

Superseded

Specification (Measurement)

**Transport and Main Roads Specifications
MRS03 Drainage, Retaining Structures and Protective
Treatments**

October 2016

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1 Introduction

This Specification applies to the construction of drainage structures, retaining structures and protective treatments in roadworks.

The requirements for reinforced soil retaining structures are specified in MRS06 *Reinforced Soil Structures*.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.5 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of measurement	Clause reference in MRS03
Drainage removal/demolition			
2101	Removal or demolition of culverts, complete	lump sum	8
2102	Removal or demolition of culvert end structures	lump sum	8
2103	Removal or demolition of culverts, excluding end structures	lump sum	8
2104	Removal or demolition of concrete kerb including kerb crossings	m	9
2105	Removal or demolition of concrete channel	m	9
2106	Removal or demolition of concrete kerb and channel including kerb crossings	m	9
2107	Removal or demolition of concrete slabs	m ²	9
2108	Removal or demolition of gullies	each	10
2109	Removal or demolition of access chambers	each	10
Supply of culverts			
2201	Supply of concrete pipe culvert components, Class [class], [diameter] mm diameter	m	11
2202	Supply of fibre reinforced concrete pipe culverts, Class [class], [diameter] mm diameter	m	11
2203	Supply of concrete box culvert components, [size]	m	11
2204	Supply of concrete spanning slabs, [size]	m	11
2205	Supply of helical lock-seam corrugated steel pipe culvert components, [size]	m	11

Standard Item No.	Description	Unit of measurement	Clause reference in MRS03
2206	Supply of helical lock-seam corrugated aluminium pipe culvert components, [size]	m	11
2207	Supply of nestable corrugated steel pipe culvert components, [size]	m	11
2208	Supply of multiple plate corrugated steel pipe culvert components, [size]	m	11
2209	Supply of multiple plate corrugated steel pipe-arch culvert components, [size]	m	11
2211	Supply of multiple plate corrugated steel arch culvert components, [size]	m	11
2212	Supply of concrete pipe drainage trough components, [size]	m	11
2213	Supply of concrete box trough components, [size]	m	11
2214	Supply of nestable corrugated steel pipe drainage trough components, [size]	m	11
Installation of culverts			
2221	Installation of concrete pipe culvert components, [diameter] mm diameter	m	12
2222	Installation of fibre reinforced concrete pipe culvert components, [diameter] mm diameter	m	12
2223	Installation of concrete box culvert components, [size]	m	12
2224	Installation of concrete spanning slabs, [size]	m	12
2225	Installation of helical lock-seam corrugated steel pipe culvert components, [size]	m	12
2226	Installation of helical lock-seam corrugated aluminium pipe culvert components, [size]	m	12
2227	Installation of nestable corrugated steel pipe culvert components, [size]	m	12
2228	Installation of multiple plate corrugated steel pipe culvert components, [size]	m	12
2229	Installation of multiple plate corrugated steel pipe-arch culvert components, [size]	m	12
2231	Installation of multiple plate corrugated steel arch culvert components, [size]	m	12
2232	Installation of concrete pipe drainage trough components, [size]	m	13
2233	Installation of concrete box trough components, [size]	m	13
2234	Installation of nestable corrugated steel pipe drainage trough components, [size]	m	13
2236	Installation of pipe culvert components using jacking methods, [diameter] mm diameter	m	14

Standard Item No.	Description	Unit of measurement	Clause reference in MRS03
Supply and installation of culverts			
2241	Supply and installation of concrete pipe culvert components, Class [class], [diameter] mm diameter	m	15
2242	Supply and installation of fibre reinforced concrete pipe culvert components, Class [class], [diameter] mm diameter	m	15
2243	Supply and installation of concrete box culvert components, [size]	m	15
2244	Supply and installation of concrete spanning slabs, [size]	m	15
2245	Supply and installation of helical lock-seam corrugated steel pipe culvert components, [size]	m	15
2246	Supply and installation of helical lock-seam corrugated aluminium pipe culvert components, [size]	m	15
2247	Supply and installation of nestable corrugated steel pipe culvert components, [size]	m	15
2248	Supply and installation of multiple plate corrugated steel pipe culvert components, [size]	m	15
2249	Supply and installation of multiple plate corrugated steel pipe-arch culvert components, [size]	m	15
2251	Supply and installation of multiple plate corrugated steel arch culvert components, [size]	m	15
2252	Supply and installation of concrete pipe drainage trough components, [size]	m	15
2253	Supply and installation of concrete box trough components, [size]	m	15
2254	Supply and installation of nestable corrugated steel pipe drainage trough components, [size]	m	15
2256	Supply and installation of pipe culvert components using jacking methods, Class [class], [diameter] mm diameter	m	15
Concrete in culverts and end structures			
2301	Concrete end plugs for culverts	m ³	16
2302	Concrete bases in culverts	m ³	17
2303	Concrete footings in culverts	m ³	17
2304	Concrete infill floors in culverts	m ³	17
2305	Concrete abutments and piers in culverts	m ³	17

