N].

13.13 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the certificate of origin for gabion units used in earthworks.

Installation of gabion units used in earthworks

13.14 Gabion units used in earthworks shall be assembled in accordance with the manufacturer’s instructions for installation and BS 8002 [Ref 5.N].

13.15 Completed gabion units shall not have bulges or depressions greater than 1 in a 100 over any vertical or horizontal dimension of an individual unit.

Documentation for installation of gabion units used in earthworks

13.16 The following Documentation shall be submitted for installation of gabion units used in earthworks prior to the commencement of construction of gabion units: Manufacturer's instructions for installation.

13.17 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the manufacturer's instructions for installation of gabion units used in earthworks.

Crib wall systems used in earthworks

13.18 Crib wall systems used in earthworks shall be as stated in CC 601/WSR/013.

Crib wall systems used in earthworks					
Unique reference of the crib wall	**Unique reference of the structure**	**Crib wall requirements**	**Drawing or model reference**	**Drawing or model title**	**Minimum working life**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the crib wall system used in earthworks.

b) Enter a unique reference, to identify the structure where crib wall system is to be installed.

c) Enter text, to identify the requirements for crib wall systems used in earthworks.

d) Enter a unique reference, to identify the earthworks layout drawing(s) or model where the crib wall system is described.

e) Enter text, to identify the earthworks drawing(s) or model title(s) which describe the crib wall system.

f) Enter a number in units of year, to identify the minimum working life of the crib wall system.

Contractor designed crib wall components and systems used in earthworks

13.19 Crib wall components and systems used in earthworks that are Contractor designed items shall be as stated in CC 601/WSR/013.

Crib wall components and systems used in earthworks that are Contractor designed items	
Unique reference of the crib wall	**Restrictions on Contractor designed crib wall components and systems used in earthworks**
(a)	(b)

a) Enter a unique reference, to identify the crib wall.

b) Enter text, to identify restrictions on Contractor designed crib wall systems used in earthworks.

13.20 Contractor designed crib wall systems used in earthworks shall be in accordance with CD 601 [Ref 8.N]and CD 622 [Ref 22.N].

13.21 The requirements for "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to Contractor designed crib wall systems.

13.22 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 14.N] shall apply to Contractor designed crib wall systems.

Non-Contractor designed crib wall systems used in earthworks

13.23 Non-Contractor designed crib wall systems used in earthworks shall be as stated in CC 601/WSR/013.

Non-Contractor designed crib wall systems used in earthworks			
Unique reference of the crib wall	**Crib wall description**	**Crib wall system structural components material**	**Crib fill material**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the crib wall.

b) Enter text, to identify the description of the crib wall.

c) Enter text, to identify the crib wall system materials.

d) Enter text, to identify the crib fill material.

Product Acceptance Schemes for crib wall systems used in earthworks

13.24 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 14.N] shall apply to crib wall systems used in earthworks.

Documentation for crib wall systems used in earthworks

13.25 The following Documentation shall be submitted for each crib wall system to be used in earthworks prior to the commencement of earthworks using crib walls: Product acceptance scheme certificate.

13.26 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the product acceptance scheme certificate for crib wall systems used in earthworks.

Installation of crib wall systems used in earthworks

13.27 Crib wall systems shall be assembled in accordance with the manufacturer’s instructions for installation and BS 8002 [Ref 5.N].

Documentation for installation of crib wall systems used in earthworks

13.28 The following Documentation shall be submitted for installation of crib wall systems prior to the commencement of construction of crib wall systems: Manufacturer's instructions for installation.

13.29 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the manufacturer's instructions for installation of crib wall systems.

Ground anchors used in earthworks

13.30 Ground anchors used in earthworks shall be compliant with BS EN 1537 [Ref 12.N]and BS 8081 [Ref 3.N].

13.31 Ground anchors used in earthworks shall be as stated in CC 601/WSR/013.

Ground anchors used in earthworks				
Unique reference of the ground anchors	**Ground anchor requirements**	**Drawing or model reference**	**Drawing or model title**	**Minimum working life**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the ground anchors used in earthworks.

b) Enter text, to identify the requirements for ground anchors used in earthworks.

c) Enter a unique reference, to identify the earthworks layout drawing(s) or model where the ground anchors are described.

d) Enter text, to identify the earthworks layout drawing(s) or model title(s) which describe the ground anchors.

e) Enter a number in units of year, to identify the minimum working life of the ground anchors.

Contractor designed ground anchors used in earthworks

13.32 Ground anchors used in earthworks that are Contractor designed items shall be as stated in CC 601/WSR/013.

Ground anchors used in earthworks that are Contractor designed items	
Unique reference of the ground anchors	**Restrictions on Contractor designed ground anchors used in earthworks**
(a)	(b)

a) Enter a unique reference, to identify the ground anchors used in earthworks.

b) Enter text, to identify restrictions on Contractor designed ground anchors used in earthworks.

13.33 Contractor designed ground anchors used in earthworks shall be in accordance with CD 601 [Ref 8.N]and CD 622 [Ref 22.N].

13.34 The requirements for "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to Contractor designed ground anchors used in earthworks.

