



TII CIVIL SPECIFICATION

25076-SP-1021-TN01 | MAY 2026

QUALITY CHECK SHEET

DOCUMENT TITLE: TII CIVIL SPECIFICATION

PROJECT TITLE: SEE CIVIL AND STRUCTURAL SPECIFICATION "SP-1001"

CLIENT: SEE CIVIL AND STRUCTURAL SPECIFICATION "SP-1001"

DOCUMENT REF: 25076-SP-1021-TN01

REVISION	DESCRIPTION	ISSUE DATE	PREPARED BY	CHECKED BY	APPROVED BY
TN01	Tender Issue	29 TH May 2026	AOG	LB	Mr. James Langan

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CIVIL INFRASTRUCTURE SPECIFICATION

PREAMBLE

1. This document is a part of a specification which has been written to accompany drawings and other contract documents associated with this scope of works.
2. This document shall be read in conjunction with the following documents:
 - a. Contract Drawings as listed in Appendix 0/4 of this SP-1021
 - b. Other parts of the Specification as detailed in this Preamble
 - c. Any document supplied with the Contract Drawings or any document/specification produced by the Local Authority/Employer
 - d. Greater Dublin Regional Code of Practice for Drainage Works
 - e. Specification for Road Works, published by TII as Volume 1 of the Manual of Contract Documents for Road Works, as extended by Appendices 0/1, 0/2, 0/3 and 0/4 (Numbered Appendices) of this SP-1021
 - f. TII Specification for Roadworks Volume 4 Local Authority or Irish Water Guidance
3. Insofar as any of the Contract Drawings may conflict or be inconsistent with any provision of any other specified document the Contract Drawings shall always prevail.
4. Insofar as any of the Numbered Appendices may conflict or be inconsistent with any provision of the TII Specification for Road Works the Numbered Appendices shall always prevail.
5. Insofar as any document/specification produced by the Local Authority/Employer may conflict or be inconsistent with any provision of this document the document/specification produced by the Local Authority/Employer shall always prevail.
6. An Additional Clause as indicated by a suffix 'AR' in Appendix 0/1 is a Contract-specific alteration.
7. A Substitute Clause as indicated by a suffix 'SR' in Appendix 0/1 is a Contract-specific alteration.
8. A Cancelled Clause indicated by a suffix 'CR' in Appendix 0/1 is a Contract-specific alteration.
9. Any reference in the Contract to a Clause number or Appendix shall be deemed to refer to the corresponding Substitute Clause number or Appendix listed in Appendix 0/1 or 0/2.
10. Where a Clause is altered, any original Table/Figure referred to in the Clause shall apply unless the Table/Figure is also altered. Where a Table/Figure is altered, any reference in a Clause to the original Table/Figure shall apply to the altered Table/Figure.
11. Where a Clause in the Specification relates to work goods or materials that are not required for the Works it shall be deemed not to apply.
12. Any Appendix referred to in the Specification that is not used shall be deemed not to apply.

13. All materials, methods and details of construction and workmanship embodied in the site development works and not covered by this document shall comply with the current relevant specifications noted in item 2 above in the order they are noted.
14. “No part of this document may be reproduced or transmitted in any form or stored in any retrieval system of any nature without the written permission of the Consulting Engineer as copyright holder except as agreed for use on the project for which the document was originally issued”.
15. All references to “the Engineer” in this SP-1021 shall be taken to mean “the Employer’s Representative”.
16. Where the requirements of the 1700 Series of SP-1021 and the TII Specification for Road Works differ from those in SP-1002, the requirements of the 1700 Series of SP-1021 and the TII Specification for Road Works shall take precedence.

SERIES 000 - INTRODUCTION

APPENDIX 0/1: CONTRACT-SPECIFIC ADDITIONAL, SUBSTITUTE AND CANCELLED CLAUSES, TABLES AND FIGURES INCLUDED IN THE CONTRACT

Table 0.1 List of Additional Clauses, Tables and Figures

Clause No. (etc.)	Title
115.2AR	Accommodation Works
115.4AR	Accommodation Works
117.20AR	Traffic Safety and Management
117.21AR	Traffic Safety and Management
117.22AR	Traffic Safety and Management
117.23AR	Traffic Safety and Management
117.24AR	Traffic Safety and Management
117.25AR	Traffic Safety and Management
117.26AR	Traffic Safety and Management
117.27AR	Traffic Safety and Management
117.28AR	Traffic Safety and Management
126.4AR	Damage to Roadways
170AR	Control of Dust
170.1AR	Control of Dust
170.2AR	Control of Dust
171AR	Protection of Watercourses from Pollution
171.1AR	Protection of Watercourses from Pollution
171.2AR	Protection of Watercourses from Pollution
172AR	Protection of Existing Works and Amenities
172.1AR	Protection of Existing Works and Amenities
173AR	Cleanliness on Completion
173.1AR	Cleanliness on Completion
173.2AR	Cleanliness on Completion
1202.10AR	General Requirements for Permanent Traffic Signs
1210.9AR	Reflective Markers
1210.10AR	Reflective Markers
1210.11AR	Reflective Markers
1470AR	Inspection and Testing to be carried out by the Contractor – Photometric Testing
1470.1AR	Inspection and Testing to be carried out by the Contractor – Photometric Testing

Table 0.2 Additional Clauses and Tables

Clause No.	Title
115.2AR	<i>Accommodation Works</i> All agreements made by the Contractor with landowners or occupiers shall be confirmed to the Engineer in writing.
115.4AR	<i>Accommodation Works</i> (i) The Contractor shall be aware that all landowner Accommodation Works are identified in this Contract as specified in Appendix 1/15 of the Specification. The Contract shall be deemed to include for putting all instructed Accommodation Works arrangements in place. The Contractor shall confirm pre-entry requirements with each individual landowner in writing and inform the Engineer.
117.20AR	<i>Traffic Safety and Management</i> Where required in Appendix 1/17, the Contractor shall provide, erect, maintain and remove Driver Information Signs and temporary variable message signs in accordance with sub-clauses 21 to 26 of this clause.
117.21AR	<i>Traffic Safety and Management</i> Sign face layouts shall be in accordance with Chapter 8 of the Department of the Transport Traffic Signs Manual (2019). Variable message sign messages shall be provided at locations agreed by the road's authority and the Engineer.
117.22AR	<i>Traffic Safety and Management</i> The Driver Information Signs shall be located within road works when part of the road is coned off, for any length of time.
117.23AR	<i>Traffic Safety and Management</i> Signs located within road works shall only be used where they can be located in advance of a taper and in a position, which does not prejudice traffic safety.
117.24AR	<i>Traffic Safety and Management</i> Driver information signs shall be sited at the beginning and end of the Works. They shall not be placed where they may distract drivers negotiating traffic management provisions.
117.25AR	<i>Traffic Safety and Management</i> The Contractor shall provide adequate storage facilities clear of any safety zone.
117.26AR	<i>Traffic Safety and Management</i> Information signs shall only be displayed within road works where they accurately reflect the reason for the traffic restrictions.
117.27AR	<i>Traffic Safety and Management</i> All necessary traffic safety precautions shall be taken by the Contractor to ensure the safety of all traffic and pedestrians using the existing roads adjacent to the Site and connecting minor roads during the execution and completion of the Works, and all precautions shall be taken to minimise disruption to the local residents.
117.28AR	<i>Traffic Safety and Management</i> The Contractor shall ensure that no item of plant, goods or equipment (including stores or offices) shall be placed or parked on the public roadway or its verges in a manner which shall / may result in danger to the personnel on the Site or members of the public, or which shall / may restrict sight distances on all accesses to the Site or on public roads.
126.4AR	<i>Damage to Roadways</i> All roads, accesses, drains, ditches and grips shall be kept clear of all dirt, mud and material arising from the execution and completion of the Works and suitable clearing equipment and labour shall be provided by the Contractor for this purpose. Particular attention shall be paid to the loading of lorries carrying bulk materials into the Site and spoil from the Site to ensure that these shall not be overloaded or loaded in such a way that spillage shall be unavoidable. Any dirt or mud adhering to the tyres or chassis of any vehicles shall be thoroughly cleaned off before the vehicle shall be permitted to leave the Site. In the case of delivery to the Site,

Clause No.	Title
	vehicles shall be thoroughly cleaned before they leave the point of collection. The Contractor shall be equally responsible for the vehicles of his sub-Contractors and suppliers and the like.
170AR	Control of Dust
170.1AR	<i>Control of Dust</i> The Contractor shall take all necessary steps to control dust caused by construction traffic to the satisfaction of the Engineer.
170.2AR	<i>Control of Dust</i> This shall include measures such as: (i) Wetting of haul road and storage areas. (ii) Covering or dousing of any dry, imported or excavated material. (iii) Reducing the duration for stockpiling in fill materials. Introduction of a wheel wash for construction traffic.
171AR	Protection of Watercourses from Pollution
171.1AR	<i>Protection of Watercourses from Pollution</i> The Contractor shall ensure that waste products of whatever description associated with the execution and completion of the Works shall not enter watercourses, whether dry or not, which are adjacent to the execution and completion of the Works.
171.2AR	<i>Protection of Watercourses from Pollution</i> The Contractor shall consult and comply with the requirements of relevant authorities in relation to measures to be implemented for the protection of watercourses from pollution in the execution and completion of the Works.
172AR	Protection of Existing Works and Amenities
172.1AR	<i>Protection of Existing Works and Amenities</i> Prior to the commencement of the execution of the Works, the Contractor shall provide to the Engineer complete records (photographic or otherwise) of existing structures and other properties that shall or may be affected by the execution and completion of the Works.
173AR	Cleanliness on Completion
173.1AR	<i>Cleanliness on Completion</i> On completion of the Works, the Contractor shall leave the Site and any adjoining property affected by his activities, in a neat and tidy condition to the satisfaction of the Engineer. Carriageway and footway surfaces shall be thoroughly swept and freed from mud and loose chippings. Boundary walls, fences and adjacent properties shall be cleaned of any splashing or dirt which may be attributed to the execution and completion of the Works, and paintwork shall be repaired to the satisfaction of the Engineer where it has been damaged due to the Contractor's activities.
173.2AR	<i>Cleanliness on Completion</i> Notwithstanding any other provisions of the Contract, any of the Contractor's rubbish, debris, litter, equipment, tools and implements and the like deposited on adjoining property during this Contract shall be removed and the property reinstated as necessary.
179 AR	Independent Check Certificate for Temporary Works & Structural Elements and Other Features to be Designed by the Contractor
179.1 AR	<i>Independent Check Certificate for Temporary Works & Structural Elements and Other Features to be Designed by the Contractor</i> In addition to the requirements of the Conditions of Contract, the Contractor shall submit independent check certificates for the significant elements of temporary works Structural Elements and Other Features to be Designed by the Contractor The checking organisation shall be independent of the Works design organisation. The check shall be carried out by or under the close supervision of a Chartered Engineer with relevant experience. The checker may not make reference to the temporary works designer's calculations in order to fulfil his/her duties.

Clause No.	Title
	With the exception of the Contract Documents, the Independent Checker shall not be provided with any design information by the Employer. The Provision of Independent Check Certificates does not relieve the Contractor of his obligations under the Contract to provide design calculations, fabrication drawings, method statements, working drawings etc. The following elements of work require independent check certification: • Traffic management • Temporary Works Design The Contractor shall submit Independent Check Certificates to the Engineer and the Project Supervisor Design Process a minimum of four weeks in advance of works listed above as required.
1202.10AR	<i>General Requirements for Permanent Traffic Signs</i> All posts, brackets, sign frames and the reverse side of signs shall be coloured grey, unless otherwise specified.
1210.9AR	<i>Reflective Markers</i> Where specified, the reflective markers shall be mounted on barriers including safety barriers, concrete barriers and bridge parapet railings. The support brackets for the markers shall consist of either aluminium or steel to the dimensions shown on the drawings in the Contract. A rubber isolation pad shall be provided where two different metals are in contact. The marker brackets shall be securely shot fixed to the supporting surface, and the Contractor shall submit details of the proposed fixing method to the Engineer at least 6 weeks prior to the planned commencement of the execution of these Works.
1210.10AR	<i>Reflective Markers</i> Reflective markers shall be mounted at a minimum height of 600 millimetre above road level. On bridge parapet railings the nearest rail above the 600-millimetre level shall be used. The alignment and levels of the post mounted reflective markers on the approaches to the barrier mounted section shall be adjusted to ensure a smooth line as viewed by drivers on the road.
1210.11AR	<i>Reflective Markers</i> All details relating to the reflectors shall be as specified in Clause 1210, except that a rectangular shape of equivalent area may be used.
1470AR	Inspection and Testing to be carried out by the Contractor - Photometric Testing
1470.1AR	<i>Inspection and Testing to be carried out by the Contractor - Photometric Testing</i> The Contractor shall verify the performance after all lamps have operated for a minimum of 100 hours by taking luminance [Lux] measurements on the road surface after dark over not more than 10% of the total road length at locations to be agreed in writing by the Engineer [Specialist responsible for the design of road lighting]. The Contractor shall take a range of the representative measurements at each location chosen and record the results in an agreed format.

Table 0.3 List of Substitute Clauses and Tables

Clause/ Table/ Figure No.	Title

APPENDIX 0/2: CONTRACT – SPECIFIC MINOR ALTERATIONS TO EXISTING CLAUSES, TABLES AND FIGURES INCLUDED IN THE CONTRACT

Table 0.4 List of Altered Clauses

Clause/ Table/ Figure No.	Title
113	Programme of Works
612	Compaction of Fills
630	Ground Improvement
1702	Concrete – Ordinary Structural – Constituent Materials
1708	Surface Finishes for Concrete
1803	Amendments and Additions to BS5400 Part 6: 1999

Table 0.5 List of Altered Clauses

Clause No.	Alterations to be made
1702	Concrete – Ordinary Structural – Constituent Materials 2 <i>Add at end of Clause: "Aggregates of marine origin may not be used"</i>
1708	Surface Finishes for Concrete <i>Delete the paragraph in (ii) at sub-clause 4 beginning 'Class U4 finish. This finish is for and replace with:</i> 4 "Class U4 shall be for surfaces which shall receive deck waterproofing. Unless the manufacturers of the waterproofing membrane requires a higher standard of finish, surfaces to receive deck waterproofing shall be finished as follows: The surfaces of the concrete to be waterproofed shall be uniformly levelled, screeded and then power-floated to produce a plain textured surface. When the concrete deck is 28 days old, the surface shall be vacuum blasted with a "Blastrac" (or approved equivalent machine) vacuum blasting unit to remove laitance/skin from top of deck and to produce a tough "fine sandpaper" type surface on the concrete. Vacuum blasting unit shall use suitable steel shot, automatically recirculated by the machine which shall also pick up all dust, laitance etc. (detached by the shot) by vacuum action. The finished surface shall be: (i) finished to an accuracy such that, when tested with a 3 metres straight edge, the maximum depression does not exceed 6mm, height of any ridge shall not exceed 2 millimetres; (ii) clean and dry before priming or waterproofing; (iii) free from membrane curing compounds, ice and projecting tying wires; (iv) free from honeycombing, surface cavities, laitance, mortar or other surface deficiencies."
1803	Amendments and Additions to BS 5400: Part 6: 1999 After 4.7.4, Paragraph 3, line 5 amendment insert

Clause No.	Alterations to be made
	"4.7.5, Paragraph 1, line 3 Delete "but not before the rectification procedure has been approved by the Engineer".
1803	After 4.16 line 3 amendment insert "4.16, line 5 Delete "with the approval of the Engineer and using a procedure complying with the requirements of BS5135", insert "in accordance with the standards designated in the Contract."

APPENDIX 0/3: LIST OF NUMBERED APPENDICES REFERRED TO IN THE SPECIFICATION AND INCLUDED IN THE CONTRACT

This Appendix 0/3 is comprised of a list of the Numbered Appendices referred to in the Specification and included in this Contract.

Responsibility for the compilation/completion of the appendices is indicated by the following symbols:

E Employer compiles

C Contractor to compile and submit to the Employer

E/C Employer partially compiles, and Contractor completes and submits to the Employer

T/C Tenderer compiles and returns with his Tender. Post award of Contract the Contractor reviews and submits to the Employer.

(P) The symbol 'P' indicates the appendix is national pro-forma and the format must not be altered.

Where a Contractor or Tenderer is required to compile or complete an Appendix, they shall do so in accordance with the sample appendices included in the Notes for ~Guidance to the Specification for Road Works.

Appendix 0/3 is comprised of two lists, A and B, of Numbered Appendices as follows.

List 'A' is a complete list of the Numbered Appendices referred to in the SPW with those not adopted marked "Not Used". Those identified by the letters 'T' or 'C' shall be compiled by the Tenderer or the Contractor respectively.

List 'B' gives a list of Contract – specific Numbered Appendices devised for this Contract.

Table 0.6 List of Numbered Appendices- List A

Compiled/ Completed By	Appendix No.	Title
		Introductions
E	0/1	Contract-specific Additional, Substitute and Cancelled Clauses and Tables included in the Contract
E	0/2	Contract-specific Minor Alterations to Existing Clauses and Tables included in the Contract
E	0/3	List of Numbered Appendices Referred to in the Specification and included in the Contract

Compiled/ Completed By	Appendix No.	Title
E	0/4	List of drawings included in the Contract
		Preliminaries
E	1/1	Accommodation and Equipment for The Employer
E	1/2	Vehicles for the Employer's Personnel
E	1/3	Communications System for the Employer's Personnel
E	1/4	Working and Fabrication Drawings
E	1/5	Testing to be Carried out by the Contractor
E	1/6	Supply and Delivery of Samples to the Employer
E	1/7	Site Extent and Limitations on Use
E	1/8	Operatives for the Employer
E	1/9	Control of Noise and Vibration
E	1/10	Principal Structures to be Designed by the Contractor
E	1/11	Structural Elements and Other Features to be Designed by the Contractor
E	1/12	Setting Out and Existing Ground Levels
E	1/13	Programme of Design and Execution and Completion of the Works
E	1/14	Monthly Statements
E	1/15	Accommodations Works
E	1/16	Privately & Publicly Owned Services & Supplies
E	1/17	Traffic Safety & Management
E	1/18	Temporary Diversions for Traffic
E	1/19	Routeing of Vehicles
E	1/20	Recovery Vehicles for Breakdowns
E	1/21	Information Boards
E	1/22	Progress Photographs
E	1/23	Substances Hazardous to Health
E	1/24	Quality Management System
E	1/25	Product Certification Schemes
E	1/26	Irish Agrément Board Roads and Bridges Certificates
		Site Clearance
E	2/1	List of Buildings, etc., to be Demolished (to be deleted?)
E	2/2	Filling of Trenches and Pipes
E	2/3	Retention of Material Arising from Site Clearance
E	2/4	Explosives and Blasting
E	2/5	Hazardous Materials

Compiled/ Completed By	Appendix No.	Title
		Fencing and Environmental Noise Barriers
E	3/1	Fencing, Gates and Stiles
E	3/2	Fencing: TII Road Construction Details
		Safety Barriers & Pedestrian Guardrail
E	4/1	Safety Barriers
E	4/2	Pedestrian Restraint Systems
E	4/3	Safety Barrier Terminals
E	4/4	Safety Barrier Maintenance
E	4/5	Anti-Glare Screens
E	4/6	Safety Barriers: TII Road Construction Details
E	4/7	Vehicle Parapet Systems
		Drainage and Service Ducts
E	5/1	Drainage Requirements
E	5/2	Service Duct Requirements
E	5/3	Surface Water Channels and Drainage Channel Blocks
E	5/4	Fin Drains and Narrow Filter Drains and Geotextiles for Filter Drains
E	5/5	Combined Drainage and Kerb Systems
E	5/6	Linear Drainage Channel Systems
E	5/7	Drainage and Service Ducts: TII Road Construction Details
E	5/8	Thermoplastics Structural Wall Pipes and Fittings
E	5/9	Attenuation
		Earthworks
E	6/1	Requirements for Acceptability & Testing of Earthworks Materials
E	6/2	Requirements for Dealing with Class U2 Unacceptable Material
E	6/3	Requirements for Excavation, Deposition, Compaction (other than Dynamic Compaction)
Not Used	6/4	Not Used
E	6/5	Geotextiles Used to Separate Earthworks Materials
E	6/6	Fill to Structures
E	6/7	Sub-formation & Capping & Preparation & Surface Treatment of Formation
E	6/8	Topsoiling, Grass Seeding and Turfing
E	6/9	Earthwork Environmental Bunds, Landscape Areas, Screening Mounds, Strengthened Embankments
E	6/10	Ground Anchorages, Crib Walling and Gabions

Compiled/ Completed By	Appendix No.	Title
E	6/11	Swallow Holes & Other Naturally Occurring Cavities & Disused Mine Workings
E	6/12	Instrumentation & Monitoring
E	6/13	Ground Improvement
Road Pavements- General		
E	7/1	Permitted Pavement Options
E	7/2	Excavation & Reinstatement of Existing Surfaces
E	7/3	Surface Dressing Product (End Performance)
E	7/4	Bituminous Sprays
Not Used	7/5	Road Pavements: TII Road Construction Details
E	7/6	Breaking Up or Perforation of Existing Pavement
Not Used	7/7	Not Used
Not Used	7/8	Not Used
E	7/9	Cold Milling (Planing) of Bituminous Bound Flexible Pavement
E	7/10	Micro surfacing
E	7/11	High Friction Surfacing
E	7/12	Low Energy Bound Mixtures
E	7/21	Recipe Surface Dressing
Kerbs, Footways and Paved Areas		
E	11/1	Kerbs, Footways and Paved Areas
E	11/2	Access Steps
E	11/3	Kerbs, Footways and Paved Areas: TII Road Construction Details
Traffic Signs		
E	12/1	Traffic Signs: General
E	12/2	Traffic Signs: Reflective Markers
E	12/3	Traffic Signs: Road Markings & Studs
E	12/4	Traffic Signs: Cones, Cylinders, FTD's & Other Traffic Delineators
E	12/5	Traffic Signs: Traffic Signals
E	12/6	Traffic Signs: Special Sign Requirements on Gantries
E	12/7	Traffic Signs: Preparation and Finish of Metal and Other Surfaces
Road Lighting Columns & Brackets		
E	13/1	Information to be Provided by the Designer for the Road Lighting Works when Specifying Lighting Columns and Brackets
C (P)	13/2	Column & Bracket Data Sheets 1 & 2
(P)	13/3	Instructions for Completion of Column and Bracket Data Sheet

Compiled/ Completed By	Appendix No.	Title
E/C (P)	13/4	Certification for Lighting Columns
E	13/5	Road Lighting Column and Brackets: TII Road Construction Details
		Electrical Work for Road Lighting and Traffic Signs
E	14/1	Site Records
E	14/2	Location of Lighting Units and Feeder Pillars
E	14/3	Temporary Lighting
E/C	14/4	Electrical Equipment for Road Lighting
E	14/5	Electrical Equipment for Traffic Signs
E	14/6	Preparation and Finish of Metal and Other Surfaces
		Motorway Communications
C	15/1	Motorway Communications
		Piling and Diaphragm Walling
E	16/1	General Requirements for Piling and Embedded Retaining Walls
E	16/2	Precast Reinforced and Prestressed Concrete Piles and Precast Reinforced Concrete Segmental Piles
E	16/3	Bored Cast-in-Place Piles
E	16/4	Bored Piles Constructed Using Continuous Flight Augers and Concrete or Grout Injection Through Hollow Auger Stems
E	16/5	Driven Cast-in-Place Piles
E	16/6	Steel Bearing Piles
E	16/7	Reduction of Friction on Piles
E	16/8	Non-Destructive Methods for Testing Piles
E	16/9	Static Testing of Piles
E	16/10	Diaphragm Walls
E	16/11	Hard/Hard Secant Pile Walls
E	16/12	Hard/Soft Secant Pile Walls
E	16/13	Contiguous Bored Pile Walls
E	16/14	King Post Walls
E	16/15	Steel Sheet Piles
E	16/16	Integrity Testing of Wall Elements
E	16/17	Instrumentation for Piles and Embedded Walls
E	16/18	Support Fluid
		Structural Concrete
E	17/1	Concrete – Classification of Mixes
E	17/2	Concrete – Impregnation and Coating Schedule

Compiled/ Completed By	Appendix No.	Title
E	17/3	Concrete – Surface Finishes
E	17/4	Concrete – General
E	17/7	Precast Concrete Elements
Structural Steelwork		
E	18/1	Requirements for Structural Steelwork
Protection of Steelwork against Corrosion		
E/C (P)	19/1	(Specification for Road Works) Sheet No. Form BE/P1 (New Works) Paint System Sheet
E/C	19/2	(New Works) Requirements for Other Work
C (P)	19/3	(Specification for Road Works) Form BE/P2 Paint Data Sheet
C (P)	19/3*	(Specification for Road Works) Form BE/P3 Paint Sample Despatch List: Sheet 1
C (P)	19/3*	(Specification for Road Works) Form BE/P3 Paint Sample Despatch List: Sheet 2
E	19/4	(New Works) General Requirements
E/C (P)	19/5	(Specification for Road Works) Form BE/PE1 (Maintenance) Paint System Sheet 1
C (P)	19/6	(Specification for Road Works) Form BE/P1 (Maintenance) Paint System Sheet 2
E/C	19/7	(Maintenance) Requirements for Other Work
E	19/8	(Maintenance) General Requirements
Waterproofing for Concrete Structures		
C (P)	20/1	Form PWS Proprietary Waterproofing System Data Sheet (1991 & Annex 'A')
E	20/2	Waterproofing for Concrete Structures
Bridge Bearings		
E	21/1	Bridge Bearing Schedule
Parapet		
Not used	22/1	Parapet Schedule
Bridge Expansion Joints and Sealing of Gaps		
E	23/1	Bridge Deck Expansion Joint Schedule
E	23/2	Sealing of Gaps Schedule (other than in Bridge Deck Expansion Joints)
Brickwork, Blockwork and Stonework		
E	24/1	Brickwork, Blockwork and Stonework
E	24/2	Brickwork, Blockwork and Stonework: TII Road Construction Details
Special Structures		
E	25/1	Requirements for Corrugated Steel Buried Structures

Compiled/ Completed By	Appendix No.	Title
E	25/2	Requirements for Reinforced Soil and Anchored Earth Structures
E	25/3	Requirements for Reinforced Clay Brickwork Retaining Walls of Pocket Type and Grouted Cavity Construction Structures
		Miscellaneous
Not used	26/1	Ancillary Concrete
Not used	26/2	Bedding Mortar
Not used	26/3	Cored Thermoplastic Node Markers
		Watermains, Utilities and Accommodation Works
E	27/1	Requirements for Watermains
E	27/2	Watermains: TII Road Construction Details
		Trenchless installation of Road Drainage & Service Ducts
E	28/1	Trenchless and Minimum Dig Techniques
		CCTV Survey of Road Drainage Systems
E	29/1	CCTV Survey of Road Drainage Systems

Table 0.7 List of Contract-Specified Numbered Appendices Devised for the Contract- List B

Compiled/ Completed By	Appendix No.	Title
E	AR 1/70	As-Built Records
E	AR 1/71	Emergency Services
E	AR 1/72	Property Condition Survey
Not used	AR 1/80	Marine Works General
E	AR 1/81	Environmental Monitoring
Not used	AR 6/80	Rock armour/ rock revetments in hydraulic engineering (e.g. marine/ river)

APPENDIX 0/4: LIST OF DRAWINGS INCLUDED IN THE CONTRACT

Table 0.8 List of Drawings: Contract-specific Drawings Supplied to Each Tenderer

Drawing Number	Drawing Name
Refer to Project Master Document Registers.	

Table 0.9 List of Drawings: (i) Standard Drawings Supplied to Each Tenderer

Drawing Number	Drawing Name
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Table 0.10 List of Drawings: (ii) Inspected by Tenderers

Drawing Number	Drawing Name
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Table 0.11 List of Drawings: (iii) Standard Drawings Brought into the Contract by Reference

Refer to Project MDR file Accompanied in the Tender.

1 SERIES 100 – PRELIMINARIES

1.1 APPENDIX 1/1: ACCOMMODATION AND EQUIPMENT FOR THE EMPLOYER

Not used.

1.2 APPENDIX 1/2: VEHICLES FOR THE EMPLOYER'S PERSONNEL

Not used.

1.3 APPENDIX 1/3: COMMUNICATIONS SYSTEM FOR THE EMPLOYER

Not used.

1.4 APPENDIX 1/4: WORKING AND FABRICATION DRAWINGS

1.4.1 GENERAL REQUIREMENTS

- 1.4.1.1 Whenever required by the Employer Representative, the Contractor shall supply calculations, test reports, data sheets, etc. in support of his detailed working and fabrication drawings. Such documents shall remain the property of the Employer Representative.
- 1.4.1.2 The Contractor shall submit three copies of all relevant documents to the Employer Representative at least four weeks in advance of the date on which the Contractor proposes to commence such works.
- 1.4.1.3 Drawings shall be to an appropriate scale and standard and in sufficient detail to enable the Employer Representative to assess the Contractor's proposals.
- 1.4.1.4 The Contractor shall supply the Employer Representative with the following working and/or fabrication drawings.

Table 1.1 Description of Works

Series	Description of Works
N/A	Refer to the Works Requirements document

1.5 APPENDIX 1/5: TESTING TO BE CARRIED OUT BY THE CONTRACTOR

- 1.5.1 The following testing set out in the tables below to be carried out by the Contractor shall be included as a minimum.
- 1.5.1.1 Tests comparable to those specified in this Appendix shall be necessary for any equivalent work, goods or materials proposed by the Contractor (see sub-Clause 105.4).
- 1.5.1.2 (IL) indicates that an Irish National Accreditation Board (INAB) test report or certificate shall be required. IAB indicates that an Irish Agrément Board Certificate or British Agrément Board Certificate shall be required.
- 1.5.1.3 Unless otherwise shown in this Appendix 1/5 of the Specification, tests for work, goods or materials as scheduled under one clause are required for all such work, goods or materials in the Works.
- 1.5.1.4 Cube strengths shall not be required for concrete complying with Clause 2602 of the Specification.
- 1.5.1.5 Unless otherwise shown in this Appendix 1/5 of the Specification, test certificates for work, goods or materials as scheduled under any one Clause shall be required for all such work, goods or materials in the execution and completion of the Works.

Table 1.2 Testing to be carried out by the Contractor

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 300					
Series 400					
402	Welding	Welding procedures (Manufacturer's tests)	(Every seven years)		Quality management scheme applies
		Welder qualification (Manufacturer's tests)	(Every two years)		
		Production testing (Manufacturer's test)	Sub-Clause 402.5 (iv)		
	Welded joints	Destructive testing (IL)	Sub-Clause 402.5 (v)		
403	Anchorage and attachment systems for use in drilled holes.	Ultimate tensile load (Manufacturer's tests)		Required	To provide attested and documented evidence.
407	Anchorage's in drilled holes	Loading test on site	2 no. anchorage to be tested		
	Post foundations		10 no. posts to be tested		
Series 500					
501	Pipes for drainage and service ducts				Product certification scheme applies
	Vitrified clay				
	Concrete - PC/SRC not exceeding 900 millimetre diameter				

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments		
	Concrete - Pre-stressed not exceeding 900 millimetre diameter						
	Iron – cast				See Clause 509.8		
	Iron – ductile						
	UPVC						
	GRP Plastics						
	Plastics						
	Corrugated steel	(Manufacturer's tests)		Required (AASHTO)			
	Corrugated steel bitumen protection						
	Concrete PC/SRC exceeding 900 millimetre diameter	Proof load, Maximum load, Chloride ion, Cube strength (Manufacturer's tests).	Random Sample from each batch for Proof load 1 pipe for Maximum load	Required (AASHTO)			
Other materials				IAB certification applies			
503	Pipe bedding	Grading	1 per 500 tonnes (min of 3)				
		Soluble sulphate content (IL)	1 per source				
		10% fines value (IL)					
505	Filter medium backfill	Plastic index (IL)	1 per source				Washing and sieving method to be used.
		10% fines value (IL)					
		Soluble sulphate content (IL)					
		Grading	1 per 500 tonnes				
		Permeability (IL)	1 per source				
506	Sealing existing drains						
	Concrete						
	Grout						
507	Chambers						
	Precast concrete				Product certification scheme applies		
	Corrugated galvanised steel	(Manufacturer's tests)		Required			
	Manhole steps				Product certification scheme applies		
	Steel fitments						
	Covers, grates and frames				Product certification scheme applies		
	Cover bolts				Quality management scheme applies		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
508	Gullies and pipe junction				Product certification scheme applies
	Precast concrete				
	Clay				
	Cast iron and steel				
509	Watertightness of joints	Air test	All pipelines with watertight joints		
		Water Test			CI 509.7
512	Backfill to pipe bays	Grading	1 per 500 tonnes (min of 3)		
		Soluble sulphate content (IL)	1 per source		
513	Permeable backing to earth retaining structures	Plastic index (IL)	1 per source		
		Soluble sulphate content (IL)			
		10% fines value (IL)			
		Grading	1 per 200 tonnes (min of 3)		
		Permeability (IL)	1 per source		
	Precast hollow concrete blocks	(Manufacturer's tests)		Required	
517	Linear drainage systems	Load test	A minimum of 1 test and not less than 1 test per 1000m for each type and source		Certification that the systems comply with Clause 517 is required
518	Watermains	All tests required by Irish Water	All pipelines before connection to existing network		Testing to be in accordance with the requirements of Irish Water
Series 600					
601 631 to 633 635 to 637 640 contd	Acceptable material				
	Class General Description				
	1. General granular fill	Grading/uniformity coefficient	Twice a week per source		
	1C only	Los Angeles Coefficient (IL)	Minimum of 2 per source		
	2. General cohesive fill	Grading	Twice a week per source		
		mc/MCV/PL	2 per 1000m3 up to max of 5 per day		
		Undrained shear strength of remoulded material (IL)			
	4. Landscape fill	Grading/mc/MCV (IL)	Daily 1 per 2000m3 per source		
	5. Topsoil	Grading	One per source		
	6. Selected granular fill	Grading/uniformity coefficient	1 per 250m3		
		Optimum moisture content (vibrating hammer) (IL)	One per source		
		Los Angeles coefficient (IL)	Minimum of 2 per source		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
		Moisture content (IL)	1 per 400 tonnes		
		Organic matter/water soluble sulphate content (IL)	Weekly plus source approval		
		pH/chloride ion content (IL)	Weekly plus source approval		
		Resistivity (IL)	One per source		
		Undrained and drained shear parameters (IL)	One per source		
	7. Cohesive fill	Grading/mc/MCV/bulk density (IL)	1 per 250m3		
		PI/LL (IL)	Daily per source		
		Water soluble sulfate content (IL)	Twice a week or daily where sulphates are expected		
		pH/chloride ion content (IL)	Weekly per source		
		Undrained and drained shear parameters (IL)	One per source		
		CBR (IL)	1 per 5000m3		
	8. Miscellaneous fill	mc/MCV (IL)	Daily per source		
	Fill adjacent to cementitious material or metallic items	Total sulphur content IS EN 1744-1 2009: Test 11 for material (IL)	1 per source.		
602	Earthworks material beneath surface of a road, TLOF area, FATO area, turning area or parking layby	Frost heave (IL)			
	(i) Off site source		1 every four months		
	(ii) On site source		1 per 5000m3 or part thereof		
609 & 621	Geotextiles	Tensile load	1 per 400 square metres		Refer to Appendix 6/5 and 6/9
		Permeability			
		Pore size			
612	Compaction of fills				
	Method compaction	Field dry density (IL)	1 per 2,000 square metres or such lesser frequency directed by the Employer's Representative		
	End product compaction	Optimum mc (2.5kg rammer/vibrating hammer method) (IL)	Each class or sub class of material		
		Field dry density (IL)	1 per 250m3		
622 & 639	Earthworks for reinforced earth and anchored earth structures	Redox potential	5 locations within the affected area		
	Drainage layers	Grading	1 per 400 tonnes		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
		Chemical analysis			
	Reinforcing elements	Coefficient of friction	Each type of element with each type of fill		
	Anchor elements	Adhesion			
624	Ground anchorages	Proof loading			Refer to Appendix 6/10
626	Gabions				
	Fill	Grading	1 per 400 tonnes		
		10% fines value (IL)			
	Geomesh		1 per 400 square metres		Refer to Appendix 6/10
	PVC coated wire			Required (ASTM G23)	
642	Earthworks materials adjacent to structures	Constrained soil modulus (M)	3 on each side of each structure		
Series 700					
705	Sub-base and road base material beneath surface of a road, TLOF area, FATO area, turning area or parking layby	Frost heave (IL)	1 per source		
Series 800					
801	Unbound sub-base and road base material (other than slag) adjacent to cement bound materials, concrete pavements, structures or products	Acid Soluble sulfate content (IL)	1 per 400 tonnes or per source if less than 400 tonnes		
803	Granular material Type A	Grading / Composition	1 per 1000 tonnes or minimum of 2 per day		Composition testing only if required using recycled aggregates
		Moisture Content			
		Methylene Blue (IL)	1 per week		
		Flakiness Index (IL)			
		Plasticity Index (IL)			
		CBR (IL)			
		OMC (IL)	2 per year		
		Density (IL)			
		Los Angeles Coefficient (IL)			
		Magnesium Sulphate Soundness (IL)	1 per 2 years		(Where required – refer to NG 803)
		Water absorption (IL)	(as required)		
804	Granular material Type B	Grading	1 per 1000 tonnes or minimum of 2 per day		To provide source approval
		Moisture Content			
		Methylene Blue (IL)	1 per week		
		Liquid Limit (IL)			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
		Flakiness Index (IL)	2 per year		
		OMC (IL)			
		Los Angeles Coefficient (IL)			
		Magnesium Sulphate Soundness (IL)	1 per 2 years		(Where required – refer to NG 804)
		Water absorption (IL)	(as required)		
805	Granular material Type C	Grading	1 per 1000 tonnes or minimum of 2 per day		
		Moisture Content			
		Methylene Blue (IL)	1 per week		
		Liquid Limit (IL)			
		Flakiness Index (IL)			
		CBR (IL)			
		OMC (IL)	2 per year		
		Density (IL)			
		Los Angeles Coefficient (IL)			
		Magnesium Sulphate Soundness (IL)	1 per 2 years		(Where required – refer to NG 805)
		Water Absorption (IL)	(as required)		
806	Wet-mix Macadam	Grading	1 per 1000 tonnes or minimum of 2 per day		
		Moisture Content			
		Methylene Blue (IL)	1 per week		
		Liquid Limit (IL)			
		Flakiness Index (IL)			
		OMC (IL)	2 per year		
		Los Angeles Coefficient (IL)			
		Magnesium Sulphate Soundness (IL)	1 per 2 years		
		Water absorption (IL)	(as required)		
808	Unbound Materials placed adjacent to Cement-Bound Materials	Grading	1 per 1000 tonnes or minimum of 2 per day		To provide source approval
		Moisture Content			
		Methylene Blue (IL)	1 per week		
		Liquid Limit (IL)			
		Flakiness Index (IL)			
		OMC (IL)	2 per year		
		Los Angeles Coefficient (IL)			
		Magnesium Sulphate Soundness (IL)	1 per 2 years		(Where required – refer to NG 804)
		Water absorption (IL)	(as required)		
		Water-soluble sulfate (WS) content as described in Clause 808 (IL)	One set of tests per source		
		Oxidisable sulfides (OS) content as described in Clause 808 (IL)	One set of tests per source		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
822	Lean Mix Concrete CBGM B C _{16/20}	Mixture	1 per source	Contractor QA certificate	In accordance with BS EN 14227-1 and SHW Cl 811
		Aggregate	1 per source then monthly		In accordance with BS EN 14227-1 Figure 1 Envelope B and SHW Clause 822 and BS EN 13242
		Water content	1 per source		In accordance with SHW Cl 822 and BS EN 14227-1. The mixture shall be produced and constructed in accordance with SHW Clause 814 and comply with the general construction requirements of SHW Cl 813
		Laboratory mechanical performance: compressive strength test	From each sample two cubes shall be made. One sample shall be taken from every 50m ³ of laid material		In accordance with BS EN 14227-1. The minimum required compressive strength of the cubes is grade C _{16/20} . Minimum 28 days characteristic strength = 20MPa. No individual test result shall be less than 17MPa.
Series 900					
1.5.1.6 925 937 938 942 943	Aggregates for bituminous mixtures			Required	IS EN 13108-21 Factory Production Control procedures apply. The test certificate is the CE mark for the mixture
	Resistance to fragmentation (hardness)	Resistance to fragmentation (IL)	Monthly		
	Resistance to freezing and thawing (durability)	Soundness (IL)	1 per source		
		Water absorption (IL)	[As required]		
	Cleanliness	Sieve test (mass passing 0.0063mm sieve) (IL)	Monthly		Washing and sieving method to be used
	Shape	Flakiness Index	Monthly		
		Bulk density	1 per 500 tonnes		{IS EN 1097-3}