Standard Item No.	Description	Unit of measurement	Clause reference in MRTS03
2306	Concrete slab decks and kerbs in culverts	m ³	17
2307	Concrete unitary box culverts	m ³	17
2308	End structures to culverts, reinforced concrete	m ³	18
2309	End structures to culverts, unreinforced concrete	m ³	18
2311	End structures to culverts, rock masonry	m ³	18
2312	End structures to culverts, concrete masonry	m ³	18
2313	Aprons to culverts, reinforced concrete	m ³	18
2314	Aprons to culverts, unreinforced concrete	m ³	18
2315	Aprons to culverts, grouted rock pitching	m ³	18
2316	Aprons to culverts, steel wire mattresses	m ³	18
2317	Precast concrete end structures to culverts, [size]	each	19
Pavement drainage			
2401	Concrete kerb, [type]	m	20
2402	Concrete kerb crossings, [type]	m	20
2403	Concrete channel, [type]	m	20
2404	Concrete kerb and channel, [type]	m	20
2405	Concrete kerb and channel crossings, [type]	m	20
2406	Precast concrete kerb blocks, [type]	m	21
2407	Precast concrete channel blocks, [type]	m	21
2408	Precast concrete kerb and channel blocks, [type]	m	21
2409	Shoulder dykes, concrete	m	22
2411	Shoulder dykes, asphalt	m	22
2412	Shoulder dykes, precast concrete blocks	m	22
2413	Concrete gullies, [size/description]	each	23
2414	Concrete access chambers, [size/description]	each	24
2415	Precast concrete access chambers, [size/description]	each	25
2416	Precast concrete side inlet gullies with precast shaft, [size/description]	each	26
2417	Precast concrete side inlet gullies with cast-in-place pit, [size/description]	each	26
Subsurface drainage			
2501	Subsoil drains, Type B, [size] mm diameter	m	27
2502	Subsoil drains, Type D	m	27

Standard Item No.	Description	Unit of measurement	Clause reference in MRS03
2503	Subsoil drain outlet connection, [size] mm diameter, [type]	each	27
2504	Subsoil drain clean-out, [size] mm diameter, [type]	each	27
2505	Sheet filter drains	m ²	28
2506	Strip filter drains	m	28
2507	Sheet or strip filter drain outlet connection, [type]	each	28
2511	Vertical wick filter drains, plastic core	m	29
2512	Vertical sand drains	m	29
2513	Granular working platform for stone columns	m ³	30
2514	Supply and installation of reinforcement geosynthetic material for stone columns	m ²	30
2515	Supply and installation of geotextile, Strength Class [strength class], Filtration Class [filtration class]	m ²	30
2516	Stone columns	m	30
Protective treatments			
2601	Concrete paved inverts in corrugated steel/aluminium culverts, [size]	m	31
2611	Linings in drains and channels, unreinforced concrete	m ³	32
2612	Linings in drains and channels, reinforced concrete	m ³	32
2613	Linings in drains and channels, grouted rock pitching	m ²	32
2614	Linings in drains and channels, steel wire mattresses	m ³	32
2615	Berm drain, [width] mm wide	m	33
2621	Concrete margins	m ³	34
2622	Concrete batters	m ³	34
2623	Concrete rail track crossings	m ³	35
2624	Concrete machinery crossings	m ³	35
2631	Hand placed concrete paving, [thickness] mm thick	m ²	36
2632	Sprayed concrete paving, [thickness] mm thick	m ²	37
2633	Block paving, [thickness] mm thick	m ²	38
2641	Rock masonry	m ³	39
2642	Grouted rock pitching	m ²	40
2643	Rock protection	m ³	41