13.35 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 14.N] shall apply to Contractor designed ground anchors used in earthworks.

Installation of ground anchors used in earthworks

13.36 Installation of ground anchors used in earthworks shall be in accordance with BS EN 1537 [Ref 12.N]and BS 8081 [Ref 3.N].

Installation verification of non-Contractor designed ground anchors used in earthworks

13.37 Verification shall be undertaken for non-Contractor designed ground anchors by suitability and acceptance testing in accordance with BS EN 1537 [Ref 12.N], BS EN ISO 22477-5 [Ref 17.N], and CC 601/WSR/013.

13.38 The frequency of suitability testing of ground anchors shall be as stated in CC 601/WSR/013.

13.39 The requirements for "Verification" in Section 14 of GC 101 [Ref 14.N] shall apply to suitability testing of ground anchor installation.

13.40 Suitability and acceptance testing of ground anchors shall be as stated in CC 601/WSR/013.

Suitability and acceptance testing of ground anchors							
Unique reference of the ground anchors	**Ground anchorage type**	**Test method**	**Frequency of suitability tests**	**Suitability test proof load**	**Acceptance test proof load**	**Creep or load loss limit for suitability test**	**Creep or load loss limit for acceptance test**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference, to identify the ground anchors.

b) Enter a value, from options Passive anchor, Active anchor, to identify the ground anchorage type.

c) Enter text, to identify the test method for testing of ground anchors in accordance with BS EN ISO 22477-5 [Ref 17.N].

d) Enter a number, to identify the number of suitability tests required.

e) Enter a number in units of kN, to identify the proof load required for suitability testing of ground anchors.

f) Enter a number in units of kN, to identify the proof load required for acceptance testing of ground anchors.

g) Enter text, to identify the limiting criteria for creep or load loss of the anchor under suitability proof load.

h) Enter text, to identify the limiting criteria for creep or load loss of the anchor under acceptance proof load.

Suitability and acceptance testing of ground anchors (continued)	
Unique reference of the ground anchors	**Acceptance test lock-off load**
(a)	(i)

i) Enter a number in units of kN, to identify the lock off load to be applied to be anchor upon confirmation of the acceptance test.

Documentation for ground anchors used in earthworks

13.41 The following Documentation for ground anchors used in earthworks shall be submitted as continuous records: Ground anchor installation and testing record in accordance with BS EN 1537 [Ref 12.N].

13.42 The requirements of "Records" in Section 3 of GC 101 [Ref 14.N] shall apply to the ground anchor installation and testing record.

Earthworks for reinforced soil and anchored earth structures

13.43 Earthworks for reinforced soil and anchored earth structures shall be as stated in CC 601/WSR/013.

Earthworks for reinforced soil and anchored earth structures				
Unique reference of the earthworks	**Unique reference of the structure**	**Earthworks requirements**	**Drawing or model reference**	**Drawing or model title**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the earthworks for reinforced soil and anchored earth structures.

b) Enter a unique reference, to identify the reinforced soil or anchored earth structure.

c) Enter text, to identify the requirements for earthworks for reinforced soil and anchored earth structures.

d) Enter a unique reference, to identify the earthworks layout drawing(s) of model where the earthworks for reinforced soil and anchored earth structures are described.

e) Enter text, to identify the earthworks layout drawing(s) or model which describe the earthworks for reinforce soil and anchored earth structures.

13.44 Earthworks for reinforced soil and anchored earth structures shall be compliant with BS EN 14475 [Ref 13.N]and BS 8006-1 [Ref 4.N].

13.45 Reinforcing and anchor elements, units and fasteners for reinforced soil and anchored earth structures shall be as stated in "Reinforced soil and anchored earth structures" in Section 1 of CC 606 [Ref 29.N].

Contractor designed earthworks for reinforced soil and anchored earth structures

13.46 Contractor designed earthworks for reinforced soil and anchored earth structures that are Contractor designed items shall be as stated in CC 601/WSR/013.

Contractor designed earthworks for reinforced soil and anchored earth structures that are Contractor designed items	
Unique reference of the earthworks	**Restrictions on Contractor designed earthworks for reinforced soil and anchored earth structures**
(a)	(b)

a) Enter a unique reference, to identify the earthworks for reinforced soil and anchored earth structures.

b) Enter text, to identify restrictions on Contractor designed earthworks for reinforced soil and anchored earth structures.

13.47 Contractor designed earthworks for reinforced soil and anchored earth structures shall be in accordance with CD 601 [Ref 8.N] and CD 622 [Ref 22.N].

13.48 The requirements for "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to Contractor designed earthworks for reinforced soil and anchored earth structures.

13.49 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 14.N] shall apply to Contractor designed earthworks for reinforced soil and anchored earth structures.

Installation of earthworks for reinforced soil and anchored earth structures

13.50 Installation of earthworks for reinforced soil and anchored earth structures shall be in accordance with BS EN 14475 [Ref 13.N]and BS 8006-1 [Ref 4.N].

13.51 Retained earthworks fill at the rear of reinforced soil and anchored earth structures shall be maintained at the same level as the adjoining reinforced soil or anchored earth fill.