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
		Blast furnace Slag	Soundness (IL)	Once every 4 months		[These are for air-cooled blast furnace slag]
			Dicalcium silicate disintegration (IL)	1 per 500 tonnes		
			Iron disintegration (IL)	1 per 500 tonnes		
		Steel slag	Bulk density	1 per 500 tonnes		
			Volume stability (IL))	1 per 500 tonnes		
		Course aggregate for surface courses	Resistance to polishing (PSV) (IL)	1 per source		
			Resistance to surface abrasion (AAV) (IL)	1 per source		
901 925 937 938 942 943 (cont'd)	Binders for bituminous materials	Penetration (IL)	1 per 750 tonnes	Required	IS EN 13108-21 Factory Production Control procedures apply. The test certificate is the CE mark for the mixture. Except where specifically called for in the Specification for Roads Works, the inclusion of polymer modified bitumen is subject to TII approval	
Softening point (IL)		1 per 750 tonnes				
[Other IS EN tests]		[As required]				
902	Reclaimed bituminous materials	Recovered penetration (IL)	1 per 1000 tonnes or one per day whichever is greater	Required	[Recovered penetration of the final plant mixed material]	
903 906 907 909 to 912 916 925 929 930 937 938 942 943	Bituminous mixtures	Grading (IL)	BS EN 13108-21 Factory Production Control (FCP) procedures apply. In addition, a minimum of 1 per 375 tonnes or minimum 2 per five day period or part thereof whichever is greater of the FPC samples shall be retrieved from the delivery site vehicle on arrival at site.	Required	The test certificate is the CE mark for the mixture. The site samples shall be split with one sample going to the FPC process and the second sample stored for audit test purposes.	
Binder content (IL)						
911	Hot Rolled Asphalt surface course (Design Mixtures)	Design Binder content	1 per source	Required	The test certificate is the CE Mark for the mixture.	
915		Hot sand test (IL)	1 per source			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
	Coated chippings for application to Hot Rolled Asphalt Surfacing's	Rate of spread (IL)	[As required]		
		Determination of resistance to fragmentation – Los Angeles coefficient (IL)	1 Monthly		
		Determination of particle size distribution (IL)	1 per 75 tonnes		
		Binder content (IL)	1 per 75 tonnes		
		Determination of particle shape of aggregates – Flakiness index (IL)	Monthly		
		Determination of the polished stone value (PSV) (IL)	2 per year per source		
		Determination of resistance to surface abrasion Aggregate Abrasion Value (AAV) (IL)	[2 per year per source]		
918	Slurry sealing				
	Site control tests	Tests specified in Clause 918	As required in Clause 918		
919	Surface dressing				
	Aggregates	[Other IS EN/BS tests]	[As required]		As required in IAT guidelines
	Binder	Penetration (IL)	1 per 750 tonnes or part thereof		[More frequent tests/samples should be scheduled for modified binders]
		Softening point (IL)	1 per 750 tonnes or part thereof		
		[Other IS EN/BS tests]	[As required]		As required in IAT guidelines
	Rate of spread of binder	Tests specified in IAT Publication "Guidelines for Surface Dressing in Ireland"	Daily		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
920	Bond coats, tack coats and other bituminous sprays				
		Binder	Tests as specified for surface dressing binder	As required for surface dressing binder	As per IAT guidelines
		Blinding material	Determination of particle size distribution (IL)	1 per contract	
			Rate of application	Daily	
921	Surface macrotexture	Volumetric Patch (IL)	[As required]	Required	
924	High friction surfaces				
	Aggregate	Resistance to polishing (Manufacturer's test) (PSV) (IL)	1 per source	Required	
		Determination of particle size distribution (IL)	1 per source		
	Binder	Rate of spread	[As required]		
	Cured binder	Tensile strength	2 per 1000m2 / shift		
		Elongation			
929	Base and binder Course Asphalt Concrete (Design Mixtures)	Permanent Works – In situ air void content (IL)	[As required]	Required	
		Permanent Works – Refusal air void content (IL)			
		Permanent Works – Deformation resistance			
		Deformation resistance (design)	[As required]	Required	The test certificate is the CE Mark for the mixture
		Stiffness (design)			
930	EME2	Permanent Works – In situ air void content (IL)	[As required]	Required	The test certificate is the CE Mark for the mixture
		Richness modulus (design)			
		Duriez (design)			
		Deformation Resistance (design)			
		Stiffness (design)			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
937	Stone mastic asphalt (SMA) regulating course	Permanent Works – In situ air void content (IL)	[As required]	Required	
		Permanent Works – Deformation resistance			
		Binder drainage (design)	[As required]	Required	The test certificate is the CE Mark for the mixture
		Deformation Resistance (design)			
938	Porous asphalt	Relative hydraulic conductivity (IL)	As required by Clause 938	Required	In addition, European in-situ drainability testing required
943	Hot Rolled Asphalt surface course and binder course (performance related design mixtures)	Permanent Works – In situ air void content (IL)	[As required]	Required	
		Permanent Works – Deformation resistance			
		Deformation resistance (design)	[As required]	Required	The test certificate is the CE Mark for the mixture
906 929 930 937 943	Bituminous mixtures	Compaction control (IL)	As required by BS 594987 and the individual clauses of SRW	Required	
Series 1000 (Note for PQ concrete refer to Table 1/1A)					
1001 1030 1035	Cement				Quality management and product certification scheme apply
	Portland cement				Tests and test certificates are required as scheduled under Clause 1702 to 1704
	Portland PFA cement				
	Pulverised-fuel ash				Test and test certificates are required as scheduled under Clause 1702 to 1704 Product certification schemes apply
	Admixtures				

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
	Aggregates	Soundness value (IL)	1 per source		Results of routine control tests by the manufacturer/supplier to be provided. Product certification scheme applies
		Water absorption (IL)	[as required]		
		Flakiness index (IL)	1 per source		
		Shell content (IL)	1 per source		
		10% fines value (IL)	Monthly		
		Grading	Daily		Washing and sieving method to be used for CBM aggregate
		Chloride content (IL)	Daily (1 per source for CBM aggregate)		
	Fine aggregate	Acid-soluble material (IL)	Monthly		Not required for CBM aggregate
	Pulverised-fuel ash			Required (BS 3892: Part 2)	
1003 1004	Concrete	Density of in situ concrete cores (IL)	3 per 1200m		
		Cube strength (IL)	As required in Table 10/7		
1005	Workability	Compacting factor (IL)	As required in Table 10/7		
		Vebe (IL)			
1011 1012	Dowel bars			Required (BS4449)	Product certification scheme applies
	Tie bars				
	Dowel bars and supporting cradles	Load test	1 per arrangement		
	Sheathed dowel bars	Bond stress	4 bars		
	Cranked tie bars (coated)	Bend test	4 bars		
1015	Joint filler board	Salt fog cabinet	4 bars		Normally undertaken by manufacturer
		Weathering test	3 per source		
		Compression and recovery	4 per source		
	Cork filler board	Extrusion	1 per source		
		Immersion in water	2 per source		
1016 1017	Applied sealants	Immersion in acid	2 per source		
				Required (ASTM) (BS2499) (BS5212: Part 1) (BS4254)	
		Initial Penetration	1 per 1000m or 1 per day		
1026	Surface texture	Resilience	1 per 1000m or 1 per day		
		Sand patch (IL)	1 per day (set of 10)		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
1027	Aluminised curing compound	Efficiency index	1 per source		
1030	Not Used				
1038 to 1040	Cement bound material	Laboratory wet density	1 per cube		
1040		In situ wet density (IL)	1 per 800m2 or part thereof laid each day		
		Cube strength (IL)	1 per 800m2 or part thereof laid each day		
1043	Foamed Concrete	Cube strength (IL)	2 Cubes per 12m3		
Series 1100					
1101	Precast concrete kerbs, channels, edgings and quadrants	Transverse strength	Minimum of 3 per 1000 units of each product (BS7263: Part 1)		
		Water absorption			
1102	In situ asphalt kerbs	Grading	1 test per 500 metres laid		
		Binder content			
1104	Precast concrete flags	Transverse strength	Minimum of 3 per 1000 units of each product (BS7263: Part 1)		
		Water absorption			
	Bedding I				
	Granular material				
	Mortar				
1107	Concrete block paving	Compressive strength	16 per 5000 blocks (BS6717: Part 1)		
1103	In situ Concrete Kerbs	Cube Strength (IL)	1 test per 500 metres laid		
Series 1200					
Series 1300					
1305	Anchorage for use in drilled holes	Tensile load (Manufacturer's tests)		Required	To provide well attested and documented evidence
1306	Anchorage in drilled holes to columns with flange plates	Loading test on site	10% of Anchorage's installed		
1310	Welding	Welding procedures (Manufacturer's test)	(Every seven years)		Quality management scheme applies
		Welding qualification (Manufacturer's tests)	(Every two years)		
		Production testing (Manufacturer's tests)	(Clause 1310 (7.1.4))		
	Welded joints	Destructive testing (IL)	(Clause 1310 (7.1.5))		
Series 1400					
1421	Cable				Product certification scheme applies

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
1424	Lighting Units	Tests specified in Clause 1424	Each unit	Required	Product certification scheme applies. Certification that the installation complies with the National Rules for Electrical Installations is required.
	Networks	Test specified in Clause 1424	Each network	Required	Certification that the installation complies with the National Rules for Electrical Installations is required.
1470	Lighting Performance	Photometric Testing	As required by clause 1470	Required	As required by Clause 1470
Series 1500					
Series 1600					
1601	Soil samples in-situ soil tests				
1602 to 1606 1610 to 1615 1610 to	Concrete	As Series 1700	As Series 1700	As Series 1700	
	Reinforcement	As Series 1700	As Series 1700	As Series 1700	
	Bentonite	Apparent viscosity range - Gel strength range (Manufacturer's test)		Required for each consignment	Certification that the Bentonite complies with Clause 1618 is required
	Drilling fluid (other than Bentonite)	Density	Daily To be proposed by the Contractor and agreed by the Engineer		
		Fluid Loss			
		Viscosity			
		Sand content			
		Shear Strength			
		pH			
	Welding	Radiographic	10% of welded connections		
	Prestressing	As Series 1700	As Series 1700	As Series 1700	
	Steelwork	As Series 1800	As Series 1800	As Series 1800	
	Protection against corrosion	As Series 1900 for steelwork	As Series 1900 for steelwork	As Series 1900 for steelwork	
1606	Coatings for protection against corrosion	Adhesion	1 per 100m2	Required	
1607	Reduction of friction on piles				
1608 1616	Integrity testing	Bridge Structures / Foundation Elements	Sonic logging 25% of cast in place piles. Sonic echo 100% of precast driven.	Required	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
		Retaining Wall Substructures	Sonic logging 25% of cast in place piles. Sonic echo 100% of precast driven.	Required	
	Dynamic testing	Bridge Structures / Foundation Elements	With Case and CAPWAP analysis 20% of concrete piles and steel bearing piles	Required	
		Retaining Wall Substructures	With case and CAPWAP analysis 20% of concrete piles and steel bearing piles	Required	
1609	Static load testing of working piles	Bridge Structures / Foundation Elements	1+1%	Required	In accordance with clause 1609.33
			Uplift and lateral load testing as required by the Designer.		
		Retaining Wall Substructure	1+1%	Required	In accordance with clause 1609.33
			Uplift and lateral load testing as required by the Designer.		
	Static load testing of preliminary piles	Bridge Substructure	1 per structure unless otherwise agreed with the Engineer	Required	In accordance with clause 1609.34
1610	Diaphragm Walls	Density	3 per panel		
	Drilling Fluid (Bentonite)	Apparent viscosity range - Gel strength range (Manufacturer's test)		Required for each consignment	Certification that Bentonite complies with Clause 1618 is required
	Drilling fluid (other than Bentonite)	Density	Daily		
		Fluid Loss	To be proposed by the Contractor and agreed with the Engineer		
		Viscosity			
		Sand content			
		Shear Strength			
		pH			
1612	Self-hardening slurry mixes		To be proposed by the Contractor and agreed with the Engineer		
1618	Support Fluids		To be proposed by the Contractor and agreed with the Engineer		
Series 1700					
1702	Cement				Certificate to be provided monthly for each type of cement Quality management and product certification schemes apply
1703	Normal and Rapid hardening Portland	Chloride content	Monthly	Required	
1704		Sulfate content			
		Acid-soluble alkali content			
	White or Coloured Portland			Required)	
	Portland-blast furnace			Required	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
	Sulphate resisting Portland			Required	
	Portland pulverised fuel ash			Required	
	Low heat Portland			Required	
	High Slag blast furnace			Required	
	Pulverised-fuel ash	Colour index	Monthly	Required (	Certificate to be provided monthly Product certification scheme applies.
1702 1703 1704 contd	Ground granulated blast furnace slag			Required	Certificate to be provided monthly Product certification scheme applies
	Cements (all types)	Chloride content	Monthly		Tests to be carried out by the manufacturer and results included on the test certificates required above
	Pulverised-fuel ash	Sulphate content	Monthly		
	Ground granulated blast furnace slag	Acid-soluble alkali content	Daily (PC) Weekly (PFA ggbs)		
	Aggregates	Grading	1 per delivery (min 1 weekly per source)		Results of routine control tests by the manufacturer / supplier to be provided.
		Shell content (IL)	Monthly		
		Flakiness index (IL)	Monthly		
		10% fines value (IL)	Monthly		Product certification scheme applies
		Drying shrinkage (IL)	Monthly		
		Chloride content (IL)	Daily or as otherwise agreed		
		Sulphate content (IL)	Monthly		
	Blast furnace slag	Bulk density (IL)	1 per 500 tonnes		
		Stability (IL)	1 per 500 tonnes		
		Sulphur content (IL)	1 per 500 tonnes		
	Water	Tests specified in BS3148			
		Chloride content	Monthly		
		Sulphate content	Monthly		
		Acid-soluble alkali content	Weekly		
	Admixtures	Chloride content	1 per consignment	Required (BS 5075)	Product certification scheme applies
		Sulphate content	1 per consignment		
		Acid-soluble alkali content	1 per consignment		
1707 17	Concrete	Cube strength (IL)	As per Drawing 1001		Contractor to cast and test sufficient additional cubes to demonstrate cube strength before transfer

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
		Cube strength special testing as described in Appendix 17/4 (IL)	2 cubes from each of 2 samples of each batch		
		Density	Every cube		
		Modulus of elasticity	Every cube		
	Fresh concrete	Workability (compacting factor or Vebe) (IL)	Each batch		
		Air content	Each batch of air entrained concrete		
		Cement content	Once every 1,000m3		
		Water/cement ratio			
1709	Silane and siloxane and coatings			Required for each delivery	Certification that products comply with Clause 1709 is required
1710	Concrete packing Mortar packing Epoxy resin bonding agent	Strength, Density, Workability Strength, Density, Workability Strength, Density, Workability	Each Batch Each Batch Each Batch	Required for each delivery Required for each delivery Required for each delivery	
17	Precast concrete manufactured off Site	Cube strength (Manufacturer's test)			Contractor to make available records of tests by the manufacturer
	Nonparticipating formwork	As required by BA 36	1 per 150m2	Required	
	Participating formwork	As required by BA 36	1 per 150m2	Required	
1711	Grout	Full scale grout trial	1 per 5 post tensioned insitu concrete bridge structures or part thereof		
		Fluidity	1 per mix		
		Bleeding	1 per mix		
		Volume change	1 per mix		
		Free expansion	1 per mix		Only applicable if an expanding agent is used
		Cube strength	3 cubes from each batch		
	Admixtures			Required (BS5075)	
1712	Reinforcement				Product certification scheme applies
	Steel bars			Required (BS4449)	
	Steel wire			Required (BS4482)	
	Steel fabric			Required (BS4483)	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
1713	Fabricated reinforcement			Required	Certification that fabricated reinforcement complies with the routine inspection / testing requirements is required if the fabrication is not covered by a product certification scheme listed in Appendix 1/25
1716	Reinforcement jointing systems	Permanent elongation Characteristic strength (Manufacturer's test)	1 per type of mechanical joint used	Required for each type of connection	
1717	Reinforcement metal arc welding	Welding procedure approval (BS7123)	As required in BS7123		
		Welder approval (BS7123)			
1718	Prestressing tendons				Product certification scheme applies
	Steel wire			Required (BS5896)	
	Steel bar			Required (BS4486)	
	Seven-wire strand			Required (BS5896)	
	Prestressing steel (all types)	Proof Load	Each reel		
		Breaking load			
		Elongation			
		Ductility			
		Relaxation			
		Modulus of elasticity			
	Super strand to BS5896 or other than lowest strength 3-7 millimetre diameter. wires to BS5896	0.1% proof load Breaking load	Each reel	Required (BS5896)	
1724	Post-tensioning anchorages	Tests in accordance with BS4447 (Manufacturer's tests)			Contractor to make available records of tests by the manufacturer
1726	Stainless steel bar			Required (BS6744)	
1727	Inspection and testing of structures and components	Precast beam load tests	1 per precast beam type and size		In accordance with Notes for guidance of TII SRW or test procedure agreed with the Engineer
Series 1800					
1801	Structural steels to			Required (Euronorm 21)	Inspection certification Type

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
1803	BS EN 10025, BS EN 10113, BS EN 10137, BS EN 10155, BS EN 10210				3.16 as defined in Clause 3.16 of BS EN 10204
	Structural steels to BS 7668			Required (BS7668)	
	Stainless steels to BS 970			Required (BS 970)	
	Stainless steel to BS 1449: Part 2			Required (BS 1449: Part 2)	
	Steel plate	Ultrasonic testing	As required in BS5400 P6 1999	Required	
	Steel plate in cruciform and 'T' Joints	Ultrasonic	100% of welds in cruciform and T joints within the zone indicated in figure 3 of BS5400 pt 6 1999		
	Bolts, nuts and washers				Quality management scheme applies
	All types except HSFG	Test specified in BS 4395: Part 2	As required in BS 4395: Part 2		
	HSFG	Test specified in BS 4395: Part 1 or Part 2	As required in BS 4395: Part 1 or Part 2		
	Welding electrodes	Covered steel		Required (BS EN 499)	
		Wire		Required (BS4165)	
	Welding				
	Welding procedures	Tests specified in BS EN 288: Part 3	As required in BS EN 288: Part 3 and Appendix 18/1		Results to be reported in accordance with Annex A of BS EN 288: Part 3
	Welder qualification	Tests specified in BS EN 287: Part 1	As required in BS EN 287: Part 1 for each welder	Required (BS EN 287: Part 1)	Certificate to be in accordance with Annex B of BS EN 287: Part 1
	Butt weld 'run-off' plates	Destructive tests specified in BS 5400: Part 6: 1999	As required in BS 5400: Part 6: 1999		
	Butt welds and adjacent areas of steelwork	Non-destructive tests using methods to be agreed	As required in BS 5400: Part 6: 1999 and the minimum requirements for weld testing shall be as described in Steel Construction Institute Document "Steel Bridge Group: Guidance Notes for Best Practice in Steel Bridge Construction" and shall be scheduled in Appendix 18/1		
	Fillet welds	Non-destructive tests	As required in BS 5400 Part 6 1999 and the minimum requirements for		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
			weld testing shall be as described in Steel Construction Institute Document "Steel Bridge Group: Guidance Notes for the Best Practice in Steel Construction" and shall be scheduled in Appendix 18/1		
	Flame cutting and shearing	Tests to demonstrate procedures comply with BS5400: Part 6: 1980 and Appendix 18/1			
	Stud shear connectors	Fixing (BS 5400: Part 6) Bending (BS5400: Part 6)	Each stud		
Series 1900					
1903	Abrasives	Grading	Samples shall be selected by the Engineer		Refer to NG 1903
		Hardness			
1909	Glass Flake epoxy coating system	Spark test	1 per 100m2	Required	Spark test to use an elcometer 236DC6-15K at 3K
1910	Paints				
	Samples 'A' and 'B'	Specific gravity	Samples shall be selected by the Engineer		
		Colour match			
		Composition			
		Application characteristics			
1911	Galvanised coatings	Test specified in EN ISO 1461	1 set of tests per delivery load	Required	Method of sampling to be in accordance with clause 1912
	Aluminium and zinc spray coatings	Tests specified in BS2569: Part 1	1 set per 250m2 of coating	Required	Area to be tested to be in accordance with clause 1912
	Aluminium coating material			Required (BS1475)	
	Zinc coating material			Required (BS3436)	
	Sherardized coatings	Tests specified in BS4921	1 set per 500no fasteners		
	Zinc electroplated coatings	Tests specified in BS3382: Part 2	1 set per 500no fasteners		
	Plating to HSFG bolts				
1912	Metal spray coatings	Tensile Test specified in ISO 2063	1 set per 250m2 of coating		
		Grid Test specified in ISO 2063	1 set per 250m2 of coating		
Series 2000					
2003	Mastic asphalt	Test specified in BS6925	1 per source	Required (BS6925)	Sampling to comply with BS6925

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
	Proprietary waterproofing systems	Test specified in BS 3900: E10: 1989 and in accordance with BD 47/94, for bond thickness and pinhole detection. Minimum bond to be 0.7 N/mm ²	10 tests per deck	Required	IAB certification apply
	Additional bituminous protection	Tests specified in BS594: Part 1	1 per 15 tonnes		Sampling to comply with BS594: Part 1
	Stability value	Test specified in BS598: Part 107	1 per 15 tonnes		
	Cut back bitumen	Tests specified in BS3690: Part 1	1 per source		Sampling to comply with BS3690: Part 1
2004	Tar	Tests specified in BS76	1 per source		Sampling to comply with BS76
Series 2100					
Series 2200					
Series 2400					
2401	Masonry cement			Required (BS5224)	Quality management scheme applies
		Chloride content	Monthly		Test to be carried out by the manufacturer and results included on the test certificate
2402	Sand			Required per consignment (BS1199 and 1200)	
		Chloride content	Monthly		Test to be carried out by the manufacturer and results included on the test certificate
2404	Mortar admixtures			Required (BS 4887) (BS 5075)	Product Certification Scheme applies
2405	Lime			Required (BS890)	
2406	Bricks				
	Clay	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (IS 91)			
	Calcium silicate			Required (BS 187)	
	Concrete			Required (IS 189)	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
2407	Blocks				
	Concrete			Required (IS 20)	
2408	Reconstituted stone	Compressive Strength	10 per consignment of 1000 or part thereof	Required BS 1217 and BS 6457	Tests to be carried out by the manufacturer and included on the Test Certificate. Test to BS 1217 shall be as agreed by the Engineer .
		Dimensional Checks			Tests to be carried out by the manufacturer and included on the Test Certificate.
		Drying Shrinkage Determination			
2410	Stainless steel				
2411	Wire/fabric			Required (BS970: Part 1)	
	Bars			Required (BS6744)	
Series 2500					
2501	Materials for corrugated steel buried structures				Approval by the Engineer applies IAB or BBA certification applies
	Steel plate			Required as appropriate to the standard or specification listed in BD 12	
	Nuts and bolts				
	Metal coating				
	Protective coating				IAB or BBA certification applies
	Paved invert system			IAB or BBA certification applies	
2502	Materials for reinforcing elements, prefabricated facing and capping units, and washers				
	Aluminium alloy strip			Required (BS1470)	Mechanical properties to be stated on the certificate
	Copper strip			Required (BS2870)	Mechanical properties to be stated on the certificate
	Carbon steel strip			Required (BS1449: Part 1)	Silicon content and mechanical properties to be stated on the certificate. Test scheduled under clauses 1716

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
					and 2206 are required for welding and galvanising of anchor elements
	Stainless steel strip			Required (BS1449: Part 2)	Mechanical properties to be stated on the certificate
	Reinforcing bar for anchor elements		Required (BS4449)	Tests scheduled under Clauses 1716 and 1911 are required for welding and galvanising of anchor elements	
	Materials for fasteners				
	Aluminium alloy bar		Required (BS1473) (BS1474)		
	Copper alloy		Required (BS2874)		
	Steel alloy			Required (BS3692) (BS4449) (Euronorm 21)	Tests scheduled under Clause 1911 are required for galvanising
	Stainless steel			Required (BS970: Part 1)	
	Black hexagon bolts, screws and nuts			Required (BS4190)	Tests scheduled under Clause 1911 are required for galvanising
2503	Materials for pocket type reinforced brickwork retaining wall structures			Required	
	Clay bricks	Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)	1 set of tests per type of brick		Random sampling to IS 91 to be employed
Series 2600					
2601	Bedding mortar materials			Required for each batch	Certification in accordance with Clause 2601 is required
	Bedding Mortar	Flow cone test	Each batch		(IL) Laboratory tests
		Flow between glass plates			
		Compressive strength			
		Expansion test			
		Water absorption			
		Elastic stability	1 per source		
		Flow cone test Compressive strength	Each load		Site control tests

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
2604	Plastic coating to fencing posts, gates and ancillaries	Impact test			Records of all tests to be available for inspection
		Adhesion			
		Retention of adhesion			
		Salt spray			
		Accelerated weathering			
		(Manufacturer's tests)			

Table 1.3 Testing to be carried out by the Contractor

Reference Spec.	Work, Goods or Material	Property Tested	Defined and Tested in Accordance with Clause	Frequency	Acceptable Limits		Certification Requirements	Comments
					Upper	Lower		
SERIES 1000 to DE Spec 033 Specification - PQ Concrete								
Defence Estates Specification 033 (DE Spec 033)	Water	Source Sulfate Content (N)	DE Spec 033 Cl 3.5 Tested in accordance with BS EN 1008	1 per source	Tab 6/2	Tab 6/2	Required	Water from a water company can be used without testing. Water from other sources shall be tested to show compliance with BS EN 1008.
DE Spec 033	Cement	Source	DE Spec 033 Cl 3.4, BS EN 197-1 & BS EN 197-2	1 per source			Supplier certification	Supplier certificate providing the information described in Cl 3.4.4 (Table 3.4) of the specification.
DE Spec 033	Fine Aggregate	Sieve Analysis	DE Spec 033 Cl 3.3 & 8.2, BS EN 933-1	1 per week	Table 3.3	Table 3.3	Supplier certification	Visual assessment to be undertaken daily and additional tests carried out if consistency of material is suspect.
		Soundness Value	DE Spec 033 Cl 3.3 & 8.2	1 per source	Table 3.2	Table 3.2	Supplier certification	
		Fines Content	DE Spec 033 Cl 3.3 & 8.2, BS EN 933-1	1 per source	Table 3.2	Table 3.2	Supplier certification	
		Moisture Content		1 per day				Moisture content should be taken daily and batch weights adjusted accordingly.
DE Spec 033	Coarse Aggregate	Sieve Analysis	DE Spec 033 Cl 3.2 & 8.2 BS EN 933-1	1 per week	Table 3.1	Table 3.1	Supplier certification	Visual assessment to be undertaken daily and additional tests carried out if consistency of material is suspect.
		Soundness Value	DE Spec 033 Cl 3.2 & 8.2.	1 per source	Table 3.1	Table 3.1	Supplier certification	
		Flakiness Index	DE Spec 033 Cl 3.2 & 8.2 BS EN 933-3	1 per source	Table 3.1	Table 3.1	Supplier certification	
		Resistance to Fragmentation	DE Spec 033 Cl 3.2 & 8.2 BS EN 1097-2	1 per source	Table 3.1	Table 3.1	Supplier certification	
		Fines Content	DE Spec 033 Cl 3.2 & 8.2, BS EN 933-1	1 per source	Table 3.1	Table 3.1	Supplier certification	

		Moisture Content		1 per day				Moisture content should be taken daily, and batch weights adjusted accordingly.
DE Spec 033	PQ Mix	Compacting Factor	DE Spec 033 Cl 5.15.1, 6.2.4 & 8.5 BS EN 12350-4	First daily delivery from each mixer, then at least every hour during production.	+ 0.03 of the job standard compacting factor	- 0.03 of the job standard compacting factor	Contractor QA certificate	No more than 3/20 trials will fall outside the acceptable limits. A mean compacting factor shall be obtained from the accepted trial area.

Reference Spec.	Work, Goods or Material	Property Tested	Defined and Tested in Accordance with Clause	Frequency	Acceptable Limits		Certification Requirements	Comments
					Upper	Lower		
DE Spec 033		Air Content	DE Spec 033 Cl 5.15.3, 7.2.2 & 8.5 BS EN 12350-7	First daily delivery from each mixer, then at least every hour during production i.e. on the same deliveries the compacting factor test is applied.	Air content by volume, for: 20mm nominal maximum aggregate 6.0% +/- 1%		Contractor QA certificate	If the air content of the sample falls outside of these limits, then two further tests shall be undertaken. If either of these fail, then mixing shall stop and the mix adjusted.
		Cube Strength	DE Spec 033 Cl 5.15.2, 6.1.2, 6.2.3 & 8.5 BS EN 12390-3	From each sample two cubes shall be made. One sample shall be taken from every 50m ³ .	The minimum required compressive strengths of the cubes are given in DE Spec 033 Cl 5.15.2, 6.1.2, 6.2.3, and 8.5.		Contractor QA certificate	
		Corrected core strength	DE Spec 033 Cl 5.28.1, 6.2.5, & 8.6 prEN 13877-2	Cores will be taken from laid concrete 7 and 14 days after it has been laid.	The minimum required compressive strengths of the cores are given in DE Spec 033 Cl 5.28.1, 6.2.5 and 8.6		Contractor QA certificate	
		Concrete Density	DE Spec 033 Cl 5.28.1, 6.2.5 & 8.6 BS EN 12390-7	2 for every 5 bays laid, with a minimum of 2 per day.			Contractor QA certificate	
		Voids/ honeycombing	DE Spec 033 Cl 5.28.1, 6.2.5 & 8.6		Cl 6.2.5	Cl 6.2.5	Contractor QA certificate	
		Slab Thickness	DE Spec 033 Cl 5.28.1 & 8.6 prEN 13863-4		-	0mm	Contractor QA certificate	
		Joint Filler	DE Spec 033 Cl 3.9	1 per source			Supplier certification	
		Joint Seals	DE Spec 033 Cl 5.29.3.4, 5.30.5 & 8.6	1 per 100m laid.	BS 2499 Part 2	BS 2499 Part 2	Contractor QA certificate	

			BS 2499 Part 2		BS 5212 Part 2	BS 5212 Part 2		
			BS 5212 Part 2					

1.6 APPENDIX 1/6: SUPPLY AND DELIVERY OF SAMPLES TO THE ENGINEER

- 1.6.1 Samples comparable to those specified in this Appendix shall be necessary for any equivalent work, goods or materials proposed by the Contractor (Refer to Sub-Clause 105.4 of the Specification).
- 1.6.2 Unless otherwise shown in this Appendix 1/6 samples of work, goods or materials schedule under any one Clause are required for all such works, goods or materials in the Works.
- 1.6.3 Unless otherwise scheduled under Clause 2602 of the Specification samples of concrete complying with that Clause are not required.
- 1.6.4 These samples shall be in addition to those taken and tested by the Contractor in accordance with Clause 105.2 of the Specification.

Table 1.4 List of delivered samples

Specification / Series or Clause	Sample Description	Frequency of Sampling	Delivery Location	Comments
503,505, 512,513	Samples of Aggregates	Samples to establish compliance with the Specification shall be supplied as the Engineer may reasonably require	Site Office of the Engineer	
600 series	Samples of earthwork materials	Sample to establish compliance with the specification schedule supplied as the Engineer may reasonably require	Site Office of the Engineer	
612	Field dry density test samples		Site Office of the Engineer	
800 series	Samples of road pavement unbound materials		Site Office of the Engineer	
900 series	Samples of bituminous mixtures		Site Office of the Engineer	
924	Samples of binder as described in sub-Clause 924.14	2 samples for each shift worked for each 1000m ² completed, whichever is the lesser	Site Office of the Engineer	
1000 series	Samples of fresh concrete and aggregates		Site Office of the Engineer	
1700 series	Samples of aggregates and fresh concrete		Site Office of the Engineer	
1903	1kg bagged sample of abrasive	Before start of working and once during each work session	Site Office of the Engineer	

Specification / Series or Clause	Sample Description	Frequency of Sampling	Delivery Location	Comments
1910	A and B samples in 500mm tins	2 sets of A sample 25 sets of B sample	Independent testing laboratory to be advised by Engineer	
2204 Series	Samples as described in sub-Clause 2204 – BS6779 Part 1 sub-clause 19.2.5	Samples as described in Clause 2204 - BS6779: Part 1 sub-clause 19.2.5	Independent testing laboratory to be advised by Engineer	Qualified welding inspector to select sample component
2409	Samples of natural building stone	One sample comprising not less than 10 stones per type	Site Office of the Engineer	

1.7 APPENDIX 1/7: SITE EXTENT AND LIMITATIONS ON USE

Refer to the Civil and Structural Specification “SP-1001”

1.8 APPENDIX 1/8: OPERATIVES FOR THE EMPLOYER

Refer to the Civil and Structural Specification “SP-1001”.

1.9 APPENDIX 1/9: CONTROL OF NOISE AND VIBRATION

Refer to the Civil and Structural Specification “SP-1001”.

1.10 APPENDIX 1/10: PRINCIPAL STRUCTURES TO BE DESIGNED BY THE CONTRACTOR

1.10.1 GENERAL REQUIREMENTS

1.11 APPENDIX 1/11: STRUCTURAL ELEMENTS AND OTHER FEATURES TO BE DESIGNED BY THE CONTRACTOR

Table 1.5 List of features to be designed by the Contractor

Structural Element or another Element to be Designed by Contractor	Location	Design Specification
Carriageway Protection Measures	N/a	Series 100
Public lighting network, columns, foundations, lighting levels (permanent and temporary)	n/a	Series 1300
Protection measures for Privately and Publicly Owned Services and Supplies	All Locations	Series 100
Foundations for the FATO and TLOF lighting, including sub-soil drainage for insert lights.	All locations	In accordance with the manufacturer's written requirements, EN 1990-1999,

Structural Element or another Element to be Designed by Contractor	Location	Design Specification
		the Specification and the Drawings listed in Appendix 0/4 of SP-1021.
Traffic Management Plans	All Locations	Chapter 8 of Traffic Signals Manual
Waste Management Plan	All Locations	
Construction Management Plan	All Locations	
Steel Connections	All Locations	Eurocode
All Temporary Works	All Locations	Eurocode
Bridge Deck, parapets and road resurfacing	As shown on the Drawings listed in Appendix 0/4 of SP-1021.	See requirements below.

1.12 APPENDIX 1/12: SETTING OUT AND EXISTING GROUND LEVELS

Refer to the Civil and Structural Specification “SP-1001”.

1.13 APPENDIX 1/13: PROGRAMME OF DESIGN AND EXECUTION AND COMPLETION OF THE WORKS

Refer to the Civil and Structural Specification “SP-1001”.

1.14 APPENDIX 1/14: MONTHLY STATEMENTS

Refer to the Civil and Structural Specification “SP-1001”.

1.15 APPENDIX 1/15: ACCOMMODATIONS WORKS

1.15.1 Accommodation works may be agreed during the period of the Contract, the Contractor should provide for working out of sequence while such agreements are finalised.

1.15.2 Accommodation Works and boundary treatment proposed by the Employer and included in the Tender Documentation are shown on Drawing 1111 as listed in Appendix 0/4 of this SP-1021.

1.15.3 The Contractor shall complete any Accommodation Works as early as possible within the period for completion of the Works. Not with standing this, private access must be provided across the Site to adjoining landowners and affected parties to the same level as that which will be provided by the Accommodation Works until such time as the Accommodation Works are complete. The

Accommodation Works shall be carried out in accordance with a stated programme of which each owner shall be kept informed.