Standard Item No.	Description	Unit of measurement	Clause reference in MRS03
2644	Steel wire gabion protection work	m ³	42
2645	Steel wire mattress protection work	m ²	43
2646	Fabric encased concrete batter protection on batter faces	m ²	44
2647	Fabric encased concrete batter protection in cut-off walls	m ²	44
2651	Bridge abutment protection Type 1 – rock spillthrough, [location] abutment	each	45
2652	Bridge abutment protection Type 2 – reinforced concrete over road embankment spillthrough, [location] abutment	each	46
2654	Bridge abutment protection Type 4 – rockwork over road embankment spillthrough, [location] abutment	each	47
2656	Bridge abutment protection Type 6 – interlocking blockwork over road embankment spillthrough, [location] abutment	each	48
2657	Shotcreting	m ³	50
2658	Bridge abutment protection Type 7 – Rock-filled gabion protection over road embankment, [location] abutment	each	49
Retaining walls			
2701	Concrete retaining wall, concrete in footing, [wall location/wall number]	m ³	51
2702	Concrete retaining wall, concrete in wall, [wall location/wall number]	m ³	51
2703	Concrete retaining wall, steel reinforcing bar, [wall location/wall number]	tonne	51
2711	Concrete masonry retaining wall, concrete in footing, [wall location/wall number]	m ³	52
2712	Concrete masonry retaining wall, masonry in wall, [wall location/wall number]	m ²	52
2713	Concrete masonry retaining wall, steel reinforcing bar, [wall location/wall number]	tonne	52
2721	Crib walls.	m ²	53
2722	Boulder retaining wall	m ³	54
2731	Soil nailing	m	55
2741	Passive rock dowels	m	56
2751	Active rock bolts	m	57

Standard Item No.	Description	Unit of measurement	Clause reference in MRTS03
Surveying requirements			
2761	Conformance and As Constructed survey for culverts	each	59
2762	Conformance and As Constructed survey for gullies	each	59
2763	Conformance and As Constructed for insitu concrete access chambers	each	59
2764	Conformance and As Constructed for precast concrete access chambers	each	59
2765	Conformance and As Constructed for concrete retaining wall footings	each	59
2766	Survey information for existing underground assets	lump sum	60

2.2 Work Operations

2.2.1 General

The listed work operations for the Standard Work Items are given below.

2.2.2 Removal or demolition of culverts and culvert end structures

Item 2101 Removal or demolition of culverts, complete

Item 2102 Removal or demolition of culvert end structures

Item 2103 Removal or demolition of culverts, excluding end structures

Work Operations incorporated in the above items include:

- Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- carrying out any necessary excavations
- removing or demolishing complete culverts or end structures or culvert units as relevant
- utilising or disposing of excavated and removed or demolished materials
- stacking removed culvert or end structure components
- backfilling resulting excavations, and
- transport of culverts or end structures selected for salvage to the nominated storage site.

2.2.3 Removal/demolition of kerbs and channels and concrete slabs

Item 2104 Removal or demolition of concrete kerb including kerb crossings

Item 2105 Removal or demolition of concrete channel

Item 2106 Removal or demolition of concrete kerb and channel including kerb crossings

Item 2107 Removal or demolition of concrete slabs

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) removing or demolishing concrete kerbs, channels and slabs
- c) utilising or disposing of excavated and removed or demolished material, and
- d) backfilling resulting excavations.

2.2.4 Removal/demolition of gullies and access chambers**Item 2108 Removal or demolition of gullies****Item 2109 Removal or demolition of access chambers**

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) carrying out any necessary excavations
- c) removing or demolishing concrete gullies and access chambers
- d) utilising or disposing of excavated and demolished material, and
- e) backfilling resulting excavations.

2.2.5 Supply of precast and preformed culvert and drainage trough components

- Item 2201 Supply of concrete pipe culvert components, Class [class], [diameter] mm diameter**
- Item 2202 Supply of fibre reinforced concrete pipe culverts, Class [class], [diameter] mm diameter**
- Item 2203 Supply of concrete box culvert components, [size]**
- Item 2204 Supply of concrete spanning slabs, [size]**
- Item 2205 Supply of helical lock-seam corrugated steel pipe culvert components, [size]**
- Item 2206 Supply of helical lock-seam corrugated aluminium pipe culvert components, [size]**
- Item 2207 Supply of nestable corrugated steel pipe culvert components, [size]**
- Item 2208 Supply of multiple plate corrugated steel pipe culvert components, [size]**
- Item 2209 Supply of multiple plate corrugated steel pipe-arch culvert components, [size]**
- Item 2211 Supply of multiple plate corrugated steel arch culvert components, [size]**
- Item 2212 Supply of concrete pipe drainage trough components, [size]**
- Item 2213 Supply of concrete box trough components, [size]**
- Item 2214 Supply of nestable corrugated steel pipe drainage trough components, [size]**

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

- b) supply of all materials
- c) delivery to the site, and
- d) storage on the site.