13.52 To prevent the formation of voids in the earthworks fill material, temporary shoring of existing retained material at the rear of reinforced soil or anchored earth structures shall be removed progressively as the earthworks for reinforced soil and anchored earth structures are being installed.

13.53 The deposition, spreading, levelling, and compaction of earthworks fill for reinforced soil and anchored earth structures shall carried out in a direction parallel to the facing.

13.54 Compaction plant used within 2 m of the back of any facing shall be one of the following types.

1. Vibratory roller having a mass per meter width of roll not exceeding 1,300kg;

2. vibrating plate compactor; or,

3. Vibro tamper having a mass not exceeding 75 kg.

14. Instrumentation and monitoring of earthworks

Contractor designed instrumentation and monitoring of earthworks

14.1 Contractor designed instrumentation and monitoring of earthworks shall be in accordance with CD 601 [Ref 8.N] and CD 622 [Ref 22.N].

14.2 Contractor designed instrumentation and monitoring of earthworks shall be as stated in CC 601/WSR/014.

Contractor designed instrumentation and monitoring of earthworks			
Unique reference of the earthwork	**Instrumentation and monitoring type**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the type of instrumentation and monitoring of earthworks.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for Contractor designed instrumentation and monitoring of earthworks.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for Contractor designed instrumentation and monitoring of earthworks.

14.3 The requirements for "Technical approval of earthworks for Contractor designed items" in Section 1 of this document shall apply to instrumentation and monitoring of earthworks.

14.4 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 14.N] shall apply to instrumentation and monitoring of earthworks.

Non-Contractor designed instrumentation and monitoring of earthworks

14.5 Non-Contractor designed instrumentation and monitoring of earthworks shall be as stated in CC 601/WSR/014.

Non-Contractor designed instrumentation and monitoring of earthworks			
Unique reference of the earthwork	**Instrumentation and monitoring type**	**Earthworks construction procedures document reference**	**Earthworks construction procedures document title**
(a)	(b)	(c)	(d)

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

b) Enter text, to identify the type of instrumentation and monitoring of earthworks.

c) Enter a unique reference, to identify the earthworks construction procedures document reference that contains the requirements for non-Contractor designed instrumentation and monitoring of earthworks.

d) Enter text, to identify the earthworks construction procedures document title that contains the requirements for non-Contractor designed instrumentation and monitoring of earthworks.

15. Sampling and testing methods for earthworks materials

Sampling and sample preparation for testing of earthworks materials

15.1 Sampling of earthworks materials for testing shall be carried out in accordance with BS 5930 [Ref 6.N], unless otherwise stated in CC 601/WSR/015.

Sampling of earthworks materials for testing	
Unique reference of earthworks material sample	**Earthworks material sampling method**
(a)	(b)

a) Enter text, to identify the earthworks material sample.

b) Enter text, to identify the earthworks material sampling method.

15.2 Earthworks material sample preparation prior to testing shall be carried out in accordance with BS 1377-1 [Ref 24.N], unless otherwise stated in CC 601/WSR/015.

Earthworks material sample preparation prior to testing	
Unique reference of earthworks material sample	**Earthworks material sample preparation method**
(a)	(b)

a) Enter text, to identify the earthworks material sample.

b) Enter text, to identify the earthworks material sampling preparation method.

Earthworks material properties testing methods

15.3 Earthworks material properties testing methods shall be carried out in accordance with Table 15.3, unless otherwise stated in CC 601/WSR/015.

Table 15.3 Earthwork material properties testing methods		
Material property	Test method	Test standard or method description to be followed
Adhesion between fill and reinforcing elements	Determination of shear strength by the large shearbox apparatus	BS 1377-2 [Ref 23.N]

	In accordance with "Adhesion and coefficient of friction between fill and reinforcing elements" in this Section.	
Chloride ion content	Determination of water-soluble chloride salts using the Volhard method	BS EN 1744-1 [Ref 36.N]
Coefficient of friction between fill and reinforcing elements	Determination of shear strength by the large shearbox apparatus	BS 1377-2 [Ref 23.N]
	In accordance with "Adhesion and coefficient of friction between fill and reinforcing elements" in this Section.	
Dry density / water content relationship	Determination of dry density/water content relationship	BS 1377-2 [Ref 23.N]
	In accordance with "Maximum dry density and optimum water content" in this Section.	
Effective angle of friction	As stated in CC 601/WSR/019.	BS 1377-2 [Ref 23.N]
	In accordance with "Effective shear strength parameters" in this Section.	
Effective cohesion	As stated in CC 601/WSR/019.	BS 1377-2 [Ref 23.N]
	In accordance with "Effective shear strength parameters" in this Section.	
Grading	In accordance with "Grading and uniformity coefficient" in this Section.	
Intact dry density of chalk	Method for saturation water content of chalk	BS 1377-2 [Ref 23.N]
In situ density	In situ density tests	BS 1377-9 [Ref 25.N]
	In accordance with "In situ density" in this Section.	
Liquid limit	Determination of liquid limit	BS 1377-2 [Ref 23.N]
Los Angeles coefficient	Determination of resistance to fragmentation by the Los Angeles test method	BS EN 1097-2 [Ref 38.N]
Microbial activity index	Subsidiary method for sulphate reducing bacterial activity assessment	TRL CR 54 [Ref 31.N]
Maximum dry density	Determination of dry density / water content relationship	BS 1377-2 [Ref 23.N]
	Determination of maximum and minimum dry densities for coarse soils	BS 1377-2 [Ref 23.N]
	In accordance with "Maximum dry density and	