- 1.15.4 Before any construction is begun in the vicinity of any property the Contractor shall, at his own cost, engage an independent engineer to prepare a written and photographic record of the internal and external condition of each property.
- 1.15.5 The permanent fencing used for accommodation works shall be in accordance with point 3 of F.2 of S148 Department of Agriculture, Food and the Marine "Minimum Specification for Farm Fencing (with one row of barbed wire below the sheep wire and one row of barbed wire on the top, except that the upper strand of barbed wire is to be replaced with plain wire for any fence adjoining a public or private road).
- 1.15.6 All field gates used in the Works shall comply with the details shown in TII CC-SCD-00309 Type 1, unless shown otherwise, and shall include mesh fabric in accordance with TII CC-SCD-00309 on the lower half of the gate.

1.16 APPENDIX 1/16: PRIVATELY & PUBLICLY OWNED SERVICES & SUPPLIES

- 1.16.1 The Contractor must satisfy himself as to the exact location of all services, prior to carrying out work in any area of the Site.
- 1.16.2 Details of preliminary arrangements that have been made with Statutory Undertakers and others for the alteration of services affected by the Works are listed in this Appendix. No arrangements have been made in respect of temporary alterations of service and supplies necessary for the execution of the Works. The Contractor shall make arrangements with the Statutory Undertakers for such temporary alterations of service or supplies.
- 1.16.3 The Contractor shall make arrangements with the Statutory Undertakers and others concerned for the co-ordination of his work with all work that needs to be done by them or their Contractors concurrently with the Works. Compliance with the periods of notice given in this Appendix does not relieve the Contractor of his obligations.
- 1.16.4 Private services to individual properties have not generally been listed or shown on the Drawings. The Contractor shall make arrangements with the Statutory Undertakers and others concerned for the phasing of all necessary disconnections and diversions of private services affected by the Works.
- 1.16.5 Disconnected apparatus shall be removed by the Contractor only with the prior consent of the Authority concerned.
- 1.16.6 It may be necessary to extend some of the existing services and their protection to ensure that maintenance access is available outside of the areas under construction.
- 1.16.7 The names, addresses and telephone numbers of the authorities and public utilities companies serving in the locality are available upon request.
- 1.16.8 All chamber covers; gratings and frames are to comply to D400 unless service provider specifies a lower grade.

1.17 APPENDIX 1/17: TRAFFIC SAFETY AND MANAGEMENT

1.17.1 TRAFFIC SAFETY MANAGEMENT REQUIREMENTS

- 1.17.1.1 The Contractor shall be responsible for the planning, implementation, maintenance and removal of traffic safety and management measures required in order to facilitate the work.
- 1.17.1.2 All work will require a road opening licence is applied for from the Road Management Office. The conditions of the road opening licence are to be complied with by the Contractor.
- 1.17.1.3 All text displayed on any temporary traffic signage is to be bi-lingual.
- 1.17.1.4 The Contractor shall comply at all times with the requirement of "Chapter 8 of the Traffic Signs Manual" and of "Guidance for the control and management of traffic at road works" of the Department of Transport, published by TII and available from the Government Publications Office, Sun Alliance House, Molesworth Street, Dublin 2 and from online sources (e.g. www.lgma.ie and www.trafficsigns.ie), and any additional requirements detailed in the Design Manual for Roads and Bridges.
- 1.17.1.5 Without prejudice to the General Conditions of Contract, the Contractor shall, within one week of the commencement of work on Site provide the Engineer with detailed traffic management plans showing the sequence of construction, within the programme constraints of Appendix 1/13, including the following information as a minimum:
- Geometric Design
 - Width of Lanes
 - Working Areas
 - Safety Zones
 - Access and exit locations for construction vehicles
 - Barriers
 - Signing
 - Road markings
 - Temporary lighting
 - Provision for pedestrians
 - Provision for emergency services
 - Timing of operations.
 - Road lighting
- 1.17.1.6 Drawings showing the Contractor's Traffic Management plans shall be to a scale not less than 1/2000, supplemented by drawings at 1/500 scales as necessary, or as required by the Engineer.
- 1.17.1.7 The Contractor shall be subject to the full statutory procedures outlined in the Temporary Closing of Roads Regulations. The period of closure shall be the minimum to facilitate construction of the Works. All applications relating to road closures, lane occupations, signs or signals must be submitted to the Engineer in writing and require the following notice:
- for making road closures 16 weeks (if permitted on the scheme)
 - of non-prescribed signs 4 weeks

- temporary traffic signals 4 weeks

1.17.1.8 Should the Contractor wish to pursue a special Road Works Speed Limit Order shall be subject to the full statutory procedures as outlined in the Road Traffic Act of 2004. As set out in the Act the period of order shall be at the discretion of the County Manager although the Garda Commissioner is named in the Act as having the power to ask for the Order to not be granted or to be rescinded. The order cannot stand for any period longer than one year by law and is unlikely to be awarded for this length. All applications relating to Reduced Speed Limit Orders shall be submitted to the Engineer in writing prior to being made to the Statutory Authority. It should be noted that like the application for Road Closure this is a statutory process outside of the Contract. The application will require the following notice:

- 12 weeks

1.17.1.9 The Contractor shall, in accordance with Clause 117, be responsible for the maintenance of all public roads, site access roads and temporary diversions within the site until the date the Employer's Representative considers the Works to be substantially. The Contractor shall constantly monitor the public roads during the execution of the Works. Any defects identified shall be rectified immediately to the satisfaction of the Engineer.

1.17.1.10 The Contractor shall keep a daily record of all defects, the times when they were identified or reported to him, the action taken to correct the defects, and the times when they were successfully corrected. A copy of this record shall be forwarded to the Engineer on the following day, until the completion of those Works.

1.17.1.11 In the event of a traffic accident occurring adjacent to any of the Works, the Contractor shall immediately contact the Gardaí and the Engineer informing them of the following:

- Location of the accident
- The seriousness of the accident and whether any persons are trapped, whether the collision involves vehicles carrying inflammable, corrosive or hazardous substances, whether there is a possibility of ignition from leaking fuel or chemicals

1.17.1.12 Liaison with Traffic Gardaí shall be through the local Garda office.

- The Contractor shall provide telephone numbers of a minimum of 3 No. Personnel who can be contacted by the Gardaí and/or Engineer, both during and outside normal working hours, and who shall be responsible for initiating whatever action shall reasonably be required in the event of an emergency.

1.17.1.13 All drivers including those delivering plant and materials must be given clear instructions regarding the traffic arrangements applicable at any particular time.

1.17.1.14 The Contractor shall be responsible for maintaining the running traffic carriageway and any pedestrian routes adjacent to the Works in a clean and safe condition at all times.

1.17.1.15 The Contractor shall assist the Gardaí in moving wide/abnormal loads

through the Works by modifying the signing/coning as necessary. Signs/cones so moved shall be replaced immediately the abnormal loads have passed through the Works.

- 1.17.1.16 Heavy Goods Vehicles used on Site by the Contractor, his sub-contractors or suppliers must be fitted with an audible reversing warning device.
- 1.17.1.17 Regular meetings between the Engineer, Contractor, the Gardaí and Roads Authority shall be arranged and take place throughout the duration of the Works.
- 1.17.1.18 Pedestrian Traffic.
- 1.17.1.19 The Contractor shall programme the Works with the aim of ensuring the safety of pedestrians / cyclists at all times and keeping disruption to pedestrians / cyclists to an absolute practical minimum, and shall provide the Engineer with a method statement to demonstrate how he intends to achieve that aim.
- 1.17.1.20 The Contractor shall liaise with other traffic management schemes that may affect or be affected by the scheme traffic management to provide a co-ordinated traffic management design of the area.
- 1.17.1.21 The Contractor is to maintain all turning movements to a minimum at all times throughout the Works.

1.18 APPENDIX 1/18: TEMPORARY DIVERSIONS FOR TRAFFIC

1.18.1 GENERAL REQUIREMENTS

- 1.18.1.1 No temporary diversions have been agreed with the Local Authority/Employer and the Contractor shall not rely on the approval of any temporary diversions when planning the Works.
- 1.18.1.2 The Contractor shall provide for the construction and maintenance of all temporary roadways that are necessary for the temporary diversion of traffic wherever the Works interfere with existing public or private roads or other ways over which there is a public or private right of way, whether vehicular or pedestrian. Before proposing any temporary traffic diversions.
- 1.18.1.3 The Contractor shall provide for the construction and maintenance of all temporary traffic management necessary for the temporary diversion of traffic and or pedestrians wherever works are to be executed by a service or utility provider engaged by the Employer in the execution of works associated with the completion of the project.
- 1.18.1.4 The Contractor shall consult with the Local Roads Authority, and the Gardaí, and shall then submit an outline of his requirements to the Engineer for his comments. Following this, the Contractor shall submit a formal application to the appropriate Authority for any statutory orders required to be made or notices required to be published. The Contractor shall allow a period of 6 weeks for the orders to be made and notices to be published.
- 1.18.1.5 The Contractor shall comply with the following provisions for constructing temporary roadways:
 - The temporary roadways shall be constructed to an alignment and design approved by the Engineer. Any temporary diversions of National Roads

shall be designed in accordance with the Design Manual for Road and Bridges to a design speed of 85Kph. Any temporary diversions of Regional, Local or Link roads shall be designed in accordance with the Design Manual for Road and Bridges to a design speed of 50Kph, unless noted otherwise and agreed with the Engineer.

- Temporary diversions of roads shall have a bituminous surface, consisting of not less than 100mm thick dense bitumen macadam on 200mm thick sub-base to Clause 804 on a firm foundation.
- The minimum cross fall or super-elevation shall be 3%, and gradients shall not be greater than 6 per cent (except where otherwise agreed in writing by the Engineer).
- The minimum carriageway width, radius and headroom for temporary diversions and temporary roads shall be as follows:

Table 1.6 Carriageway dimensions

	Width (m)	Headroom (m)
Single lane traffic	3	5.1
Two lane traffic – two ways	6	5.1
Access roads	3	4.25
Footpaths	1.8	2.5

- The standard of construction and lighting of diversions shall be suitable in all respects for the class or classes of traffic using the existing carriageways.
- Suitable drainage is to be provided.
- Temporary road markings, traffic signs and barriers are to be provided as necessary.
- Temporary fencing/barriers shall be provided to separate pedestrians from vehicular traffic.
- Where single file traffic is necessary on a public road by reason of the construction of the Works, the Contractor shall, subject to the approval of the Engineer, provide and maintain a minimum carriageway width of 3.0m or wider where necessary at curves, junctions and other locations specified in documents.
- When alternate one-way (shuttle) working of traffic is required, the Contractor shall provide and maintain time activated electric traffic light control signals and such traffic signs as may be approved by the Engineer and the Local Roads Authority.
- Any temporary diversion of a farm track shall have a smooth finished of a minimum of 200 mm compacted granular materials.
- The temporary road pavement shall be maintained during the construction of the Works until such time as the traffic diversion is no longer required.
- When the diversion is no longer required, the diversion materials are to be removed and the area treated as per the requirements of the Contract.

1.18.1.6 The Contractor shall supply details of the following for each temporary road diversion:

- Phasing of the Works

- Drawings showing traffic management layouts including as follows:
 - Position of traffic signs and signals
 - Width of Lanes
 - Working areas
 - Safety zones
 - Entry points for site vehicles

1.18.1.7 The Contractor shall provide and maintain access to all existing properties adjacent to the Works.

1.18.1.8 Temporary traffic lights powered by a generator will not be permitted within 100 metres of any occupied property.

1.18.1.9 The Contractor is to keep all turning movements to a minimum throughout the Works.

1.18.1.10 The existing traffic lights are to be maintained as operational until the new lights are switched on.

1.18.1.11 At least 4 weeks in advance with weekly repeat and daily repeat in the week prior to the proposed diversion of any temporary diversions required for the Works the Contractor shall advise AA Road watch to make notices on local roads to advertise to the general public the proposed diversions.

Table 1.7 Temporary diversions for traffic specified by the engineer

Description	Drawing ref or number	Construction/ design requirements	Maintenance requirements (including timescale for responsibilities)	Remarks (including constraints or reinstatement details)
None	None	None	None	None

1.18.2 TEMPORARY DIVERSIONS PROPOSED BY CONTRACTORS

1.18.2.1 All proposals by the Contractor to comply with Clause 117, 118 and 119 of the National Roads Authority Specification for Road Works.

1.18.2.2 Were the Contractors wishes to avail of a road closure and or traffic diversion an application must be made in the first instance to the relevant Local Authority.

1.18.2.3 The application is subject to statutory procedure; the Contractor should provide for a minimum period of 16 working weeks for completion of the process.

1.18.2.4 Any closure will be restricted to a period of not exceeding 6 working weeks.

1.18.2.5 Any closure will be restricted to a maximum length of 300m.

1.18.2.6 At all times the Contractor will provide access and through traffic for residents if applicable.

1.18.2.7 All costs attributed to the application and execution of the temporary closure will be borne by the Contractor, this includes any temporary works to facilitate local access.

1.18.2.8 For the restrictions on the provision of temporary speed limits please see

Appendix 1/17 Point 1.8 also see the Road Traffic Act of 2004.

- 1.18.2.9 The extents of any one section of works shall be limited to no more than 300m of open excavation at one time unless agreed otherwise with the Employer

1.19 APPENDIX 1/19: ROUTEING OF VEHICLES

1.19.1 GENERAL REQUIREMENTS

- 1.19.1.1 The Contractor shall consider the requirements of the Employer regarding restrictions on the routeing of vehicles under the control of the Contractor, his sub-Contractors and suppliers when planning and programming the execution of the Works.
- 1.19.1.2 The Contractor shall provide, erect and maintain such traffic signs, lamps, barriers, and the like, complying with Clause 117 of the Specification as may be required to ensure the observance of the requirements and restrictions detailed in this Appendix.
- 1.19.1.3 The Contractor shall limit the passage of constructional plant, equipment and materials, to and from the Site to permitted access roads.
- 1.19.1.4 The Contractor's proposals for taking access to the Site from the public road shall comply with the requirements of the Employer.
- 1.19.1.5 The Contractor shall establish and comply with the requirements of the Roads Authority in respect to loaded dump trucks using Public Roads.
- 1.19.1.6 Were the Contractors wishes to avail of a road closure and or traffic diversion an application must be made in the first instance to the relevant Local Authority.
- 1.19.1.7 The application is subject to statutory procedure; the Contractor should provide for a minimum period of 16 working weeks for completion of the process.
- 1.19.1.8 Any closure will be restricted to a period of not exceeding 6 working weeks.
- 1.19.1.9 At all times the Contractor will provide access and through traffic for residents.
- 1.19.1.10 All costs attributed to the application and execution of the temporary closure will be borne by the Contractor, this includes any temporary works to facilitate local access.

1.19.2 PERMITTED ACCESS TO AND FROM SITE

- 1.19.2.1 The Contractor, his subcontractors and suppliers shall use only the public local road to the site entrance for all purposes in connection with the Works (including the import of acceptable and disposal of unacceptable materials) unless otherwise agreed by the Engineer. To bringing material to the bridge, the Contractor, his subcontractors and suppliers shall only use public roads.

1.20 APPENDIX 1/20: RECOVERY VEHICLES FOR BREAKDOWNS

- 1.20.1 At all times when the public road has been restricted in width due to the Works, the Contractor shall be responsible for the removal of shed loads and vehicles that are stationary due to mechanical breakdowns, accident damage or have been abandoned in the trafficked road. The Contractor shall accept the instructions of the Engineer or the Gardaí in connection with this service but generally will be required to remove the obstruction clear of the Works, such that the running carriageway is cleared in the shortest possible time. Should the Gardaí be unavailable then the driver's consent will be obtained prior to such removal.
- 1.20.2 The Contractor shall make no charge for this recovery service to the owner or driver of the recovered vehicle but will be deemed to have allowed in his Tender Total for meeting this requirement.
- 1.20.3 If a vehicle cannot be moved immediately and, in the opinion of the Engineer and Gardaí, the traffic flows are heavy enough to justify such action; traffic shall be directed onto an emergency route.

1.21 APPENDIX 1/21: INFORMATION BOARDS

- 1.21.1 Information boards are not required.

1.22 APPENDIX 1/22: PROGRESS PHOTOGRAPHS

- 1.22.1 The following specification fulfils the progress photographs requirements for the whole of the Works.
- 1.22.1.1 Ground Progress Photographs
- 1.22.1.2 A set of ground progress photographs -1 digital copy and 1 No. A5 colour print supplied for each one. The photographs shall also be supplied in Kodak photo CD standard format, or equivalent. A set of ground progress photographs shall be taken at 1 month intervals and as directed by the Engineer. The first set shall be taken prior to commencement of the Works.
- 1.22.1.3 The prints and CD's arising from above shall be supplied in suitable albums/cases.

Table 1.8 Temporary diversions for traffic specified by the Employer's Representative

Location	Type	No.	Aerial/ Ground	Frequency	Remarks
Whole works	Digital and paper	2 no. set	Ground/ hoist	Stat of project and on completion of project	To be carried out on the first working day of each month and delivered to employers' representatives within 5 working days

1.23 APPENDIX 1/23: SUBSTANCES HAZARDOUS TO HEALTH

1.23.1 AC. “ASBESTOS” CONCRETE

1.23.1.1 Asbestos is a naturally occurring mineral, made up of long thin fibres. These fibres can be dangerous if they are inhaled as dust and are known to contribute to increased risk of lung cancer, asbestosis (scarring of the lung tissue) and mesothelioma (cancer of the lining of the chest and the lining of the abdominal cavity).

1.23.1.2 The Contractor is responsible for those working in an environment with possible asbestos- containing materials are required by law to follow these guidelines:

- Identify any asbestos on a site before work commences.
- Assess the risks to employees' health from the work that they do and decide what precautions are necessary to protect them (i.e., assess the type, condition, quantity, location of material(s), etc.)
- Provide employees with information, instruction and training so they know the risks involved in their work and the precautions they should take.
- Provide employees with the necessary protective gear (clothing and respiratory protective equipment) and be responsible for its cleaning and upkeep, as appropriate.
- Make sure there are adequate facilities for employees to wash, eat and drink.
- Prevent employees' exposure to asbestos or do all that is possible to keep the amount of asbestos in the air to a minimum.
- Dispose of any waste containing asbestos properly.
- Let employees know the results of any measurement of asbestos dust in the air in their work area. There are limits to the amount of asbestos dust a person can breathe over an eight-hour period. The limits are 0.3 fibres per millilitre of air for blue and brown asbestos and 0.6 fibres per millilitre of air for white asbestos.

1.24 APPENDIX 1/24: QUALITY MANAGEMENT SYSTEM

1.24.1 For QMS requirements refer to the main Civil and Structural Specification “SP-1001” and the following section.

1.24.2 The following shall be the list of accepted Quality Management Schemes referred to in Sub-Clause 104.3 and 104.4 of the Specification.

1.24.3 Manufacturers of Portland Cement as per Concrete Specification “SP-1002”.

1.24.4 Supply and Erection of Fences

1.24.4.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9

1.24.4.2 Specification:

- General fencing shall be in accordance with Series 300 of the TII Specification for Road Works, the Department of Agriculture, Food and the Marine “Minimum Specification for Farm Fencing (S148)” and the following or equivalent standards - BS 1722: Parts 1 to 13-Specification for Fences.
- Safety fencing shall be in accordance with Series 400 of the TII Specification for Road Works and the drawings referred to in the Contract.
- Note: This scheme applies for general fencing and safety fencing. The part of this scheme which relates to safety fences requires training on an approved course run through the Local Government Management Board or the Construction Industry Training Board.

1.24.5 Manufacture of Safety Fencing Components

1.24.5.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd's Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.5.2 Specification:

- Safety fencing components shall be in accordance with Series 400 of the TII Specification for Road Works and the Drawings referred to in the Contract.

1.24.6 Manufacture of Industrial Fasteners and Associated Items

1.24.6.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd's Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.6.2 Specification:

- Nuts, bolts and fixings shall be in accordance with the 300, 400, 500, 1300, 1800, 2200 and 2500 Series of the Specification and shall be manufactured to the requirements of the following standards or their equivalent Irish or British Standard or European Norm.
- BS 3410 - Specification for Metal Washers for General Engineering Purposes
BS 4320 - Specification for Metal Washers for General Engineering Purposes
- BS 4395 - Specification for High Strength Friction Grip Bolts and Associated Nuts and Washers for Structural Engineering.
- BS 4933 - Specification for ISO Metric Black Cup and Countersunk Head Bolts and Screws with Hexagon Nuts
- ISO 898 - Mechanical Properties of Fasteners
- Part 1: Bolts, Screws and Studs
- Part 2: Nuts with Specified Proof Load Values ISO 4014 -
Hexagon Head Bolts Product Grades A and B ISO 4016
- Hexagon Head Bolts Product Grade C

- ISO 4017 - Hexagon Head Screws Product Grades A and B ISO 4018 - Hexagon Head Screws Product Grade C
- ISO 4032 - Hexagon Nuts, Style 1 Product Grades A and B ISO 4034 - Hexagon Nuts Product Grade C
- Alternatively, nuts, bolts and fixings shall be manufactured to the dimensions and tolerances of the Standards listed above, using materials to the following Standards.
- BS 6105 - Specification for Corrosion Resistant Stainless-Steel Fasteners
- ASTM A325-89 Specification for High Strength Bolts for Structural Steel Joints Notes:
- (i) Where the Contractor can demonstrate that the fastener required is made by fewer than three firms within this scheme, the requirements to comply with the scheme shall be deemed not to apply.
- (ii) Where the Contractor obtains fasteners from a stockist, the stockist shall be registered under Part 1 of the BSI Registered Stockist System. The System Requirement shall be Level A, Quality Assured Material with Lot Traceability (P00012). Where the Contractor can demonstrate that the fastener required is supplied by fewer than three stockists within this system, the requirements to comply with the System shall be deemed not to apply.

1.24.7 Timber Preservation shall be as per the Department of Agriculture, Food and the Marine “Minimum Specification for Farm Fencing (S148)”, the Specification for Road Works and the following.

1.24.7.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd’s Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.7.2 Specification:

- Chemicals used and timber preservative treatment to be carried out shall comply with Clause 311 of the Specification and the Department of Agriculture, Food and the Marine “Minimum Specification for Farm Fencing (S148)”.
- Timber used for general fencing shall be treated by firms registered by these bodies, and firms shall only obtain chemical specialities used in treatment from a registered source.

1.24.8 The Manufacture, Supply and Verification of Lighting Columns and Bracket Arms

1.24.8.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd’s Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.8.2 Specification:

1.24.8.3 The manufacture, supply and verification of lighting columns and bracket arms shall comply with Series 1300 of the TII Specification for Road Works and the Department of Transport's Departmental Standards BD/26 and BD/90 Part IV.

1.24.9 Application of Road Markings

1.24.9.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd's Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.9.2 Specification:

- Road marking material shall be in accordance with Series 1200 of the TII Specification for Road Works and shall be manufactured to comply with all the appropriate requirements and the following standards.
- I.S. EN 1436 Road marking materials - road marking performance for road users.

1.24.10 I.S. EN 1871 Road marking materials - physical properties. Traffic Sign Manufacture.

1.24.10.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd's Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.10.2 Specification:

- All works shall be in accordance with the relevant Clauses of Series 1200 of the TII Specification for Road Works.

1.24.11 Installation and Maintenance of Electrical Apparatus and Cabling for Highway Lighting and Traffic Signs

1.24.11.1 Certification Body shall be:

- BSI, 389 Chiswick High Road, London W4 4AL, UK; or
- The Certification and Inspection Dept. NSAI, Eolas, Glasnevin, Dublin 9; or
- Lloyd's Register Quality Assurance Ltd. Norfolk House, Wellesley Road, Croyden CR9 2DT, UK.

1.24.11.2 Specification:

- All works shall be in accordance with the relevant Clauses of Series 1400 of the TII Specification for Road Works.

1.25 APPENDIX 1/25: PRODUCT CERTIFICATION SCHEMES

The following shall be the list of accepted product certification schemes accepted in the Contract and referred to in Clauses 104.4 and 104.6 of the Specification.

Table 1.9 Marked Schemes

Where a BS No. or Equivalent Irish Standard listed here has been withdrawn or superseded, the replacement standard shall be used as an accepted product certification scheme. Where a BS No. or Equivalent Irish Standard listed in Table 1.9 has been replaced by a harmonised European standard, products produced in accordance with such harmonised standards shall be CE marked.

Kitemark or Irish Standard Mark (ISM)		
Certification Body:	BSI: The Certification and Inspection Dept., 389 Chiswick High Road London W4 4AL or NSAI, Eolas, Glasnevin, Dublin 9	
BS No. or Equivalent Irish Standard	Title	Specification Series
BS 12	Specification for Portland Cement	500 1600 1700
BS 65	Specification for vitrified clay pipes, fittings and ducts	500
BS 437	Specification for cast iron spigot and socket drainpipes and fittings	500
BS 1247	Manhole steps Part 1: Specification for galvanized ferrous or stainless-steel manhole steps Part 2: Specification for plastic encapsulated manhole steps	500
BS 3262	Hot-applied thermoplastic road marking materials	1200
BS 3506	Specification for unplasticized PVC pipe for industrial purposes	500
BS 3656	Specification for asbestos-cement pipes, joints and fittings for sewerage and drainage	500
BS 4346	Joints and fittings for use with unplasticised PVC pressure pipes	500
BS 4962	Specification for plastic pipes and fittings for use as sub-soil field drains	500
IS 1	Portland cement	500 1600 1700
IS 5	Aggregates for concrete	500 1600 1700
BS 5481	Specification for unplasticised PVC pipe and fittings for gravity sewers	500
BS 5911	Precast concrete pipes, fittings and ancillary products Part 100: Specification for unreinforced and reinforced pipes and fittings and fittings with flexible joints. Part 103: Specification for prestressed non-pressure pipes and fittings with flexible joints Part 110: Specification for ogee pipes and fittings (including perforated) Part 114: Specification for porous pipes Part 200: Specification for unreinforced and reinforced manholes and soakaways of circular cross section Part 230: Specification for road gullies and gully cover slabs	500

BS 6044	Specification for pavement marking paints	1200
BS 6087	Specification for flexible joints for grey or ductile cast iron drainpipes and fittings (BS 437) and ventilating pipes and fittings (BS 416)	500
BS 6088	Specification for solid glass beads for use with road marking compounds and other industrial uses	1200
EN 124	Gully tops and manhole tops for vehicular pedestrian areas. Design requirements, type testing, marking, quality control.	500
EN 295	Vitrified clay pipes and fittings and pipe joints for drains and sewers	500
EN 598	Ductile iron pipes and Ductile iron pipes, accessories and the joints for sewerage applications. Requirements and test methods	500
EN 60920	Specification for ballasts for tubular fluorescent lamps. General and safety requirements.	1400
EN 60921	Specification for ballasts for tubular fluorescent lamps. Performance requirements.	1400
EN 60922	Specification for general and safety requirements for ballasts for discharge lamps (excluding tubular fluorescent lamps).	1400
EN 60923	Specification for performance requirements for ballasts for discharge lamps (excluding tubular fluorescent lamps).	1400
EN 61048	Specification for capacitors for use in tubular fluorescent and other discharge lamp circuits. General and safety requirements	1400
EN 61049	Specification for capacitors for use in tubular fluorescent and other discharge lamp circuits. Performance requirements	1400
(b) Safety Mark		
Certification Body:	BSI: The Certification and Inspection Dept., 389 Chiswick High Road, London W4 4AL or NSAI, Eolas, Glasnevin, Dublin 9	
BS No. or Equivalent Irish Standard	Title	Specification Series
BS 5467	Specification for cables with thermosetting insulation for electricity supply for rated voltages of up to and including 600/1000 Volts and 1900/3000 Volts	1400
BS 6004	Specification for PVC-insulated cables (non-armoured) for electric power and lighting	1400
BS 6346	Specification for PVC-insulated cables for electricity supply	1400
(i) Reinforcing and prestressing steel		
Certification Body:	UK Certification Authority for Reinforcing Steels (CARES), 21 Pembroke Road, Sevenoaks, Kent TN 13 1XR or The Certification and Inspection Dept., NSAI, Eolas, Glasnevin, Dublin 9	
BS No. or Equivalent Irish Standard	Title	Specification Series
BS 4449	Specification for carbon steel bars for the reinforcement of concrete	1000 1700 2500
BS 4466	Specification for scheduling, dimensioning, bending and cutting of steel reinforcement for concrete. (Except that the Contractor or manufacturer of pre-cast concrete products may opt to obtain	1700

	straight bars from a firm within the Scheme and cut and bend them on site or at the pre-casting works respectively provided that the levels of inspection and quality assurance specified in BS 4466 are maintained.)	
BS 4482	Specification for cold reduced steel wire for reinforcement of concrete	1000 1700
BS 4483	Specification for steel fabric for the reinforcement of concrete	1000 1700
BS 5896	Specification for high tensile steel wire and strand for the prestressing of concrete	1700

Table 1.10 Non-Marked Schemes

Where a BS No. or Equivalent Irish Standard listed in Table 1.10 has been withdrawn or superseded, the replacement standard shall be used instead.

(a) Ready Mixed Concrete		
Certification Body:	The Quality Scheme for The Cert	
BS No. or Equivalent Irish Standard	Title	Specification Series
BS 12	Specification for Portland Cement	500 1600 1700
BS 146	Specification for Portland blast furnace cement	1000 1700
BS 822	Specification for aggregates from natural resources for concrete	500 1000 1100 1700 2600
BS 1014	Specification for pigments for Portland cement and Portland cement products	1700
BS 1047	Specification for air cooled blast furnace slag aggregate for use in construction	1000 1700
BS 1305	Specification for batch type concrete mixers	1000 1700
BS 1881	Testing concrete Part 106: Methods for determination of air content of fresh concrete	1700 2600
BS 3148	Methods of test for water for making concrete (including notes on the suitability of water)	1700 2400 2600
BS 3797	Specification for lightweight aggregates for masonry units and structural concrete	1700
BS 3892	Pulverised fuel ash Part 1: Specification for pulverised fuel ash for use as a cementitious component in structural concrete	500 1000 1700
BS 4027	Specification for sulphate resisting Portland cement	1700 2400

BS 4246	Specification for high slag blast furnace cement Concrete admixtures Part 1: Specification for accelerating admixtures, retarding admixtures and water reducing admixtures Part 2: Specification for air entraining admixtures Part 3: Specification for super plasticising admixtures	1000 1700
BS 5328	Concrete Part 1: Guide to specifying concrete mixers Part 2: Methods for specifying concrete mixers Part 3: Specification for the procedures to be used in producing and transporting concrete Part 4: Specification for the procedures to be used in sampling, testing and assessing compliance of concrete	1000
BS 6588	Specification for Portland pulverized fuel ash cements	1000 1700
BS 699	Specification for ground granulated blast furnace slag for use with	1000
	Portland cement	1700

1.26 APPENDIX 1/26: IRISH AGRÉMENT BOARD ROADS AND BRIDGES CERTIFICATES AND BRITISH BOARD OF AGRÉMENT CERTIFICATES

The following shall be a list of types of work, goods or materials for which proprietary products shall be required to have either an Irish Agrément Board Roads Certificate or a British Board of Agrément Certificate or an appropriate European Alternative:

Table 1.11 List of work, goods or materials that require an Agrément Certificate

Description	Specification Series
Pipes for Drainage and/or Service Ducts other than those listed in Tables 5/1 and 5/2	500
Permanent Shuttering for Road Gullies	500
Fin Drains and Constituent Materials of Edge of Pavement Drainage	500
Prefabricated Temporary Road Marking Material	1200
Reflecting Road Studs	1200
Traffic Signal and Control Equipment	1200
Concrete Coating Material	1700
Paint Formulation	1900
Waterproofing for Bridge Decks	2000
Anchorage for Metal Parapets for Vehicle Containment	2200
Bridge Deck Expansion Joints	2300
Materials for Corrugated Steel Buried Structures	3200
Protective Coatings for Corrugated Steel Buried Structures	3200
Paved Invert Systems for Corrugated Steel Buried Structures	3200

Details of products conforming to the above requirements are listed in the Index of Current Publications which may be obtained from the Publications Department, Irish Agreement Board.

Where types of work, goods or material for which proprietary products are required to have an Irish Agreement Board Roads and Bridges Certificate, a British Agreement Board Certificate shall be acceptable.

1.27 APPENDIX AR1/70: AS-BUILT RECORDS

The Contractor shall prepare a complete set of as-built drawings for the scheme to be submitted to the Engineer and PSDP within one month of the date of substantial completion. Drawings shall be prepared for, inter alia, as appropriate:

- Safety barriers
- Fencing
- Drainage pipes, manholes, gullies and petrol interceptors
- Ducting and chambers
- Earthworks and Capping
- Pavement Construction
- Kerbs and Paved Areas
- Traffic Signs and Road Markings including gantry signage
- Public Lighting
- Cabling
- Landscaping
- Amendments to all existing Services

All drawings submitted for formal review shall be provided in the following format, to be agreed with the Engineer:

- AutoCAD DWG format and PDF
- Hard Copy Format (2 No. Copies at A1). The scale of all drawings should match the scales used in the Drawings as listed in Appendix 0/4 of SP-1021.

The following standards shall also apply:

- All CAD files shall be translated to an acceptable version of AutoCAD 2026 DWG format, along with any font, line style, block or other necessary definition.
- Each transfer shall be fully documented to detail items such as level use cross-referenced files, necessary directory structure, etc.
- Full details of the programs used to generate the DWG format file shall be attached for reference.
- Data transfers shall be readable using equipment currently employed by the Engineer. For small transfers this may take the form of cc: Mail attachments; for large transfers e.g. area completion, this may also be on a USB memory key or shared data web-link.

Generally, the current version of all application software, shall be deemed to be standard, if it is compliant with the operating characteristics of the Engineer's computer systems.

The Contractor shall also submit the completed Safety File, as required in the Health, Safety and Welfare at Work (Construction) Regulations 2013-2021. The submitted safety file shall be submitted as a complete file in both soft and hard copies. The Safety File shall be submitted no later than one month after substantial completion.

Water and wastewater infrastructure As-built information shall comply with the Irish Water and Transport Infrastructure Ireland (TII) As-built requirements.

1.28 APPENDIX AR1/71 EMERGENCY SERVICES

The Contractor shall develop and clearly communicate a 24hr, 7 day a week emergency services protocol from the start of the Contract until the completion of the Works. This shall include:

- Details of all emergency services, locations and contact numbers.
- The Contractor shall provide a first aid kit on each active site and have a minimum of 1 member of personnel Qualified in emergency first aid present on each site.
- The Contractor shall provide a mobile telephone on site(s) for summoning assistance if required.
- The Contractor shall provide fire extinguishers at identified fire points along the length of the site(s). The extinguishers shall be appropriate to the nature of the potential fire.
- Hospital route maps shall be displayed and available from the Contractors Site office.
- Telephone Numbers for doctors and A Garda Síochána shall be displayed and available from the Contractor's Site Office.
- Water safety protocols shall be in place including, but not limited to, PPE, training, safety boat etc.

1.29 APPENDIX AR1/72 PROPERTY CONDITION SURVEY

1.29.1 GENERAL

The onus is on the Contractor to ensure that no damage is caused to properties neighbouring the Works.

1.29.2 ROAD CONDITION SURVEY

The Contractor shall carry out a road and road boundary condition survey of the access roads local to the site in accordance with the requirements of the Employer. The following is in addition to the NRA requirements:

The report must contain:

- Photographic Survey: The report must be supported by means of annotated photographs and sketches such that any subsequent deterioration later can be easily assessed.

- **Geometric Survey:** including measurements documenting the XYZ coordinates of the structure(s) to assess movement. Baseline measurements reading will be required to be taken prior to the Works commencing. A second reading will be required on completion of the Works. The relevant observations and conclusions must be included in the report stating net movement in the vertical and horizontal planes if applicable.

In addition, the Contractor shall arrange to have a pre and post construction survey of the following features carried out by an independent Chartered Engineer prior to the commencement of any construction works:

- The existing road surface and bridge deck used to transport materials or plant to / over the bridge.
- The surrounding public roads that give access to the site.
- The stone abutments and stone parapets.
- Any other building or structure which may, based on a risk assessment carried out by the Contractor (taking account of its proposed methodology for carrying out the works), warrant such a survey.

The pre-construction survey findings shall be delivered to the Employer's Representative at least 5 working days before any construction works (which shall be deemed to include the delivery of plant or materials) commence. The post-construction survey findings shall be delivered to the Employer's Representative at least 10 working days before the date on which the works are considered to be substantially complete.

1.29.3 VIBRATION MONITORING

Vibration monitoring of adjacent structures is to be undertaken as part of the Works and maintained for the duration as per Appendix 1/9.

The Contractor shall set up crack gauges on buildings and structured adjacent to the Works, or which, based on the Contractor's assessment, warrant a pre/post construction survey by agreement with the property owner and monitor any defects occurring because of the Works. The Contractor shall immediately alert the Employer regarding defects occurring.

The Contractor shall proceed with the Works in a manner that will cause zero impacts to structures or properties.

The Contractor shall be responsible for remedial works to any property damaged as a direct or indirect result of the Works during the construction stage or defects stage.

The vibration records will be compiled and maintained by the Contractor and issued on a daily basis by email to the Engineer.

1.30 APPENDIX AR1/80 MARINE WORKS GENERAL

The Works are located below, within and immediately adjacent to the inter-tidal zone. It is likely that tide, wave action and weather will affect all of the Works. The Contractor shall note the likelihood of encountering adverse weather conditions.

1.30.1 ATTENDANCE OF ENGINEER

The Contractor shall provide all necessary attendance upon the Employer on-site to enable him to monitor the progress and check technical aspects of the Works.

1.30.2 EQUIPMENT

All plant and testing equipment shall be maintained in good work order to the satisfaction of the Engineer. The major items of plant and equipment shall not be varied from those stated in the Tender without prior written authorisation by the Engineer. The use of jack-up barges is permitted; however, they shall have a full Temporary Works Design for the site geotechnical and metocean conditions. The Contractor shall satisfy himself as to the suitability of all plant and that working methods are suited to the materials to be handled and placed.

1.30.3 SAFETY OF PERSONNEL

The Contractor shall comply with all statutory obligations and take all reasonable precautions to ensure the safety of his operatives, particularly those engaged in over-water work. If used, floating plant shall be equipped with property life-saving equipment, and a rescue boat shall be immediately available at all times that the platform is manned.

1.30.4 CLEARANCE OF WORK ON COMPLETION

On the completion of the Works, the Contractor shall clear away from the site all his plant, surplus materials, waste and temporary work of every kind, and shall leave the whole of the site and works free of all obstructions to the satisfaction of the Engineer.