2.2.6 Installation of precast and preformed culvert components

Item 2221	Installation of concrete pipe culvert components, [<i>diameter</i>] mm diameter
Item 2222	Installation of fibre reinforced concrete pipe culvert components, [<i>diameter</i>] mm diameter
Item 2223	Installation of concrete box culvert components, [<i>size</i>]
Item 2224	Installation of concrete spanning slabs, [<i>size</i>]
Item 2225	Installation of helical lock-seam corrugated steel pipe culvert components, [<i>size</i>]
Item 2226	Installation of helical lock-seam corrugated aluminium pipe culvert components, [<i>size</i>]
Item 2227	Installation of nestable corrugated steel pipe culvert components, [<i>size</i>]
Item 2228	Installation of multiple plate corrugated steel pipe culvert components, [<i>size</i>]
Item 2229	Installation of multiple plate corrugated steel pipe-arch culvert components, [<i>size</i>]
Item 2231	Installation of multiple plate corrugated steel arch culvert components, [<i>size</i>]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials excluding culvert components
- c) carrying out excavations (†)
- d) utilising or disposing of excavated material (†)
- e) placing and compacting foundation bedding material and haunch zone material (†)
- f) cartage of culvert components from the storage site
- g) laying and jointing or placing and assembling culvert components
- h) cutting culvert components where necessary
- i) installing dowel bars and holding down anchors
- j) constructing concrete end blocks
- k) placing and compacting concrete infill material
- l) constructing thrust blocks and ring beams
- m) finishing and curing concrete
- n) supply, placing and compacting backfill material (including side zone and overlay zones) (†), and
- o) labelling drainage structures.

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.7 Installation of precast and preformed drainage trough components

Item 2232 Installation of concrete pipe drainage trough components, [size]

Item 2233 Installation of concrete box trough components, [size]

Item 2234 Installation of nestable corrugated steel pipe drainage trough components, [size]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials, excluding drainage trough components
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting foundation bedding material
- f) cartage of drainage trough components from the storage site
- g) laying and jointing or placing and assembling culvert components
- h) cutting culvert components where necessary
- i) installing holding down anchors
- j) supply, placing and compacting backfill material, and
- k) labelling drainage structures.

2.2.8 Installation of precast pipe culvert components using jacking methods

Item 2236 Installation of pipe culvert components using jacking methods, [diameter] mm diameter

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials excluding culvert components
- c) establishment of excavating and jacking equipment on the site
- d) carrying out all excavations including jacking and receiving pits where necessary
- e) utilising or disposing of excavated material
- f) cartage of culvert components from the storage site
- g) jacking culvert components
- h) cutting culvert components where necessary
- i) filling pipe joints with mortar
- j) supply, placing and compacting backfill material, and
- k) labelling drainage structures.

2.2.9 Supply and installation of precast and preformed culvert and drainage trough components

Item 2241	Supply and installation of concrete pipe culvert components, Class <i>[class]</i> , <i>[diameter]</i> mm diameter
Item 2242	Supply and installation of fibre reinforced concrete pipe culvert components, Class <i>[class]</i> , <i>[diameter]</i> mm diameter
Item 2243	Supply and installation of concrete box culvert components, <i>[size]</i>
Item 2244	Supply and installation of concrete spanning slabs, <i>[size]</i>
Item 2245	Supply and installation of helical lock-seam corrugated steel pipe culvert components, <i>[size]</i>
Item 2246	Supply and installation of helical lock-seam corrugated aluminium pipe culvert components, <i>[size]</i>
Item 2247	Supply and installation of nestable corrugated steel pipe culvert components, <i>[size]</i>
Item 2248	Supply and installation of multiple plate corrugated steel pipe culvert components, <i>[size]</i>
Item 2249	Supply and installation of multiple plate corrugated steel pipe-arch culvert components, <i>[size]</i>
Item 2251	Supply and installation of multiple plate corrugated steel arch culvert components, <i>[size]</i>
Item 2252	Supply and installation of concrete pipe drainage trough components, <i>[size]</i>
Item 2253	Supply and installation of concrete box trough components, <i>[size]</i>
Item 2254	Supply and installation of nestable corrugated steel pipe drainage trough components, <i>[size]</i>
Item 2256	Supply and installation of pipe culvert components using jacking methods, Class <i>[class]</i> , <i>[diameter]</i> mm diameter

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of all materials
- c) carrying out excavations (†)
- d) utilising or disposing of excavated material (†)
- e) placing and compacting foundation bedding material and haunch zone material (†)
- f) cartage of culvert components from the storage site
- g) laying and jointing or placing and assembling culvert components
- h) jacking culvert components where appropriate
- i) cutting culvert components where necessary

- j) installing dowel bars and holding down anchors
- k) constructing concrete end blocks
- l) placing and compacting concrete infill material
- m) constructing thrust blocks and ring beams
- n) finishing and curing concrete
- o) supply, placing and compacting backfill material (including side zone and overlay zones) (†), and
- p) labelling drainage structures.