	optimum water content" in this Section.	
Moisture condition value	In accordance with "Moisture condition value" in this Section.	
Moisture condition value / water content relation	Determination of the MCV / water content relation of a soil	BS 1377-2 [Ref 23.N]
	In accordance with "Moisture condition value" in this Section.	
Water content	Determination of water content	BS 1377-2 [Ref 23.N]
Optimum water content	Determination of dry density / water content relationship	BS 1377-2 [Ref 23.N]
	In accordance with "Maximum dry density and optimum water content" in this Section.	
Organic matter content	Determination of the organic matter content	BS 1377-3 [Ref 26.N]
Oxidisable sulfides content	Determination of acid soluble sulfides	BS EN 1744-1 [Ref 36.N]
	In accordance with "Sulfate content" in this Section.	
Particle density	Determination of particle density	BS 1377-2 [Ref 23.N]
Permeability	As stated in CC 601/WSR/019.	BS 1377-2 [Ref 23.N]
	In accordance with "Permeability" in this Section.	
pH	Determination of the pH value	BS 1377-3 [Ref 26.N]
Plastic limit	Determination of plastic limit and plasticity index	BS 1377-2 [Ref 23.N]
Redox potential	In accordance with "Redox potential" in this Section.	
Resistivity	In accordance with "Resistivity" in this Section.	
Saturation water content of chalk	Method for saturation water content of chalk	BS 1377-2 [Ref 23.N]
Sulfide and hydrogen sulfide	Determination of acid soluble sulfides	BS EN 1744-1 [Ref 36.N]
	In accordance with "Sulfate content" in this Section.	
Total sulfur	Determination of total sulfur content	BS EN 1744-1 [Ref 36.N]
	In accordance with "Sulfate content" in this Section.	
Undrained shear strength	Unconsolidated undrained triaxial test	BS 1377-2 [Ref 23.N]
	In accordance with "Undrained shear strength" in this Section.	

Undrained shear strength of remoulded material	Unconsolidated undrained triaxial test	BS 1377-2 [Ref 23.N]
	In accordance with "Undrained shear strength" in this Section.	
Uniformity coefficient	In accordance with "Grading and uniformity coefficient" in this Section.	
Water soluble sulfate content	Determination of water-soluble sulfates	BS EN 1744-1 [Ref 36.N]
	In accordance with "Sulfate content" in this Section.	

15.4 Alternative earthwork material property testing shall be in accordance with the standards stated in CC 601/WSR/015.

Alternative earthwork material property testing				
Unique reference of the earthwork material	**Material property**	**Test method**	**Test standard or method description to be followed**	**Test-specific procedures**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to identify the earthwork material.

b) Enter text, to identify the material property to which the test applies.

c) Enter text, to identify the test method.

d) Enter text, to identify the test standard or method description to be followed.

e) Enter text, to identify any test-specific procedures.

Specific testing procedures for specific earthworks material properties

Adhesion and coefficient of friction between fill and reinforcing elements

15.5 The testing of adhesion between fill and reinforcing elements shall be carried out in accordance with BS 1377-2 [Ref 23.N] and the requirements of "Effective shear strength parameters" in this Section.

15.6 When carrying out testing of adhesion between fill and reinforcing elements, the method of preparation of the shearbox shall be as stated in BS 1377-2 [Ref 23.N], amended in the following manner.

1. No flat-toothed grid is fitted at the bottom of the shearbox.

2. The lower half of the shearbox is filled with a closely fitting steel block, equal in height to the lower half of the shearbox less the thickness of the reinforcing element material.

3. The reinforcing element material is cut to fit the interior plan shape of the shearbox using a sufficient number of strips of such material abutting to completely fill the interior plan area without overlap.

4. The reinforcing element material is firmly fixed to the top of the steel block so that the top face of the reinforcing material is flush with the top edge of the lower half of the shearbox and aligned so that shearing occurs in a direction parallel to the longitudinal axis of a reinforcing element.

5. The fill material sample is sieved to obtain a test sample passing the 20 mm sieve, in accordance with BS 1377-2 [Ref 23.N].

6. The upper and lower halves of the shearbox are fixed together.

7. The upper half of the shearbox is filled and the fill material sample compacted.

15.7 The adhesion between fill and reinforcing elements shall be the shear stress corresponding with zero normal stress.

15.8 The coefficient of friction between fill and reinforcing elements shall be the angle from the horizontal of a straight line obtained by plotting the values of peak shear stress against applied normal stress.