1.30.5 ACCESS TO WORKS

The Contractor shall be deemed to have included in his tendered rates and prices for all costs and charges associated with providing access to and from the Works for personnel, equipment, materials, samples, etc.

1.30.6 STORAGE AREA

The Contractor shall make his own arrangements for site storage and shall be responsible for providing and removing any hut or fencing that he requires and for the security of any plant or equipment stored. The Contractor shall leave the area clean and tidy at the completion of the Works and shall make good any damage or disturbance to the satisfaction of the Engineer.

The Contractor shall liaise with any other contractor with respect to shared storage areas and other equipment. He shall ensure that works do not hamper, or delay work being undertaken by other contractors.

1.30.7 OBSTRUCTIONS

No guarantee is given that the area of the Works is free from obstructions. The Contractor shall investigate the area, prior to the Works. Any non-geological materials found shall be removed at such time as to minimise interference with the Works.

1.30.8 SUNKEN PLANT

The Contractor shall, without delay, remove any sunken plant, other object which may be sunk during the course of the Contract by him or his staff or sub-contractors.

If such sunken plant causes an obstruction in or about the beach or its approaches, the Employer may remove the sunken plant causing the obstruction and all costs involved in such removal shall be borne by the Contractor.

If any plant, equipment or material sinks from any cause in the site vicinity it shall be lighted and buoyed at the Contractor's own expense. Immediately upon sinking, the Contractor shall take all necessary steps to remove the sunken objects from the location to a location determined by the relevant authority, at the expense of the Contractor. The plant, equipment or material shall be removed by a means approved by the relevant authority at the expense of the Contractor. Any loss to the Contractor arising from the removal method shall be at the expense of the Contractor. If any sunken plant, equipment or material causes an obstruction, the Employer reserves the right to remove same. The costs of removal will be borne by the Contractor.

1.30.9 DAMAGE TO EXISTING PROPERTY

The Contractor shall exercise great care when carrying out the Works that his operations do not cause any damage to existing structures or property or to any other structures or property including ships or boats of any kind.

1.30.10 OWNERSHIP OF OLD MATERIALS OR OBJECTS

All old materials or objects recovered from the riverbed shall be the property of the Employer. They shall be set aside carefully and handed over to the Employer or otherwise disposed of as directed by the Engineer.

and enter the Harbour each day, stopping work if necessary. The Contractors rates shall include for such stoppages, and no extras will be allowed for same. The Contractor shall

1.30.11 LEGISLATION

The Works shall be carried out in accordance with the following Legislation and Regulations:

- Bathing Water Quality Regulations, 2008.
- European Communities (Maritime) (International Safety Management Code) Regulations, 2008.
- European Communities Act, 1972 – 2007.
- European Union (Marine Equipment) Regulations, 2014.
- Foreshore Acts, 1933 – 2011.
- Maritime Safety Act, 2005.
- Merchant Shipping (Health and Safety: General Duties) Regulations, 1988.
- Safety in Industry (Diving Operations) Regulations, 1981.
- Safety, Health and Welfare at Work (Construction) Regulations, 2013.
- Safety, Health and Welfare at Work Act, 2005.
- Sea Pollution Act, 1991.
- Sea-Fisheries and Maritime Jurisdiction Act, 2006.
- Waste Management (Shipment of Waste) Regulations, 2007.
- Waste Management Act, 1996.
- The above list is non-exhaustive.

1.30.12 PUBLIC NOTICES

The Contractor shall provide public notices around the site informing the general public of the Works in progress, with approximate programme dates.

1.30.13 MARINE NOTICE

Does not apply.

1.30.13.1 WIND DATA

Site specific wind data is not available at the site. The Contractor is required to design for wind loading in accordance with BS EN 19911-1-4.

3.5 Flood Warnings

The Contractor shall register for the national flood warning services and other local flood warning services. The Contractor shall not be operating machinery in fluvial waters.

1.30.13.2 WEATHER WARNINGS

The Contractor shall register for the national extreme weather and flood warning services and other local flood warning services. See the contract documents for more information.

1.30.13.3 GENERAL

The Works require the grouting of any voids within the existing walls and step structures.

1.30.13.4 REPAIRS OF DECK AND WALLS

The Contractor shall remove all loose material, growth and vegetation from the structure. The Contractor shall remove all degraded concrete by mechanical means.

Surfaces shall be broken out and prepared as per repair mortar and grout product guidelines. New cast in-situ concrete shall be minimum of 150mm deep and keyed into existing structure using a detailed agreed with the engineer.

For re-pointing and crack repair the surface cleaning and preparation will be same as above. All cracks from 0.3mm to 9mm shall be filled and pointed with FOSROC Nitofill LV/ TH Epoxy resin injection grout or equivalent approved. All cracks greater than 9mm shall be broken out to a minimum of 15mm and filled and pointed with FOSROC Renderoc Plug 20 cement-based repair mortar or equivalent approved. All repairs shall be carried out as per repair product installation instructions.

All vertical (downwards) anchors/ dowels shall be installed using FOSROC Lokfix S25 or equivalent approved. Minimum embedment shall be 500mm.

All horizontal (vertical face) anchors/ dowels shall be installed using Lokfix E55 or equivalent approved. Minimum embedment shall be 500mm.

All expansion joints to be sealed using FOSROC NITOSEAL PU12 or equivalent approved.

1.30.13.5 TEST PANELS

The Contractor shall provide a 10x10m sample of cleaning, preparation and re-pointing and repairs works to be approved by the Engineer prior to carrying out all the works.

1.31 APPENDIX AR1/81 ENVIRONMENTAL MONITORING

All works will be carried out in accordance with CIRIA “Coastal and Marine Environmental Site Guide” (C584). Works will also be in accordance with the granted Planning Permission Conditions and, where applicable, Foreshore Lease/Licence Conditions.

The Contractor shall take all necessary steps so as to ensure no discharge of cement residues, silt or any other deleterious or polluting matters to waters.

1.31.1 NATURE CONSERVATION

During construction the working area and access to the Works should also be kept a minimum to minimise the effects of disturbance.

In order to reduce the effects of smothering, the area affected by any temporary haul road should be kept to a minimum and wherever possible it should be kept within the footprint of the Works.

Site monitoring of works to ensure compliance of works to method statements agreed with NPWS and The Local Authority, where relevant, should be carried out by a suitably qualified ecologist.

1.31.2 PUBLIC ACCESS

In order to minimise the effects on public access, any area of the Works which needs cordoning off should be kept to a minimum. In addition, effects of access restrictions can be mitigated by informing the public in advance about the Works.

1.31.3 POLLUTION

The Contractor shall not discharge oil, grease, sewage, waste, rubbish or deleterious matter of any kind into the surrounding environment, including harbour waters. The Contractor's attention is drawn to the relevant regulations concerning pollution.

The Contractor shall abide by the measures detailed in the associated Environmental Reports relating to fuel management in particular and work methods in general and how these are not to impact on ecologically sensitive areas nearby.

2 SERIES 200 - SITE CLEARANCE

2.1 APPENDIX 2/1: LIST OF BUILDINGS, ETC., TO BE DEMOLISHED

The list of items to be demolished is shown on the issued Contract Drawings.

2.2 APPENDIX 2/2: FILLING OF TRENCHES AND PIPES

All trenches to be backfilled as part of the site clearance and all pipe and ductwork more than 1m below the ground must be backfilled with ST2 lean mix concrete.

All redundant gully connector pipes are to be backfilled with ST2 leanmix from the connection with the mainline sewer to the end of the pipe.

2.3 APPENDIX 2/3: RETENTION OF MATERIAL ARISING FROM SITE CLEARANCE

All materials arising from the demolition and site clearance process are to be disposed of offsite, except as described below and as shown on the site clearance drawings.

The stone in the existing parapet wall is to be retained and re-used to reconstruct the walls in question.

2.4 APPENDIX 2/4: EXPLOSIVES AND BLASTING

The Contractors attention is drawn to the requirements of Appendix 6/3 in relation to blasting and to measures for the control of noise and vibration which are included in Appendix 1/9.

2.5 APPENDIX 2/5: HAZARDOUS MATERIALS

The following shall be included as part of the Specification Appendix 2/5 to be completed by the Contractor.

- The Contractor shall liaise with and comply with the requirements of the relevant Authorities for the handling and disposal of hazardous material found in Site Clearance.
- In the event of hazardous material being found during Site Clearance, the Contractor shall employ suitably qualified personnel to undertake a full ground contamination survey and report, as required by the relevant Authority.
- A full method statement of the Contractors proposals for the removal of such material must be forwarded to the Engineer for review prior to the commencement of any works.

3 SERIES 300 - FENCING AND ENVIRONMENTAL NOISE BARRIERS

3.1 APPENDIX 3/1: FENCING, GATES AND STILES

3.1.1 LOCATIONS OF FENCES, GATES AND SITES

The locations of fencing, gates and stiles are shown on the issued Contract Drawings.

The permanent fencing shall be in accordance with point 3 of F.2 of Department of Agriculture, Food and the Marine “Minimum Specification for Farm Fencing, (with one row of barbed wire below the sheep wire and one row of barbed wire on the top, except that the upper strand of barbed wire is to be replaced with plain wire for any fence adjoining a public or private road).

All field gates used in the Works shall comply with the details shown in TII CC-SCD-00309 Type 1, unless shown otherwise, and shall include mesh fabric in accordance with TII CC-SCD-00309 on the lower half of the gate.

3.1.2 TREATMENT OF TIMBER

Posts and rails are to be pressure treated in accordance with any requirements on the Contract Drawings, other specified documents, the Minimum Specification for Farm Fencing (S148) issued by the Department of Agriculture, Food and the Marine and the TII Details in Volume 4 of the TII Specifications for Road Works.

3.2 APPENDIX 3/2: FENCING: TII ROAD CONSTRUCTION DETAILS

All fencing to be provided as part of the Works must comply with Series 300 of the TII Specifications for Road Works Volume 1 and Volume 4 and the Minimum Specification for Farm Fencing (S148) issued by the Department of Agriculture, Food and the Marine. The TII Details from Volume 4 of the TII Specifications for Road Works are shown but not limited to the list below.

Table 3.1 List of drawings and titles

TII SCD Number	Title
Refer to Contract MDR file.	

4 SERIES 400 - ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)

4.1 APPENDIX 4/1: SAFETY BARRIERS

- 4.1.1 Safety Barriers, their terminals and transitions shall strictly comply with TII document TD 19 Part 8A – Safety Barriers.
- 4.1.2 The locations of safety fences and barriers where applicable are shown on the Contract Drawings.
- 4.1.3 Testing for anchorages and attachment systems, posts and foundations in accordance with Clause 404 shall be carried out by the Contractor, who shall also provide the equipment. All testing requirements and procedures to IS EN 1317. The Contractor shall carry out loading tests on the post foundations as follows:
- 4.1.4 Testing shall be carried out at locations determined by, and in the presence of the Employer.

4.2 APPENDIX 4/2: PEDESTRIAN RESTRAINT SYSTEMS

Pedestrian Guardrails are to be installed at locations shown on issued Contract Drawings and shall be constructed as detailed on TII CC-SCD-00401.

Pedestrian guardrails to be 1100 mm high above ground level and shall comply with BS 3049. The materials shall be in accordance with BS 4300.

4.3 APPENDIX 4/3: SAFETY BARRIER TERMINALS

Any Safety Fence Details shall comply with Series 400 of the TII Specification for Road Works, TII TD19, TII BD52 and Appendix 4/1 and Appendix 4/2 of this document.

4.4 APPENDIX 4/6: SAFETY BARRIERS: TII ROAD CONSTRUCTION DETAILS

As per TII Specification.

4.5 APPENDIX 4/7: VEHICLE PARAPET SYSTEMS

As per TII Specification.

5 SERIES 500 - DRAINAGE AND SERVICE DUCTS

5.1 APPENDIX 5/1: DRAINAGE REQUIREMENTS

5.1.1 IRISH WATER COMPLIANCE

5.1.1.1.1 The Contractor shall ensure all water services and wastewater services infrastructure is constructed in accordance with the latest Irish Water requirements.

5.1.1.2 IRISH WATER: GENERAL GUIDANCE

5.1.1.2.1 The Contractor shall ensure compliance with the following Irish Water Quality Assurance requirements:

5.1.1.2.1.1 Quality Assurance (QA) Design Requirements Manual. Connections and Developer Services (A Guide for Self-Lay Developers) January 2018 (Revision2) Document: IW-CDS-5010-01.

5.1.1.2.1.2 Quality Assurance (QA) Field Inspection Requirements Manual. Connections and Developer Services (A Guide for Self-Lay Developers) January 2018 (Revision2) Document: IW-CDS-5010-02.

5.1.1.2.2 The Contractor shall provide the certificates necessary to enable certification of the Works by the Engineer, in particular the following requirements apply:

No.	Document Description	CONTRACTOR TO PROVIDE CERTIFICATIONS/ DOCUMENTATION (Y/)
1	Confirmation by a Chartered Engineer that the water/wastewater infrastructure has been installed in accordance with the design submitted in the Connection Application	Y
2	Confirmation by a Chartered Engineer that the water/wastewater infrastructure has been installed using appropriate material and workmanship.	Y
3	Confirmation by a Chartered Engineer and test result certificates indicating that the water/wastewater infrastructure has undergone appropriate on-site testing, off-site testing and commissioning. The appropriate site tests for wastewater collection infrastructure would be as follows:	Y
	Water retaining tests completion results for manholes and pumping station structures associated with wastewater infrastructure	Y
	Air tests and water tests completion results for sewers	Y

	Testing completion results of pumping plant (if appropriate),	Y
	Pressure testing completion results of rising mains and for water mains	Y
	Visual inspection completion results of manholes	Y
	CCTV report of sewer pipework	Y
	Commissioning reports of wastewater infrastructure and for water infrastructure (cleansing, flushing, swabbing, disinfection, bacteriological testing, etc.)	Y
4	Provision of “As-Constructed” drawings and records of the constructed water and wastewater infrastructure	Y
5	“As Constructed” record of service pipe installation completion (including link to WPRN),	Y
6	Provision of Safety File in accordance with the current Safety and Health Construction Regulations	Y
7	Provision of Operation and Maintenance Manuals for pumping plant (if appropriate)	Y
8	Provision of wayleave and easement agreements,	
9	Provision of drawings to Irish Transverse Mercator coordinates (ITM) for wayleave/easement/land acquisition	
10	Proof of ownership of site (copy of Deeds/Solicitor letter),	
11	Confirmation by a Chartered Engineer of compliance with the Building Regulations and the Building Control (Amendment) Regulations, in particular evidence of compliance with the Building Regulations to ensure plumbing systems compliance and no risk of contamination.	Y

5.1.1.3 IRISH-WATER: WATER SERVICES GUIDANCE

5.1.1.3.1 The Contractor shall ensure compliance with the following Irish Water Codes of Practice requirements:

5.1.1.3.1.1 Code of Practice for Water Infrastructure: Connections and Developer Services, Design & Construction Requirements for Self-Lay Developments 2017 (Revision 1). Document: IW-CDS-5020-03.

5.1.1.3.1.2 Water Infrastructure Standard Details. Connections and Developer Services. Construction Requirement for Self-Lay Developments. December 2017 (Revision 03) Document: IW=CDS-5020-01.

5.1.1.3.1.3 Design Risk Assessment for Water Infrastructure Standard Details. Connection and Developer Services. Construction Requirement for Self-Lay Developments. December 2017, (Revision v4.01). Document: IW-CDS-5020-02.

5.1.1.4 IRISH WATER: WASTEWATER SERVICES GUIDANCE

5.1.1.4.1 The Contractor shall ensure compliance with the following Irish Water Codes of Practice requirements:

5.1.1.4.1.1 Code of Practice for Wastewater Infrastructure: Connections and Developer Services, Design & Construction Requirements for Self-Lay Developments 2017 (Revision 1). Document: IW-CDS-5030-03.

5.1.1.4.1.2 Wastewater Infrastructure Standard Details. Connections and Developer Services. Construction Requirement for Self-Lay Developments. December 2017 (Revision 03) Document: IW=CDS-5030-01.

5.1.1.4.1.3 Design Risk Assessment for Wastewater Infrastructure Standard Details. Connection and Developer Services. Construction Requirement for Self-Lay Developments. December 2017 (Revision v4.01). Document: IW-CDS-5030-02.

5.1.2 GENERAL REQUIREMENTS

5.1.2.1 All drainage works shall comply with the “Greater Dublin Regional Code for Practice for Drainage Works” and the TII Specification for Road Works. If at any time within Appendix 5/1 through to 5/7 of this document that there is a conflict or be inconsistent with any provision of the above-named documents the Greater Dublin Regional Code for Practice for Drainage Works shall always prevail.

5.1.2.2 The Contractor shall supply all plant and labour, materials, equipment and engineering services and preform all works necessary to install, test and commission and render operational a complete system as specified herein and detailed on the Contract Drawings.

5.1.2.3 Delivery, receiving, off-loading, handling, storing, putting in position, assembling and erection of all equipment and materials shall form part of this Contract.

5.1.2.4 For locations of chambers, surface water gullies, slot drains, drainage channels, flood flow inlets, drainage pipes, attenuation tanks, petrol oil interceptors, pumping stations, rising mains, watermains and sewage pipes refer to the Contract Drawings.

5.1.2.5 Where cover depth is less than 1.2m from finished surface level to the crown of the pipe a concrete bed and surround shall be used.

5.1.2.6 For details of trench and bedding details refer to the Contract Drawings, The Greater Dublin Regional Code of Practice for Drainage Works and the TII Specification for Road Works Volume 4. Note the requirements within item 1(i) of this Appendix for guidance on conflicts and ambiguity.

5.1.2.7 Where rock is encountered within the trenches it shall be excavated and trimmed to prescribed level of underside of pipe bedding. Explosives may not be used to loosen rock in trenches.

5.1.2.8 Trenches and pits shall be kept free of water until any concrete therein is sufficiently set. The Contractor shall construct any necessary sumps or temporary drains and provide any necessary pumping to keep trenches and pits free of water.

5.1.2.9 Back of wall drainage indicated on the 1700 series drawings shall consist of a

300mm thick trench of 20mm nominal size aggregate to Cl.513 of the TII Specification for Road Works along with a 150mm diameter perforated uPVC pipe with a no fines concrete surround.

- 5.1.2.10 Unless otherwise shown on the drawings, where existing chambers or gullies are made redundant by the Works they shall be removed where they are within 1m of formation and backfilled with Clause 804 subbase material. Chambers extending below this level and those beneath the existing pavement shall be removed down to 1m below formation and the remainder shall be cleared of all silt and debris and backfilled with C15/20 concrete.
- 5.1.2.11 Where existing pipes are made redundant by the Works, they shall be grouted up in accordance with Clause 506.3 of the TII's Specification for Road Works.
- 5.1.2.12 All existing foul and surface water drainage shall be maintained until the permanent drainage for the execution and completion of the Works have been executed, completed and functioning satisfactorily including its discharge to approved outfalls.
- 5.1.2.13 Existing drainage retained in the execution and completion of the Works shall be flushed and cleared of debris and all repairs carried out to ensure drains shall fulfil the requirements of the Contract. The clearing and repair of any existing drainage shall not have any negative impact on local watercourses.
- 5.1.2.14 The Contractor shall take all steps necessary, and bear all associated costs, to protect all existing utilities to be retained which are encountered during the Works. All utilities damaged during the execution of the Works shall be repaired at the Contractors expense. The Contractor shall be responsible for all liaising with the relevant utility companies for the duration of the Works.

5.1.3 CHAMBER COVERS, GRATINGS AND FRAMES

- 5.1.3.1 Refer to Table 5.1 of Appendix 5/1 for details of chamber cover classification.
- 5.1.3.2 Non-recessed manhole covers and frames shall be in accordance with IS EN 124.
- 5.1.3.3 Non-recessed manhole covers and frames which are located in softscape areas shall minimum 600mm x 600mm clear opening with a minimum load classification of D400 in accordance with IS EN 124.
- 5.1.3.4 Non-recessed manhole covers and frames that are located in hardscape areas shall be load classification D400 in accordance with IS EN 124 with a 600mm x 600mm clear opening.
- 5.1.3.5 All perforated chamber covers and frames shall have a 600mm x 600mm clear opening and a load classification of D400 in accordance with IS EN 124.
- 5.1.3.6 All inspection chamber covers and frames shall be minimum 450mm x 450mm and shall have a minimum load classification of D400 in accordance with IS EN 124.
- 5.1.3.7 Recessed manhole covers and frames shall be 610mm x 610mm clear opening and shall have a load classification of D400 in accordance with IS EN 124.

- 5.1.3.8 All covers and frames shall be in accordance with IS EN 124.
- 5.1.3.9 All units shall incorporate a permanent non-rock feature either triangular point suspension or machined faces. All covers, gratings and frames shall be supplied coated by dipping, or other equivalent means, using a cold applied black bitumen material complying with the requirements of BS 3416 or BS6949. No coating shall be applied to any casting unless the surfaces of the casting are clean, dry and free from rust.
- 5.1.3.10 All chamber covers are to be provided with a locking mechanism, where the mass of the frame exceeds 15kg, suitable lifting holes or hooking points in the frames are to be provided. These should be located to give a balanced lift. Any lifting holes within the bedding area of the frame should be considered when determining the minimum bearing area of the frame. Suitable keyways shall be provided in each cover as detailed in BS 7903. The minimum frame depth for manholes shall be 150mm.
- 5.1.3.11 Bolts supplied for loosely coupling sections of covers and grating shall be steel hexagon headed, complying with the requirements of ISO 4016, ISO 4018 and ISO 4034. They shall not be less than size M16 complete with Hexagon nut and shall be provided with means to prevent undue tightening of unit sections.
- 5.1.3.12 Bedding material for fixing manhole frames in position shall be cement and mortar. The maximum depth of bedding shall be 50mm.

Table 5.1 Chamber cover classification

Chamber Type	Carriageway	Footpaths and Cycle Tracks	Grassed Areas
Manhole	D400	D400	D400
Drainage Channels and Sump Units	D400	D400	-
Gully	D400	-	-
Flood Flow Inlet	D400		

5.1.4 CHAMBERS FOR DRAINAGE AND SEWERAGE PIPELINES

- 5.1.4.1 Refer to Contract Drawings for pipeline and chamber schedules.
- 5.1.4.2 Refer to the Greater Dublin Regional Code of Practice for Drainage for all details on drainage manholes/chambers.
- 5.1.4.3 Chambers shall be as per the Contract Drawings. Chambers in excess of 5.5m to top of pipe shall be constructed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. Each foul sewer chamber immediately upstream of a connection manhole to the an existing combined sewer shall incorporate a channel interceptor and be constructed in accordance with drawing 2127/09 of the Greater Dublin Regional Code of Practice for Drainage Works.
- 5.1.4.4 Precast concrete chambers shall comply with BS 5911-3, IS EN 1917 and this Appendix. Cast in situ concrete chambers shall be constructed of C20/25 concrete complying appendix 17/1 of this specification. All proposed foul

combined and surface water sewer chamber and pipelines to be taken in charge by the Local Authority/Employer shall be constructed to the Greater Dublin Regional Code of Practice for Drainage Works.

- 5.1.4.5 Where chamber cover levels must be increased, the maximum number of brickwork courses shall be three as per drawings as per the relevant detail in the Greater Dublin Regional Code of Practice for Drainage Works.
- 5.1.4.6 The Contractor shall be responsible for the final positioning, setting out and sizing of each chamber to ensure co-ordination of the whole of the Works and compliance with the specification and drawings.
- 5.1.4.7 Foundations to chambers shall be of mix C20/25 concrete in accordance with appendix 17/1 of the specification with steel mesh to BS 4483 Ref A252, 40mm cover from top of foundation, laid on 75mm thick blinding concrete of grade C10/15 in accordance with appendix 17/1 of the specification. Precast manhole bases shall not be permitted.
- 5.1.4.8 Chambers for drainage and sewerage shall be tested for water tightness as agreed with the Employer.

5.1.5 PIPING

- 5.1.5.1 In accordance with the Greater Dublin Regional Code of Practice for Drainage uPVC pipes are not to be used in any Dublin City Council areas.
- 5.1.5.2 Concrete pipes of diameter not exceeding 900mm shall be Class 120 spigot and socket joints with rubber ring fittings (fitted in accordance with manufacturers specification) to comply with IS EN 1916 and IS6.
- 5.1.5.3 Concrete pipes of diameter exceeding 900mm shall be Class 120 spigot and socket joints with rubber ring fittings (fitted in accordance with manufacturers specification) to comply with IS EN 1916, IS166 and IS6.
- 5.1.5.4 Vitrified clay pipes and fittings must comply with the requirements of I.S. /EN 295- 1/2/3:1992 or equivalent standard. Class 160 or 200.
- 5.1.5.5 Plastic pipes for drainage and sewerage shall have ultimate pipe stiffness (STES) in excess of 1400 N/m² tested in accordance with BS 4962 and IS EN 13476. Resistance to impact shall comply with BS 4962 except that the striker used in the test shall have a mass of 1kg and a 25mm hemispherical radius.
- 5.1.5.6 The Contractor shall submit test certificates to the Employer for all pipes proposed by the Contractor for use in the Works prior to the installation of those pipes. The Employer may at its sole discretion direct that pipes incorporated in the Works, where test certificate have not been presented, be exhumed and replaced. All costs associated with such a direction shall be borne by the Contractor.
- 5.1.5.7 The Contractor shall ensure that plastic pipes are not subject to deterioration due to sunlight during the period between manufacture and installation in the ground as Specified in Clause 501.2 of the TII Specification for Road Works.
- 5.1.5.8 Coupling sealing rings shall be manufactured from elastomers, conforming to the performance requirements of IS EN 681: Part 2. All seals shall be ethylene propylene diene monomer (EPDM) or equivalent. Joint lubricants for sliding

joints shall have no deleterious effect on either the joint rings or pipes and shall be unaffected by the material to be conveyed.

- 5.1.5.9 Joints in non-porous pipework shall be watertight as specified in Clause 504.3 and in filter drains partly tight as specified in Clause 504.6 of the TII Specification for Road Works.
- 5.1.5.10 Clearing of the existing chambers, gullies and drains is to be carried out to Clause 509.5 of the TII Specification for Road Works.
- 5.1.5.11 Before entering or breaking into an existing sewer or drain, the Contractor shall give notice of his intention to do so to, and receive written approval to proceed from, the authority responsible for the pipeline to which the connection is to be made.
- 5.1.5.12 All drainage and sewerage pipework shall be air tested in accordance with Clause 509.2 of the TII Specification for Road Works. The Contractor shall ensure that all testing procedures and results shall use and state the same pipeline and chamber annotation as that shown on the as-constructed drawings for the Works.
- 5.1.5.13 The Contractor shall also prepare, and present to the Employer for approval, a schedule for all drainage constructed as part of the Works. The schedule shall, at the very minimum, detail the following for each pipeline and chamber:
- Date of Jet Washing
 - Date and details of the air-test and result achieved. If the air-test failed, the reason why, the repair (if required) undertaken including exact location of the repair, and details of the retest.
 - CCTV results
- 5.1.5.14 All tests and results must be witnessed and signed off by the Employer. No test result will be accepted in the absence of the Employer sign off and the Contractor shall be responsible for any retesting arising and costs associated therein.

5.1.6 PERMEABLE PAVEMENT DRAINAGE

- 5.1.6.1 For locations of subsurface drainage for permeable pavement areas refer to the Contract Drawings.
- 5.1.6.2 Type 1X granular material shall be crushed rock, crushed slag or crushed concrete. The material shall be well graded and lie within the following grading envelope.

Table 5.2 Material grading specification

BS Sieve Size	Percentage by Mass Passing
75mm	100
50mm	80-100
20mm	40-75
5mm	20-35

600 micron	0-10
75 micron	0-5

The particle size shall be determined by the washing and sieving method of BS812 Part 102.

5.1.6.3 The material passing the 425 micron sieve shall be non-plastic as defined by BS1377 part 2 (1990) and tested in compliance therewith.

5.1.6.4 The material shall be transported, laid and compacted without drying out or segregation.

5.1.6.5 The material shall have a 10% fines value of 50kN or more when tested in compliance with BS812 except that samples shall be tested in a saturated and surface dried condition. Prior to testing the selected test portions shall be soaked in water at room temperature for 24 hours without previously having been oven dried.

5.1.7 BUILDING EDGE DRAINAGE

5.1.7.1 For building edge drainage details refer to the Contract Drawings.

5.1.8 GULLIES

5.1.8.1 For gully locations refer to the Contract Drawings.

5.1.8.2 All road gullies (excluding gullies in the DCC area) shall be Kent KDHMG/D400/400 or similar type approved. They shall be pre-cast (trapped) and in accordance with drawing Series 500 of the TII Specifications for Road Works. Gullies shall be load class D400 in accordance with IS EN 124.

5.1.8.3 The following requirements are for gullies in DCC's area:

- Sealed Gullies (Outlets to combined sewers) are to have bottom outlets. Surface water discharging from roadways to a combined sewer shall drain through a sealed gully. The gully unit shall be to the Local Sanitary Authority standard in ductile iron with a cleaning eye and a bottom outlet.
- Unsealed Gullies (Outlets to surface water sewers) are to have side outlets.
- Foundation slabs for gully pits shall be a minimum thickness of 150mm and built in class 20N/mm² in situ concrete.
- Each grating and gully frame shall have clearly marked thereon:
 - I.S./EN 124:1994 - Class D400
 - The name and/or identification mark of the manufacturer and the place of manufacture
 - The year of manufacture
 - Mark of the certification body
 - Lockable frames and gratings are not permitted.

5.1.8.4 In DCC pre-cast gully pots are not acceptable.

- 5.1.8.5 Road gully gratings shall have a minimum clear waterway area of 530cm².
- 5.1.8.6 Road gully connections shall be provided between gully pots and adjacent carrier drains. These shall be 150mm diameter, of maximum length 15m uPVC spigot and socket flexible jointed connections. Gully connections shall be backfilled in accordance with drawing with Series 500 of the TII Specifications for Road Works.
- 5.1.8.7 Non road gullies used to collect water from downpipes shall be Hunter Plastic bottle gully DS49 with 200mm x 200mm top or similar type approved. Non road gullies shall be set flush to the building face to intercept downpipes. Connections for the non-road gullies shall be 110mm in diameter UPVC pipe work.
- 5.1.8.8 Junctions shall be used for all gully branch connections onto pipes of up to 300mm internal diameter, saddle connections shall be permitted on connection pipes that are greater than 300mm internal diameter.
- 5.1.8.9 All road gully gratings shall be provided with lockable mechanism laid 5-10mm below finished surface level.

5.1.9 LAND DRAINS

- 5.1.9.1 Existing land drains and mole drains which are permanently severed by the Works shall be led into the new drainage in accordance with Clause 511 of the TII Specification for Road Works.
- 5.1.9.2 The Contractor shall record and mark with suitable stakes all land drains disturbed or damaged in carrying out the Works and shall submit daily schedules of these to the Employer stating size and type of drain, details and location of reinstatement or connection into new drain or ditch.

5.1.10 CHAMBERS FOR ELECTRICITY DUCTS

- 5.1.10.1 Cable access chambers for electricity ducts shall comply with the requirements set out in Drawings 1367/E/01 and 1367/E/02. In relation to "Detail 'B'" on Drawing 1367/E/02, the foundation the concrete base shall extend for a distance of 200mm beyond the outer edge of the chamber walls and shall be constructed using in-situ ST4 concrete with A393 mesh top and bottom. The Contractor shall be responsible for selecting a suitably sized lintel where two or more ducts are laid side by side. The cable access chambers shall be constructed using concrete blocks, complying with I.S. EN 771-3 having a compressive strength of 13N, laid on their flat, resulting in a chamber wall thickness of at least 215mm.
- 5.1.10.2 Covers for cable access chambers, which shall have a clear opening of 600mm x 600mm, shall comply with the requirements of Table 5.1 of Appendix 5/1 of SP-1021.

5.2 APPENDIX 5/2: SERVICE DUCT REQUIREMENTS

5.2.1 GENERAL REQUIREMENTS

- 5.2.1.1 The Contractor shall supply all labour, materials, equipment and engineering services and perform all works necessary to install, test, commission and render operational a complete system as specified herein, detailed in the schedules and shown on the drawings.
- 5.2.1.2 Delivery, receiving, off-loading, handling, storing, putting into position, assembling and erection of all equipment shall form part of this Contract.
- 5.2.1.3 Where applicable the general requirements as stated in Appendix 5/1 should be adhered to.
- 5.2.1.4 All ducts and chambers shall comply with any requirements within the relevant utility provider specifications.
- 5.2.1.5 The Contractor is to be familiar with working with ESN and 3rd party telecom providers and the coordination, attendance and management of these utility providers required in order to install an ESN and telecom network of this type in line with the programme schedule. All costs associated with the delivery of these utilities shall be borne by the Contractor.
- 5.2.1.6 All underground cables shall be fully ducted along their entire length.
- 5.2.1.7 Unless otherwise stated service ducting shall be in accordance with table 5/2 of the TII Specification for Road Works.
- 5.2.1.8 Where specified as being required by a particular utility provider (e.g. ESN Networks), ducts shall be un-plasticised polyvinyl chloride (uPVC), single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of BS 3506. The duct colour shall be in accordance with the recognised standard for each service provider.
- 5.2.1.9 Ducts shall be manufactured from 100% virgin material.
- 5.2.1.10 All ducts, bends, coupling etc. shall be sourced from a single manufacturer.
- 5.2.1.11 All ducts shall be suitable for the depth of burial and the types of cables to be pulled through them.
- 5.2.1.12 Ducts shall be of 'normal' duty in accordance with IS EN 50086-2
- 5.2.1.13 Ducts shall comply with IS EN 50086-2 in terms of duct deformation (<5% deformation requirement for 450N loading on 200mm sample) and impact resistance requirements (no crack for 5kg striker, 12 samples and 570mm fall height >28 Joules).
- 5.2.1.14 Service ducting shall have a smooth internal bore without any sharp edges to the ends of pipes. The inner surface shall be completely free of ripples, sharp edges and protrusions with a friction coefficient of less than 0.28.
- 5.2.1.15 Maximum duct ovality shall be 2mm.
- 5.2.1.16 Ducts shall be constructed in 6m lengths (approximately) with a socket at one end and a corresponding spigot at the other the plain end bevelled to allow easy jointing of ducts on site.
- 5.2.1.17 The Contractor shall submit test certificates to the Employer prior to the

installation of any plastic ducts, bends couplings etc.

- 5.2.1.18 Ducts shall have a circumferential mark to indicate the correct push in distance for duct jointing for spigot and socket joints.
- 5.2.1.19 The internal diameter of all ducts shall be as indicated on the drawings. Minimum internal diameter of ducts shall be 50mm.
- 5.2.1.20 Long radius bends only shall be used with a minimum duct bend radius of 1.2m for all bends.
- 5.2.1.21 The colour coding of service ducts shall conform to IS EN 370:2007 and Table 5/3 of Appendix 5/2.
- 5.2.1.22 Colour fastness of 1 year minimum is required so as to provide 12 month storage period. In addition to colour coding, the ducts shall be stamped with the words “Danger Electricity Cables”, “Public Lighting”, “Telecommunications Cables”, etc. as appropriate, printed in large block capitals continuously along their length, to the approval of the Employer. Text on legends shall be minimum 18mm high black lettering at maximum 1m intervals.
- 5.2.1.23 Materials shall contain pigments and UV stabilisers to provide maximum colour stability and weathering. All pigments shall be of high purity and shall resist leeching in contact with soil acids.

Table 5.3 Service colour coding

Utility & infrastructure service	Colour
MV Electricity	Red
ESBN Electricity	Red
LV Electricity	Red
Public Lighting	Red
Telecommunications	Purple
ICT	Green
Security & Wi-Fi	Green

5.2.2 SPECIFIC REQUIREMENTS FOR ESB MV DUCTS

Ducts and installation shall comply with the following ESB Networks documents:

- 5.2.2.1 Standard Specification for ESB Networks MV/LV Networks Ducting.
- 5.2.2.2 Duct Specifications of LV Cable for Non-Domestic Connections
- 5.2.2.3 ESB National Code Of Practice for Customer Interface 4th Edition 2008
- 5.2.2.4 Approved Material Suppliers for Housing Schemes & MV Substation Buildings
- 5.2.2.5 All ducts and associated materials used for installation of ESB ducts (ducts, draw ropes, duct plugs, mandrels, brushes etc.) shall be sourced from ESB Networks approved suppliers.
- 5.2.2.6 Ducts shall be un-plasticised polyvinyl chloride (uPVC) single wall pipes with a

minimum wall thickness of 3.8mm complying with Class B or better of BS 3506.

- 5.2.2.7 Ducts shall have a minimum internal diameter of 125mm unless otherwise specified.
- 5.2.2.8 ESB Networks marker tape or strip should not be laid over any other services ducts.
- 5.2.2.9 ESB Networks approved marker tape (marked "Danger Electricity Cables") only shall be used above ESB ducts. Yellow marker tape shall be installed in footways. Yellow marker tape and red marker strip shall be installed in carriageways and grassed areas.
- 5.2.2.10 Minimum duct spacing shall be 75mm for up to two ducts in any layer and 150mm for more than two ducts in any layer.
- 5.2.2.11 Minimum clearance to other services (apart from large pipelines or high-pressure pipes) shall be 300mm.

5.2.3 SPECIFIC REQUIREMENTS FOR LV DUCTS

- 5.2.3.1 Ducts shall have a minimum internal diameter of 125mm.
- 5.2.3.2 Marker tape shall be yellow with the following words printed on it "Danger LV Electricity Cables".

5.2.4 SPECIFIC REQUIREMENTS FOR MV DUCTS

- 5.2.4.1 Ducts shall have a minimum internal diameter of 125mm.
- 5.2.4.2 Marker tape shall be yellow with the following words printed on it "Danger MV Electricity Cables".
- 5.2.4.3 Yellow marker tape shall be installed in footways. Yellow marker tape and red marker strip shall be installed in carriageways and grassed areas.

5.2.5 SPECIFIC REQUIREMENTS FOR PUBLIC LIGHTING DUCTS

- 5.2.5.1 Ducts shall have a minimum internal diameter of 100mm.
- 5.2.5.2 Marker tape shall be yellow with the following words printed on it "Danger Public Lighting Cable".