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.10 Concrete end plugs for existing culverts

Item 2301 Concrete end plugs for culverts

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) placing and compacting concrete, and
- d) finishing and curing concrete.

2.2.11 Insitu concrete culvert components

Item 2302 Concrete bases in culverts

Item 2303 Concrete footings in culverts

Item 2304 Concrete infill floors in culverts

Item 2305 Concrete abutments and piers in culverts

Item 2306 Concrete slab decks and kerbs in culverts

Item 2307 Concrete unitary box culverts

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations (†)
- d) utilising or disposing of excavated material (†)
- e) fabricating and placing steel reinforcement
- f) placing and compacting concrete
- g) supplying and placing embedded dowel bars and galvanised arch channels
- h) finishing and curing concrete, and
- i) supply, placing and compacting backfill material (†).

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.12 End structures to culverts

Item 2308	End structures to culverts, reinforced concrete
Item 2309	End structures to culverts, unreinforced concrete
Item 2311	End structures to culverts, rock masonry
Item 2312	End structures to culverts, concrete masonry
Item 2313	Aprons to culverts, reinforced concrete
Item 2314	Aprons to culverts, unreinforced concrete
Item 2315	Aprons to culverts, grouted rock pitching
Item 2316	Aprons to culverts, steel wire mattresses

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing end structures
- f) constructing aprons
- g) laying and jointing masonry units
- h) installing dowel bars, and
- i) finishing and curing concrete work.

2.2.13 Precast concrete end structures to culverts

Item 2317	Precast concrete end structures to culverts, [size]
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Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all material
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting foundation bedding material, and
- f) placing and jointing end structures.

2.2.14 Cast-in-place concrete kerb, channel and kerb and channel

Item 2401	Concrete kerb, [type]
Item 2402	Concrete kerb crossings, [type]

Item 2403 Concrete channel, [type]

Item 2404 Concrete kerb and channel, [type]

Item 2405 Concrete kerb and channel crossings, [type]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting concrete
- f) forming expansion and contraction joints, and
- g) finishing and curing concrete.

2.2.15 Precast concrete kerb, channel and kerb and channel blocks

Item 2406 Precast concrete kerb blocks, [type]

Item 2407 Precast concrete channel blocks, [type]

Item 2408 Precast concrete kerb and channel blocks, [type]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting bedding material
- f) installing precast concrete kerb blocks, and
- g) installing precast concrete channel blocks.

2.2.16 Shoulder dykes

Item 2409 Shoulder dykes, concrete

Item 2411 Shoulder dykes, asphalt

Item 2412 Shoulder dykes, precast concrete blocks

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) placing and compacting concrete, asphalt or concrete blocks, and
- d) finishing and curing concrete.

2.2.17 Concrete gullies

Item 2413 Concrete gullies, [size/description]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) fabricating and placing steel reinforcement
- g) placing and compacting concrete
- h) finishing and curing concrete
- i) placing cement mortar
- j) placing and compacting backfilling material
- k) fabricating, coating and installing grates and frames, and
- l) installing precast concrete back-units.

2.2.18 Concrete access chambers

Item 2414 Concrete access chambers, [size/description]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) fabricating and placing steel reinforcement
- g) placing and compacting concrete
- h) finishing and curing concrete
- i) placing cement mortar
- j) placing and compacting backfilling material
- k) shaping concrete benching, and
- l) installing step irons.

2.2.19 Precast concrete access chambers

Item 2415 Precast concrete access chambers, [size/description]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) placing and compacting backfilling material
- g) installing precast concrete access chambers
- h) placing cement mortar, and
- i) shaping concrete benching.

2.2.20 Precast concrete side inlet gullies

Item 2416 Precast concrete side inlet gullies with precast shaft, [size/description]

Item 2417 Precast concrete side inlet gullies with cast-in-place pit, [size/description]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) placing and compacting foundation bedding material
- g) placing and compacting concrete
- h) finishing and curing concrete
- i) installing precast concrete side inlet gully components
- j) placing cement mortar
- k) placing and compacting backfilling material, and
- l) shaping concrete benching.

2.2.21 Subsoil drains

Item 2501 Subsoil drains, Type B, [size] mm diameter

Item 2502 Subsoil drains, Type D

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing concrete cradles
- f) placing, jointing and fixing geotextiles and textile sleeves
- g) installing, jointing and fixing prefabricated strip filter drains
- h) installing drainage pipes
- i) placing and compacting backfilling material, and
- j) installing marker maintenance posts.

Item 2503 Subsoil drain outlet connection, [size] mm diameter, [type]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) constructing outlet ends
- d) installing maintenance marker post, and
- e) installing galvanised chicken-wire cones/pest-proof flaps to the outlets of drainage pipes.