15.9 When carrying out testing of adhesion between fill and reinforcing elements, the following additional information shall be recorded for each test:

1. Normal stress applied;

2. Peak shear stress;

3. Strain at peak shear stress;

4. Water content of fill after test, for Class 7B, Class 7C, and Class 7D earthworks materials.

Effective shear strength parameters

15.10 Effective shear strength testing apparatus, method, and procedure shall be as stated in CC 601/WSR/015.

Effective shear strength testing apparatus, method, and procedure			
Unique reference of the earthworks material	**Test apparatus**	**Test method**	**Test procedure**
(a)	(b)	(c)	(d)

a) Enter text, to identify the earthworks material.

b) Enter a value, from options Large shearbox only, Small and large shearboxes, Triaxial, to identify the test apparatus.

c) Enter text, to identify the test method.

d) Enter text, to identify the test procedure.

15.11 When determining effective shear strength parameters of earthworks materials except Class 7B earthworks material using shearbox apparatus, the test shall comply with the following conditions.

1. The large shearbox is nominally 300 mm square

2. The small shearbox is nominally 60 mm square.

3. Prior to testing, the sample is compacted at the optimum water content to a dry density of 92% ± 2% of the maximum dry density of the sample material.

4. The sample fully occupies the full depth of the shearbox.

5. A three sample set is sheared for each test, with normal stresses for each sample being the maximum vertical pressure in the fill at the base, quarter-height, and mid-height of the structure, respectively.

6. The rate of shearing is such that no pore water pressure is generated.

7. Prior to shearing, cohesive samples are immersed in water for a minimum period of 24 hours and then have normal stresses applied for a further minimum period of 24 hours.

8. Granular samples are sheared in a single stage test within one hour of compaction.

9. Effective angle of friction and effective cohesion corresponds to the maximum strength envelope.

15.12 When determining effective shear strength parameters of Class 7B earthworks material, the test shall comply with the following conditions.

1. The large shearbox is nominally 300 mm square

2. The small shearbox is nominally 60 mm square.

3. Prior to testing, the sample is compacted at the optimum water content to a dry density of 92% ± 2% of the maximum dry density of the sample material.

4. The sample fully occupies the full depth of the shearbox.

5. A four sample set is sheared for each test, with normal stresses for each sample being the maximum vertical pressure in the fill at the base, quarter-height, mid-height of the structure, and the greater of either three quarters of the height of the structure or the lowest attainable normal stress, respectively.

6. The rate of shearing is such that no pore water pressure is generated.

7. Prior to shearing, the sample is concurrently immersed in water and subjected to the applied normal stress for a period of 24 hours.

8. Granular samples are sheared in a single stage test within one hour of compaction.

9. Effective angle of friction and effective cohesion corresponds to the maximum strength envelope.

15.13 When determining effective shear strength parameters of earthworks materials using the small and large shearbox apparatus, the tests results shall be used in the following manner.

1. During suitability testing, properties of the earthworks material are determined from test results obtained using the large shearbox apparatus.

2. During suitability testing, results from the small shearbox apparatus are correlated to those obtained from the large shearbox apparatus.

3. During acceptability testing, properties of the earthworks material are determined from test results obtained using the small shearbox apparatus.

Grading and uniformity coefficient

15.14 Grading shall be determined in accordance Table 15.14.

Table 15.14 Grading testing		
Earthworks material class	**Test Method**	**Test standard or method description to be followed**
Class 1	Non-aggregates: Determination of particle size distribution	BS 1377-2 [Ref 23.N]
	Aggregates: Determination of particle size distribution - sieving method	BS EN 933-1 [Ref 37.N]
Class 2	Determination of particle size distribution	BS 1377-2 [Ref 23.N]
Class 4	Determination of particle size distribution	BS 1377-2 [Ref 23.N]
Class 6	Non-aggregates: Determination of particle size distribution	BS 1377-2 [Ref 23.N]
	Aggregates: Determination of particle size distribution - sieving method	BS EN 933-1 [Ref 37.N]
Class 7	Determination of particle size distribution	BS 1377-2 [Ref 23.N]

15.15 Grading of Class 5B earthworks material shall be in accordance with BS 3882 [Ref 32.N].

15.16 Grading of Class 8 earthworks material shall be by test method equivalent to the original earthworks material class.

15.17 Particle size distribution for all earthwork material samples to be tested shall be measured by sieving in accordance with BS 1377-2 [Ref 23.N].

15.18 The sieve series used for measuring the particle size distribution shall be R 20 in accordance with ISO 565 [Ref 35.N], with the addition of sieves with nominal aperture size 500 mm, 300 mm, 75mm, 37.5 mm, 3.35 mm, 1.18 mm, 0.6 mm, 0.3 mm, 0.15 mm.

15.19 Prior to undertaking particle size distribution testing in accordance BS 1377-2 [Ref 23.N], separation of specimens shall be undertaken in accordance with BS EN 17892-4 [Ref 16.N], using sieves with nominal aperture sizes of 20 mm and above.

15.20 Determination of particle size distribution by sedimentation shall be undertaken on samples where more than 10% of particles by mass are smaller than 0.063 mm.

15.21 Where determination of particle size distribution is undertaken using sieving and sedimentation methods, the results shall be reported as a combined particle size distribution for the sample tested.