5.2.6 SPECIFIC REQUIREMENTS FOR TELECOMMUNICATION DUCTS

- 5.2.6.1 Ducts shall be un-plasticised polyvinyl chloride (uPVC) single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of BS 3506.
- 5.2.6.2 Ducts and installation shall comply with the Department of Public Enterprise publication "Recommendations for Underground Telecommunications Cable Works".
- 5.2.6.3 Ducts shall have a minimum internal diameter of 100mm.

- 5.2.6.4 Marker tape shall be yellow with the following words printed on it: "Telecommunications Cable" and the name of the network operator or authority responsible for the on-going maintenance of the duct system.
- 5.2.6.5 Minimum clearance to electricity services shall be 300mm.
- 5.2.6.6 Telecommunications duct runs shall be plug and socket airtight and watertight to facilitate the blowing of fibre optic cables.

5.2.7 SPECIFIC REQUIREMENTS FOR INFORMATION & COMMUNICATIONS TECHNOLOGY DUCTS

- 5.2.7.1 Ducts shall be un-plasticised polyvinyl chloride (uPVC) single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of BS 3506.
- 5.2.7.2 Ducts shall have a minimum internal diameter of 100mm.
- 5.2.7.3 Marker tape shall be yellow with the following words printed on it: "Information & Communications Cable" and the name of the network operator or authority responsible for the on-going maintenance of the duct system.
- 5.2.7.4 Minimum clearance to electricity services shall be 300mm.
- 5.2.7.5 Information & Communications ducts runs shall be plug and socket airtight and watertight to facilitate the blowing of fibre optic cables.

5.2.8 SPECIFIC REQUIREMENTS FOR SECURITY & WI-FI TECHNOLOGY DUCTS

- 5.2.8.1 Ducts shall be un-plasticised polyvinyl chloride (uPVC) single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of BS 3506.
- 5.2.8.2 Ducts shall have a minimum internal diameter of 100mm.
- 5.2.8.3 Marker tape shall be yellow with the following words printed on it: "Information & Communications Cable" and the name of the network operator or authority responsible for the on-going maintenance of the duct system.
- 5.2.8.4 Minimum clearance to other services (apart from large pipelines or high-pressure pipes) shall be 300mm.
- 5.2.8.5 Security & Wi-Fi ducts runs shall be plug and socket airtight and watertight to facilitate the blowing of fibre optic cables.

5.2.9 DUCT HANDLING AND STORAGE

- 5.2.9.1 Care should be taken when loading/unloading ducts to avoid damage to the ducts. Any damaged or defective ducts shall be marked in a conspicuous manner and removed from site.
- 5.2.9.2 The Contractor shall ensure that plastic pipes are not subject to deterioration due to sunlight during the period between manufacture and installation in the ground as Specified in Clause 501.2 of the TII Specification for Road Works.
- 5.2.9.3 Ducts shall be stored on a smooth flat horizontal surface, supported by side supports at intervals of not more than 1.5m and fully in accordance with the

manufacturer's recommendations. Ducting supplied in factory strapped bundles may not require side supports; however, care should be taken when removing strapping when tension may be released.

- 5.2.9.4 Socket ducts shall be stacked in layers in accordance with manufacturer's recommendations and with the socket at alternate ends of each layer. The socket on one layer should project beyond the duct spigots on the layer below so that the ducts are evenly supported along their length.
- 5.2.9.5 Duct stacks shall not exceed 7 layers with a maximum height of 2m.
- 5.2.9.6 The method of stacking shall be such as to ensure that the integrity of the ducts is maintained and that distortion is avoided.
- 5.2.9.7 Ducts shall not be stored in a place where they are likely to be in contact with surface water or other foreign matter which could make its way into the ducts.
- 5.2.9.8 Ducts shall not be stored in total (builder's provider's yard and site etc.) for a period longer than 1 year.

5.2.10 EXCAVATION, BEDDING AND SURROUND FOR SERVICE DUCTS

- 5.2.10.1 All excavation for service ducts shall be carried out by the Contractor to Clause 502 of the TII 'Specification for Road Works'.
- 5.2.10.2 Bedding and surrounding of ducts shall be carried out in accordance with Clause 503 of the TII 'Specification for Road Works', and M&E drawing 1367/ E-02
- 5.2.10.3 Ducts shall be evenly and solidly bedded and all material shall be adequately compacted.
- 5.2.10.4 Particular care shall be taken to ensure that material is compacted into the spaces in between any multi-ducts.
- 5.2.10.5 The excavation, bedding and surround of service ducts for ESB Networks (ESBN) (i.e. from the ESB supply pole to the kiosk which shall contain the ESB metre) shall be in accordance with the requirements of ESBN, and in particular the requirements set out in the ESBN publication "Duct Specifications of LV Cable for non-domestic connections".

5.2.11 DUCT LAYING

- 5.2.11.1 Each duct shall be carefully examined immediately prior to laying and any damaged or defective ducts shall be marked in a conspicuous manner and removed from site.
- 5.2.11.2 All duct systems shall be installed so that no undue strain is placed on cables when pulled.
- 5.2.11.3 Ducts shall be aligned as straight as possible in the horizontal and vertical directions. All sweeps shall be gradual as possible and jointed above ground prior to installation.
- 5.2.11.4 The location and arrangement of the various duct banks shall generally be as indicated on the drawings, but the precise positions/lines of the duct banks

shall be agreed between the Contractor and the Employer on commencement of the Works.

- 5.2.11.5 Ducts shall not be laid in trenches where water is lying in the bottom.
- 5.2.11.6 Every effort must be made to prevent dirt ingress into the ducts. Allowing dirt to enter ducts on the basis that the dirt should be removed later during the duct cleaning process is not acceptable.
- 5.2.11.7 Bricks or other hard packing shall not be used as temporary duct supports.
- 5.2.11.8 For ducts in trefoil formation, the ducts shall be bound together with duct ties at 3m intervals or more frequently as required to maintain the duct formation.
- 5.2.11.9 Horizontal and vertical separation between ducts shall be maintained through the use of manufactured injection moulded plastic duct spacers. 300mm or 600mm horizontal spacers shall be used to achieve horizontal spacing from other utilities as required. Spacers shall be installed at intervals as recommended by the manufacturer or at minimum intervals of 2m, whichever is lower. The Contractor shall ensure that backfill is installed and compacted correctly around the spacers to eliminate any point loading of ducts. Vertical spacers shall not be used for installation of ESB Networks ducting in accordance with their standard specification for network ducting.
- 5.2.11.10 Where duct routes are located within the loading zone of influence of existing structures the trench shall be filled with concrete of minimum strength 10N/mm² in order to ensure the structural integrity of the adjacent structure, as may be directed by the Employer.
- 5.2.11.11 Ducts shall be laid on the trench bed with the sockets towards the duct layer. The spigot end and inside of the duct to be joined shall be thoroughly cleaned with a dry rag. A duct shall be temporarily inserted to prevent ingress of soil or foreign material prior to jointing.
- 5.2.11.12 Ducts shall be laid so as to drain naturally towards one or both ends, where adequate provision for drainage shall be made. Adequate precautions shall be taken to prevent the cable duct system acting as a stormwater or ground water drainage system. A minimum fall of 1 in 200 shall be provided for drainage purposes.
- 5.2.11.13 Ducts shall be laid with the legend facing upwards.
- 5.2.11.14 The spigot end of the duct shall be pushed into the socket initially by hand and then driven in to achieve proper engagement by tapping with a hammer against a suitable wooden batten placed across the remote socket. Full engagement is when the indicator on the duct seals properly. Joints shall be made in such a manner as to avoid any sharp internal edges that may interfere with cabling operations.
- 5.2.11.15 Cutting of ducts shall be with a suitable non-electrical hand cutting tool. All cut ends shall be square to the axis of the duct and all burrs removed before use. Cutting of occupied ducts, if required, shall be carried out with extreme care.
- 5.2.11.16 Ducts not required to enter a jointing chamber shall by-pass the chamber either to the side or beneath the chamber. In certain circumstances and with the

approval of the Employer, ducts may pass through the chambers uninterrupted.

- 5.2.11.17 Ducts for road crossings shall be straight and, wherever possible, perpendicular to the axis of the road.

5.2.12 DUCT CLEANING AND TESTING

- 5.2.12.1 Immediately following the installation of any duct run, the interior of the duct shall be thoroughly cleaned by twice drawing an approved brush through the ducts, once in each direction. The cleaning procedure shall be in accordance with the manufacturer's recommendations and to the approval of the Employer.
- 5.2.12.2 Following cleaning and prior to backfilling, the ducts shall be tested by drawing a cylindrical wooden/iron mandrel through them in accordance with the TII 'Specification for Road Works'.
- 5.2.12.3 The mandrel shall be cylindrical, polished hardwood or iron, 300mm long having spherical ends and a diameter equal to the internal diameter of the ducts -10% or the internal diameter of the ducts -10mm, whichever is larger. Refer to CC-SCD-00552 of the National Roads Authority Manual of Contract Documents for Road Works.
- 5.2.12.4 Mandrels should pass through the whole length of the completed ducts when testing.
- 5.2.12.5 In the case of ESN ducts this must be done in the presence of the authorised ESN representative and the Contractor shall communicate, coordinate and make arrangements with ESN to ensure the ESN representative can witness the tests in line with the programme schedule.
- 5.2.12.6 A duct numbering schedule shall be compiled by the Contractor and each duct numbered ELV1, 2, 3, etc. ICT 1, 2, 3 etc. The schedule will detail the dated of brushing roping and mandrelling of the duct. The mandrelling of the ducts shall be witnessed and signed off by the ER on the schedule.
- 5.2.12.7 Immediately after cleaning and testing, each individual duct run shall be fitted with a strong continuous piece of polypropylene draw rope free of knots with a design life of not less than 20 years.
- 5.2.12.8 Draw ropes used in ESB ducts shall be 12mm polypropylene rope with a certified safe breaking load of 1.5 tons. Draw ropes in all other ducts shall be 10mm diameter polypropylene rope free of knots with a minimum 8kN breaking strength. The types of draw ropes used shall be approved by the Employer prior to installation.
- 5.2.12.9 A surplus of 2 meters of draw rope shall be left neatly coiled at each end of each duct run, with the ends suitably and effectively secured to prevent accidental withdrawal of the rope.
- 5.2.12.10 After installation of the draw ropes a plastic purpose-made plug or cap shall be placed in/over all open ends of ducts to prevent ingress of water and/or foreign matter. Duct plugs/caps shall be approved by the Employer prior to installation.
- 5.2.12.11 All ducts are to be sealed by this method until cables are installed. Any

unused ducts shall remain sealed by this method.

5.2.13 MARKER TAPE AND IDENTIFICATION

- 5.2.13.1 Marker tape should be laid directly above each section of duct at a depth of 300mm above the top of the duct. ESB Networks yellow marker tape shall be laid at a maximum depth of 300mm.
- 5.2.13.2 Marker tape should provide full lateral cover over the ducts and should be in vertical alignment with the duct run. For large duct configurations, more than one width of tape may be necessary to cover the extra width of the duct section.
- 5.2.13.3 Marker tape shall be manufactured from high quality material to an approved international or national standard in order to assure its long-term performance with regard to physical integrity and readability.
- 5.2.13.4 Marker tape should be not less than 200mm wide and coloured high visibility yellow.
- 5.2.13.5 Marker tape shall be marked with the relevant lettering detailed above for individual services in large black block capitals continuously along its length.
- 5.2.13.6 Marker tape including a metal foil strip shall not be used.
- 5.2.13.7 ESB Networks marker tape or strip should not be laid over any other services ducts.
- 5.2.13.8 Should any tape other than ESB Networks approved marker tape be installed overlying ESB networks ducts, the Contractor will be required to remove the unapproved marker tape and install approved material in its place.

5.2.14 CABLE CHAMBERS, FRAMES AND COVERS

- 5.2.14.1 Cable chambers shall be provided in accordance with the. However, the Contractor shall be responsible for the final positioning, setting out and sizing of each cable chamber to ensure co-ordination of the whole of the Works and compliance with the specification and drawings.
- 5.2.14.2 Adequate and safe access/egress to the cable chambers shall be provided to facilitate the installation and future maintenance of cables.

5.2.15 FRAMES AND COVERS TO CABLE CHAMBERS

- 5.2.15.1 Frames and covers to cable chambers shall comply with the requirements of IS EN 124.
- 5.2.15.2 The material used in frame and cover manufacture shall be ductile iron grade 500- 7 of ISO 1083:1987 or equivalent standard.
- 5.2.15.3 The covers shall have a secure lockable system and should prevent material entry.
- 5.2.15.4 All covers shall provide a clear opening.

5.3 APPENDIX 5/3: SURFACE WATER CHANNELS AND DRAINAGE CHANNEL BLOCKS

All surface water channels, and drainage blocks shall comply with Clause 510 of the Specification.

5.4 APPENDIX 5/4: FIN DRAINS AND NARROW FILTER DRAINS AND GEOTEXTILES FOR FILTER DRAINS

- 5.4.1 The geotextile for filter drains shall have a size distribution of pore openings such that the apparent size 090 when determined in accordance with BS 6906: Part 2 or other appropriate test is less than 300 microns.
- 5.4.2 The geotextile shall allow water to flow through it, in either direction, normal to its principal plane at a rate of not less than 10 l/m²/s under a constant head of water of 100 mm and a maximum breakthrough head of 50 mm when determined in accordance with BS 6906: Part 3.

5.5 APPENDIX 5/5: COMBINED DRAINAGE AND KERB SYSTEMS

Combined Drainage kerb is as detailed on the Drawings and shall comply with Clause 516 of the Specification.

5.6 APPENDIX 5/6: LINEAR DRAINAGE CHANNEL SYSTEMS

Table 5.4 Road construction drawing numbers

Clause No.	SCD Drawing No.
501.8	CC-SCD-00550
503.3(i)	CC-SCD-00501 and CC-SCD-00502
503.3(iii)	CC-SCD-00501 and CC-SCD-00502
508.1	CC-SCD-00514, CC-SCD-00515 and CC-SCD-00516
509.9	CC-SCD-00551
517.4	CC-SCD-00501

5.7 APPENDIX 5/7: DRAINAGE AND SERVICE DUCTS: TII ROAD CONSTRUCTION DETAILS

Clause Number	Standard Construction Detail
See project MDR file	

5.8 APPENDIX 5/8: THERMOPLASTICS STRUCTURAL WALL PIPES AND FITTINGS

5.8.1 The Contractor shall provide the following information, in accordance with Sub-clause 518.2, for the range of pipes and fittings (to be verified by the Certification body - see Sub-clause 518.10):

5.8.1.1 Technical drawings showing dimensions and tolerances including sealing rings and weight per metre, together with properties, as specified in Sub-clauses 518.3 and 518.5.

5.8.1.2 Material specification, as required in Sub-clause 518.2:

Table 5.5 Unplasticised Polyvinyl-Chloride (PVC-U)

Property	Test method reference	Specification
Tensile Properties	IS EN ISO 6259, IS EN ISO 527-1	
Vicat	IS EN ISO 2505	
Longitudinal reversion	IS EN 743	
K-value	IS EN 922	
PVC content	IS EN 1905	
Density	IS EN ISO 1183-3, ISO 4451	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	IS EN ISO 580	

Table 5.6 Polyethylene (PE)

Property	Test method reference	Specification
Tensile Properties	IS EN ISO 6259 IS EN ISO 527-1	
Vicat	IS EN 728	
Longitudinal reversion	IS EN ISO 1133	
K-value	IS EN ISO 1183-3, ISO 4451	
PVC content	ISO 4440	
Density	ISO 12091	
Heat Reversion	IS EN ISO 580	
Effects of heating (injection moulded fittings only)	IS EN ISO 6259 IS EN ISO 527-1	

Table 5.7 Polypropylene (PP)

Property	Test method reference	Specification
Tensile Properties	BS EN ISO 6259, BS EN ISO 527-1	
Vicat	BS EN 728	
Longitudinal reversion	BS EN ISO 1133	
K-value	BS EN ISO 1183-3, ISO 4451	
PVC content	ISO 4440	
Density	ISO 12091	
Heat Reversion	BS EN ISO 580	
Effects of heating (injection moulded fittings only)	BS EN ISO 6259, BS EN ISO 527-1	

5.9 APPENDIX 5/9: ATTENUATION

5.9.1 ATTENUATION

- 5.9.1.1 For location of attenuation system refer to the Contract Drawings.
- 5.9.1.2 Refer to the Contract Drawings for proposed details.
- 5.9.1.3 Invert levels of the attenuation facility shall be as per details on the Contract Drawings.
- 5.9.1.4 Refer to the Contract Drawings for surface water schedules showing pipe levels entering the attenuation system.
- 5.9.1.5 A geotextile liner shall be used on the bottom and sides of the excavation for the attenuation facility as per manufacturer specification.
- 5.9.1.6 Note all liners shall be as manufactures specifications
- 5.9.1.7 A Siemens Direct acting float switch 9G EF or similar type approved shall be provided in the chamber containing the hydro brake. This will be set to provide an alert if the water level approaches the top of the attenuation structure. For details refer to series 1500 of the TII Specification for Road Works.
- 5.9.1.8 The minimum storage capacity of the attenuation system shall cater for 1 in 100 year on site storage. The Contractor shall prepare a method statement for the installation of the attenuation facility. Installation shall be in accordance with manufacturer's instructions and best practice methods

6 SERIES 600 - EARTHWORKS

6.1 APPENDIX 6/1: REQUIREMENTS FOR ACCEPTABILITY & TESTING OF EARTHWORKS MATERIALS

6.1.1 EARTHWORKS OVERVIEW

The Contractor shall note that his earthworks construction must be planned and carried out taking account of the following particular constraints:

- 6.1.1.1 The requirements to keep earthworks free from water (SRW 602.15, 602.16).
- 6.1.1.2 The requirement to install drainage at an appropriate time (SRW 603.3).
- 6.1.1.3 The disposal of unsuitable materials to properly licensed facilities.
- 6.1.1.4 Other miscellaneous works such as drainage, etc. required as part of the road works construction.

6.1.2 GENERAL

- 6.1.2.1 The permitted classes, acceptable limits and material properties required for acceptability for fill material are given in Table 6/1 of the TII Specification for Road Works, and Table 6.1A of this Appendix. Grading requirements for each class of fill are given in Table 6/2 of the TII Specification for Road Works. The compaction requirements are given in Table 6/4 of the TII Specification for Road Works. It should be noted that if crushed concrete is to be used as a constituent material of any of the acceptable Classes of fill shown in Table 6/1 the onus is on the Contractor to prove that the concrete is free from unacceptable materials.
- 6.1.2.2 Confirmation of CBR values on-site shall be provided by the Contractor via plate bearing tests or equivalent approved method. Generally 5 no. plate test will be required. Plate tests will not be carried out where formation is on sound rock. Where directed by the Employer's Representative, additional plate bearing tests shall be carried out to confirm that the formation strength meets the design requirements.

6.1.3 CLASS 4 LANDSCAPE FILL MATERIAL

- 6.1.3.1 All cohesive materials to be excavated on the site, excluding those deemed as Classes U1 and U2 unacceptable material may be used for landscaping purposes beneath top soiling, subsequent to the requirements defined in Appendix 6/8. Cohesive materials classified as Class U1 unacceptable material from cut zones on account of an MCV value outside the acceptable limits that would otherwise satisfy the requirements for acceptability shown in Table 6.1 may be used as Class 4 material provided that their MCV value lies within the range 4 to 18 and provided that these low strength soils are not required to support traffic or fence lines. We also note that peat may be mixed with low strength fills in landscaping however this will be at the discretion of the Engineer.

6.1.4 CLASSIFICATION AND TESTING OF MATERIALS

- 6.1.4.1 The classification and acceptability of the earthworks materials shall be the responsibility of the Engineer. The Contractor shall arrange for sampling and testing of materials selected by the by the Engineer at a frequency of two samples per trial holes, with the full range of tests to determine the classification of the material being carried out on each of the samples selected.
- 6.1.4.2 The Contractor will be expected to open trial holes to the Engineer's requirements to facilitate sampling, testing and classification of the earthworks materials. The frequency of these trial holes in cut areas shall be at intervals of 25 metres, unless otherwise directed by the Engineer. In areas of material where acceptability is marginal, the Engineer may direct a higher frequency of trial pits. The requirements for testing, classification and determining acceptability do not detract from the Contractors overall responsibility to provide and maintain the condition of acceptable material as defined in the Contract.
- 6.1.4.3 The Contractor is required to undertake all testing of material he wishes to use for capping and sub-base in accordance with series 800 of the TII Specification for Road Works.

6.1.5 REQUIREMENTS FOR DEALING WITH CLASS U1 UNACCEPTABLE MATERIAL- GENERAL

- 6.1.5.1 If unacceptable Material Class U1, as defined in Clause 601.2 of the Specification for Road Works is encountered on the scheme the Contractor may process this material so that it complies with the permitted constituents and material properties of Table 6.1 for a particular material.
- 6.1.5.2 Where this material is not processed, the material shall be removed and disposed of. The Contractor shall obtain a Landfill Licence or an exemption from the Environmental Protection Agency (EPA) or the Planning Department of the Local Authority as appropriate within whose jurisdiction the Contractor intends to dispose of the unacceptable U1 material.

6.1.6 ALTERNATIVE MATERIALS AND ADDITIONAL SUB-DIVISION OF CLASSES

- 6.1.6.1 The permitted classes of material, and the acceptable limits for the various properties to be assessed when determining acceptability, are presented in Table 6/1 of the TII Specification for Road Works and in Table 6/1A below. Where the acceptability limits in Table 6.1 of the TII Specification for Road Works differ from those in Table 6.1A of this Appendix, the limits set out in the latter shall apply.

Table 6.1A Acceptable Limits for Materials to be used on site

CLASS	MATERIAL PROPERTIES			
	PROPERTY	TEST	ACCEPTABLE LIMITS	
			LOWER	UPPER
1A	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity Coefficient	BS 1377: Part 2	10	—
1B	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity Coefficient	BS 1377: Part 2	—	10
1C	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity Coefficient	BS 1377: Part 2	5	—
	LA Co-efficient.	Clause 635	50 kN	—
2A	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Liquid Limit	BS 1377: Part 2	—	—
	Plastic Limit	BS 1377: Part 2	—	—
	Moisture Content	BS 1377: Part 2	PL - 4	-
	MCV	Clause 632	8	14
	Undrained shear strength of remoulded material (IL)	Clause 633	40 kPa	—
2B	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Plastic Limit	BS 1377: Part 2	—	—
	Moisture content	BS 1377: Part 2	-	PL – 4
	MCV	Clause 632	8	14
	Undrained shear strength of remoulded material (IL)	Clause 633	40 kPa	-
2C	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Moisture Content	BS 1377: Part 2	-	-
	Optimum Moisture Content (OMC)	BS 1377: Part 3	—	—
	MCV	Clause 632	8	14
	Undrained shear strength of remoulded material (IL)	Clause 633	40 kPa	—
2D	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Moisture Content	BS 1377: Part 2	—	—
	MCV	Clause 632	8	14
	Undrained shear strength of remoulded material	Clause 633	40kPa	-

CLASS	MATERIAL PROPERTIES			
	PROPERTY	TEST	ACCEPTABLE LIMITS	
			LOWER	UPPER
4	Grading (IL)	BS 1377:Part 2	As per Class 2 Table 6/2 or as agreed by Employer	
	MCV		6 or as specified by the Employer	18 or as specified by the Employer
5A	Grading	Clause 618	–	Clause 618
6A	Grading	Visual Assessment / BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity Coefficient	BS1377: Part 2	10	–
	Plasticity Index	BS 1377: Part 2		Non-plastic
6B	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
6C	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity Coefficient	BS 1377: Part 2	10	–
	Plasticity Index	BS 1377: Part 2		Non-plastic
	Soaked 10% Fines Value (IL)	Clause 635	50 kN	–
	MC		OMC-2%	OMC+1%
	Moisture Content (on that part of material passing 20mm BS sieve) (IL)	BS 1377: Part 2	–	TBC
6F1	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Plasticity index	BS 1377: Part 2		Non-plastic
	Soaked 10% fines value (IL)	Clause 635	50 kN	–

CLASS	MATERIAL PROPERTIES			
	PROPERTY	TEST	ACCEPTABLE LIMITS	
			LOWER	UPPER
	Moisture content (on that part of the material passing 20 mm BS sieve) & OMC (IL)	BS 1377: Part 2 BS 1377: Part 4 (Vibrating hammer method)	--	OMC
6F2	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Plasticity index	BS 1377: Part 2		N on - pl as tic
	Soaked 10% Fines Value (IL)	Clause 635	50 kN	–
	Moisture content (on that part of the material passing 20 mm BS sieve) & OMC (IL)	BS 1377: Part 2 BS 1377: Part 4 (Vibrating hammer method)	–	OMC
6F3	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Plasticity index	BS 1377: Part 2		N on - pl as tic
	Soaked 10% Fines Value (IL)	Clause 635	50 kN	–
	Moisture content (on that part of the material passing 20 mm BS sieve) & OMC (IL)	BS 1377: Part 2 BS 1377: Part 4 (Vibrating hammer method)	OMC-2%	OMC
6G	Grading	BS 812: Part 103	Clause 626	Clause 626
	Soaked 10% fines value (IL)	Clause 635	50 kN	–
6H	(i) Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	(ii) Plasticity index	BS 1377: Part 2		N on - pl as tic
	(iii) Soaked 10% fines value (IL)	Clause 635	50 kN	–

CLASS	MATERIAL PROPERTIES			
	PROPERTY	TEST	ACCEPTABLE LIMITS	
			LOWER	UPPER
	(iv) mc (IL)	BS 1377: Part 2	–	–
	(v) MCV	Clause 632	8	14
	(vi) pH value (IL)	BS 1377: Part 3	Table 6/3	Table 6/3
	(vii) Chloride ion content (IL)	BS 812: Part 117	–	Table 6/3
	(viii) Sulphates (IL)			
	(ix) Resistivity (IL)	Clause 637	Table 6/3	–
	(x) Redox potential (IL)	Clause 638	Table 6/3	–
	(xi) Organic content (IL)	BS 1377: Part 3	–	Table 6/3
	(xii) Microbial activity index (IL)	Table 6/3	–	Table 6/3
6I	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity Coefficient	BS1377: Part 2	10	–
	Plasticity index	BS 1377: Part 2		N on pl as tic
	(iii) Soaked 10% fines value (IL)	Clause 635	50 kN	–
	Effective angle of friction (ϕ') and effective cohesion (c') (IL)	Clause 636	$\phi' = 36^\circ$ $c' = 0$	–
	Coefficient of friction and adhesion (fill/elements) (IL)	Clause 639	$\phi' = 36^\circ$ $c' = 0$	–
	pH value (IL)	BS 1377: Part 3	Table 6/3	Table 6/3
	Chloride ion content (IL)	BS 812: Part 117	–	Table 6/3
	Sulphates (IL)		–	
	Resistivity (IL)	Clause 637	Table 6/3	–
	Redox potential (IL)	Clause 638	Table 6/3	–
	Organic content (IL)	BS 1377: Part 3	–	Table 6/3
	Microbial activity index (IL)	Table 6/3	–	Table 6/3

CLASS	MATERIAL PROPERTIES			
	PROPERTY	TEST	ACCEPTABLE LIMITS	
			LOWER	UPPER
	Moisture content (on that part of the material passing 20 mm BS sieve) & OMC (IL)	BS 1377: Part 2 and BS 1377: Part 4 (Vibrating hammer method)	OMC– 2%	OMC+3%
6J	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Uniformity coefficient	BS 1377: Part 2	5	10
	Plasticity index	BS 1377: Part 2		N on pl as tic
	Soaked 10% Fines Value (IL)	Clause 635	50 kN	–
	Effective angle of friction (ϕ') and effective cohesion (c') (IL)	Clause 636	$\phi' = 36^\circ$	–
			$c' = 0$	
	Coefficient of friction and adhesion (fill/elements) (IL)	Clause 639	–	–
	pH value	BS 1377: Part 3	Table 6/3	Table 6/3
	Chloride ion content	BS 812: Part 117	–	Table 6/3
	Sulphates (IL)			
	Resistivity (IL)	Clause 637	Table 6/3	–
	Redox potential (IL)	Clause 638	Table 6/3	–
	Organic content	BS 1377: Part 3	–	Table 6/3
	Microbial activity index (IL)	Table 6/3	–	Table 6/3
	Moisture content (on that part of the material passing 20 mm BS sieve) & OMC (IL)	BS 1377: Part 2 and BS 1377: Part 4 (Vibrating hammer method)	OMC– 2%	OMC+2%
	Grading	BS 1377: Part 2	Table 6/2	Table 6/2
	Soaked 10% fines value	Clause 635	50 kN	–
	Undrained shear parameters (c and ϕ) (IL)	Clause 633	–	–
	effective angle of friction (ϕ') and effective cohesion (c') (IL)	Clause 636	$\phi' = 36^\circ$ $c' = 0$ kPa	–
	Permeability (IL)	Clause 640	5×10^{-5} m/s	–

CLASS	MATERIAL PROPERTIES			
	PROPERTY	TEST	ACCEPTABLE LIMITS	
			LOWER	UPPER
6N	pH value (IL)	BS 1377: part 3	6	9
	Moisture content (on that part of the material passing 20 mm BS sieve) & OMC (IL)	BS 1377: Part 2 and BS 1377: Part 4 (Vibrating hammer method)	OMC-2%	OMC+1%
	Sulphates (IL)	TRL447 (see Notes 2 to 4)	-	TRL447 (see Notes 2 to 4)
	MCV	Clause 632	-	-
	Slope stability test	Clause 610	1V:1.5H	-
6P	Grading	BS 1377: part 2	Table 6/2	Table 6/2
	Soaked 10% Fines	Clause 635	50 kN	-
	Value (IL)			
	Undrained shear parameters (c and ϕ)	Clause 633	-	-
	Effective angle of friction (ϕ') and effective cohesion (c') (IL)	Clause 636	$\phi' = 40^\circ$ $c' = 0 \text{ kPa}$	-
	Permeability (IL)	Clause 640	$5 \times 10^{-5} \text{ m/s}$	-
	pH value (IL)	BS 1377: part 3	6	9
	Sulphates (IL)	TRL447 (see Notes 2 to 4)	-	TRL447 (see Notes 2 to 4)
	mc (indicative) (IL)	BS 1377: part 2	OMC-2%	OMC+2%
	MCV	Clause 632	-	-
	Slope stability test	Clause 610	1V:1.5H	-
8	MCV	Clause 632	8	14

6.1.7 GROUNDWATER

6.1.7.1 If some seepage of groundwater is encountered during the excavation of foundations and cuttings the Contractor should note the requirements of Clause 602.16 and Clause 602.17.

6.1.7.2 The Contractor shall allow for the control of groundwater in all temporary excavations and in all temporary situations during the course of the Works, and it shall be noted that pumping into existing watercourses or sewers shall only be permitted upon provision of a detailed Method Statement, including but not limited to approved environmental controls and consents, to the Engineer and local authority and its subsequent approval.

- 6.1.7.3 The Contractor should note that he is required to take measures to prevent any surface runoff from the construction works flowing directly into any of the watercourses, both existing and proposed, on the site. The Contractor shall provide measures to channel surface water runoff to specific discharge points where silt traps, screens or any other measures deemed necessary by the Engineer shall be employed to prevent contamination and siltation of the watercourses.

6.1.8 EARTHMOVING

- 6.1.8.1 Clause 602 of the Specification sets out arrangements the Contractor shall make for maintaining the integrity of the acceptable materials arising from the Site. The attention of the Contractor is especially drawn to the physical constraints as outlined in Appendix 6/1 paragraph 1.

6.2 APPENDIX 6/2: REQUIREMENTS FOR DEALING WITH CLASS U2 UNACCEPTABLE MATERIAL

6.2.1 GENERAL

- 6.2.1.1 For the purpose of this Contract, Unacceptable Material Class U2 shall be as defined in Clause 601.3 of the Specification, where hazardous chemical properties shall be defined as containing biodegradable (putrescible) material (i.e. capable of producing landfill gas) or containing leachate or capable of producing leachate or containing asbestos or as defined hazardous by the Environmental Protection Agency and shall include materials containing coal tar with a level of PAH greater than that permissible under Air quality 4th Daughter Directive (2004/107/EC), and any subsequent Irish Legislation. Bituminous mixtures containing coal tar and coal tar products are listed in the European Waste Catalogue as hazardous waste (Chapter 17 Construction and Demolition Waste: Waste ID 17 03 01 and 17 03 03 respectively) pursuant to Directive 91/689/EEC on hazardous waste.

6.2.2 MEASURES FOR DEALING WITH UNACCEPTABLE MATERIAL CLASS U2

- 6.2.2.1 In the event that the Contractor encounters any other area where the presence of Unacceptable Material Class U2 is suspected, the Contractor shall cease any excavation work in that area immediately. The Contractor shall make arrangements to have an approved Sub-Contractor, specialising in the identification of such material, carry out testing and sampling on suspected hazardous material. Testing shall be agreed with the engineer.
- 6.2.2.2 The Contractor shall make arrangements for the Class U2 material to be excavated and removed off site by a specialist waste-disposal Contractor approved by the Engineer, and disposed of to a properly licensed site subject to the approval of the appropriate Waste Regulation Authority. No material shall leave the site without the approval of the Engineer. The Contractor shall keep records of the materials removed and shall obtain the Engineer's authentication of the records.

- 6.2.2.3 The Contractor shall prepare appropriate Method Statements and safety plans to cover any such operations which will be subject to the approval of the Engineer.
- 6.2.2.4 Groundwater/Leachate from contaminated areas shall not be discharged to public or private surface water or foul sewers, or to watercourses without prior approval from the appropriate authority. Should groundwater or leachate be found in contaminated areas, it shall be contained so as to prevent contamination of uncontaminated ground, prior to disposal off site.

6.3 APPENDIX 6/3: REQUIREMENTS FOR EXCAVATION, DEPOSITION, COMPACTION (OTHER THAN DYNAMIC COMPACTION)

6.3.1 GENERAL

- 6.3.1.1 Ground investigation information is given for information purposed in the Tender Documents where available.
- 6.3.1.2 The Contractor is deemed to have included in his rates for the excavation, processing, handling, deposition and compaction of the materials described in the site investigation document.

6.3.2 DRAWINGS

- 6.3.2.1 The drawings for the earthworks are as listed in Appendix 0/4 of SP-1021.

6.3.3 BLASTING

Not Required

6.3.4 MAKING GOOD PRIOR TO TOPSOILING

- 6.3.4.1 Isolated patches of soft/fragmented or insecure material shall be excavated and filled by well compacted material ramming in a class with similar characteristics to the surrounding intact material.

6.3.5 EMBANKMENT CONSTRUCTION

- 6.3.5.1 Acceptable materials for use are classified in Table 6/1 of the TII Specification for Road Works and Table 6/1A of Appendix 6/1 of SP-1021. The Contractor may, with the approval of the Engineer, determine that suitable material is available from excavated material and be used in the construction of the embankments.

6.3.6 EXCAVATION BELOW EMBANKMENTS AND BELOW FORMATION LEVEL IN CUTTINGS

6.3.6.1 Where any material below the natural ground level under embankments is required to be excavated, the resultant excavation shall be backfilled to a level directed by the Engineer with Class 1C coarse granular material, deposited and compacted using plant and a working method suited to the materials to be handled and traversed. Below standing water, the Contractor shall use Class 6A material deposited without the associated use of compaction.

6.3.7 EXCAVATION TOLERANCES AT FORMATION AND SUB-FORMATION

6.3.7.1 The excavation tolerances at formation and sub-formation shall comply with the following, unless otherwise noted on the drawings;

- Formation: + 10mm/ -30mm
- Sub-Formation: + 10mm/ -30mm

6.3.8 PERMANENT DRAINAGE INSTALLATION

Where directed by the Engineer for the purposes of improving strength of the sub-grade, the Contractor shall install the permanent drainage as soon as is practicable. The Contractor shall in any event install the permanent drainage before the bulk excavation reaches a level 300mm above formation level. The base of cuttings shall be kept well drained at all times. The Contractor shall ensure that plant utilised in the earthworks operations does not in any way damage or alter the locations or levels of drainage works already constructed.

6.3.9 PROTECTION OF MATERIALS

The Contractor shall control his excavation, transport, stock piling, draining, placing and compacting operations so that the classification of any material is not degraded by reason of increase in moisture content, or by any other means, to a lesser category. Such control measures shall include, but shall not be limited to, curtailment of topsoil stripping so as to protect underlying soils and organisation of drainage and excavation operations so as to reduce where possible the moisture contents of materials. The Engineer shall request such tests as he may deem necessary to determine if materials are being controlled so as to protect their respected classification categories. Where the classification category of any material has been allowed to degrade, the Contractor shall take corrective measures in accordance with the provisions of Clause 602 at no extra cost to the Contract.

- The Contractor shall ensure that no materials/underlying earthworks are damaged by excessive trafficking – whether unexcavated, future formation/sub-formation or fills.

6.3.10 COMPACTION

Nuclear density gauge shall be permitted for use to measure in-situ bulk densities provided that it is calibrated, well maintained and shown to be suitable to the Engineer's satisfaction for the materials being tested. However, for determination of the moisture content and hence the dry density, correlation against the oven dried moisture content is required for each material type encountered.

6.3.11 ARCHAEOLOGICAL EVALUATIONS

- 6.3.11.1 If any object of archaeological interest is exposed during the course of the Works, the Contractor shall notify both the Engineer and the National Monuments Service, and desist from work in the immediate vicinity of the find until such time as the area can be fully investigated.
- 6.3.11.2 The Contractor shall make available this land and accommodate any reasonable requests to assist in the investigation. Anything found as a result of such an investigation shall become the property of the State.
- 6.3.11.3 The Contractors attention is drawn to the requirements of Appendix 1/13 regarding programming constraints.