Item 2504 Subsoil drain clean-out, [size] mm diameter, [type]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) installing pipe and fittings
- d) installing concrete surrounds, and
- e) installing maintenance marker post.

2.2.22 Sheet or strip filter drains

Item 2505 Sheet filter drains

Item 2506 Strip filter drains

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) installing, combining, joining and fixing prefabricated sheet filter and strip filter drains

- f) installing collector pipes including all fittings, slitting of pipes and provision of filling around pipes, and
- g) supplying and installing marker maintenance posts.

Item 2507 Sheet or strip filter drain outlet connection [type]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) constructing outlet ends
- c) supplying and installing maintenance marker post, and
- d) supplying and installing galvanised chicken-wire cones/pest-proof flaps to the outlets of drainage pipes.

2.2.23 Vertical Drains

Item 2511 Vertical wick filter drains, plastic core

Item 2512 Vertical sand drains

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and fixing vertical wick filter drains, and
- f) placing and compacting and monitoring sand drains.

2.2.24 Stone Columns

Item 2513 Granular working platform for stone columns

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) preparation of the existing surface
- c) supply of granular material, and
- d) construction of the granular working platform.

Item 2514 Supply and installation of reinforcement geosynthetic material for stone columns

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and
- b) supply and installation of reinforcement geosynthetic material.

Item 2515 Supply and installation of geotextile, Strength Class [*strength class*], Filtration Class [*filtration class*]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and
- b) supply and installation of geotextile.

Item 2516 Stone columns

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) installation of stone columns
- d) clearing the Site of spoil, mud and sedimentation ponds, and
- e) reinstatement of disturbed areas.

2.2.25 Concrete paved inverts in corrugated culverts

Item 2601 Concrete paved inverts in corrugated steel/aluminium culverts, [*size*]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) preparing the surfaces on which paved inverts are to be constructed, and
- d) constructing paved inverts.

2.2.26 Linings in drains and channels

Item 2611 Linings in drains and channels, unreinforced concrete

Item 2612 Linings in drains and channels, reinforced concrete

Item 2613 Linings in drains and channels, grouted rock pitching

Item 2614 Linings in drains and channels, steel wire mattresses

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material below surfaces to be lined, and
- f) constructing lining.

2.2.27 Berm drains

Item 2615 Berm drain, [*width*] mm wide

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material below surfaces to be lined, and
- f) constructing concrete lining.

2.2.28 Concrete margins and batters

Item 2621 Concrete margins

Item 2622 Concrete batters

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material below surfaces covered by margins and batters
- f) constructing margins (including cut-off walls)
- g) constructing batters (including cut-off walls)
- h) supplying and installing steel sleeves, and
- i) providing weepholes.

2.2.29 Concrete rail track crossings and machinery crossings

Item 2623 Concrete rail track crossings

Item 2624 Concrete machinery crossings

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) placing and compacting foundation bedding material, and
- g) constructing concrete crossings.

2.2.30 Hand placed concrete paving

Item 2631 Hand placed concrete paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) fabricating and placing steel reinforcement
- g) placing and compacting concrete
- h) placing compressible packing, and
- i) finishing and curing concrete.

2.2.31 Sprayed concrete paving

Item 2632 Sprayed concrete paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) fabricating and placing steel reinforcement
- g) spraying concrete
- h) placing compressible packing, and
- i) finishing and curing concrete.

2.2.32 Block paving

Item 2633 Block paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) placing bedding material

- g) placing paving blocks
- h) compaction of blocks and bedding
- i) cutting paving blocks, and
- j) filling gaps between blocks and edge restraints.

2.2.33 Rock masonry

Item 2641 Rock masonry

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing cement mortar
- f) placing compressible filler
- g) placing rock
- h) placing tightly packed rock behind the pile and between blocks of rock masonry, and
- i) placing geotextile, sheet and strip filter drain.

2.2.34 Grouted rock pitching

Item 2642 Grouted rock pitching

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing foundation bedding material
- f) placing rock, and
- g) placing cement mortar.

2.2.35 Rock protection

Item 2643 Rock protection

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material, and

- e) dumping or otherwise placing rock.

2.2.36 Steel-wire gabion protection work

Item 2644 Steel wire gabion protection work

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) assembling, positioning and joining gabions
- f) forming shapes
- g) placing rock filling, and
- h) closing gabions.

2.2.37 Steel-wire mattress protection work

Item 2645 Steel wire mattress protection work

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) installing anchor plates, anchor bolts and anchor pickets
- f) assembling, positioning and joining mattresses
- g) forming shapes
- h) placing rock filling, and
- i) closing mattresses.