15.22 Uniformity coefficient shall be determined in accordance with the ratio stated in BS EN ISO 14688-2 [Ref 15.N].

In situ density

15.23 In situ density testing methods shall be determined in accordance with BS 1377-9 [Ref 25.N], and as stated in CC 601/WSR/015.

In situ density testing methods	
Unique reference of the earthworks material	**Test method**
(a)	(b)

a) Enter a unique reference, to identify the earthworks material.

b) Enter a value, from options Sand replacement method suitable for fine- and medium-grained soils (small pouring cylinder method), Sand replacement method suitable for fine- medium- and coarse-grained soils (large pouring cylinder method), Water replacement method suitable for coarse-grained soils, Core cutter method for cohesive soils free from coarse-grained material, Nuclear methods suitable for fine- medium- and coarse-grained soils, to identify the test method from BS 1377-9 [Ref 25.N].

15.24 The results of in situ density testing shall be calibrated to the results of sand replacement tests, in addition to the requirements of BS 1377-9 [Ref 25.N].

15.25 Calibration ratio for in situ dry density test to sand replacement test shall be as stated in CC 601/WSR/015.

Calibration ratio for in situ dry density test to sand replacement test	
Unique reference of the earthworks material	**Calibration ratio**
(a)	(b)

a) Enter text, to identify the earthworks material.

b) Enter text, to identify the in situ dry density test to sand replacement test calibration ratio.

Maximum dry density and optimum water content

15.26 Compaction apparatus for the determination of dry density / water content relationship of earthworks materials during the determination of effective shear strength parameters shall be as stated in Table 15.26.

Table 15.26 Compaction apparatus for the determination of dry density / water content relationship of earthworks materials during determination of effective shear strength parameters	
Earthworks material class	**Compaction apparatus**
Class 6I, Class 6J, Class 6N, or Class 6P	Vibrating hammer
Class 7A, Class 7C, or Class 7D	4.5 kg rammer
Class 7B	2.5 kg rammer

15.27 Test reports for the determination of dry density / water content relationship shall include presentation of curves corresponding to 0 %, 5 % and 10 % air voids of the material tested.

15.28 In order to calculate the curves corresponding to 0 %, 5 % and 10 % air voids of the material tested, the particle density shall be determined for each sample tested for the determination of dry density / water content relationship.

Moisture condition value

NI/15.29 Moisture condition value shall be determined in accordance with test method 'determination of moisture condition value' as stated in BS 1377-2 [Ref 23.N].

15.30 Determination of moisture condition value shall include determination of the moisture condition value / water content relation.

NI/15.31 The moisture condition value / water content relation shall be determined in accordance with test method 'determination of the MCV/water content relation of a soil' as stated in BS 1377-2 [Ref 23.N].

15.32 Use of the rapid assessment procedure for determining moisture condition value shall be as stated in CC 601/WSR/015.

Use of the rapid assessment procedure for determining moisture condition value	
Unique reference of the earthworks material	**Allowed / Not allowed**
(a)	(b)

a) Enter a unique reference, to identify the earthworks material.

b) Enter a value, from options Allowed, Not allowed, to identify whether the rapid assessment procedure for determining moisture condition value is allowed or not allowed.

NI/15.33 The rapid assessment procedure for determining the moisture condition value shall be determined in accordance with test method 'rapid

assessment of whether a soil is stronger than a precalibrated standard' as stated in BS 1377-2 [Ref 23.N].

NI/15.34 No nationally determined requirement is provided.

NI/15.35 No nationally determined requirement is provided.

NI/15.36 No nationally determined requirement is provided.

Permeability

15.37 Permeability testing of fill materials shall be as stated in CC 601/WSR/015.

Permeability testing of fill materials		
Unique reference of the earthworks material	**Test method**	**Test standard or method description to be followed**
(a)	(b)	(c)

a) Enter a unique reference, to identify the earthworks material.

b) Enter text, to identify the test method.

c) Enter text, to identify the test standard or method description to be followed.

Redox potential

15.38 Redox potential testing type shall be as stated in CC 601/WSR/015.

Redox potential testing type	
Unique reference of the earthworks material	**Redox potential test type**
(a)	(b)

a) Enter a unique reference, to identify the earthworks material.

b) Enter a value, from options Laboratory, In situ, to identify the redox potential test type.

15.39 Redox potential of fill materials by laboratory test methods shall be determined in accordance with the test method 'determination of the redox potential' as stated in BS 1377-3 [Ref 26.N].

15.40 Where redox potential of excavated rock fill material is determined in the laboratory, the tests shall be carried out on samples of material crushed to meet the grading requirements of the earthwork material class.

15.41 Where redox potential of fill material is determined in the laboratory, tests shall be carried out at the anticipated maximum natural water content in order to obtain the lowest redox potential.

15.42 Redox potential of fill materials by in situ test methods shall be determined in accordance with the test method 'determination in-situ of the redox potential of soil' as stated in BS 1377-9 [Ref 25.N].