6.4 APPENDIX 6/4: NOT USED

6.5 APPENDIX 6/5: GEOTEXTILES USED TO SEPARATE EARTHWORKS MATERIALS

6.5.1 GEOTEXTILE

- 6.5.1.1 It is proposed that geotextiles shall be used as a separator between the sub-grade and the Class 6C material placed in soft spots and at any other locations deemed necessary by the Employer.
- 6.5.1.2 The Contractor shall submit a Method Statement to the Employer at least four weeks prior to starting his earthworks, detailing his proposals for securing the geotextile in place. The proposed method should in no way alter the original characteristics of the material or create any localised stresses in the material through piercing of the material with nails or pegs.
- 6.5.1.3 The Contractor shall submit a proposal for the type of geotextile to be used based on the following requirements:
- 6.5.1.4 The minimum Design Strength of the geotextile, allowing for a design life of 50 years shall be;
- 50.0kN/m run.
 - The design strength of the geotextile shall be calculated from creep data, environmental and installation damage coefficients.
 - These coefficients shall be clearly stated in the Contractors method statement.

- The strength of the geotextile required when tested in accordance with ISO 10319 and expressed as the lower 95% confidence limit in accordance with ISO 2602-1988 (BS 2846, Part 2, 1981), shall be calculated to achieve the design strength with a peak strain of around 5% (longitudinal) and 5% (transverse).
- 6.5.1.5 The geotextile shall be inert to all chemicals naturally found in soils and shall have no solvents at ambient temperature. It shall not be susceptible to hydrolysis, shall be resistant to aqueous solutions of salts, acids and alkalis, and shall be non-biodegradable.
- 6.5.1.6 The geotextile shall have a minimum of 2% finely divided carbon black, as determined by BS 2782 Part 4, method 452B; 1993, well dispersed in the polymer matrix to inhibit attack by ultra violet light.
- 6.5.1.7 The geotextile shall be manufactured in accordance with the Quality Assurance requirements ISO 9002. If required by the Employer, the Contractor shall provide evidence that the manufacturer's Quality Assurance System has been certified to conform to ISO 9002 by an external authenticating authority approved by the Department of Trade and Industry.
- 6.5.1.8 Adjacent sheets of the geotextile shall be overlapped according to the Manufacturer's design requirements.
- 6.5.1.9 The Contractor shall ensure that the layer of material on which the geotextile is to be placed shall not have protrusions or sharp projections which are likely to damage the geotextile during installation or whilst in service.
- 6.5.1.10 The geotextile shall be a bi-directional material with similar strength exhibited in each direction or two layers shall be used in the longitudinal and transverse directions.

6.6 APPENDIX 6/6: FILL TO STRUCTURES & FILL ABOVE STRUCTURAL FOUNDATIONS

- 6.6.1.1 Fill above Structural foundations in accommodation works boundary walls and the like to be acceptable material unless otherwise directed by the Employer.
- 6.6.1.2 Fill to all other structural foundations to be Class 6N.
- 6.6.1.3 Fill to Structures to be Class 6N.
- 6.6.1.4 Fill to Building foundations or up to buildings shall comply with Clause 808 of the Specification.

6.7 APPENDIX 6/7: SUB-FORMATION PREPARATION & SURFACE TREATMENT OF FORMATION

- 6.7.1.1 The design is shown on the Drawings.
- 6.7.1.2 Unless otherwise noted on the Drawings, typically 300mm will be required on fills below the bridge deck slab.
- 6.7.1.3 CBR compliance testing on the sub-formation shall be carried out using in-situ

CBR tests in accordance with B.S. 1377: Part 9 or Plate Bearing Tests (PBT) according to B.S. 1377: Part 9, carried out in accordance with Note 1 of the “Earthworks Notes” on Drawing 1201 as listed in Appendix 0/4 of SP-1021. Compliance testing is required to confirm that the in-situ CBR is no less than the design CBR. CBR compliance testing shall be carried out immediately prior to placement of the pavement construction to confirm design values. This testing shall not be used to increase the design CBR values.

- 6.7.1.4 Where in-situ CBR tests are carried out the test location shall be selected where possible to avoid particles of more than 20 mm diameter and particular attention shall be given to the requirements of BS 1377: Part 9 Clause 4.3.4.10. Moisture content tests on the fraction passing the 20 mm sieve to this clause and Atterberg Limit tests are required for both the in-situ CBR and plate bearing tests.
- 6.7.1.5 Approved alternative tests shall be correlated with adjacent in-situ CBR or plate bearing tests.
- 6.7.1.6 Where the in-situ CBR is lower than the design CBR, the capping thickness is to be increased accordingly as determined by the Employer’s Representative. If any degradation of capping is noted prior to placement of pavement materials, remedial measures shall be undertaken as agreed by the Employer’s Representative.
- 6.7.1.7 The sub-formation shall be protected at all times.
- 6.7.1.8 Shaping requirements of sub-formation shall be to Clause 613.4
- 6.7.1.9 Not used.
- 6.7.1.10 A minimum CBR of 15% is required at the top of the capping (formation) layer. CBR compliance testing should be in accordance with Note 1 of the “Earthworks Notes” on Drawing 1201 as listed in Appendix 0/4 of SP-1021.
- 6.7.1.11 In cuttings where rock is present at formation level the Employer’s Representative shall inspect the formation and may direct further excavation and placement of regulatory course to take place to achieve the tolerances as described below.
- 6.7.1.12 Where excavation has taken place to full sub-base depth on direction of the Employer’s Representative, the Employer’s Representativeshall again inspect the formation and direct further excavation to achieve the tolerances as described below or continue excavation to provide the required depth of capping layer.
- 6.7.1.13 Where rock is encountered during excavation to the capping level, the Employer’s Representative shall inspect the extents of the rock surface and direct excavation to continue to sub-formation level at either a depth determined by the Employer’s Representative, or to the original proposed level of the sub-formation.
- 6.7.1.14 The ground investigation report contains factual information only, and is not provided for measurement purposes.
- 6.7.1.15 Permitted GIL materials are included in Table 6.1 as Class 6F4. This is to be used to improve the ground such that capping is not required and may be used on cohesive embankments or in cuttings in cohesive material. Ground

improvement layers will be used with a granular blinding layer so that all surface voids are filled before sub-base is constructed.

- 6.7.1.16 Capping shall be constructed with Class 6F2 material complying with Table 6/1. All capping shall be non-frost susceptible, as defined in 602.20 of the TII Specification for Road Works.
- 6.7.1.17 Where excavation has taken place to full sub-base depth on direction of the Employer's Representative, the Employer's Representative shall again inspect the formation and direct further excavation to achieve the tolerances as described below or continue excavation to provide the required depth of the capping layer.
- 6.7.1.18 The Contractor's attention is drawn to the requirements of SRW 608.9(ii) and SRW 613 and his responsibilities therein to protect the sub formation from the effects of weather.
- 6.7.1.19 Where rock is present at formation level and at the direction of the Employer's Representative, the material shall be excavated a minimum depth of 75mm below formation level such that the surface level of any part of the excavation is below +20mm of the proposed formation level. The exposed excavation shall then be regulated by depositing Clause 804 material so that the surface level tolerance of the completed formation is within +20mm and -30mm relative to its designed level.
- 6.7.1.20 Where rock is encountered during excavation for the capping layer, the Employer's Representative shall inspect the extents of the rock surface and direct excavation to continue to sub-formation level at either a depth determined by the Employer's Representative, or to the original proposed level of the sub-formation. Whereupon the surface of the sub-formation shall be excavated to a minimum depth of 75mm such that the surface level of any part of the excavation is below +20mm of the determined sub-formation level design.
- 6.7.1.21 The exposed excavation shall then be regulated by depositing capping layer material so that the surface level tolerance of the completed formation is within +20mm and -30mm relative to the design level.

6.8 APPENDIX 6/8: TOPSOILING, GRASS SEEDING AND TURFING

All topsoil under fill areas and in cuts shall be excavated, and stockpiled in accordance with Clause 602.11 for re-use. Re-use of this topsoil shall be subject to the approval of the Engineer.

6.8.1 GROWING MEDIUM

The growing medium shall be in accordance with BS 3882 and shall be a good quality medium loam in a workable consistency. It shall not have been previously compacted, shall not be in an inert state and shall exhibit its true natural structure and characteristics.

The growing medium shall be free of pernicious weeds, straw, stones, sticks, clay, lumps, brick tiles, glass, timber, plastics, metals, paper and any other foreign matter which exceeds 50mm in diameter in any plane.

The side slopes are to be top soiled, fertilised and seeded (Treatment 1) as per Clause 618.4(i) and as shown on the drawings. Topsoil shall be deposited to a minimum depth of 150mm on side slopes and landscaped areas.

6.9 APPENDIX 6/9: EARTHWORK ENVIRONMENTAL BUNDS, LANDSCAPE AREAS, SCREENING MOUNDS, STRENGTHENED EMBANKMENTS

- 6.9.1.1 It is the responsibility of the Contractor to establish location of services prior to excavation.
- 6.9.1.2 All setting out to be by direction of or to the approval of the Engineer prior to planting. Planting areas are to be marked on site as shown in the drawing. The plot areas and hedgerows must be marked in outline with pegs spaced at not more than 20 metres apart, around the total perimeter of the planting area. On completion of the pegging out of planting positions, no further work shall be commenced until the Engineer is satisfied as to the position of the planting areas as marked by the pegs.
- 6.9.1.3 No alteration is to be made to the position of the planting shown in the drawings or to the Specification of the Works without prior approval from the Engineer.
- 6.9.1.4 If the Contractor, having used his best endeavour, cannot source plants for such species as specified in the Plant Schedules but can obtain plants of an acceptable alternative species then the Contractor shall give written notice to the Engineer stating the details of the suggested alternative, such notice shall be given not later than 3 weeks after the Engineer order to commence the Works to enable the Engineer to consider and if necessary give effect to any change which may be required and to avoid delay in the performance of the Contractor's obligations.
- 6.9.1.5 Plants shall be distributed as follows: For native woodland and woodland edge plots, species shall be randomly mixed in groups of 3 to 10. Native hedge plants shall be placed in a double staggered row, and species distributed as shown in Hedge Planting Detail.
- 6.9.1.6 Rabbit protection: either individual guards fitted to each plant or rabbit proof fencing.
- 6.9.1.7 All planted areas should be provided with a minimum of 450mm of topsoil
- 6.9.1.8 To each transplant, standard tree and contained grown station the Contractor shall supply an incorporate a slow release fertilizer.
- 6.9.1.9 All preparation for and planting transplants, shrubs and standard trees shall be carried out during the period 31 October to 31 March.
- 6.9.1.10 Transplant pits should be excavated to a depth of 300mm in diameter and 300mm below existing levels. All pits should be excavated to a sufficient depth and width to accommodate the plant without disturbing the roots. All pits will be backfilled and sufficient soil shall be replaced to raise the level 40mm above that of adjacent levels. Container grown stock shall be planted in a pit excavated to a sufficient depth and width to accommodate the plant without disturbing the roots.

- 6.9.1.11 A circle of between 600mm and 800mm around each plant station should be kept free of all competitive plant growth for a period of 3 years to ensure establishment.

6.10 APPENDIX 6/10: GROUND ANCHORAGES, CRIB WALLING AND GABIONS

All works involving ground anchorages, crib walling or gabions shall comply with Clause 624, Clause 625 and Clause 626 of the Specification.

6.11 APPENDIX 6/11: INSTRUMENTATION & MONITORING

6.11.1 MONITORING OF VIBRATION

Monitoring to be carried out during working hours.

The Contractor is required to ensure construction works do not affect the stability of existing buildings, plant or equipment. The Contractor is required to provide evidence of survey performance completed on a daily basis.

The Contractors procedure to provide for monitoring survey every 2 hours with rates of settlement analysed and assessed. Provision for construction methods to be modified or activity cessation if deemed applicable from analysis.

Measurement is required by manual surveying and remote monitoring. Records to be provided in digital format. Clause 4.3.2 refer to SP-1001 for further details on vibration monitoring.

6.12 APPENDIX 6/12: GROUND IMPROVEMENT

All works involving Ground Improvement shall comply with Clause 630 of the Specification.

6.13 APPENDIX AR6/80: ROCK ARMOUR/ ROCK REVETMENTS IN HYDRAULIC ENGINEERING (E.G. MARINE / RIVER)

Not required

6.13.1 ROCK ARMOUR/ REVETMENT

6.13.1.1 Materials

Reference to CIRIA in this clause shall mean reference to "*CIRIA Special Publications 83 / CUR Report 154, Manual on the use of rock in coastal and shoreline engineering, (Appendix 1)*". CIRIA terminology and abbreviations are used in the following, and CIRIA definitions shall prevail where no other definitions are given in the Tender Documents.

All stone materials for construction of the revetment shall be graded quarry stone of igneous type rock. The material shall be dense, sound, durable, and free from weathering or mechanical weakening or chemical decomposition. Size for underlayer

refers to the standard sieve size with square openings. Size of rock armour refers to the nominal side dimension of a theoretical cube.

The material shall be rock from approved quarries. The Contractor shall submit with his Tender all relevant particulars of his proposed suppliers and sources of rock materials. The Contractor shall submit relevant testing certificates to prove the suitability of the proposed materials before commencing the Works. The Contractor may propose additional suppliers and sources during the execution of the Contract, but any change shall be subject to the Employer's approval.

The following specific requirements shall apply to stone material:

6.13.1.1.1 Granular Underlayer Grading:

The particle size distribution of granular underlayer for the revetments, designated 5kg – 40kg on the Drawings, shall be as follows in accordance with CIRIA, (Table 3.5):

Table 6.2 5kg-40kg Under Layer Rock Grading

Sieve Size (mm)	Percentage Passing*
80	97-100
40	70-100
5	0-10
1.5	0-2

* Note: Cumulative weight passing sieve (or smaller than) as a percentage of total weight

6.13.1.1.2 Rock Armour Grading:

Rock armour grading shall be in accordance with the standard class designations given in EN 13383 (CIRIA C683 Table 3.5).

Requirements to weight distribution and effective mean weight for 1000-3000 kg rock armour is as follows:

Table 6.3 1000-3000kg Rock Armour Grading

Sieve Size (mm)	Percentage Passing*	
4500	97-100	
3000	70-100	
1000	0-10	
700	0-5	
	Min	Max
Effective mean weight (kg)	1700	2100

* Note: Cumulative weight of rocks lighter than class limit as a percentage of total weight

Requirements to weight distribution and effective mean weight for 300-1000 kg rock armour is as follows:

Table 6.4 300-1000kg Rock Armour Grading

Sieve Size (mm)	Percentage Passing*	
1500	97-100	
1000	70-100	
300	0-10	
200	0-5	
	Min	Max
Effective mean weight (kg)	540	690

* Note: Cumulative weight of rocks lighter than class limit as a percentage of total weight

Conversion between size and weight shall presume particles of cubic shape, i.e. side dimension $D = (W/\rho)^{(1/3)}$

6.13.1.1.3 Reuse of Rock:

Where existing rock armour is of an acceptable quality it may be reused in coastal protection works. Rock quality shall be agreed with the Designer's Representative prior to reuse.

6.13.1.1.4 Shape:

Quarried rock shall not contain more than 5% of stones with a length to thickness ratio (l/d) of greater than 3, or 50% with l/d greater than 2, where the length, l , is defined as the greatest distance between two points on the stone and the thickness, d , is defined as the minimum distance between two parallel straight lines through which the stone can just pass.

6.13.1.1.5 Density:

The average mass density of the quarry stone shall be at least 2,650 kg/m³, with 90% of the stones having a mass density of at least 2,600 kg/m³.

6.13.1.1.6 Water Absorption:

The average water absorption of the quarry stone shall be less than 2.0%, measured in accordance with BS812.

6.13.1.1.7 Resistance to Weathering:

The average freeze-thaw weight loss, determined in accordance with BS812 shall be less than 0.5 %. This requirement shall be deemed to have been met, if the water absorption of all samples tested is less than 0.5 %.

6.13.1.1.8 Resistance to Impact and Mineral Fabric Breakage:

The 10% fines value of the quarried material, determined in accordance with BS812, shall be not less than 100kN.

6.13.1.1.9 Resistance to Abrasion:

The Aggregate Abrasion Value (AAV) of the quarried material, determined in accordance with BS812, shall not exceed 15%.

6.13.1.1.10 Block Integrity:

Blocks shall be free from visible cracks, veins, fissures, shale layers, stylolite seams, laminations, foliation planes, cleavage planes, unit contacts or other such flaws which could lead to breakage during loading, transportation, unloading or placing. The discontinuity spacing of the parent rock shall be not less than 1.5 metres. The Drop Test Breakage Index as specified in CIRIA shall be less than 5%.

6.13.1.1.11 Impurities:

The quarried rock shall not contain visible or chemically detectable impurities or foreign matter in such quantities that these are damaging for the constructive application of the quarried stone, or for stone in the marine environment.

Topsoil shall mean the top layer of soil that can support vegetation.

6.13.1.2 Workmanship

6.13.1.2.1 Transport

Quarried rock shall be transported and handled in such a manner as to minimise segregation and breakage.

6.13.1.2.2 Handling and Storage

Rock delivered to site shall be stockpiled as soon as practicable above the level of mean high water springs to ensure minimum interference with natural beach processes, including local wave conditions and sediment transport.

The Contractor shall provide all facilities necessary for any on-site inspection, categorisation, and approval/rejection activities on the specified materials. The Contractor shall store rocks of different class designation in separate stockpiles on Site, for inspection by the Employer prior to placing. The Contractor shall use weighing equipment, or other approved means, for sorting rocks into class designations on Site.

Surplus material shall be removed from Site and disposed of at an approved location

6.13.1.2.3 Templates

To achieve the desired level of workmanship and to facilitate control measures, the Contractor shall erect templates (temporary fixing guides, such as batter rails, travellers and profiles) at a distance not exceeding 20 m along the revetment, and use the guides as required to check levels and lines. The guides shall show the finished cross-section profile from crest to bottom of slope.

6.13.1.2.4 Placement of Underlayer

Underlayer to revetments shall be placed so as to achieve as near as possible a target bulk density of stone placed of 2.0 t/m³, with a tolerance of ± 0.25 t/m³.

The granular underlayer may be placed in bulk, but not tipped or dropped, provided that no damage or dislocation is caused to the geotextile, all voids are filled properly, and the target bulk density is achieved.

The underlayer material shall be protected by the armour layer as soon as possible after placement. Underlayer material eroded by wave action or other causes shall be made good before placing the armour layer. The cost of this shall be borne by the Contractor.

The Contractor shall employ suitable methods of construction to avoid contamination of underlayer material by beach material. Stockpiled material that has been contaminated by beach material shall be sieved using plant with meshed bucket base, or other means, prior to placement. Underlayer material that becomes contaminated by beach material after placement shall be removed and replaced. The cost of this shall be borne by the Contractor.

6.13.1.2.5 Placement of Rock Armour

The rock armour shall not be tipped or dropped, ensuring that no damage or dislocation is caused to the geotextile.

Stockpiled material that has been contaminated by beach material shall be cleaned prior to placement.

The Contractor shall plan his work such that the need for workmen on the slope is minimised. Proper gangways shall be provided where access for workmen and inspection of the Works is necessary. The plant and equipment used for placing of rock armour shall be in perfect condition, and workmen shall not be allowed near rocks being lifted or placed.

Armour rocks shall be placed individually and keyed into place. Individually placed stone shall not be dropped or tipped into position, but shall be placed piece by piece into the structure to achieve a minimum "three-point support" and be stable to the lines and levels shown on the Drawings. Stones shall not be placed so that they can rock or so that their stability relies on frictional resistance alone prior to placing further stones.

Stones shall be tightly packed so as to achieve as near as possible a target weight of stone placed of 1.8 t/m³ for the specified minimum rock density, with a tolerance of ± 0.1 t/m³. The target as-placed density of the rock armour shall be adjusted to represent the actual rock density, aiming at an as-placed porosity in the layer of about 32%.

The Contractor shall employ the use of grabs, if necessary to ensure that the armour layer does not become contaminated with undersized rocks and beach material.

6.13.1.2.6 Survey and Tolerances

During the course of construction of the Works, measurement of the constructed rock revetment surface shall be carried out in a series of measurement profiles, taken at minimum 10 metre centres along the length of the revetment. This information, which is additional to the pre-commencement and post-construction survey, shall be forwarded to the Employer as the Works progress, in order to facilitate approval of completed lengths of the Works.

Measurement of the rock armour surface shall be carried out using a probe ending with a 200 mm diameter sphere (equal to 50% of the nominal mean stone size D_{n50} of the layer to be surveyed). Measurements of all surfaces shall be carried out at 1m intervals along the measurement profiles.

Placement of rock armour shall be to the levels, dimensions and slopes shown on the Drawings, and the measured surface profile shall comply with the following vertical tolerances:

Table 6.5 Rock Armour Placement Tolerances

Granular Underlayer 5 – 40 kg	Rock Armour 300 – 1000 kg	Rock Armour 1000 – 3000 kg
+0.2m	+0.3m	+0.4m
-0.2m	-0.2m	-0.2m

In addition, the average deviation from the specified level, along a profile, shall not be negative on two consecutive profiles of the rock armour measured 10 m apart.

6.13.1.3 Compliance Testing

6.13.1.3.1 Materials

The Contractor shall supply evidence of compliance of the source material with the requirements of Sections a) through k) above, prior to commencement of the Works. The Employer shall select further random samples for testing during the course of the Works.

Prior to delivery of any rock to Site, the Contractor shall provide the Employer with the following details:

- Details of the quarry from which the rock is to be sourced, including a description of the rock material,
- Particle size or weight distributions for each class designation of the proposed rock armour and underlayer material,
- Results of tests specified in item d) through j) above applied to a sample of material from the proposed quarry, and carried out not more than three months prior to the date of first delivery to the Site.

Sampling and testing requirements shall be as per CIRIA C683 Table 3.19.

Sampling and testing requirements. "As per CIRIA" or "As per BS" means that the requirements in the quoted document, including related and referenced clauses or standards, etc. in other documents, shall be followed in full in every aspect from sampling over preparation and testing up to and including reporting.

The dates and times of the grading tests, and the time of shipping of the material of which the tests were performed, shall be recorded. Details and results of all tests carried out shall be issued to the Employer within one week of testing.

A failed test shall mean that further testing and/or remedial action of material stockpiled and/or placed in the revetment on Site will be required as specified by the Employer. Failed tests shall also mean that the frequency of sampling and testing will be increased. Failed sections of constructed revetment shall be removed and re-constructed unless agreed otherwise with the Employer.

Prior to the delivery of any rock to Site, the Contractor shall make arrangements for the Employer to visit the quarry if required, in order to inspect the following:

- Quarry procedures, and rock armour and underlayer material stockpiles,
- Selection and setting aside of armour rocks of average, maximum and minimum size, to assist with visual monitoring of the rock size and quality,
- Measurement of weight distribution of a sample of rock armour (not less than 20 rocks),
- Measurement of particle size analysis of underlayer material (not less than 3 tonnes,
- Performance of a Drop Test as specified above.

The Contractor shall make all necessary arrangements with the quarry to ensure that all necessary steps are taken to facilitate this inspection, and shall attend the inspection with the Employer if required.

6.13.1.3.2 Workmanship

The Contractor shall prepare a test panel approximately 5 m long for the acceptance of the Employer's representative. The Contractor shall provide evidence that the test panel adheres to all the requirements outlined above.

The rest of the Works has to be carried out in accordance with the accepted test panel.

6.13.2 GEOTEXTILES USED IN ROCK ARMOUR / REVETMENTS

6.13.2.1 Materials

The geotextile shall be Bontec VNW 300 or similar approved and be produced by manufacturer certified in accordance with ISO 9001.

6.13.2.2 Workmanship

Geotextile shall be protected against direct exposure to the sun during storage and handling.

The geotextile shall be protected by underlayer material immediately after placement. Special care shall be taken to avoid puncturing of geotextile during placement of the underlayer material. In order to avoid damage, material to be bulk-placed shall not be dropped directly onto the geotextile from a height more than 0.5 m.

Geotextile shall be placed strictly in accordance with the manufacturer's instructions, and in a manner that ensures that it is properly anchored in accordance with the details shown on the Drawings.

Laps at joints in geotextile shall not be less than 1 m, and shall be aligned down the slope only. Laps parallel to the crest line shall not be permitted. The Contractor shall ensure that adequate overlap is achieved in geotextile placed below water. This may be achieved by increasing the overlap (i.e. to 2 m), by placing additional geotextile along the toe of the revetment, by pinning down the geotextile with reinforcement bars, or by other means to the approval of the Employer. Temporary fixing or ballasting of geotextile shall be provided and maintained until the geotextile has been covered with rock material.

Each layer of any constructed sections of Works shall be trimmed back to ensure proper overlapping of the geotextile with that of the adjacent section to be constructed and to ensure that placed rocks do not fall onto exposed geotextile. Geotextile that becomes torn or otherwise damaged during construction shall be removed and replaced.

Care shall be taken by the Contractor to ensure that geotextile is trimmed at the toe of the revetment to the correct dimension, and that it is placed to a level above the first gabion basket on the crest side of the revetment, as specified on the Drawings.

7 SERIES 700 - ROAD PAVEMENTS – GENERAL

7.1 APPENDIX 7/1: PERMITTED PAVEMENT OPTIONS

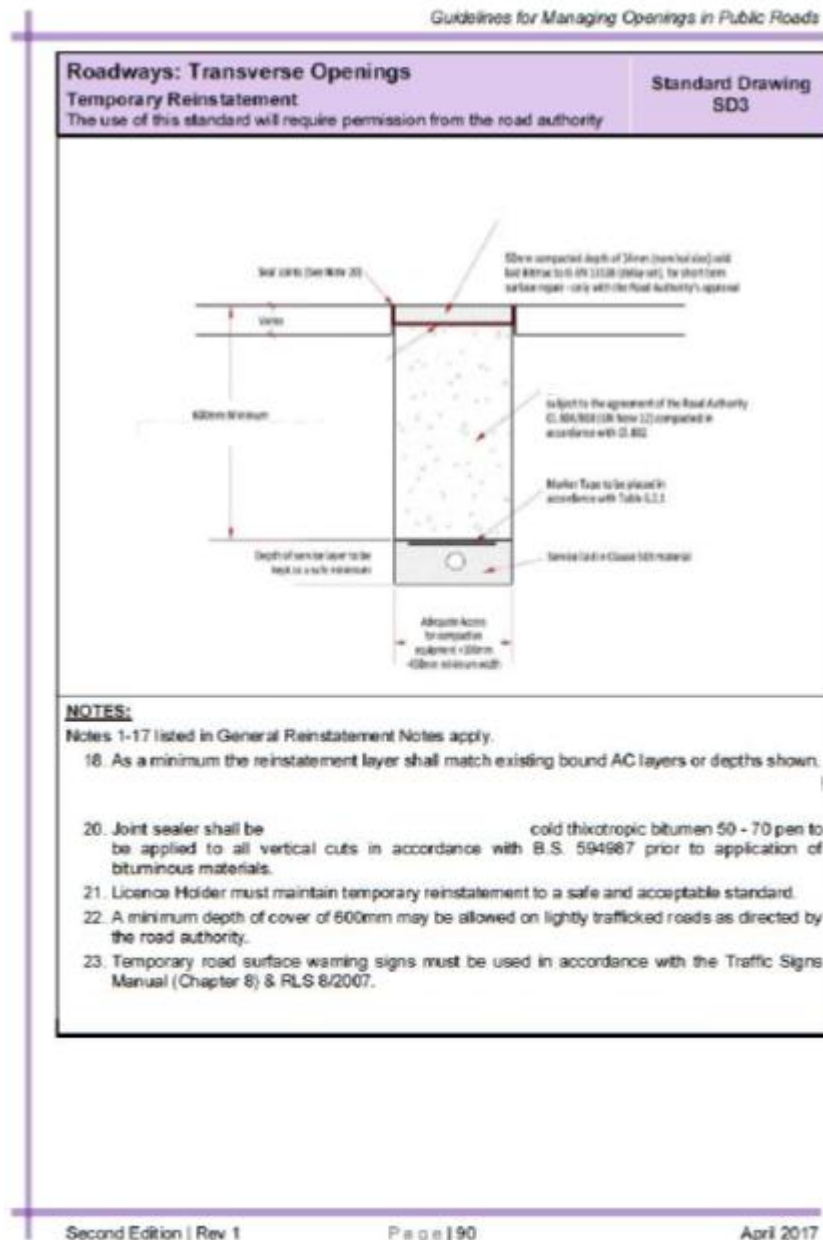
- 7.1.1 The construction of all pavement within the Works must comply with the requirements as set out in Series 700, Series 800, Series 900 and Series 1000 of the TII Specification for Road Works. The concrete slab of the TLOF shall comply with the requirements of Series 1700 of the TII Specification for Road Works.
- 7.1.2 The job specific requirements for the permitted pavement options are shown on the Contract Drawings.
- 7.1.3 Pavement course thicknesses shall comply with the requirements of the Contract Drawings.
- 7.1.4 The Contract Drawings shall be read in conjunction with this Appendix and the documents referenced in Item 1 above.
- 7.1.5 Not used.
- 7.1.6 Not used.

7.2 APPENDIX 7/2: EXCAVATION & REINSTATEMENT OF EXISTING SURFACES

- 7.2.1 Reinstatement of trenches in existing carriageways and private driveways/carparks necessitated during the course of the Works shall comply with the details shown in the “General reinstatement notes GN1” - Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads”, shown in the table below.
- 7.2.2 Pavement edge shall be finished as per CC-SCD-00702 (in-situ kerb) where kerbs are used and as per CC-SCD-00706 at all other locations.

Table 7.1 Extracts from Purple Book: General reinstatement notes GN1

Guidelines for Managing Openings in Public Roads	
General Reinstatement Notes	General Reinstatement Notes GN1
to be read in conjunction with Chapter 6, General Arrangement and Standard Drawings	
1. Compliance with these drawings and details are mandatory. 4. All works shall have a temporary traffic management plan, which shall be available for inspection on site, and shall comply with the Traffic Signs Manual and health and safety requirements. 5. Prior to any excavation works taking place, the location of all underground and over ground services must be identified and marked by a competent person trained in the use of cable detectors. Contact shall be made with all relevant service providers in this regard. 6. All works and materials shall comply with the TII Specification for Road Works. Series 900 of that specification will be the March 2011 version. All other Series will be to the current version. 8. All bound (or concrete) edges shall be saw cut to expose the full vertical thickness of each layer prior to excavation. All edges shall be essentially straight, smooth and vertical. 9. Excavations shall be sufficiently protected to avoid harmful effects caused by weather or adjacent wheel loading. 11. The method of work shall ensure proper compaction and such compaction may be tested by the road authority. To ensure adequate compaction, minimum clearances must be maintained vertically and horizontally between individual ducts or services installed in a group. 12. CI 808 to be used within 500mm of cement bound materials, concrete pavements, concrete structures or concrete products. Otherwise CI. 804 may be used. 13. Where steel plates or other trench covers are used, they must comply with Section 6.3.7. 14. Hand laying shall be restricted to the following circumstances: The method of laying shall be such that the finished surface is free from dragging, tearing and segregation of the material. 15. Temporary surfaces to be managed in accordance with RLS8/2007. 16. Any damage to the road structure or areas adjacent to the opening and resulting from the works shall be repaired and included within the area to be reinstated. 17. Where there are exceptional circumstances not covered by the drawings, the reinstatement specification must be agreed with the road authority.	



7.3 APPENDIX 7/3: SURFACE DRESSING PRODUCT (END PERFORMANCE)

Any surface dressing shall comply with Clause 919 of the Specification using the spray rates and chipping rated detailed on CC-SCD-00706.

7.4 APPENDIX 7/4: BITUMINOUS SPRAYS

- 7.4.1 Bituminous sprays shall comply with the requirements of Clause 920 of the Specification and have spread rate 0.5-0.7 l/m² excluding tack coats for thin surfaces which shall be agreed in writing with Engineer.

7.5 APPENDIX 7/5: ROAD PAVEMENTS: TII ROAD CONSTRUCTION DETAILS

Not used.

7.6 APPENDIX 7/6: BREAKING UP OR PERFORATION OF EXISTING PAVEMENT

- 7.6.1 Where existing carriageway is to remain as part of the permanent works it is to be punctured to its full depth and at centres no greater than a 0.5m radius.
- 7.6.2 The Contractor shall ensure the safety of any existing services.

7.7 APPENDIX 7/7: NOT USED

Not used.

7.8 APPENDIX 7/8: NOT USED

Not used.

7.9 APPENDIX 7/9: COLD MILLING (PLANING) OF BITUMINOUS BOUND FLEXIBLE PAVEMENT

Not used.

7.10 APPENDIX 7/10: MICROSURFACING

- 7.10.1 Glass Filament Reinforcing Grid/ Fabric Composites shall be mechanically bonded continuous filament non-woven textile with high strength glass filament reinforcement. Glass filaments must be stitched (not glued) to non-woven textile.
- 7.10.2 Raw material shall be 100% polypropylene (UV-stabilized), glass filaments. (Polyester or mixed fibre is not acceptable)
- 7.10.3 The glass filament reinforced composite must be produced by a manufacturer with a BS EN ISO 9001:2000 certified quality management system.
- 7.10.4 The tensile strength values for glass filament reinforcement shall be meet the following criteria:

Asphalt retention

1.1 kg/m²

ASTM D6140

Tensile Strength (MD I CD)	100/100 KN/m	ISO 3341:2000
Elongation at break	3%	ISO 3341:2000
Strength at 3% strain	68/88 KN/m	ISO 3341:2000
Mesh Width	40 x 40 mm	
Mass per unit area	0.43 kg/m ²	

7.11 APPENDIX 7/11: HIGH FRICTION SURFACING

Not used.

7.12 APPENDIX 7/12: LOW ENERGY BOUND MIXTURES

Not used.

7.13 APPENDIX 7/21: RECIPE SURFACE DRESSING

Not used.

8 SERIES 800 – NOT USED

9 SERIES 900 – NOT USED

10 SERIES 1000 – NOT USED

11 SERIES 1100 – KERBS, FOOTWAYS AND PAVED AREAS

All kerbs, footways and paved areas shall be as per Contract Drawings and the following specification.

11.1 APPENDIX 11/1: KERBS, FOOTWAYS AND PAVED AREAS

Kerbing

11.1.1 Kerbing shall be in-situ with Grade C40 concrete as specified in Clause 1103 and comply with CC-SCD-001102 with the exception that the height of the kerbing is to be 510mm.

11.1.2 Height of standard kerb as detailed on CC-SCD-001102 shall be 125mm. Height of dropped/dished kerb shall be 15mm.

11.1.3 Dropped kerbs at ramps shall be constructed as detailed on CC-SCD-001103 but the height of the kerb shall be 6 mm and not 25 mm as shown.

Concrete Footways

11.1.4 Concrete footways and paved areas shall comply with Clause 1106 of the Specification.

11.1.5 Concrete footways shall be constructed as per CC-SCD-001105 using in-situ kerbs as described and shall consist of 100 mm C30 concrete on 100 mm Type B sub-base to Clause 804.

11.1.6 Concrete footways shall be finished by floating with a wooden trowel while still "green" lightly brushed with a bass broom to produce a slight roughness.

11.1.7 Edges shall be bull-nosed with a steel trowel.

11.1.8 Ramps shall be constructed of 150 mm thick C30 concrete with A393 mesh reinforcement top and bottom on 150 mm Type B sub-base to Clause 804.

Table 11.1 Off road cycle track/ access to traffic signal controller (flexible surfacing)

Layer	Clause	Material	Grade of Binder	Thickness	Requirements
Surface Course	909	Dense Macadam asphaltic concrete AC 8 dense surf des	160/220 or 70/100	25mm	BS594987 Table 6A Table 9/4 of TII SRW
Binder Course	906	Dense Macadam asphaltic concrete AC 20 dense bin des	70/100	500mm	SHW cl 804 BS594987 Table 6A Table 9/3 of TII SRW
Sub	804	Type B Granular Material		150mm	SHW cl 804

11.2 APPENDIX 11/2: ACCESS STEPS

Not used.

11.3 APPENDIX 11/3: KERBS, FOOTWAYS AND PAVED AREAS: TII ROAD CONSTRUCTION DETAILS

Not used.

12 SERIES 1200 - TRAFFIC SIGNS AND ROAD MARKINGS

12.1 APPENDIX 12/1: TRAFFIC SIGNS: GENERAL

12.1.1 SCHEDULE OF TRAFFIC SIGNS

- 12.1.1.1 Signs shall be manufactured and constructed in accordance with Part II of the "Specification for the Construction of Traffic Signs - TS4" and the Department of the Environment "Traffic Signs Manual".
- 12.1.1.2 Traffic signs are to be located generally as shown on the accompanying Contract Drawings. The exact locations are to be agreed with the Engineer on site and shall comply with the DoE Traffic Signs Manual.
- 12.1.1.3 The types and sizes of traffic signs required for this Contract are as shown on the accompanying Contract Drawings, as specified in the Bill of Quantities and are listed in the following Schedule of Signs.
- 12.1.1.4 Foundations to posts are to be as specified in Clause 1203(3), with posts extending 600mm below Ground Level. The first 450mm of the foundation shall be filled with concrete as specified. The remaining 150mm shall be reinstated with material to match the existing surface.
- 12.1.1.5 Signs shall have EN Class Ref 2 retro reflective finish.
- 12.1.1.6 The sign manufacturer shall be an approved manufacturer under the Traffic Signs Certification Scheme or similar quality assurance scheme.
- 12.1.1.7 The following table details the types, sizes and quantities of the permanent traffic signs to be used for the scheme.

All sign faces, foundations and pole sets are detailed in the drawings.

12.2 APPENDIX 12/2: TRAFFIC SIGNS: REFLECTIVE MARKERS

Marker posts are required to indicate location of buried fittings chambers to watermain, refer CC-SCD-002713. Post to be erected to the rear of the footway/cycle lane or as agreed with the Engineer.

For each sluice valve, scour valve, air valve and hydrant the Contractor shall fix a marker post adjacent to the particular fitting. Where approved by the Engineer one marker post may suffice for two or more fittings which are in close proximity.

Marker posts shall be pre-cast concrete Grade 25 to dimensions shown on Drawings. Each post shall be reinforced with 3No. 12mm dia M.S. bars 1m long and shall be set in ground in 0.05m³ concrete Grade 20. Each plate shall be set in a recess previously formed in post and shall be fixed to post with 4Nr 12mm dia M.S. rag bolts. Hydrant indicator plates shall be single hydrant indicator plates with fixed black letters complying with B.S. 3251 except that the plates shall conform to colour reference no. 309 (canary yellow) in B.S. 381C. Air valve and sluice valve indicator plates shall comply with the specification for single hydrant indicator plates with fixed letters in B.S. 3251 except that they shall be coloured white and, instead of the letter H, shall bear the letters A.V. and S.V. respectively as approved.

