



Scheme Delivery Framework Specification

CONTENTS AMENDMENT SHEET

Amend. No.	Revision No.	Amendments	Initials	Date
0	0	Contract Issue	AJP	Sept 21

PREAMBLE TO SPECIFICATION

1. The Specification referred to in the Tender shall be the 'Specification for Highway Works', published by The Stationery Office (formerly HMSO) as Volume 1 of the Manual of Contract Documents for Highway Works, as modified and extended by the following:
 - i. Appendix 0/1: Contract-specific Additional, Substitute and Cancelled Clauses, Tables and Figures;
 - ii. Appendix 0/2: Contract-specific minor alterations to existing Clauses, Tables and Figures;
- I. The contract specific Numbered Appendices listed in Appendix 0/3;

Appendix 0/4: contains a list of Drawings;

2. The relevant publication date of each page of the Specification for Highway Works is given in the Schedule of Pages and Relevant Publication Dates in Table 0/1.
3. An Additional Clause as indicated by a suffix 'AR' in Appendix 0/1 is a Contract-specific alteration.
4. A Substitute Clause as indicated by a suffix 'SR' in Appendix 0/1 is a Contract-specific alteration.
5. A Cancelled Clause indicated by a suffix 'CR' in Appendix 0/1 is a Contract-specific alteration.
6. Insofar as any of the Numbered Appendices may conflict or be inconsistent with any provision of the Specification for Highway Works the Numbered Appendices shall always prevail. Additionally, Numbered Appendices 0/1 and 0/2 shall take precedence over Numbered Appendix 0/5.
7. 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.
8. 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.
9. Where a Clause in the Specification relates to work goods or Plant and Materials which are not required for the Works it shall be deemed not to apply.
10. Any Appendix referred to in the Specification which is not used shall be deemed not to apply.
11. Any reference in the Contract or Specification to a British or European Standard or Code of Practice is deemed to refer to the latest update, revision or superseded version current at the date of tender.
12. Other than where references to the Overseeing Organisation are made in the context of the Overseeing Organisation granting statutory or type approvals, the roles and functions of the Overseeing Organisation shall be undertaken by the Project Manager. Where the Specification requires the provision of documentation to the Overseeing Organisation for statutory or type approval such documentation shall be provided to the Project Manager.
13. For references to the Contractor, the roles and functions of the Contractor shall be undertaken by the Contractor.

14. If the Specification is used in conjunction with a Contract under which the Contractor is responsible for the design or any part of the Permanent Works, the delegation of the roles and functions of the Overseeing Organisation as stated in paragraph 12 above shall be amended as follows:
- (i) If any agreement, consent or approval required to be obtained from the Overseeing Organisation impacts on the health and safety of the general public, the environment or any property or equipment not owned or operated by the Contractor or the Design Build Finance and Operate concessionaire, such agreement, consent, approval shall be obtained from the Project Manager.
 - (ii) Where the Specification provides for the Overseeing Organisation to require a test, waive the requirement for a test or alter testing frequency, the party to whom the Overseeing Organisation's roles and functions have been ascribed by paragraph 12 above shall exercise such decisions in accordance with the Secretary of State's requirements stated in the Contract. ***
15. Where Standards and other documents are incorporated into the Contract by reference the respective edition used shall be that which is current on the date on which the Final Tender Submission shall be submitted unless otherwise stated in the Specification.