15.43 Test pit plan dimensions for in situ redox potential testing shall be minimum 600 mm square.

15.44 Test pit depth for in situ redox potential testing shall be as stated in CC 601/WSR/015.

Test pit depth for in situ redox potential testing	
Unique reference of the earthworks material test	**Redox potential test pit depth**
(a)	(b)

a) Enter a unique reference, to identify the in situ earthworks material test.

b) Enter a number in units of mm, to identify the redox potential test pit depth.

15.45 Where redox potential of fill material is determined in situ, a sample shall be taken from the base of the test pit and kept in a hermetically sealed container for determining the pH value of the fill material in accordance with BS 1377-3 [Ref 26.N].

15.46 Where redox potential of fill material is determined in situ, the pH of the fill at each location shall be determined prior to redox potential testing.

15.47 The in situ pH of the fill at each location where redox potential testing is to be undertaken shall be less than 5.5.

15.48 The following Documentation shall be submitted for in situ determination of redox potential prior to the commencement of any testing: Written notice stating date, time, and location of each test and the volume of fill material to be tested.

15.49 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the written notices for in situ determination of redox potential of fill materials.

Resistivity

15.50 Resistivity testing type shall be as stated in CC 601/WSR/015.

Resistivity testing type	
Unique reference of the earthworks material	**Resistivity test type**
(a)	(b)

a) Enter a unique reference, to identify the earthworks material.

b) Enter a value, from options Laboratory, In situ, to identify the resistivity test location.

15.51 Resistivity of fill materials by laboratory test methods shall be determined in accordance with BS 1377-3 [Ref 26.N].

15.52 Resistivity of fill materials by laboratory test methods shall be determined in accordance with the test method stated in CC 601/WSR/015.

Resistivity of fill materials by laboratory test methods	
Unique reference of the earthworks material test	**Resistivity laboratory test method**
(a)	(b)

a) Enter a unique reference, to identify the earthworks material test.

b) Enter a value, from options Undisturbed cylindrical sample method, Open container method, Wenner probe method, to identify the resistivity laboratory method.

15.53 Where resistivity of excavated rock fill material is determined in the laboratory, the tests shall be carried out on samples of material crushed to meet the grading requirements of the earthwork material class.

15.54 Resistivity of fill materials by in situ test methods shall be determined in accordance with the test method 'determination in-situ of the apparent resistivity of soil' as stated in BS 1377-9 [Ref 25.N].

15.55 Where resistivity of fill materials is determined in situ, the distance between test locations shall not exceed the lessor of three times the maximum spacing of the electrodes or 50 m.

15.56 Where resistivity of fill materials is determined in situ, tests shall be carried out at the anticipated maximum natural water content in order to obtain the lowest resistivity.

15.57 Where resistivity of fill materials is determined in situ, two measurements shall be made at each selected depth, such that the

electrode alignment for the second measurement is approximately at right angles to the electrode alignment for the first measurement.

15.58 Where resistivity of fill materials is determined in situ, the first selected depth of the material to be tested shall be no more than 1.5 m below the upper surface of the material to be tested.

15.59 Where resistivity of fill materials is determined in situ, measurements subsequent to those at the first selected depth, shall be made at 2 m increments to the full depth of material to be tested.

15.60 The following Documentation shall be submitted for in situ determination of resistivity prior to the commencement of of any testing: Written notice stating date, time, and location of each test, volume of fill material to be tested, proposals for undertaking tests at depths too great to be tested from the surface.

15.61 The requirements for "Documentation" in Section 2 of GC 101 [Ref 14.N] shall apply to the written notices for in situ determination of resistivity of fill materials.

Sulfate content

15.62 Test results and limiting values for sulfate when determining sulfate content shall be given as SO_4, determined by the following formula.

Equation 15.62 Converstion to sulfate

15.63 Where five to ten samples have been tested for water soluble sulfate content, oxidisable sulfide content, and total potential sulfate, the mean of the highest two values shall be used for comparison with the limiting values of oxidisable sulfide content, and total potential sulfate.

15.64 Where ten or more samples have been tested for water soluble sulfate content, oxidisable sulfide content, and total potential sulfate, the mean of the highest 20% of the results shall be used for comparison with the limiting values of oxidisable sulfide content, and total potential sulfate.

15.65 Oxidisable sulfate content shall be calculated by the difference between total potential sulfate and acid soluble sulfate.

Undrained shear strength

15.66 When determining undrained shear strength, fill material specimens shall be nominal diameter 100 mm and nominal height 200 mm.

15.67 Where the undrained shear strength of remoulded fill materials are being determined, the specimen shall be at its natural water content and

compacted into the mould in accordance with BS 1377-1 [Ref 24.N] using the 2.5 kg rammer method described in BS 1377-2 [Ref 23.N].

15.68 Operating cell pressure and axial strain used in the determination of undrained shear strength shall be as stated in Table 15.68, unless otherwise stated CC 601/WSR/015.

Table 15.68 Operating cell pressure and axial strain used in the determination of undrained shear strength	
Operating cell pressure	**Axial strain**
200 ± 10 kN/m^2	1% per minute

15.69 Operating cell pressure and axial strain used for determining the undrained shear strength, where not as stated in Table 15.68 shall be as stated in CC 601/WSR/015.