12.3 APPENDIX 12/3: TRAFFIC SIGNS: ROAD MARKINGS & STUDS

Thermoplastic road markings shall be white and yellow in colour and as shown on the Contract Drawings.

Permanent road markings shall be as specified in the Contract and shall comply with the D.O.E. "Traffic Signs Manual" and "Thermoplastic Road Markings – Guidelines and Tender Documentation" published by the County and City Engineers' Association.

Road Markings shall be temporarily covered, if deemed necessary, at the direction of the Engineer.

12.4 APPENDIX 12/4: TRAFFIC SIGNS: CONES, CYLINDERS, FTD'S & OTHER TRAFFIC DELINEATORS

Road studs/delineators shall be as specified in the Contract and shall comply with the D.O.E. "Traffic Signs Manual" and "Thermoplastic Road Markings – Guidelines and Tender Documentation" published by the County and City Engineers' Association and Comply with BS 873: Part 4: 1987.

See signage schedule for various types of poles for the road signage.

12.5 APPENDIX 12/5: TRAFFIC SIGNS: TRAFFIC SIGNALS

12.5.1 GENERAL

- 12.5.1.1 The Works shall be carried out in compliance with the latest relevant Irish or UK. Department for Transport/Highways Agency guidelines, specifications, etc. and Design Manual for Roads and Bridges (DMRB). All materials and equipment shall comply with current relevant specifications and Irish or British Standards specifications and standards.
- 12.5.1.2 Installation shall comply with the requirements of the UK Local Transport Note (LTN) 1/98, The Installation of Traffic Signals and Associated Equipment. All electrical installations shall have due regard to the Electro-Technical Council of Ireland (ETCI) procedures. All installations shall comply with all relevant Irish Regulations and Statutes.
- 12.5.1.3 All materials and work necessary to achieve satisfactory installation shall be provided whether or not specifically referred to.
- 12.5.1.4 Where specifications or standards, etc. conflict with each other advice shall be sought from the Employers' Representative.
- 12.5.1.5 The contact details for the Traffic Control Engineer for the Roads Authority will be available upon request from the Employer.
- 12.5.1.6 Traffic signal pole positions and duct chambers shall be marked out on site and agreed with the Engineer prior to any works commencing.

12.5.2 PERMANENT TRAFFIC SIGNALS

- 12.5.2.1 Location of all traffic signal poles, heads, loops, ducting and ground boxes are shown on the Contract Drawings and included within the Bill of Quantities for the Traffic Signal Installations.
- 12.5.2.2 Duct crossings and associated box works must be carried out as one operation to ensure adequacy of the duct/box locations.
- 12.5.2.3 Box orientation must be parallel to the proposed kerb line. Where parallel orientation is not feasible then the orientation of boxes shall be agreed with the Engineer prior to Construction.
- 12.5.2.4 The Main Contractor shall be responsible for:
- The provision and installation of all signal ducting with draw cords included and duct boxes.
 - The provision and erection of all signal poles with draw cords, and controller bases.
 - The installation of ESB and communication ducting required to serve traffic signal controllers.
 - Arranging for the ESB and telecom to provide service supplies to controllers.
 - Employ an Approved Traffic Signal Installation Contractor.
 - Providing attendance on the Traffic Signals Installation Contractor.
- 12.5.2.5 The Traffic Signals Installation Contractor shall be responsible for the provision and installation, including cabling, of all Traffic Signal equipment (signal heads, controllers, loop detectors, etc.).
- 12.5.2.6 Only the prequalified Traffic Signals Installation Specialist shall be permitted to design and install the traffic signals.

12.5.3 SIGNAL INSTALLATION LOCATIONS

- 12.5.3.1 The Contractor's nominated specialist sub-Contractor in conjunction with the main Contractor shall carry out all works detailed in the traffic signal drawings.

12.5.4 CONTROLLER AND POWER SUPPLY

- 12.5.4.1 Controllers shall be Swarco ITC-2 or similar approved by the Traffic Control Engineer. Detectors and other related equipment shall be approved to/comply with relevant Irish or European standards and specifications.
- 12.5.4.2 Controllers cabinets shall be finished with an anti-fly posting/anti-graffiti coating.
- 12.5.4.3 Integral red lamp monitoring facilities associated with the provision of tactile pedestrian units shall be provided. Integral Outputs shall be provided and available for output to a MOVA unit. The MOVA unit must be supplied and configured to the Local Authority/Client's satisfaction.
- 12.5.4.4 The manual panel shall be fitted with:
- An LED indicating when Traffic Controller is operational

- 12.5.4.5 Dimming shall be operated by a photoelectric cell and normally operate at 160 volts.
- 12.5.4.6 The Contractor shall be responsible for the provision of electrical supply which shall include liaising and co-ordinating works with ESB Networks on site. A metered ESB mini pillar, mini pillar cable vault and mini pillar earthing system to ESB Network requirements shall be installed. A single-phase supply shall be made available at the pillar and shall provide power at Low Voltage (LV) 230V, 50Hz to the Road Traffic Controller (RTC) which in turn shall provide power to the Road Traffic Signals at Extra Low Voltage (ELV) 50V. The RTC and Mini pillar shall be earthed independently via earth electrodes including concrete earth rod inspection chambers.
- 12.5.4.7 A consumer earth terminal shall be supplied. This terminal shall be located adjacent to the mains 'cut out'.
- 12.5.4.8 A controller shall be provided for each of the junctions listed in Section 3 above and shall:
- be fitted with an interface and shall provide lamp failure reply bits (first red, second red and any lamp);
 - support operation of kerbside detection so the demand is latched if the kerbside detector has not been activated when the pushbutton is pressed;
 - support gapping out for all moves under MOVA; and
 - be linked to all controllers listed above.
- 12.5.4.9 A 483mm (19 inch) rack shall be supplied for the Controller interface and a second 483mm (19 inch). Rack for communications and priority equipment.
- 12.5.4.10 A minimum of six auxiliary power supplies shall be provided for communications and Controller equipment.
- 12.5.4.11 All cabinet locks shall be securely lockable with 4 sets of keys supplied to the Traffic Control Engineer.
- 12.5.4.12 The controller shall be fitted with all the necessary equipment for remote monitoring communication via fibre optic and the tenderer shall provide details of this facility. The remote monitoring shall be capable of two-way communication with the Traffic Management Centre, via either dial up PSTN, ISDN telephone lines or via leased lines.
- 12.5.4.13 The fault mode shall be flashing amber to the main route and flashing red to the side roads.
- 12.5.4.14 Controllers must be capable of meeting the following requirements: -The lights shall appear in the following order: Green - Amber - Red - Green, etc.
- The starting amber shall remain dormant until required by the Employer.
 - On "switch on" the signals shall commence with a minimum of a four second "all red" period. A four second flashing amber is permitted as an alternative.
- 12.5.4.15 All new installations shall MOVA as agreed with the Traffic Control Engineer and the Engineer.
- 12.5.4.16 The MOVA unit requires a private communication circuit to communicate with the Local Authority/Client's system. The Traffic Signal Specialist shall

arrange for the appropriate company to connect the circuit between the communications termination cabinet at the required location of the Local Authority and the termination unit outside the controller cabinet.

- 12.5.4.17 CCTV Equipment for Traffic Signal Sites should be provided in accordance with the requirements as set out by the Employer and/or as stated on the Contract Drawings.

12.5.5 ELECTRICAL STANDARDS

- 12.5.5.1 The equipment to be installed is to be of high quality and shall comply with the appropriate national and international standards recognised by the Electro-Technical Council of Ireland. Commissioning and certification must comply with the ETCI National Rules for Electrical Installations, 2nd Edition.
- 12.5.5.2 Electro-magnetic compatibility and comprehensive protection against electrical disturbance, transients, surges and interruptions of electrical supply is to be provided to comply fully with the EC directive on all equipment supplied. The level of such protection is to be specified and the relevant standards or certification to be detailed.
- 12.5.5.3 The supplier and installer shall be familiar with the Health, Safety and Welfare at Work Act 2013 and undertake to implement all appropriate regulations as apply specifically to manufacturers and suppliers of equipment.
- 12.5.5.4 Acceptance testing is to be undertaken by the Engineers' Staff or Consulting Engineer taking instructions from the supplier. Commissioning of the equipment will be undertaken in the presence of the same representative as generally set out in the relevant Codes of Practice.

12.5.6 SIGNAL HEAD SPECIFICATION

- 12.5.6.1 The signal heads shall be constructed as a modular three-aspect unit with a durable impact resistant aluminium housing and integral frame. The cowls shall be riveted to the housing or fixed securely.
- 12.5.6.2 Traffic signal and pedestrian heads shall be fitted with appropriate hoods and installed so that no part of any head fixed to the pole shall be within 450mm of the nearest kerb face. When circumstances dictate, for example narrow footways, poles may be installed with 500mm from the kerb face. To maintain 450mm clearance from the kerb face:
- heads may be side mounted (away from the carriageway);
 - and/or mounted on 'D' brackets; or
 - swan-neck cranked poles may be used if shown on the drawing or by prior agreement
- 12.5.6.3 If poles have to be located at the back of the footway, e.g. very narrow footpaths, appropriate brackets shall be used to ensure the heads are moved towards the kerb so that they are well located.
- 12.5.6.4 Pedestrian display facilities shall be far side with red / amber / green aspects.

- 12.5.6.5 All Traffic Signal Heads being provided for installation shall be LED units and conform to TR0102 and the EU IS EN12368 Standards.
- 12.5.6.6 The body shall have a wide range of adjustment in the horizontal plane and shall be supplied with suitable brackets for lateral mounting to the signal pole.
- 12.5.6.7 Easy access to the optical units shall be provided. Optics shall be 200mm nominal diameter unless otherwise specified.
- 12.5.6.8 Regulatory signs where these are required shall conform to Irish Standards and shall be continuously illuminated.
- 12.5.6.9 The signal heads shall be composed of discreet components which can be replaced individually where necessary. The lens, for instance, shall not be integral with the door.
- 12.5.6.10 The signal heads to be supplied are subject to the specific approval of Roads Authority. The final selection of equipment shall be to the satisfaction of the Traffic Control Engineer and the Engineer.

12.5.7 PEDESTRIAN PUSH-BUTTON/ DETECTORS

- 12.5.7.1 The pedestrian push button unit shall be the "Prisma Teknik Audio/Tactile" push button unit or similar approved. The housing shall be manufactured in strong aluminium and electro- oxidized in blue colour. The unit shall be controlled and supervised by a microprocessor. The unit shall have a built-in microphone capable of measuring ambient noise level and the microprocessor shall automatically adjust the output volume.
- 12.5.7.2 Audible devices shall be utilised only when there is a full 'all red' pedestrian stage but tactile devices shall always be installed in all pushbuttons.
- 12.5.7.3 Kerbside detectors to be installed at each pedestrian waiting area. Kerbside Detectors to be approved by the Engineer prior to use.

12.5.8 CABLING

- 12.5.8.1 All electrical and communications cables shall have the outer sheath in orange colour, this being the standard for traffic and public lighting installations.
- 12.5.8.2 Sixteen or eight core LV (Low Voltage) and ELV (extra low voltage) cabling may be used and shall be steel wire armoured colour coded except for detector feeder cables that shall be armoured single pair. The armouring shall be utilised as the Earth Continuity Conductor and shall have adequate conductivity.
- 12.5.8.3 Loop cable shall be double insulated.
- 12.5.8.4 Sites shall be cabled as follows:
- the nearside primary on each approach shall be separately cabled back to the controller and not linked via other poles. Subsequent secondary or offside primary heads on the same approach shall be fed separately to allow signals to remain on after a knockdown;

- poles on splitter islands shall be cabled separately from poles in verges. Cables shall not be looped out of short poles;
- at least four number or 25 percent (whichever is greater) spare cores shall be provided for each LV cable run.

12.5.8.5 Joints shall not be permitted for LV cabling. Joints between loop tails and feeders shall be made in chambers using PTC Traffic reusable cable termination device or agreed equivalent product.

12.5.8.6 All cables shall be laid in ducts and LV and ELV shall be segregated into different cables and whenever possible LV and ELV cables shall utilise different ducts.

12.5.8.7 All cables shall be clearly labelled at the controller and in chambers using indelible ink on plastic labels securely fixed to the cable to indicate their function in sufficient detail to allow future maintenance and modification.

12.5.8.8 Unused cable cores at the controller shall be connected to earth at the controller end only. Unused cable cores between poles shall be connected to earth at one pole only.

12.5.8.9 Cable cores shall be identified by colour that shall be used consistently throughout the installation.

12.5.8.10 Traffic signal cables shall not pass through ducts or chambers used by any other service and other services shall not utilise traffic signal ducts including street lighting.

12.5.8.11 The Contractor shall supply and install a 6mm², 3 core PVC/SWA/PVC cable between the power termination pillar and the controller.

12.5.8.12 Prior to commencing cabling a draft cable diagram shall be submitted for approval by the Employers' Representative and the Traffic Control Engineer.

12.5.8.13 Earthing shall be in accordance with BS 7430: 1991.

12.5.8.14 All loops shall be separately cabled back to the controller and if required inputs shall be communed together in the controller.

12.5.8.15 Detector feeder cables shall be terminated in a reusable terminal block in the controller and wired with permanent controller cabling from the terminal block to the detectors.

12.5.8.16 Loop tails shall be taken to a NAL or equivalent loop box through the kerb in a 50mm duct to the adjacent chamber. The connecting duct to the chamber in verge / footway shall be 50mm orange flexible ducting.

12.5.9 CIVIL WORKS

12.5.9.1 The installation of Service Ducts shall cater for the installation of electric cable to all the traffic signal poles at each junction and cater for the provision of the ESB power supply cable for each controller. The ducts shall be linked through to each pole in turn as against providing radial connections to the controller position.

12.5.9.2 Ducts shall be:

- 100mm diameter medium/high density smooth internal bore polyethylene, minimum wall thickness 5mm (+/- 0.1mm) and shall not utilise a

corrugated outer finishing, without the prior written approval of the Employer and the Traffic Control Engineer;

- coloured orange with the words "Traffic Signals" printed in 9mm high white lettering along the outside at intervals not exceeding 1 metre and laid with the wording uppermost;
- impact resistant, impervious to water and sufficiently flexible to accommodate undulations in the trench;
- be installed with a single polypropylene draw rope (8mm diameter, 3 strand to BS2494) firmly secured at both ends in all ducts; and
- when installed, ducts shall be properly jointed or sleeved to provide a continuous smooth internal bore.
- All 100 mm ducting shall be tested, by the Contractor by passing a 90mm mandrel through the whole length of the completed ducting; refer to clause 509.11 of SRW.
- All ducts shall be flushed clear, using compressed air, prior to the installation of traffic signal cables.
- Ducts shall be 450mm deep in verge and 750mm in carriageway, unless otherwise specified.

12.5.9.3 Demountable pole chambers shall be of strong and robust construction. Pole chambers shall allow insertion and rapid removal of 76, 115 or 140mm poles by means of an anti- rotational bracket, accessible from within the chamber. The cover and frame shall fit positively within the chamber allowing rotational alignment with surrounding paving as well as vertical and tilt adjustment to finished levels. Where space is limited, remote pole housing can be used with chamber access located as close as possible.

12.5.9.4 Access Chambers:

- A proprietary modular access chamber former and ducting system shall be used, and installed in front of the controller and at all changes in duct depth/direction/numbers and to pick up loop tails as shown on the drawings or agreed on site.
- Access chamber formers shall be of solid pre-formed modular construction. The chamber formers/chambers shall be installed in accordance with the standard details and to the manufacturer's instructions.
- The chamber formers shall be surrounded with type ST3 concrete to a minimum thickness of 150mm. The frame shall be concreted into the surround in the same pour and finished to the correct final level/cross fall. If this is not possible the concrete pour shall be stopped at a minimum depth of 150mm below the top of the chamber former. When the frame is to be installed any spoil must be cleared off the concrete surround. The final pour shall be carried out to provide a 'key' between the frame and the chamber surround. No concrete shall be placed above the level of the signal pole access chamber openings, and no concrete shall be allowed to enter the box.
- All access chambers shall be supplied with a skid resistant cover and frame. Skid Resistance Values of the cover shall be a minimum of 80 (dry) and 50 (wet).

- The cover and frame shall be tested in accordance with BS EN124. A strength of less than 12.5 tonne wheel loading will not be permitted in any location.
- The cover and frame assembly shall fit snugly inside the access chamber to provide height and tilt adjustment at surface level. The cover and frame shall be supplied complete with an integral locking facility and keyway closer caps and shall be marked 'Traffic Signals'.
- Duct chambers shall be of such depth that ducts enter horizontally.
- Ducts into chambers shall be terminated internally within 25mm of the chamber wall.

12.5.9.5 Loop boxes shall be of solid pre-formed modular construction with 50mm flexible orange duct connecting between kerb and chamber.

12.5.9.6 Where specified, carriageway loop access covers and frames shall conform to BS EN 124 Class D400 and shall be installed in accordance with the standard details. They shall be positioned at the correct distance from the kerb face. This allows sufficient room for the slot cutting machine to correctly cut into the box (see the standard drawing).

12.5.9.7 Access chambers (other than carriageway loop chambers) shall not be located within the extent of tactile paving or on trafficked carriageway.

12.5.9.8 The controller base shall be backfilled with sand and sealed with resin.

12.5.9.9 Two 50mm black copex tubes shall be installed from the controller to the nearest chamber.

12.5.10 POLES

12.5.10.1 All traffic signal poles shall be manufactured in steel to BS EN 10219 S275 and pre-drilled, hot dipped galvanised to BS EN 1461. Other colours may be used in agreement with the Traffic Control Engineer.

12.5.10.2 All traffic signal poles to be housed in a retention socket system to be approved by the Local Authority Traffic Engineer or Employer.

12.5.10.3 The poles shall be so designed and constructed as to provide adequate support and stability for up to 4 (3-aspect) traffic signal heads and shall be fitted with a weatherproof cap. The pole shall have a strength and rigidity at least equivalent to that of a seamless steel tube of 100mm outside diameter, of 4.4mm thickness and of tensile strength of + 375MN/m² and a Z-value of 39.3cm³.

12.5.10.4 The traffic signal specialist shall deliver poles in their protective plastic wrapping direct to site for immediate installation. If the poles' coating is scratched or damaged when delivered the pole shall be replaced prior to cabling work commencing.

12.5.10.5 A single cable entry hole shall be provided (below ground level). All rough edges at holes shall be removed. Holes to be provided as required to facilitate mounting of signal heads.

12.5.10.6 All mill scale and rust on the exterior and interior surfaces shall be removed by pickling or other approved process. The poles shall be protected by hot dip galvanising to a thickness corresponding to a pole thickness of 4.4mm

and in accordance with the latest edition of BS 729.

- 12.5.10.7 An access door shall be provided and recessed into the pole. The door shall be waterproof. A bonding lug shall be provided on the inside of the door and also on the door frame of the pole and an earth wire of at least 2.5mm² shall be run from the door lug to the pole lug.
- 12.5.10.8 Cranked poles shall be the swan - neck type and not the cut and welded type.
- 12.5.10.9 The Contractor shall include for the cost of any specialised equipment required for the installation of signal equipment and CCTV cameras on signal poles. It should be noted that some signal poles are cantilevered.
- 12.5.10.10 Pole shall be numbered on the pole cap in an agreed manner by the Engineer/Roads Authority.
- 12.5.10.11 Pole caps shall be securely fixed to the pole using a bolt or other mechanism. Short poles shall have welded pole caps.

12.5.11 INDUCTIVE LOOPS

12.5.11.1 Inductive loop Detectors

- a) Inductive loop detectors shall be approved to the appropriate UK DETR/HA standard specification for self-tuning detectors. Quad detector packs shall be used.

12.5.11.2 Installation of Inductive loops

- a) All loops shall be installed in accordance with the appropriate UK DETR/HA specification.
- b) The Contractor shall be deemed to have inspected the site and satisfied himself on all matters relating thereto, particularly with regard to presence of sub-surface ferrous objects, and he shall be expected to liaise with the Local Authority/Client to identify these.
- c) Feeder cables shall run under footpaths/verges in ducts. In exceptional circumstances they may, with the prior written agreement of the Local Authority/Client be run along the crown of the carriageway but not near the kerb.
- d) Joints between loop tails and feeder cables shall normally be in a 300 x 300mm chamber.
- e) Loop tails shall be as short as possible and only exceptionally shall a joint between feeder cable and loop be more than 4 metres from the loop.
- f) Where loop tail or feeder cables enter a footpath either of the following procedures will be acceptable. Slotting of the kerb for this purpose will not be accepted.
- g) A small area of carriageway is to be excavated and a high impact resistant PVC or other approved non-metallic duct about 30mm diameter and 800mm long laid through or under the kerb for each cable. The end of the slot shall be widened and deepened so that the duct lies neatly in the slot for at least 100mm;
- h) The excavated area shall be backfilled with fine aggregate concrete. The cables shall then be backfilled with compacted fine cold asphalt and hot

oxidised bitumen. The kerbstone shall be reinstated with a foundation sufficient to bear weight of heavy vehicles mounting the kerb without settlement being caused to the kerb. The Contractor shall ensure that cables entering the footpath are adequately protected from any abrasive action;

- i) At a point not less than 500mm from the face of the kerb a hole shall be drilled to at least 100mm below the roadway and through or under the kerb. A high impact resistant PVC or other approved non-metallic tight-fitting duct about 30mm diameter and 800mm long shall be passed through the hole. The damaged part of the carriageway shall then be backfilled with compacted fine cold asphalt and hot oxidised bitumen.
- j) Chambers shall be installed where joints between loop tails and feeder cables are in footpaths or verges. All chambers shall be 300 x 300mm, Cooper Clarke or equivalent, as agreed with the Engineer.
- k) Where, with the prior written agreement of the Local Authority/Employer, loop and feeder have to be jointed in the carriageway, this joint shall be positioned where it is subject to a minimum of stress exerted by wheels of vehicles such as at the crown of the road or where there is chevron marking but not near the kerb or at wheel tracks.

12.5.11.3 Loop Cable Laying

- a) The loop cable shall be to the following specification: 1.5 mm² 30/0.25 tinned annealed copper conductor, insulated with EPR/CSP insulated. Overall diameter minimum 4.0 mm.
- b) Prior to installation in slots, cable shall be dry.
- c) The Contractor shall ensure that the cable lies evenly in the bottom of the slot and shall secure the cable in such a position if necessary.
- d) Sharp implements shall not be used to seat the cable in the slot.

12.5.11.4 Loop Feeder Cable

- a) The installed feeder cable shall not exceed 300 metres in length from the equipment housing to the loop or 100 metres for bus loops.
- b) If armoured feeder cable is used it shall be terminated in the equipment housing using cable connectors approved by the Local Authority/Client, and each connector shall be bonded to the earth point using 2.5 mm² flexible earthing cable terminated with crimped connection tags. The Contractor shall ensure that no other earth connection exists along the length of the cable.
- c) When installing feeder cables the Contractor shall exercise the utmost care in storing, running-off, drawing into ducts, bending and other processes involved ensuring that the cable is not damaged in any way.
- d) Cables shall not be bent to a radius of less than 12 times their diameter or less than a radius recommended by the manufacturer whichever is the greater.
- e) Feeder cables beneath footpaths are to be laid in approved ducts.

12.5.11.5 Loop Cable Jointing

- a) The Engineer and the Traffic Control Engineer shall approve the cable joint prior to use.
- b) Feeder cables shall be electrically connected to the loop tails with heated insulated crimp connectors using a ratchet type of crimping tool. The

Contractor shall ensure that the cable conductor has been correctly crimped by visually checking the cable and also by applying a vigorous pull test to that cable on either side of the joint.

- c) The electrical connectors shall be encased in a joint approved by the Engineer and the Traffic Control Engineer and the Contractor shall ensure that the connectors are staggered to avoid the possibility of any short circuits.
- d) The Contractor shall ensure that any instructions issued by the cable joint manufacturer are provided in writing to his installation and supervisory staff. These instructions shall form part of this specification.
- e) The Contractor shall ensure that the joint is waterproof prior to backfilling.
- f) With the exception of cable joints between loop and feeder cables, no other joint shall be permitted in the loop/feeder configuration.
- g) Cables shall be terminated in the controller or detector housing using terminal connection blocks, which are adequate in size for the diameter of conductors used. Screws shall not bear directly on to conductors; either a protective leaf in the terminal or a crimped pin on the end of the conductor shall be used.

12.5.11.6 Slot Cutting for Inductive Loops

- a) The road shall be inspected before the loop laying operation commences. The layout of the loop configuration shall avoid areas of poor reinstatement in the road surface caused by other road works etc. Slots shall be cut at least 1 metre from any such disturbance.
- b) In the event that a carriageway is too weak to ensure future reliability of a loop, the carriageway shall be excavated and strengthened with a new pad laid where the loop is to be cut. In the case of a roadway being totally unsuitable for the installation of loops, the Traffic Control Engineer may request an alternative method of detection to be agreed with the Contractor.
- c) Slots shall be cut at least 1 metre from any ferrous objects such as manhole covers etc.
- d) In concrete road surfaces slots shall not be cut less than 1.5 metres from transverse joints between adjacent concrete sections.
- e) Slots for loop cables shall exceed the maximum diameter of the loop cable or cable pair by at least 2.0mm. All slot cutting shall be a minimum of 65mm deep.
- f) On all slots a minimum of 50 mm cover shall be maintained above the loop cable (40mm in concrete).
- g) The depth of each slot shall be checked with a depth gauge along the whole length of the slot and this shall conform to the requirements of this specification. The Contractor shall ensure that there are no irregularities in the base of the slot.
- h) Each loop shall be separated from adjacent loops by a minimum of 300 mm.
- i) All debris shall be cleared from the base of the slot. The slot shall be cleared out with compressed air and be completely dry before wires and resin are inserted.

12.5.11.7 Backfilling of slots for Inductive Loops

- a) Representative, to give a minimum of 50mm cover above the uppermost cable.
- b) The Bitumen shall be heated to the manufacturer's specified temperature
- c) The Contractor shall satisfy the Local Authority/Client before slot cutting operations commence, that the on-site equipment is able to raise and maintain the hot oxidised Bitumen to the temperature necessary to achieve the specified viscosity.
- d) Slot cutting of loop feeder cables in the path or roadway will not be accepted under any circumstances.
- e) Bitumen filler in slots shall be finished off level with the road surface. All excess bitumen on the road surface at edges of slots shall be removed with a heater implement.

12.5.11.8 Commissioning of Inductive Loops

- a) Each feeder cable shall be labelled at its point of entry to the controller with PVC cable markers secured around the cable with cable ties.
- b) Each loop and feeder configuration shall be tested at the controller as follows and the results submitted to the Traffic Control Engineer and Engineer as a test certificate for the loop installation.
- c) The dc series resistance of the loop feeder, with the detector disconnected, shall be measured at a current 10A dc or greater. The resistance shall not exceed 3 ohms.
- d) With the loop circuit disconnected from the detector, the impedance to earth of the two loop and feeder conductors shall be measured at a test voltage of 500V dc applied for at least one minute. This shall not be less than 10 mega ohms. The two ends of the loop circuit shall be connected together for this test.
- e) Where armoured feeder cable is used, the armouring shall be disconnected from the earth point, and the impedance to earth of the armouring shall be measured at a test voltage of 500V dc applied for one minute. This shall not be less than 10 mega ohms.
- f) Where armoured feeder cable is used with the armouring connected to the earth point of the equipment housing, the impedance to earth of the armouring shall be measured. This impedance shall not be greater than 0.5 ohms.
- g) The inductance of the loop and feeder circuit shall be measured. This shall be comparable with the theoretical value.
- h) The frequency of operation of each configuration shall be measured. Where two loop circuits share a common feeder cable their frequency of operation shall be separated by at least 5 kilohertz.
- i) The Contractor shall adjust the sensitivity and presence time of each detector to the requirements specified by the Traffic Control Engineer. The Contractor shall demonstrate correct operation of the detector at the sensitivity specified.
- j) The Contractor shall ensure that an inductance change caused by vehicles in one loop shall not induce spurious detections in any adjacent loop system.
- k) The Contractor at his own expense shall replace any loop or feeder, which fails these tests.

- l) Where inductive loop detectors are specified two full days prior to the loop laying and jointing operation the Contractor shall obtain agreement to this from the Engineer to enable the Traffic Control Engineer and Engineer to be present. The Contractor shall conduct loop-commissioning tests in the presence of the Local Authority/Client's staff.

12.5.12 TESTING

12.5.12.1 The following tests shall be undertaken:

- a) factory acceptance tests of the controller and MOVA operation;
- b) on site electrical tests, in accordance with the current edition of British standard BS7671 (Requirements for Electrical Installations) and TR0102A, including earth continuity, insulation resistance test, polarity check, earth loop impedance test and (if fitted) ELCB test; and
- c) site acceptance test of the complete installation.

12.5.12.2 Electrical tests shall be undertaken as appropriate include: continuity of protective conductors including main and supplementary bonding;

- a) continuity of ring final conductors;
- b) insulation resistance;
- c) site applied insulation;
- d) protection by separation of circuits;
- e) protection against direct contact by a barrier or an enclosure provided during erection;
- f) insulation of non-conducting floors and walls;
- g) polarity check (by continuity methods);
- h) earth electrode test (using earth electrode test meter);
- i) earth electrode resistance (using ELI meter);
- j) earth loop fault impedance test;
- k) RCD test; and
- l) functional testing of switchgear and control gear.

12.5.12.3 All kerbside detectors shall be set up by the Specialist Traffic Signal sub-Contractor. Prior to commissioning the set up shall be verified (and adjusted as required) to the satisfaction of the Traffic Control Engineer.

12.5.12.4 The Local Authority/Client, representatives of the Local Authority/Client traffic signal maintenance Contractor and others as the Local Authority/Client may consider necessary shall witness all tests and attend final commissioning and switch on. The traffic signal Contractor shall attend site on the day of switch on and for the following 6 calendar days between 07:00 and 19:00 and shall adjust the operation of the timings and timing plans in consultation with the Local Authority's Traffic Control Engineer and maintenance Contractor to optimise performance.

12.5.12.5 Commissioning and switch on will not take place until:

- a) all tests are completed to the satisfaction of the Engineer and a Completion Certificate as prescribed in BS7671 issued;
- b) all works are completed; and
- c) the final stage 3 safety audit is satisfactorily completed.

12.5.13 MAINTENANCE

- 12.5.13.1 The traffic signal Contractor shall provide maintenance of the equipment from switch-on for a period of 12 months.
- 12.5.13.2 The Contractor shall provide a one-year return to base warranty service.
- 12.5.13.3 If in any 12-week period during the one year warranty period, the controller experiences three or more controller faults, the Contractor shall within four weeks replace the controller at no charge.
- 12.5.13.4 The Contractor shall undertake an overhaul and detailed inspection of the equipment not more than three weeks prior to the end of the warranty/defects period and an appropriate report shall be submitted to the Local Authority/Client.
- 12.5.13.5 The traffic signal Contractor shall allow the Local Authority/Client's UTMC and communications Contractor's access to the control cabinet and will ensure that the installation of the Traffic Controller and communications equipment does not compromise the integrity of the controller or signalling equipment.

12.5.14 TUNING

- 12.5.14.1 The Traffic Control Engineer may, within three months of switch on, tune the operation of the timings and timing plans.
- 12.5.14.2 The Contractor shall allow for incorporating any adjustments in an updated controller EPROM and installation in the controller within 2 weeks of receiving the necessary information.

12.5.15 DETECTION

- 12.5.15.1 All traffic and pedestrian detection shall be latest model available supplied by agreed suppliers and installed and commissioned in accordance with the manufacturer's installation instructions.
- 12.5.15.2 Traffic, cyclist and pedestrian loop detectors shall be approved four channel self-tuning detectors with each channel clearly labelled in accordance with the controller specification.

12.5.16 MISCELLANEOUS

- 12.5.16.1 All heads and PDUs/pushbuttons not in use shall be bagged until switch-on.
- 12.5.16.2 Temporary signing shall be provided as required.
- 12.5.16.3 Two copies of the as-built drawing (showing staging) at 1:250 scale and the as-built cabling schematic (including layout, heads, cabling (including core allocations and spare cores) shall be handed over prior to take-over. Drawings shall also be provided electronically in AutoCAD format.
- 12.5.16.4 One controller User Manual suitable for installation, operation and

maintenance and of the traffic signals shall be provided.

12.5.16.5 Three sets of controller keys and one 'T' Key shall be provided.

12.5.16.6 A hardback site logbook shall be provided, and this shall be stored together with one set of drawings in a waterproof wallet fixed to the inside of the controller door.

12.5.17 LOCAL AUTHORITY/ CLIENT APPROVAL

12.5.17.1 All specifications, installations and programme of works shall be discussed and agreed with the Local Authority/Client prior to the commencement of the Works.

12.5.17.2 All factory tests shall be attended by representatives from the Local Authority/Client with prior arrangement. The Local Authority/Client's costs incurred in attending the factory tests shall be borne by the Contractor.

12.5.17.3 Representatives from the Local Authority/Client shall undertake site supervision works of the installation of the traffic signal installations in accordance with a programme of works to be specified by the Local Authority/Client.

12.6 APPENDIX 12/6: TRAFFIC SIGNS: SPECIAL SIGN REQUIREMENTS ON GANTRIES

The structural steelwork and foundation arrangements for fabricated steel gantries shall comply with Series 1800 of the TII Specification for Road Works and all associated Standard Construction Details (SCD's) contained in Volume 4 of the TII MCDRW.

12.7 APPENDIX 12/7: TRAFFIC SIGNS: PREPARATION AND FINISH OF METAL AND OTHER SURFACES

All works associated with the preparation and finish of metal and other surfaces shall comply with Clause 1209 of the Specification.

13 SERIES 1300 - ROAD LIGHTING COLUMNS & BRACKETS

13.1 APPENDIX 13/1: INFORMATION TO BE PROVIDED BY THE DESIGNER FOR THE ROAD LIGHTING WORKS WHEN SPECIFYING LIGHTING COLUMNS AND BRACKETS

13.1.1 GENERAL

- 13.1.1.1 The Contractor shall make provision for the design, supply and installation of all lighting, lighting columns, and brackets using galvanised columns (to heights as specified on the Contract Drawings) and lantern type to be AMR150CGN/AUS/L, Lamps: 1SON - T/CDO - TT - 150W.
- 13.1.1.2 Location factor for columns $k = 3$
- 13.1.1.3 Data sheets in Appendix 13/2 are to be completed by the Contractor and enclosed with the Tender Submission.
- 13.1.1.4 The Manufacturer shall be quality assured to ISO 9001:2000. Proof of certification shall be provided to the Employer where required.

13.1.2 REMOVAL OF EXISTING EQUIPMENT

- 13.1.2.1 The Contractor shall accurately establish the location of all existing lighting equipment, including columns, distribution pillars, cables, etc., before any work is undertaken, and provide record drawings and a programme of works for the approval of the Engineer.
- 13.1.2.2 Surplus and obsolete equipment shall be disposed of safely by the Contractor.
- 13.1.2.3 No existing lighting shall be switched off, dismantled or removed without the prior approval of the Employer.
- 13.1.2.4 Adequate temporary lighting to the satisfaction of the Employer shall be provided when it is necessary to remove existing lighting from any area still open to vehicular or pedestrian traffic.

13.2 APPENDIX 13/2: COLUMN & BRACKET DATA SHEETS 1 & 2 TO BE DELETED?

TYPICAL LIGHTING COLUMN AND BRACKET DATA - SHEET 1

Name of Manufacturer:

Column
Reference No.

Revision No.

Date

NAME OF CONTRACT

Part A General

Column nominal height

(m)

Acceptable positions of bracket
arms relative to door position

Column material

Door Opening

Material design strength

(N/mm²)

No. of door openings

Door opening size

- Height

(mm)

- Width

Cross-section of base
compartment

Height (mm)	Width (mm)	Depth (mm)

Manufacturers
drawing ref no.

Part B Foundation Data

Planted base

Planting depth

Diameter of concrete
surround (if any)

Standard Soil Type Factor G		
630	390	230

Flange plate

Bolt hole centres	Bolt Hole diameter	Design load/bolt
(mm)	(mm)	(N)

Relevant forces and moments at ground level

Line of action of max. moment relating to door
opening

NOTE: For flange plates with slotted holes a diagram shall be included with this Data Sheet.

TYPICAL LIGHTING COLUMN AND BRACKET DATA - SHEET 2

Part C Acceptable Luminaires

LUMINAIRE: MAXIMUM CHARACTERISTICS

Post Top Column:

			Standard k Factors (see BVS 5649)		
			2.5	3.0	
Lantern Connection		Lantern Max Wt (kg)	Maximum Windage Area (m ²) for standard k factors		
Diameter (mm)	Length (mm)				

Single Arm Bracket Column:

Luminaire Lever Arm (mm)	
Due to wt. of lantern	Due to windage

Bracket Projection (m)	Ref No.	Drawing No.	Material		Luminaire Fixing Angle	Lantern Connection		Lantern Maximum Wt (kg)	Maximum Windage Area (m ²) for standard k factors	
			Grade	Design Strength (N/mm ²)		Diameter (mm)	Length (mm)			

Double Arm Bracket Column:

Lantern Lever Arm (mm)	
Due to wt. of lantern	Due to windage

Bracket Projection (m)	Ref No.	Drawing No.	Material		Lantern Fixing Angle	Lantern Connection		Lantern Maximum Wt (kg)	(11/04) Maximum Windage Area (m ²) for standard k factors	
			Grade	Design Strength (N/mm ²)		Diameter (mm)	Length (mm)			

Part D Certification

It is certified that the information given in this Data Sheet has been obtained in accordance with the requirements of the National Roads Authority Specifications for Road Works Series 1300.

Signed on behalf of the Contractor Date

13.3 APPENDIX 13/3: INSTRUCTIONS FOR COMPLETION OF COLUMN AND BRACKET DATA SHEET

13.3.1 GENERAL

When information is not required a dash shall be inserted in the appropriate boxes. Where a Data Sheet is amended it shall be given a new revision number with a date. The revision numbers shall be consecutive letters of alphabet, commencing with "A". The date of the revision shall agree with the date of the Contractor's signature.

The column or bracket material shall be material approved for use in the Contract.

The material design strength shall be the minimum specified in the design. Where more than one material is used values for all materials shall be given.