Table 0/1 Schedule of Pages and Relevant Publication Dates

Series/Appendix	Page Number	Publication Date
000	1 to 3	May 2014
000	6 to 7F	February 2016
000	4 to 5	March 2020
100	1 to 2, 4 to 9, 12 to 29F, WF1, N2 to N11F	May 2014
100	3, 10 to 11, N1	December 2014
200	1 to 3F	February 2016
300	1	May 2001
300	4	November 2002
300	2 to 3, 5 to 6F	May 2008
400	1, 9 to 11, 13, 17 to 20, 21, 23F	May 2017
400	2 to 8, 12,14 to 16, 22	March 2020
500	1 to 2, 4 to 39F, N1 to N2F	February 2020
500	3	March 2020
600	1 to 68, 70 to 77F, S1 to S4F, W1 to W4F, N1 to N5F	February 2016
600	69	February 2017
700	1 to 36F, N1 to N6F	February 2016
800	1, 3 to 31	February 2016
800	2, 32 to 38F	March 2020
900	3, 5 to 7, 21 to 32	May 2018
900	1 to 2, 4, 8 to 20, 33 to 79F	July 2019
1000	1 to 51F	January 2020
1100	N1F	November 2006
1100	3	August 2008
1100	1 to 2, 4 to 6F	February 2017
1200	5	May 2001
1200	2 to 3, W1F	August 2003
1200	1, 14 to 16F	May 2004
1200	4, 9 to 11, 13	May 2005
1200	12	November 2006
1200	6 to 7, N1 to N4F	November 2007
1200	8	May 2008
1300	N2F	November 2003
1300	3 to 4	November 2004
1300	1, 5 to 10, 12F	November 2005
1300	2, 11 and N1	May 2006
1400	2, N1F	May 2001
1400	1, 3 to 9F	May 2006
1500	1 to 31F	February 2017
1600	1, 4 to 5, 9, 15, 17 to 18, 24 to 26, 29 to 31, 35, 38, 49F	March 1998
1600	2, 6 to 8, 10 to 14, 16, 19, 27 to 28, 32 to 34, 36 to 37, 39 to 42, 44 to 48	November 2003
1600	3, 20 to 23, 43	November 2005
1700	2, 4, 6 to 7, 19, 24 to 27, 30 to 34	December 2014
1700	1, 3, 5, 8 to 18, 20 to 23, 28 to 29, 35 to 39F	March 2020
1800	1 to 35F	August 2014
1900	1 to 35F, S1 to S2F	August 2014

Table 0/1 Schedule of Pages and Relevant Publication Dates (Cond.)

Series/Appendix	Page Number	Publication Date
2000	1, 3 to 4F	May 2001
2000	2	November 2004
2100	1 to 2F	February 2016
2300	1	March 1998
2300	2 to 3F	May 2001
2400	1, 4, 7F	May 2005
2400	2	May 2006
2400	3, 5 to 6	May 2008
2500	1	May 2001
2500	2, 8, 11F	November 2003
2500	10	November 2004
2500	6 to 7, 9	May 2005
2500	5	May 2006
2500	3 to 4	November 2006
2600	2 to 4	November 2003
2600	5	November 2004
2600	6	May 2005
2600	7	November 2006
2600	1, 8F	March 2020
3000	4 to 7, 10, 12 to 17, 19, 22 to 27F	May 2001
3000	20	November 2004
3000	2 to 3	May 2006
3000	8 to 9, 11, 18, 21	May 2008
5000	1, 4 to 19F, S1F	May 2005
5000	2 to 3	November 2008
5700	1 to 30F	February 2020
Appendix A	1 to 4F	May 2014
Appendix B	1 to 3F	May 2014
Appendix C	1 to 2F	May 2014
#Appendix D	1F	May 2014
Appendix D (NI)	N1F	May 2014
Appendix E	1F	May 2014
Appendix F	1 to 60F	March 2020
Appendix G	Not used	
Appendix H	1	May 2004
Appendix H	2	November 2005
Appendix H	3	November 2006
Appendix H	4 to 9F	November 2008

APPENDIX 0/1: CONTRACT - SPECIFIC ADDITIONAL, SUBSTITUTE AND CANCELLED CLAUSES, TABLES AND FIGURES INCLUDED IN THE CONTRACT**PART A: VOLUME 1 SPECIFICATION****List of Additional Clauses, Tables and Figures**

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5750AR	Welding of reinforcement	23

Additional Clauses, Tables and Figures

Clause No Title & Written Text

SERIES 100 PRELIMINARIES

171 AR Mobile Elevating Work Platforms

1. Where the Contractor utilises Mobile Elevating Work Platforms (MEWPs) to provide access to the Works for any purpose, he shall comply with the requirements of this Clause.
2. MEWPs shall comply with the codes of practice including HSE General Information Sheet No 6, and other requirements listed in Appendix 1/17. Further, when required to be used on or adjacent to the highway, each MEWP shall comply with the requirements of Appendix 1/17.