2.2.38 Fabric encased concrete batter protection

Item 2646 Fabric encased concrete batter protection on batter faces

Item 2647 Fabric encased concrete batter protection in cut off walls

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations, and
- d) utilising or disposing of excavated material.

2.2.39 Bridge abutment protection Type 1 – rock spill through

Item 2651 Bridge abutment protection Type 1 – rock spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) construction of rock masonry toe wall
- f) constructing rockfill, and
- g) constructing hand-packed rock face and grouting with cement mortar.

2.2.40 Bridge abutment protection Type 2 – reinforced concrete over earth spillthrough

Item 2652 Bridge abutment protection Type 2 – reinforced concrete over road embankment spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing concrete toe walls, edge walls and capping
- f) constructing reinforced concrete slabs, and
- g) provision of joints, where required.

2.2.41 Bridge abutment protection Type 4 – rockwork over earth spillthrough

Item 2654 Bridge abutment protection Type 4 – rockwork over road embankment spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing rock masonry toe wall
- f) constructing rockwork layer, and
- g) constructing hand-packed rock face and grouting with cement mortar.

2.2.42 Bridge abutment protection Type 6 – interlocking blockwork over earth spillthrough

Item 2656 Bridge abutment protection Type 6 – interlocking blockwork over road embankment spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing cement stabilised sand
- f) placing PVC-slotted pipe
- g) placing granular fill
- h) placing, jointing and fixing geotextile
- i) constructing concrete toe walls, edge walls, mid walls and capping, and
- j) installing interlocking blocks.

2.2.43 Shotcreting

Item 2657 Shotcreting

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of fixing pins
- d) hot-dipped galvanising of steelwork
- e) fabricating and placing steel reinforcement
- f) provision of weep holes
- g) spraying shotcrete, and
- h) provision of joints where required.

2.2.44 Bridge abutment protection Type 7 – Rock-filled gabion protection

Item 2658 Bridge abutment protection Type 7 – Rock-filled gabion protection over embankment spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials except eyebolts for safety harness. Note eyebolts are included in Item 7314 of MRS62 *Bridge Substructure*
- c) carrying out excavations
- d) utilising or disposing of excavated material

- e) constructing subsoil drainage, applicable to gabion toe only
- f) installing geotextile layer
- g) constructing gabion toe or mass concrete toe
- h) constructing cement stabilised sand layer, rock armour and rock-filled mattress toe protection
- i) constructing rock-filled gabion protection,
- j) installing medium impact polythene sheet separator for capping construction,
- k) constructing concrete capping, and
- l) Dewatering and cofferdam where required.

2.2.45 Concrete retaining walls

Item 2701 Concrete retaining wall, concrete in footing, [wall location/wall number]

Item 2702 Concrete retaining wall, concrete in wall, [wall location/wall number]

Item 2703 Concrete retaining wall, steel reinforcing bar, [wall location/wall number]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) fabricating and placing steel reinforcing
- g) placing and compacting concrete
- h) finishing and curing of concrete
- i) fabricating and placing inserts
- j) installation of expansion and contraction joints
- k) installing weep holes
- l) installing drainage behind retaining wall, and
- m) backfilling behind retaining wall where required.

2.2.46 Concrete masonry retaining walls

Item 2711 Concrete masonry retaining wall, concrete in footing, [wall location/wall number]

Item 2712 Concrete masonry retaining wall, masonry in wall, [wall location/wall number]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials, excluding reinforcing

- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) constructing concrete footings
- g) finishing and curing of concrete
- h) laying and jointing masonry units
- i) placing and compacting concrete infill
- j) fabricating and placing inserts
- k) installation of expansion and contraction joints
- l) installing weep holes
- m) constructing capping walls
- n) installing drainage behind retaining wall, and
- o) backfilling behind retaining wall where required.

Item 2713 Concrete masonry retaining wall, steel reinforcing bar, [wall location/wall number]

Work Operations incorporated in the above item include:

- a) Work Operations incorporated in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials, and
- c) fabricating and placing steel reinforcements.

2.2.47 Crib walls

Item 2721 Crib walls

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) constructing concrete footings
- g) installing crib units, and
- h) placing and compacting backfilling material.

2.2.48 Boulder retaining walls

Item 2722 Boulder retaining wall

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) placing boulders/rockfill
- g) installing drainage blanket behind boulder retaining wall
- h) installing seepage drains
- i) backfilling behind boulder retaining wall
- j) compacting backfill behind or adjacent to boulder retaining wall/drainage bracket
- k) filling voids between boulders with slurry concrete, and
- l) inspections by RPEQ Geotechnical Engineer.