All relevant entries shall be made on the Data Sheet before the document is certified by the Contractor.

13.3.2 COLUMN DATA

The column nominal height shall be selected from BS-EN 40.

The number of door openings shall agree with the manufacturer's drawing.

The cross-section of the base compartment shall be indicated by a dimensioned diagram.

The acceptable positions of bracket arms relative to the door position shall be indicated on the diagram. Where all positions are acceptable the box noted "ANY" shall be ticked.

Where concrete is necessary around the planted base in accordance with sub-clauses 1305.3 and 1305.4 the minimum diameter shall be entered.

For flange bases all forces and moments used (or for use) in the design of the foundations, anchorages and attachment systems shall be given.

The corrosion protection system used and shall be recorded. Where additional steel is provided for sacrificial purposes the amount shall be recorded.

13.3.3 BRACKET DATA

The lantern lever arms, weight and maximum windage area quoted shall be based on the most adverse loading on the bracket when it is attached to any of the columns quoted in the compatible column sections.

(Note: The lantern lever arms are the horizontal distances from the centre of gravity of the lantern and, if applicable, the centroid of the windage surface area to the end of the bracket joint).

13.4 APPENDIX 13/4: CERTIFICATION FOR LIGHTING COLUMNS

CONSULTANT'S CHECK CERTIFICATE

We certify that the design of the lighting column system accurately shown on drawings No(s)has been checked by us and fully complies with:-

(i) National Roads Authority Specification for Road Works: 2000

(ii) Range of parameters for which column system has been checked as follows :-

We further certify that the design has been accurately transferred to the working drawings.

Signed:

Team Leader

Signed:

Partner / Director

Name of Consultant:

Date:

MANUFACTURER'S DESIGN CERTIFICATE

We certify that the design of the lighting column accurately shown on drawing(s) No(s)has been designed in accordance with and fully complies with :-

(i) National Roads Authority Specification for Road Works: 2000

(ii) Range of parameters for which column system has been checked as follows :-

Signed:

Designer

Signed:

Director

Name of Manufacturer:

Date:

CERTIFICATE OF REGISTRATION ISO 9001/ 9002 (where applicable)

Manufacturer/Design House : Details of Quality Assurance System

13.5 APPENDIX 13/5: ROAD LIGHTING COLUMN AND BRACKETS: TII ROAD CONSTRUCTION DETAILS

All works shall comply with Series 1300 of the TII Specification for Road Works and all associated Standard Construction Details (SCD's) contained in Volume 4 of the TII MCDRW.

14 SERIES 1400 - ELECTRICAL WORK FOR ROAD LIGHTING AND TRAFFIC SIGNS

14.1 APPENDIX 14/1: SITE RECORDS

- 14.1.1 As-built drawings shall be supplied to the Engineer by the Contractor in AutoCAD or other computerised format acceptable to the Engineer. Three printed paper copies of each drawing shall also be provided.
- 14.1.2 All permanent works are to be included in the as built drawings.
- 14.1.3 Cross sections at a maximum of 20m centres indicating location of underground services.
- 14.1.4 Works under each series of the Specification for Road Works shall be produced as a separate drawing.
- 14.1.5 The Engineer may ask the Contractor to produce other drawings showing specific areas of work if he sees fit.
- 14.1.6 All elements of work are to be ITM (Irish Traverse Mercator) co-ordinates.
- 14.1.7 The Contractor will be required to include exact locations of all underground services and thrust blocks etc.
- 14.1.8 Each separate element of works shall be drawn on its own layer (e.g. Eircom duct and ESB ducts to be on separate layers).
- 14.1.9 Motorway communications details shall not be included on the public lighting drawings.
- 14.1.10 Information to be provided on the drawings shall be as specified in Clause 1402 and include locations and numbers of lighting columns and feeder pillars, and positions of ESB public lighting supply cables and equipment within the site boundary.

14.2 APPENDIX 14/2: TEMPORARY LIGHTING

- 14.2.1 The Contractor shall be responsible for Temporary lighting to be provided where an existing installation is to be disconnected during the Works.
- 14.2.2 The standard of lighting shall be appropriate to the speed and volume of traffic during construction.
- 14.2.3 Any temporary lighting installation shall be approved by the Employer as part of Traffic Management.
- 14.2.4 Temporary lighting shall not be removed or disconnected until the permanent installation is operative.

14.3 APPENDIX 14/3: ELECTRICAL EQUIPMENT FOR TRAFFIC SIGNS

All electrical equipment for traffic signs shall comply with Series 1400 of the TII Specification for Road Works.

14.4 APPENDIX 14/4: PREPARATION AND FINISH OF METAL AND OTHER SURFACES

Lighting Columns, steel feeder pillars and all steel and metallic accessories and components shall be treated in accordance with the relevant sub-Clauses of Clause 1307.

It shall not be a requirement to paint galvanised lighting columns, or feeder pillars.

15SERIES 1500 - MOTORWAY COMMUNICATIONS

15.1 APPENDIX 15/1: MOTORWAY COMMUNICATIONS

Not used.

16 SERIES 1600 - PILING AND EMBEDDED RETAINING WALLS

16.1 APPENDIX 16/1: GENERAL REQUIREMENTS FOR PILING AND EMBEDDED RETAINING WALLS

Not used.

16.2 APPENDIX 16/2: PRECAST REINFORCED AND PRESTRESSED CONCRETE PILES AND PRECAST REINFORCED CONCRETE SEGMENTAL PILES

Not used.

16.3 APPENDIX 16/3: BORED CAST-IN-PLACE PILES

Not used.

16.4 APPENDIX 16/4: BORED PILES CONSTRUCTED USING CONTINUOUS FLIGHT AUGERS AND CONCRETE OR GROUT INJECTION THROUGH HOLLOW AUGER STEMS

Not used.

16.5 APPENDIX 16/5: DRIVEN CAST-IN-PLACE PILES

Not used.

16.6 APPENDIX 16/6: STEEL BEARING PILES

Not used.

16.7 APPENDIX 16/7: REDUCTION OF FRICTION ON PILES

Not used.

16.8 APPENDIX 16/8: NON-DESTRUCTIVE METHODS FOR TESTING PILES

Not used.

16.9 APPENDIX 16/9: STATIC TESTING OF PILES

Not used.

16.10 APPENDIX 16/10: DIAPHRAGM WALLS

Not used.

16.11 APPENDIX 16/11: HARD/HARD SECANT PILE WALLS

Not used.

16.12 APPENDIX 16/12: HARD/SOFT SECANT PILE WALLS

Not used.

16.13 APPENDIX 16/13: CONTIGUOUS BORED PILE WALLS

Not used.

16.14 APPENDIX 16/14: KING POST WALLS

Not used.

16.15 APPENDIX 16/15: STEEL SHEET PILES

Not used.

16.16 APPENDIX 16/16: INTEGRITY TESTING OF WALL ELEMENTS

Not used.

16.17 APPENDIX 16/17: INSTRUMENTATION FOR PILES AND EMBEDDED WALLS

Not used.

16.18 APPENDIX 16/18: SUPPORT FLUID

Not used.

17 SERIES 1700 - STRUCTURAL CONCRETE

17.1 APPENDIX 17/1: CONCRETE - CLASSIFICATION OF MIXES

All concrete mix designs shall comply with the Drawings listed in Appendix 0/4 of Sp-1021, the Concrete Specification “SP-1002”, Series 1700 of the TII Specification for Road Works and I.S. EN206-1 and its National Annex.

The concrete mixes used in the Works shall be in accordance with Table 17.1 below.

Table 17.1 Mix Designs

The mix(es) below shall be supplied as designed mixes in accordance with I.S. EN 206			
1. Mix Reference		Mix LCE-HELI (to be used for all concrete on this project)	
2. Strength class		C35/45	
3. Nominal maximum size of aggregate in mm (D)		20	
4. Types of aggregate		I.S. EN 12620 (Coarse and Fine)	
5. Sulfate class		XA1	
6. Cement type(s) or combinations complying with: CEM I N to I.S. EN 197-1 CEM I R to I.S. EN 197-1 CEM I-SR to I.S. EN 197-1 CEM III/A to EN 197-1		CEM I N CEM III/A	
7. Exposure Class (As in IS EN 206-1 or combinations)		[XC4] [XD3] [XS1] [XF4] [XA1]	
8. Chloride Class EN 206-1 2000 – Table 10, adjusted to NA.2.8 referring to table NA.4		Cl 0,40 ^{1,2,3}	
9. Minimum Cement Content (kg/m ³)		360	
10. Maximum free water/ cement ration		0.50	
11. Quality assurance requirements		See Note 4	
12 Rate of sampling intended by the purchaser for strength testing (for information)		See Note 5	
13 Other requirements [alkali, colour, etc. as appropriate]		See Notes 6, 7 and 8	
In the case of fresh concrete the following shall be completed by the purchaser:			
14 Consistence	Choose one method Slump Class Compaction Class Vebe Class Flow Class	S1, S2, S3, S4, S5 V0, V1, V2, V3, V4 C0, C1, C2, C3 F1, F2, F3, F4, F5, F6	
15 Method of placing (for information)			
16 Other requirements by the purchaser of fresh concrete			

Notes to Table 17.1:

- Where type II additions are used and are taken into account for the cement content, the chloride content is expressed as the percentage chloride ion by mass of cement plus the total mass of additions that are taken into account.
- Cement type CEM III and GGBS as a type II addition may contain more than 0,10 % chloride but in that case the maximum chloride content shall be stated on the packaging and/or delivery note.
- In the case of CEM I SR cements the maximum chloride content by mass of cement shall be 0, 20% with a chloride class of Cl 0, 20.

- 4) See notes on Drawing 1001 and Appendix 1/24 and Appendix 1/25 of SP-1021.
- 5) Frequency of concrete identity/strength testing to be in accordance with Drawing 1001 and Appendix 1/5 of the SP-1021.
- 6) Coarse and fine aggregates, and cement type to be from similar sources for all concrete mixes.
- 7) Minimum % GGBS by weight of total cement.
- 8) GGBS to have 14% or less Al_2O_3 . (See also 1702.1(iii) (c) of TII Specification for Road Works.

17.2 APPENDIX 17/2: CONCRETE - IMPREGNATION AND COATING SCHEDULE

Not applicable. Road Works

17.3 APPENDIX 17/3: CONCRETE - SURFACE FINISHES

1. Trial panels are not required.
2. Unless otherwise noted in another part of the Contract, surface finishes shall be as follows:

U1 Unformed surfaces, unexposed, levelled to produce uniform surface

U3A Unformed surface, bridge deck concrete slab (see description below)

F2 All hidden faces (e.g. perimeter of bridge deck slab and parapet walls)

F4 All exposed formed concrete faces.

Class U3A surface finish.

When the moisture has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, a Class U1 finish (to Clause 1708 of the TII Specification for Road Works) shall be steel-trowelled under firm pressure to produce a dense, smooth uniform surface free from trowel marks after which a brushed finish shall be applied to the surface. When tested to I.S. EN 16165:2021, pendulum test values (PTVs) of the wetted finished surface shall be not less than 49.

Unless otherwise noted on the Contract Drawings (incl. Architect Drawings), surface finishes are as follows:

U1 = unformed surfaces, unexposed, levelled to produce uniform surface

U3 = unformed surfaces, in-situ concrete kerbs

U4 = Applied to concrete abutment deck finish

U5 = unformed surfaces, in-situ concrete footways

F1 = All formed internal surfaces unexposed (no external requirements)

F2 = Applied to all hidden wall faces

F4 = Applied to all exposed wall faces

The top of all concrete decks, walkways and steps are to have a brushed finish which should achieve a surface micro-roughness (R_z) value $>20\mu m$ in accordance with BS 8300:2009+A1:2010

The following indices should be used to indicate the slipperiness of surfaces to the satisfaction of the supervisor:

- a. Pendulum test values (PTVs) obtained using a pendulum tester in line with BS 7976-2
- b. Roughness Rz measurements using a stylus instrument in accordance with BS 1134-1.

17.4 APPENDIX 17/4: CONCRETE – GENERAL

References to Clauses and Sub-clauses in this Appendix 17/4 shall be taken to be Clauses and Sub-clauses of the edition of Series 1700 of the TII Specification for Road Works current on a date 10 days before the date from tender submission for the project to which this appendix relates.

1. Concrete need not conform to DN-STR-03012, but must conform to the remainder of sub-Clause 1701.1.
2. No part of the Work shall be required to be constructed with an execution class other than execution class 3.
3. There are no additional requirements associated with concrete for the Works which involve using special technologies, other materials (e.g. fibres, FRPs) or innovative designs.
4. The use of cements or combinations other than to Clause 1702.1 is not permitted.
5. Lightweight aggregates, if required, shall comply with the requirements of sub-Clause 1702.2.
6. Requirements for admixtures shall comply with the requirements of sub-Clause 1702.3.
7. Frequency of concrete identity/strength sampling and testing shall comply with the requirements set out in Drawing 1001 as listed in Appendix 0/4 of the Marine & Civil Works Specification, and Appendix 1/5 of the Marine & Civil Works Specification.
8. Expansion joints shall be provided as shown in Drawing 1801 as listed in Appendix 0/4 of the Marine & Civil Works Specification. The position of expansion joints shall not deviate by more than 10mm from their proposed location, and shall be aligned in a straight line across all three concrete pours.
9. Retarding agents shall not be used unless permitted by the Employer's Representative.
10. There are no requirements for permanent formwork, special formwork or slipforming envisaged in the Works, unless required by the Contractor's methodology for carrying out the Works.
11. There are parts of the works where a curing class other than 3 is to be used. Where a curing liquid, compound or membrane is used on the bridge deck, it shall be compatible with any paints used to subsequently mark the bridge deck, and shall not adversely affect the slip resistance of the finished surface (see requirement for slip resistance of bridge deck concrete slab in Appendix 17/3 above).
12. Special curing requirements do not apply to the Works.
13. Since precast concrete elements are not envisaged in the Works, references to documents and drawings which show the lifting scheme and support points for precast concrete elements, including constraints during handling and storage instructions as envisaged in 1710.8(iv)(b) and (iv)(c) do not apply.
14. Since precast concrete elements are not envisaged in the Works, requirements for assembly and erection of precast concrete members envisaged in 1710.8(iv) do not apply.

15. Welded reinforcement, other than steel fabric reinforcement, shall not be incorporated in the permanent Works.
16. Requirements relating to the stressing of prestressing tendons, as envisaged in sub-Clauses 1724.3 and 1724.4, do not apply to the Works.
17. Requirements for protection of prestressing tendons, as envisaged in sub-Clause 1725.1, do not apply to the Works.
18. Frequency of concrete identity/strength testing to be in accordance with Drawing 1001 and Appendix 1/5 of the Marine & Civil Works Specification.

Check tests on Structural Concrete, as described in sub-Clause NG1727.1 of the TII Notes for Guidance Specification for Road Works may also be used for routine inspection and for quality control, and may also be of use when concrete is found defective from visual inspection and when assessing the strength of the concrete used.

The surface of the concrete shall be inspected for defects, for conformity with the Specification and, where relevant, for comparison with approved sample finishes.

The dimensional accuracy of all elements of the Works, including, but not limited to the dimensional accuracy of the bridge deck slab (horizontal and vertical dimensional accuracy) will be inspected in advance of a concrete pour (i.e. dimensional accuracy of forms will be inspected) and after the concrete has been poured. The type, position, rigidity and amount of reinforcement shall be inspected in advance of a concrete pour, and should doubts exist about the position of reinforcement after the concrete has been poured, an inspection shall be carried out to ascertain the amount of cover to the reinforcement. The cleanliness and preparedness of expansion joints to receive flexible sealant, and concrete forms to receive concrete, shall be inspected immediately prior to placing the sealant or concrete, respectively. The findings of all such inspections shall be recorded by the Contractor and countersigned by the Employer's Representative before the relevant part of the Works is put out of sight, with the records of inspections being included in the as-built records of the Works.

19. Requirements for particular curing methods for deep / bulky elements, elements containing unusually high proportion of cement or precast units subject to special or accelerated curing methods, as envisaged in sub-Clause 1710.5, do not apply to the Works.
20. Third party inspection by an organisation different from that which executed the Works, as envisaged in sub-Clause 1710.5, do not apply to the Works.
21. The as-constructed level of the finished surface of the bridge deck slab shall be within 6mm of the target level for the point under consideration. Points at which the level of the bridge deck slab shall be inspected shall be chosen by the Employer's Representative after the concrete has cured sufficiently to allow pedestrian traffic. The finished surface of the bridge deck shall also be inspected using a straight-edge, 3m long, at locations to be selected by the Employer's Representative. The maximum allowable difference between the surface and the underside of the straight-edge shall be 3mm. Where the straight-edge spans an expansion joint, a maximum allowable difference between the surface and the underside of the straight-edge shall be 5mm.

17.5 APPENDIX 17/5: NOT USED

Not used

17.6 APPENDIX 17/6: NOT USED

Not used

17.7 APPENDIX 17/7 PRECAST CONCRETE ELEMENTS

1. All Precast Concrete Products shall comply with the requirements set by BS EN 13369. Evidence of compliance shall be demonstrated by CE marking and a Declaration of Performance by the Manufacturer.
2. Performance requirements for each Precast Concrete Product shall comply with those provided in specification and standards mentioned in clause 1 of this appendix. Evidence of compliance with the relevant standards shall be demonstrated by CE marking and a Declaration of Performance by the Manufacturer.
3. All Precast Concrete Products shall be designed for permanent works. It is the Contractor's responsibility to design the lifting anchors as well as all construction loads.
4. Support points for the precast concrete elements are shown in the relevant Contract Drawings along with handling and storage instructions. Lifting arrangements are to be designed by the Contractor
5. Tolerance requirements for precast units are to be in accordance with Clauses 10 of BS EN 13670

18 SERIES 1800 - STRUCTURAL STEELWORK

18.1 APPENDIX 18/1: REQUIREMENTS FOR STRUCTURAL STEELWORK

All requirements for structural steelwork shall comply with the Contract Drawings, Structural Steelwork Specification “SP-1003” and Series 1800 of the TII Specification for Road Works.

All external steelwork shall be hot-dip galvanised.

19 SERIES 1900 - PROTECTION OF STEELWORK AGAINST CORROSION

19.1 APPENDIX 19/1: (SPECIFICATION FOR ROAD WORKS) SHEET NO. FORM BE/P1 (NEW WORKS) PAINT SYSTEM SHEET

All requirements for structural steelwork shall comply with the Contract Drawings, Structural Steelwork Specification “SP-1003” and Series 1800 of the TII Specification for Road Works.

All external steelwork shall be hot-dip galvanised. See Contract Drawings.

All requirements for bridges, parapets and other highway structure except bearings and lighting columns shall comply with Series 2200 and Series 2300 of the TII Specification for Road Works.

19.2 APPENDIX 19/2: (NEW WORKS) REQUIREMENTS FOR OTHER WORK

All requirements for bearings shall comply with Series 2100 of the TII Specification for Road Works.

19.3 APPENDIX 19/3: (SPECIFICATION FOR ROAD WORKS) FORM BE/P2 PAINT DATA SHEET

All requirements for lighting columns and bracket arms shall comply with Series 1300 of the TII Specification for Road Works.

19.4 APPENDIX 19/3*: (SPECIFICATION FOR ROAD WORKS) FORM BE/P3 PAINT SAMPLE DESPATCH LIST: SHEET 1

All requirements for lighting columns and bracket arms shall comply with Series 1300 of the TII Specification for Road Works.

19.5 APPENDIX 19/3*: (SPECIFICATION FOR ROAD WORKS) FORM BE/P3 PAINT SAMPLE DESPATCH LIST: SHEET 2

Not used.

19.6 APPENDIX 19/4: (NEW WORKS) GENERAL REQUIREMENTS

Not used.

**19.7 APPENDIX 19/5: (SPECIFICATION FOR ROAD WORKS) FORM
BE/PE1 (MAINTENANCE) PAINT SYSTEM SHEET 1**

Not used.

**19.8 APPENDIX 19/6: (SPECIFICATION FOR ROAD WORKS) FORM
BE/P1 (MAINTENANCE) PAINT SYSTEM SHEET 2**

Not used.

**19.9 APPENDIX 19/7: (MAINTENANCE) REQUIREMENTS FOR OTHER
WORK**

Not used.

19.10 APPENDIX 19/8: (MAINTENANCE) GENERAL REQUIREMENTS

Not used.

20 SERIES 2000 - WATERPROOFING FOR CONCRETE STRUCTURES

20.1 APPENDIX 20/1: FORM PWS PROPRIETARY WATERPROOFING SYSTEM DATA SHEET (1991 & ANNEX 'A')

Not used.

20.2 APPENDIX 20/2: WATERPROOFING FOR CONCRETE STRUCTURES

All requirements for waterproofing for concrete structures shall comply with the Contract Drawings, Waterproofing Specification “SP-1006” and Series 2000 of the TII Specification for Road Works.

21 SERIES 2100 - BRIDGE BEARINGS

21.1 APPENDIX 21/1: BRIDGE BEARING SCHEDULE

Not used.

22 SERIES 2200 - NA

23 SERIES 2300 - BRIDGE EXPANSION JOINTS AND SEALING OF GAPS

23.1 APPENDIX 23/1: BRIDGE DECK EXPANSION JOINT SCHEDULE

Not used.

23.2 APPENDIX 23/2: SEALING OF GAPS SCHEDULE (OTHER THAN IN BRIDGE DECK EXPANSION JOINTS)

Not used.

24 SERIES 2400 - BRICKWORK, BLOCKWORK AND STONework

All masonry shall be as per Specification "SP-1004".

24.1 APPENDIX 24/1: BRICKWORK, BLOCKWORK AND STONework

Not used.

24.2 APPENDIX 24/2: BRICKWORK, BLOCKWORK AND STONework: TII ROAD CONSTRUCTION DETAILS

Not used.

25 SERIES 2500 - SPECIAL STRUCTURES

25.1 APPENDIX 25/1: REQUIREMENTS FOR CORRUGATED STEEL BURIED STRUCTURES

Not used.

25.2 APPENDIX 25/2: REQUIREMENTS FOR REINFORCED SOIL AND ANCHORED EARTH STRUCTURES

Not used.

25.3 APPENDIX 25/3: REQUIREMENTS FOR REINFORCED CLAY BRICKWORK RETAINING WALLS OF POCKET TYPE AND GROUTED CAVITY CONSTRUCTION STRUCTURES

Not used.

26 SERIES 2600 - MISCELLANEOUS

26.1 APPENDIX 26/1: ANCILLARY CONCRETE

Not used.

26.2 APPENDIX 26/2: BEDDING MORTAR

Not used.

26.3 APPENDIX 26/3: CORED THERMOPLASTIC NODE MARKERS

Not used.

27 SERIES 2700 - WATERMAINS, UTILITIES AND ACCOMODATION WORKS

27.1 APPENDIX 27/1: REQUIREMENTS FOR WATERMAINS

27.1.1 Drawings and Schedules

- 27.1.1.1 For location of watermains and associated infrastructure refer to the Drawings listed in Appendix 0/4 of SP-1021
- 27.1.1.2 For typical watermain details refer to Contract drawings and the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4)".
- 27.1.1.3 For details of the irrigation system refer to Contract drawings.
- 27.1.1.4 For details of chambers and chamber covers refer to Appendix 5/1 of SR-1021, the relevant Contract drawings, the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4)" and the Greater Dublin Regional Code of Practice for Drainage Works.
- 27.1.1.5 For details of potable water meters, refer to the requirements of the Contract drawings and the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4)".

27.1.2 General Requirements

- 27.1.2.1 Construction of trunk watermains shall be in accordance with the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4)".
- 27.1.2.2 Construction of distribution watermains shall be in accordance with the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4)".
- 27.1.2.3 Connections to mains, which are the property of Irish Water, shall be made by or with the written approval of Irish Water only. No other person shall interfere in any way with these mains. The Contractor should note that this includes the connections from the proposed distribution main to the proposed trunk watermain internally within the site. Such connections shall be made by or with the written approval of the Irish Water at the expense of the Contractor.
- 27.1.2.4 The Contractor shall be responsible for the coordination with and provision of attendance to the Irish Water representatives and personnel. All costs associated with this work shall be borne by the Contractor.
- 27.1.2.5 All pipes and fittings shall be stored off the ground in a clean environment to prevent any contamination of materials prior to use. All pipes shall be capped at both ends until they are used in the Works. All fittings supplied in sealed bags

shall remain sealed until immediately prior to installation.

27.1.2.6 Pipes and fittings shall be examined for damage before use. Damaged and substandard pipes and fittings shall be rejected for use in the Works.

27.1.2.7 Plastic pipes with scores or cuts penetrating more than 10% of the wall section shall be rejected for use in the Works. If, after installation, scores or cuts penetrating more than 10% of the wall section are identified, the affected lengths shall be removed and replaced. The expense of replacing damaged sections shall be borne by the Contractor.

27.1.2.8 The Contractor shall take note of the constraints listed in appendices 1/7 and 1/13 with regard to the installation of trunk and distribution watermain and their associated infrastructure.

27.1.3 Not Used

27.1.4 Piping and Fittings

27.1.4.1 All trunk mains shall be constructed using high performance polyethylene (HPPE) in accordance with BS EN 12201.

27.1.4.2 High performance polyethylene pipes and fittings shall be of type PE-100 and have a standard dimension ratio of 17.

27.1.4.3 High performance polyethylene spigot fittings and drawn bends shall conform to the UK Water Industry Specification No.4-32-15.

27.1.4.4 Not used

27.1.4.5 Not used

27.1.4.6 No materials shall be used without the prior written approval of the Employer.

27.1.4.7 All potable watermain to be taken in charge by Irish Water shall be constructed to Irish Water watermain standards.

27.1.5 Piping Joints

27.1.5.1 Materials used for piping joints shall be in accordance with this specification, the requirements of the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

27.1.5.2 Pipe Joints shall be one of the following types;

- Push in rubber ring joint,
- Bolted flanged joints,
- Flexible couplings,
- Fusion welded Joints in accordance with UK WIS 4-32-08.

27.1.5.3 The maximum angular deflection at any joint shall be two degrees. Bends shall be used to cater for greater deflection.

27.1.5.4 All joints shall be made strictly in accordance with the manufacturers' specification.

27.1.6 Copper Service Pipes and Fittings

27.1.6.1 Copper service pipes and fittings may be laid in the ground in certain

circumstances subject to the approval of the Employer and Irish Water.

27.1.6.2 Copper pipe for use in ground conditions should be type R220 (annealed) or R250 (half hard) and comply with BS EN 1057. Copper pipe joints for use underground should conform to BS EN 1254-1 capillary soldering or BS EN 1254-2: Type B; manipulative compression fittings.

27.1.6.3 Copper alloy fittings for use underground shall be made from gunmetal to BS EN 12165, BS EN 12163, BS EN 12164 or BS EN 12167 material CZ 132 (resistant to dezincification) or be tested for dezincification resistance in accordance with BS EN ISO 6509.

27.1.7 Potable Water Meters

27.1.7.1 All service pipes shall include the installation of a domestic water meter situated in the public realm adjacent to the building plot being supplied. The specific location of each meter is indicated on the Contract Drawings.

27.1.7.2 Refer to the requirements of the Contract drawings for a schedule of potable water meters to be installed.

27.1.7.3 Potable water meters and fittings shall be rated PN 16 in accordance with BS EN 1092.

27.1.7.4 Domestic water meters shall be of type as follows (or similar type approved by the Employer's

27.1.7.5 Representative):

- Elster Helix 4000
- Elster V100

27.1.7.6 Each domestic water meter shall be housed in an underground chamber. The final location of all water meter chambers shall be agreed with the Employer on-site.

27.1.7.7 Chambers for domestic water meters shall be concrete block. Precast concrete or in-situ concrete chambers may be used subject to approval by the Employer.

27.1.8 Sluice Valves

27.1.8.1 Sluice valves shall be double flanged; ductile iron resilient seal gate valves for watermain purposes and shall comply with the relevant requirements of EN 1074. The number of turns to open/close the valve must be $n=2N+1$ where N equals the equivalent diameter in inches. The spindle shall be fitted with a cast iron oval false cap (complete with grub screw). Depth from ground level to the top of the valve spindle must not be greater than 600mm.

27.1.8.2 The final location of sluice valves shall be agreed prior to installation with Irish Water.

27.1.8.3 Sluice valves and fittings shall be rated PN 16 in accordance with BS EN 1092.

27.1.8.4 The operating torque of sluice valves should not exceed the maximum allowed within EN1074, with written test results submitted to the Employer for approval. Sluice valves shall be coated with an electrostatic epoxy spray, or

bitumen – trichlorethylene solution to U.K water regulations advisory committee (WRAC) recommendations or an alternative approved coating.

27.1.8.5 All sluice valves are to be operated from above ground with a valve key and shall be ANTI CLOCKWISE CLOSING.

27.1.8.6 Sluice valves shall be metal tongued. They shall bear the following markings (either integral with the body or on a plate of durable material securely fixed to the body):-

- Nominal Diameter (i.e. DN 100, 150, etc.)
- Nominal pressure rating (i.e. PN 10 or PN 16).
- Valve number in accordance with drawings GD-T-2700-000 to 008.

27.1.8.7 Valve caps shall be fixed to the valve spindle or provided with a reducer as required to fit a standard key.

27.1.8.8 Sluice valve chambers shall be constructed in accordance with the Contract drawing. Precast concrete or in-situ concrete chambers may also be used subject to the approval of the Employer.

27.1.9 Hydrants

27.1.9.1 For hydrant locations refer to Drawing 1501 as listed in Appendix 0/4 of SR-1021.

27.1.9.2 Hydrants shall comply with the requirements of IS EN 14339, IS EN 1074-6 and BS 750.

27.1.9.3 Hydrant fittings shall be rated PN 16 in accordance with BS EN 1092.

27.1.9.4 Hydrants shall be Type 2 in accordance with BS 750, shall incorporate a screw down valve, and be “guide in head” type and incorporate bayonet lug outlets and a false spindle.

27.1.9.5 The hydrant valve shall be CLOCKWISE CLOSING. That is, the opposite of a sluice valve.

27.1.9.6 Hydrants shall be coated with an electrostatic epoxy powder spray, or bitumen - trichloroethylene solution to U.K WRAC or an alternative approved coating.

27.1.9.7 Hydrants connected to the trunk main (which are provided for emergency supply) may not be used for any other purpose without the written permission of Irish Water.

27.1.9.8 Hydrant chambers shall be constructed in accordance with the details shown on the Contract drawing. Precast concrete or in-situ concrete chambers may also be used subject to the approval of the Employer.

27.1.10 Bulk Water Meter Chamber

27.1.10.1 For the location of the bulk water meter chamber refer to the Contract Drawings.

27.1.10.2 The Contractor shall construct an in-situ bulk water meter chamber in accordance with the Contract drawings. Chamber covers shall have a clear

opening of 1.5m x 1.5m and shall be Galco Assist Lift Covers – Double Covers or similar type approved.

27.1.10.3 Cast in situ concrete chambers shall be constructed of C20/25 concrete complying with appendix 17/1 of the specification.

27.1.10.4 Foundations to chambers shall be 150mm thick, of mix C20/25 concrete in accordance with appendix 17/1 of the specification with steel mesh to BS 4483 Ref A252, 40mm cover from top of foundation, laid on 75mm thick blinding concrete of grade C15/20 in accordance with appendix 17/1 of the specification. Precast manhole bases shall be permitted. These shall have 150mm thick reinforced bases laid on 75mm thick blinding concrete of grade C15/20 in accordance with appendix 17/1 of the specification or 75mm thick blinding sand.

27.1.11 Spool Pieces

27.1.11.1 The Contractor shall install spools as indicated on the Contract drawings within the bulk water meter chambers. The length of the spool shall be confirmed with the Employer prior to installation.

27.1.11.2 All spool pieces shall be constructed using ductile iron. Ductile iron spools and fittings shall conform to Class K9 of BS EN 545. Ductile Iron pipes and fittings shall be lined with a material that is approved for contact with potable water.

27.1.11.3 Spools fittings shall be rated PN 16 in accordance with BS EN 1092.

27.1.12 Water Kiosk

27.1.12.1 For the location of the water kiosk refer to the Contract Drawings.

27.1.12.2 The water kiosk shall be a Cully Automation Type 3 Kiosk or similar type approved by the Employer. The kiosk shall conform to the following:

27.1.12.3 The water Kiosk shall have hinged doors which open to 180o.

27.1.12.4 The water Kiosk shall have IP65 rated door seals.

27.1.12.5 The water kiosk shall have IP42 rated ventilation.

27.1.12.6 The top to the water kiosk shall be sloped to shed water.

27.1.12.7 The water kiosk shall incorporate a lockable mechanism

27.1.12.8 The water kiosk shall have a concrete pad foundation as follows:

- 1000x700x400mm concrete pad foundation with steel mesh to BS 4483 ref A393 mesh top and bottom (minimum 40mm cover) with top of pad not less than 300mm below finished ground level.

27.1.12.9 The water kiosk shall be connected to the concrete pad foundation using 8 no. M20 Hilti HST safety stud anchors or similar type approved anchor bolts or in accordance with the manufacturers specifications.

27.1.12.10 The formation for the concrete pad foundation shall be minimum 250mm thick class 6N Material in accordance with series 600 of the TII Specification for Road Works.

27.1.13 Water Kiosk Telemetry

27.1.13.1 For the location of the connection point from the water kiosk to the external ICT networks refer to Contract drawings.

27.1.13.2 For the location of the ICT connection points from the water kiosk to the electrical network refer to Contract drawings.

27.1.13.3 For the location of the ICT connection points from the bulk and domestic water meter to the water kiosk refer to Contract drawings.

27.1.13.4 Service ducting and bedding shall be in accordance with appendix 5/2 of the specification.

27.1.13.5 Electrical infrastructure for the water kiosk shall be in accordance with series 1400 of the TII Specification for Road Works and the manufacturer's specifications.

27.1.14 Chamber and Surface Covers

27.1.14.1 Chamber covers shall be Class D in accordance with IS EN 124 and appendix 5/1 of the specification. Refer to Contract drawings for the chamber cover schedule and for the general arrangement of recessed manhole covers.

27.1.14.2 Surface covers for hydrants, sluice valves and potable water meters shall be in accordance with IS 261.

27.1.15 Indicator Posts

27.1.15.1 Concrete indicator posts shall be in accordance with BS 3251.

27.1.15.2 Concrete indicator posts shall be provided at the location of hydrants, sluice valves and domestic water meters.

27.1.15.3 Concrete indicator posts shall include a reference for the valve/water meter/hydrant it indicates.

27.1.16 Thrust Blocks

27.1.16.1 The Contractor shall provide concrete thrust blocks Road Works as required by the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

27.1.17 Laying of Pipes

27.1.17.1 Road Works Pipes shall be laid in accordance with the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

27.1.18 Bedding Material

27.1.18.1 Road Works. All pipe bedding material shall comply with the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

27.1.19 Backfilling

All backfill material shall comply with the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

27.1.20 Warning Mesh

27.1.20.1 Warning mesh shall comply with the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

27.1.21 Cleaning Pipes

27.1.21.1 All pipes must be examined internally for dirt, stones or any foreign matter and must be thoroughly cleansed of such foreign matter before laying in final position. To prevent foreign matter or vermin entering the watermain as it is being laid, all open ends of laid pipes must be sealed with plugs of timber or other suitable material during the periods when work at these open ends is suspended.

27.1.22 Tests

27.1.22.1 After the pipes have been laid and jointed, the main shall be tested as outlined below.

27.1.22.2 Pressure Test:

- The trunk and distribution watermains shall be subjected to 5 bar pressure for twenty four hours. This shall be increased to 1 & ½ times its normal working pressure for 1 hour in the presence of a representative of Irish Water.
- Testing shall be carried out between suitably supported blank end pieces. Testing between "live" shut valves will not be accepted.
- Watermains are to be tested prior to the installation of any service pipe tappings on the watermain (other than those required for filling the watermain).

27.1.23 Chlorination Tests

- The Contractor shall be responsible for the coordination of all chlorination testing.
- The Contractor shall inform Irish Water in advance of all chlorination testing such that he may attend all chlorination testing.
- All costs associated with chlorination testing shall be borne by the Contractor.

- All mains shall be swabbed and disinfected before being put in to supply. The pipelines shall be disinfected with water having a minimum concentration of 20mg/l of free chlorine. Irish Water shall carry this test out with the assistance of the Contractor.
- The chlorinated water shall be left in the main for a period of at least 24 hours. Chlorine residual tests shall be taken at the end of the main furthest from the point of injection. The sterilisation process shall be repeated if the chlorine residual is less than 10mg/l. All chlorinated water must be disposed of in such a manner as not to pose a pollution risk.

27.1.24 Bacteriological Test

- Following the chlorination tests the watermain shall be refilled and the Contractor shall organise a sample of the water to be taken for bacteriological analysis. Great care shall be taken when obtaining samples for testing and only sterile containers shall be used. This sampling shall be carried out in the presence of Irish Water. Samples shall be tested within 6 hours of collection. Water samples may be tested in any approved or accredited laboratory.
- All costs associated with bacteriological testing shall be borne by the Contractor.
- The Contractor will not connect the new main to the existing network until a copy of a satisfactory bacteriological test report has been submitted to, and has been approved by, Irish Water. Irish Water and/or the Employer's Representative reserve the right to take and test a sample and for the Contractor to bear the costs.

27.1.25 Flushing

- 27.1.25.1 When mains have been satisfactorily tested and connected, they shall be flushed out with potable water through a standpipe placed on the end hydrant before the main is brought into use. The flushing shall be carried out in the presence of Irish Water.

27.2 APPENDIX 27/2: WATERMAINS: TII STANDARD CONSTRUCTION DETAILS

All watermains shall be constructed in accordance with the current version of the Irish Water publication "Water Infrastructure Standard Details: Connections and Developer Services: Construction Requirements for Self-Lay Developments July 2020 (Revision 4).

28 SERIES 2800 - TRENCHLESS INSTALLATION OF ROAD DRAINAGE & SERVICE DUCTS

28.1 APPENDIX 28/1: TRENCHLESS AND MINIMUM DIG TECHNIQUES

Not used.

29 SERIES 2900 - CCTV SURVEY OF ROAD DRAINAGE SYSTEMS

29.1 APPENDIX 29/1: CCTV SURVEY OF ROAD DRAINAGE SYSTEMS

Not used.