172 AR Temporary Access Scaffolding

1. All scaffolding and temporary stairways provided shall comply with the requirements of the following:
 - (i) Common Scaffold – BS EN 12811-1
 - (ii) Suspended Scaffold – BS 5974;
 - (iii) Special Scaffold Structures – BS EN 12811-1
2. A method statement describing the proposed methods of access and sheeting shall be submitted by the Contractor, in writing, at least 7 days before it is programmed to be used. When the scaffold is complete, certification stating the time and date the scaffold is ready for use shall be maintained.
3. Full details of the safe working load shall be attached to the scaffolding giving details of the correct distribution of personnel, plant and materials and the allowable depth of debris.
4. The Contractor shall be responsible for the design of all temporary access scaffolding where it overhangs any public access and or private property and for obtaining 'Technical Approval' (TA) by completing the 'Approval In Principle' (AIP) document in accordance with the overseeing organisations requirements in CG 300. .
5. On full completion of all parts of the AIP which are shown "To be completed by the Contractor" to the agreement of the Overseeing Organisation, then the Contractor shall submit the agreed AIP and its attachments to the Overseeing Organisation. The Contractor shall allow in his programme 5 full working weeks from receipt by the

- Overseeing Organisation of the agreed AIP and Departures from Standard for the TAA to approve and sign these documents.
6. On obtaining the approved and signed AIP document from the TAA, the Contractor shall commence the detailed design and drawings.
 7. The Contractor shall only submit to his checking team (as stated within the approved AIP) a full set of detailed drawings prepared by the design team, i.e. no design calculations are to be passed to the checking team. The checking team is then to carry out a 'Category II' level of check as defined in CG 300. The checking team shall carry out the check independently, with only the necessary consultation and shall produce their own separate design calculations.
 8. The check team shall submit a schedule of detailed drawings.
 9. The submitted documentation shall be completed and signed by the respective team leaders in accordance with CG 300. Both certificates shall be countersigned by a director of the Contractor (or a representative who has the written authority to sign on behalf of the Contractor).
 10. The adequacy of the whole and all parts of the structure including any foundation bases, at all stages of installation, shall be underwritten by the Contractor.
 11. Scaffolding certificates shall be countersigned by a director of the employing Contractor, as detailed above.
 12. The design and check engineers shall be appropriately qualified.
 13. The Contractor shall submit the original signed documents to the Overseeing Organisation, who will pass these onto the TAA, as follows:-
 - i. Design Certificate(s)
 - ii. Check Certificate(s)
 - iii. Additional Departures from Standard (if required)
 14. If during the design or at the checking stage any further Departures from Standard are required, a revised AIP shall be submitted, to include these departures. The Contractor shall allow in his programme a minimum of 4 full working weeks from receipt by the Overseeing Organisation of any revised AIP and the Design and Check Certificates, for the TAA to approve and sign all these documents.
 15. If there are no additional Departures from Standard then no revision to the AIP is required and only the two certificates are to be submitted to the Overseeing Organisation, who will issue them to the TAA. The Contractor shall allow in his programme a minimum of 2 full working weeks from receipt by the Overseeing Organisation of the Certificates for the TAA to approve and sign these documents.
 16. No work on site shall commence until the TAA has approved and signed the Design and Check Certificates.
 17. In addition to the above, the Contractor shall submit detailed drawings, design calculations and a fully detailed method statement for the installation and removal of all temporary access scaffolding, to the Overseeing Organisation for approval 3 full working weeks before work commences on site.

173 AR Statutory Undertakers Special Requirements

1. Statutory Undertakers special requirements can be found in Appendix 1/16 of the Work Order.

174 AR Preliminaries: People, Facilities, Welfare Facilities, Equipment and Security

1. Considerate Constructors

1. When instructed by the Client, the Contractor registers the Work Order under the Considerate Constructor Scheme operated by Construction Umbrella Bodies (Holdings) Limited, complies with the Considerate Constructor Scheme's Code of Practice and assists Construction Umbrella Bodies (Holdings) Limited to develop the Considerate Constructor Scheme so that it applies to contracts for works or services similar to those which the Contractor carries out under this Framework Agreement.

2. Project specific management and staff (in the working area only)

1. Descriptions for each of the roles in the schedule of rates are as follows:

Project Manager

First point of contact for the Client for all scheme related queries. Overall responsibility for all aspects of successful scheme delivery including ensuring all works are completed in a safe manner, on time, to budget and to the quality required in the Scope. Defines clear lines of communications and responsibilities throughout the Project team to ensure efficient scheme delivery. Champions Safety, Health and Environment and promotes a culture of innovation, best practice and continuous improvement.