2.2.49 Soil nailing

Item 2731 Soil nailing

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of soil nails
- d) hot-dipped galvanising of steelwork
- e) drilling holes for soil nails
- f) installation of nails
- g) grouting soil nails, and
- h) acceptance testing.

2.2.50 Passive rock dowels

Item 2741 Passive rock dowels

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of dowels
- d) hot-dipped galvanising of dowels

- e) encapsulating dowels in HDPE sheath
- f) drilling holes for dowels
- g) installing dowels
- h) grouting dowels, and
- i) acceptance testing.

2.2.51 Active rock bolts

Item 2751 Active rock bolts

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of rock bolts
- d) hot-dipped galvanising of steelwork
- e) drilling holes for rock bolts
- f) installing rock bolts
- g) grouting rock bolts
- h) stressing the rock bolts, and
- i) acceptance testing.

2.2.52 Surveying requirements

Item 2761 Conformance and As Constructed survey for culverts

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 2762 Conformance and As Constructed survey for gullies

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 Surveying requirements of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 2763 Conformance and As Constructed survey for insitu concrete access chambers

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 2764 Conformance and As Constructed survey for precast concrete access chambers

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 2765 Conformance and As Constructed survey for concrete retaining wall footings

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 2766 Survey information for existing underground assets

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 60 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

2.3 Measurement

2.3.1 Measurement of removal/demolition

Where any of Items 2104–2109 are not scheduled separately, demolition and/or removal of existing infrastructure shall be included in Item 3101 in MRS04 *General Earthworks*.

2.3.2 Measurement of excavation and backfilling

In general, any excavation and backfilling required to be carried out in order to construct the work described by this Specification shall not be measured separately. Payment for excavation and backfilling shall be deemed to be included in the rate for the appropriate Standard Work Item for the particular work.

However, where specifically provided for under Clause 2.3 of MRS04 *General Earthworks*, excavation and backfilling for particular components of the work under the Contract may be measured separately. Where this is the case, appropriate Standard Work Items from MRS04 *General Earthworks* shall be included in the Schedule of Rates.

2.3.3 Measurement of precast culverts

This Specification provides Standard Work Items for:

- a) supply only
- b) installation only, and
- c) supply and installation

of precast culvert components.

Any combination of Standard Work Items relating to these methods of measurement may be used in the Schedule of Rates. However, where a Standard Work Item for supply and installation of a particular culvert structure is included in the Schedule of Rates, no supply only nor installation only Standard Work Item shall also apply to that structure.

2.4 Calculation of quantities

2.4.1 General

Unless specified otherwise in Clause 2.4, quantities shall be calculated in accordance with the provisions of Clause 2.1.1 of MRS01 *Introduction to Specifications*.

2.4.2 Precast culverts

Where precast culvert components are supplied only under the Contract (i.e., not installed), the quantity shall be the exact length supplied and quantities shall not be rounded in accordance with Clause 2.1.1 of MRS01 *Introduction to Specifications*.

Where precast culvert components are installed only or are supplied and installed under the Contract, the quantity shall be measured in accordance with the remainder of this Clause and normal rounding of the final quantity shall apply.

Where culverts are installed by other than jacking methods:

a) Single cell culverts

The quantity shall be the invert length along the centreline of the cell as shown on or calculated from the Drawings, or

b) Multiple cell culverts

Where the cells are of equal length, the quantity shall be the invert length along the centreline of one cell only as shown on or calculated from the Drawings.

Where the cells are of variable length, the quantity shall be the average of the invert lengths along the centreline of all cells as shown on or calculated from the Drawings.

Where culverts are installed using jacking methods:

a) Whole length of culvert is installed as a jacking operation

The quantity shall be the invert length along the centreline of the culvert for the complete installation as shown on or calculated from the Drawings, or

b) Part of the length of culvert only is jacked

The quantity shall be the invert length along the centreline of that section of culvert which is actually required to be jacked as shown on or calculated from the Drawings, plus an allowance of 2.4 metres for end stubs. The remainder of the culvert shall be measured as for installation other than using jacking methods.

2.4.2.1 Stone columns

The quantity of stone columns shall be the length of stone column in place and shall be the sum of the individual lengths of each column, calculated as the difference between the height of the ground surface and the founding level as shown on the Drawings or otherwise accepted by the Superintendent.

The quantity of the working platform shall be the volume calculated from the dimensions shown on the Drawings.

Embankment fill above stone columns shall be measured in accordance with the relevant Standard Work Items in MRS04 *General Earthworks*.

2.4.2.2 Soil nails, passive rock dowels and active rock bolts

The quantity of soil nails, passive rock dowels and active rock bolts shall be calculated as the sum of the lengths of soil nails, passive rock dowels or active rock bolts installed, grouted, stressed (where applicable) and load tested successfully.

Superseded