Operating cell pressure and axial strain used for determining the undrained shear strength, where not as stated in Table 15.68		
Unique reference of the earthworks material	**Operating cell pressure**	**Axial Strain**
(a)	(b)	(c)

a) Enter a unique reference, to identify the earthworks material.

b) Enter a number in units of kN/m^2, to identify the operating cell pressure used in the determination of undrained shear strength.

c) Enter a number in units of %/min, to identify the axial strain used in the determination of undrained shear strength.

16. 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 13242, 'Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction (Designated Standard - CPR)'
Ref 2.N	National Highways. GC 105, 'Arrangements for the Overseeing Organisation'
Ref 3.N	BSI. BS 8081, 'Code of practice for grouted anchors'
Ref 4.N	BSI. BS 8006-1, 'Code of practice for strengthened / reinforced soils and other fills'
Ref 5.N	BSI. BS 8002, 'Code of practice for earth retaining structures'
Ref 6.N	BSI. BS 5930, 'Code of practice for ground investigations'
Ref 7.N	National Highways. CC 605, 'Corrugated Steel Buried Structures'
Ref 8.N	National Highways. CD 601, 'Design Outputs for Earthworks and Reinforced Soil'
Ref 9.N	National Highways. CC 500 'Drainage'
Ref 10.N	BSI. BS EN 16907-3, 'Earthworks. Construction procedures '
Ref 11.N	ICE. Paul Nowak and Peter Gilbert. Nowak & Gilbert (2015), 'Earthworks: A Guide'
Ref 12.N	BSI. BS EN 1537, 'Execution of special geotechnical works. Ground anchors'
Ref 13.N	BSI. BS EN 14475, 'Execution of special geotechnical works. Reinforced fill.'
Ref 14.N	National Highways. GC 101, 'General requirements for the Specification for Highway Works'
Ref 15.N	BSI. BS EN ISO 14688-2, 'Geotechnical investigation and testing - identification and classification of soil. Principles for a classification.'
Ref 16.N	BSI. BS EN 17892-4, 'Geotechnical investigation and testing. Laboratory testing of soil. Determination of particle size

	distribution'
Ref 17.N	BSI. BS EN ISO 22477-5, 'Geotechnical investigation and testing. Testing of geotechnical structures. Testing of grouted anchors'
Ref 18.N	BSI. BS EN 13249, 'Geotextiles and geotextile-related products - Characteristics required for use in the construction of roads and other trafficked areas (excluding railways and asphalt inclusion) [Designated Standard - CPR]'
Ref 19.N	BSI. BS EN 13251, 'Geotextiles and geotextile-related products. Characteristics required for use in earthworks, foundations and retaining structures (Designated Standard - CPR)'
Ref 20.N	BSI. BS EN 13253, 'Geotextiles and geotextile-related products. Characteristics required for use in erosion control works (coastal protection, bank revetments) [Designated Standard - CPR]'
Ref 21.N	National Highways. LC 120 'Landscape and ecology'
Ref 22.N	National Highways. CD 622, 'Managing geotechnical risk'
Ref 23.N	BSI. BS 1377-2 , 'Methods of test for soils for civil engineering purposes. Classification tests'
Ref 24.N	BSI. BS 1377-1, 'Methods of test for soils for civil engineering purposes. General requirements and sample preparation'
Ref 25.N	BSI. BS 1377-9, 'Methods of test for soils for civil engineering purposes. In-situ tests '
Ref 26.N	BSI. BS 1377-3, 'Methods of test for soils in civil engineering projects. Chemical and electro-chemical tests'
Ref 27.N	National Highways. CC 495 'Miscellaneous'
Ref 28.N	National Highways. CC 201, 'Pavement foundation construction'
Ref 29.N	National Highways. CC 606 'Reinforced Soil and Anchored Earth Structures (formerly Series 2500 Cl.2502)'
Ref 30.N	National Highways. GC 109 'Site Preparation and Clearance [Series 200]'
Ref 31.N	Transport Research Laboratory. TRL CR 54, 'Soil corrosivity assessment'
Ref 32.N	BSI. BS 3882, 'Specification for Topsoil'
Ref 33.N	BSI. BS EN 10223-3, 'Steel wire and wire products for fencing

	and netting. Hexagonal steel wire mesh products for civil engineering purposes '
Ref 34.N	BSI. BS EN 10223-8, 'Steel wire and wire products for fencing and netting. Welded mesh gabion products'
Ref 35.N	BSI. ISO. ISO 565, 'Test sieves. Metal wire cloth, perforated metal plate and electroformed sheet. Nominal sizes of openings'
Ref 36.N	BSI. BS EN 1744-1, 'Tests for chemical products of aggregates. Chemical analysis'
Ref 37.N	BSI. BS EN 933-1, 'Tests for geometrical properties of aggregates. Determination of particle size distribution. Sieving method'
Ref 38.N	BSI. BS EN 1097-2, 'Tests for mechanical and physical properties of aggregates. Methods for the determination of resistance to fragmentation'