Site Manager

Main point of contact on site. Oversees and maintains the site, including effective co-ordination and planning of the works. Undertakes site briefings, inductions and safety tours. Responsible for the implementation of health and safety procedures on site and ensures the working methodology is in accordance with the risk assessments and method statements, and undertakes other such duties as required under CDM Regulations.

Supervisors (non-operational and not within the rates)

Supervises the works on site, and ensures all works are undertaken in accordance with the requirements of the Scope. Assists in the development and maintenance of pre-construction, construction, and closeout execution plans. Procures materials and other such items as required. Gathers information and provides site reports. Raises technical queries (TQs) for resolution to the Client's design team.

Health and Safety officers

Enforces health and safety policies and procedures. Carries out site safety inspections, and investigates incidents in the workplace and produces accident reports.

Planning/Programming staff

Creates, maintains and reviews the construction programme. Liaises with various parties to ensure the programme is updated and submitted in a timely manner. Provides input into progress reports and forecasts for team members, clients and stakeholders.

Quantity Surveyors

Responsible for the commercial management of the scheme, and ensures the works are completed to budget. Prepares, submits and where necessary agrees target prices, forecasts, compensation events, early warning notifications, payment applications, cost reports and other such notices as and when required. Responsible for the procurement and commercial management of subcontractors.

Environmental Manager

First point of contact for all environmental issues encountered on the site. Implements the Contractor's environmental policies and practices and ensures compliance with environmental legislation. Assesses, analyses and collates environmental performance data and reports information to internal staff, clients and regulatory bodies where required. Liaises with regulatory bodies such as the Environment Agency.

Temporary Works Engineers

Prepares and checks detailed technical designs (including calculations, drawings, risk assessments, design certificates etc.). Undertakes technical reviews of method statements for temporary works, and ensures temporary works are installed, maintained and removed as per the technical design and risk assessments and method statements.

Storeman (Non-operational)

Continually checks on site stock levels as appropriate. Manages the delivery of materials required for the works, and ensures goods are checked to ensure accuracy and are recorded in an accurate and timely manner. Ensures materials are ready as and when required by the Project Team. Keeps stores clean and tidy.

Arbiculturist

Undertakes tree inspections and surveys where required. Supervises works that may adversely impact on protected trees / shrubs, to ensure they are undertaken in accordance with the relevant legislation, and ensures the impact of such works is mitigated.

Public Liaison Officer

Responsible for implementing the scheme communications plan. First point of contact for all external stakeholders potentially impacted by the scheme such as local residents, businesses and transport companies. Facilitates effective communication with key stakeholders including press releases, letter drops and local events. Undertakes works more particularly defined in Annex 12

Ecologist

Conducts surveys where required. Identifies, records and monitors habitats and species. Analyses and interprets data and samples, and uses ecological data to help assess and understand the state of the environment on site. Supervises works that may adversely impact on the local environment to ensure they are undertaken in accordance with the relevant legislation, and ensures the impact of such works is mitigated.

3. Work Order Value not exceeding £150,000

1. For Schemes with a Work Order value not exceeding £150,000 the Contractor shall provide appropriate facilities, welfare facilities, equipment and security for his own use only.
2. Mobile welfare vans shall house a sink and microwave, hot and cold water, cabin heater, interior LED lighting, a separate toilet / WC with cassette and electric flush and wash facility, with hard wearing anti-slip flooring. Welfare units shall be VOSA approved and HSE compliant and fully in accordance with Chapter 8 livery.

4. Work Order value exceeding £150,000

10. For Schemes with a Work Order value exceeding £150,000 OR more than one supplier, Site Establishment shall be required to be provided by the General Civil Engineering, Drainage, Structures & Concrete Repairs, Road Lighting & Electrical Works, Road Restraint Systems and Fencing or Temporary Traffic Management Lot Contractor. These facilities, welfare facilities, equipment and security shall be provided for the use of the Contractor, Overseeing Organisation and other organisations involved in the delivery of the scheme.
11. National Highways shall instruct the General Civil Engineering, Drainage, Temporary Traffic Management or Road Restraint Systems and Fencing Lot contractor to provide the facilities, however on occasions another Supplier may be required to provide the facilities.
12. During the pricing stage the *Lead Contractor* will establish the total number of Full Time Equivalents (FTEs), in order that they can accurately calculate the required facilities, Welfare facilities, equipment and security.
13. When instructed, the Contractor shall be responsible for the supply, removal and maintenance of all facilities, welfare facilities, equipment, consumables, laydown / parking areas, compound fencing and security, for use by all the organisations involved in the delivery of a Scheme.

5. Duration of Time Facilities are Required

All facilities are to be provided for as long as necessary to Provide the Works.

6. Office and Equipment (for Contractors and the Overseeing Organisation)

1. Offices shall be at least equivalent to the statutory minimum per person (FTE) including work space, storage space, circulation areas, kitchens and toilets. Individual cabins shall be 32ft long x 10ft wide.
2. Meeting Rooms shall be of a minimum of 12m² for up to 10 FTE, with 2 m² per FTE thereafter. Individual cabins shall be 32ft long x 10ft wide.
3. All offices are to have locks with keys supplied, for each person using the office.
4. Office and welfare to be fully serviced with electricity (mains or generator) and water (mains or tank) facilities.
5. The following equipment shall be required per 10 FTE's:
 - five lockable filing cabinets
 - five lockable cupboards
 - Two A0 drawing racks

- Ten 4-drawer lockable desks
 - Five chairs
 - Ten upholstered swivel chairs with arms
6. Two telephone lines with handsets are to be provided per 10 FTE's, including separate extensions. Payment for calls and facilities/line rental is to be included.
 7. Broadband Fibre Optic or 4G Internet connection with wireless router, with the capacity to support up to eight users at a time carrying out their normal duties .
 8. Networked printing and photocopying facilities (capable of up to A3 colour prints & copies).
 9. Office ancillaries and consumables, e.g. print paper, pens, pencils, staplers with staples, tape, hole punches, lever arch files, note books, filing trays, as required.
 10. Fire extinguishers and fire safety precautions shall be provided and maintained as required by the Fire Authority.
 11. Heating and general requirements shall be in accordance with the Offices, Shops and Railway Premises Act 1963 and the Health and Safety at Work Act 1974. The offices shall be lined, weatherproof and insulated to achieve an overall U-value of 0.6.
 12. All windows shall be fitted with external close boarded shutters which can be fastened and secured from inside. Roller blinds shall be fitted internally to all windows.
 13. Boot cleaning facilities shall be provided outside the door.
 14. Stairs to offices shall include landings, handrails and kickplates, shall be suitably secured to the site cabins, and adequately supported.
 15. All offices shall have sufficient temporary bases and foundations where the ground bearing capacity necessitates and shall be sufficient to carry all loads (including live and weather loads) imposed by the site offices.

7. Welfare facilities

1. Welfare facilities shall be of:
 - 2 m² per person for messing facilities (split breaks may be assumed)
 - 1 m² per person for drying rooms
 - sufficient toilets and washbasins for those expected to use them
2. Chemical / Portaloo are only permitted when mains-connected facilities are not possible
3. All welfare facilities shall have suitable locks with a keys.
4. The welfare facilities shall be kept secure at all times.
5. All welfare facilities shall be cleaned daily.
6. Messing Facilities be clean, well-lit and ventilated and shall include:
 - A supply of hot and cold running water
 - A seating area for eating and drinking with means for making hot drinks e.g. kettle or vending machine
 - A means of heating food e.g. microwave / hotplate
 - A supply of clean drinking water either tap or bottled
 - Tea, coffee, sugar, milk, cutlery and crockery as required
7. Toilet facilities shall be clean, well-lit and ventilated facilities.
8. Toilet facilities shall include:
 - A supply of toilet paper, soap and a means for drying hands, e.g. paper towels or a hot air dryer
 - Separate facilities for men and women; where this is not possible, rooms with lockable doors shall be provided
 - Disabled toilets where required
 - For female employees, a means of disposing of sanitary dressings
 - Facilities with hot and cold running water

- A basin large enough to wash hands and forearms
 - Showers where necessary e.g. for particularly dirty work.
9. Drying / Changing facilities shall be provided if the work activity involves wearing specialist clothing, i.e. wet-weather gear.
 10. Drying / Changing facilities shall:
 - Be readily accessible
 - Contain - or connect directly to - washing facilities and a clothing storage area
 - Provide seating
 - Provide a means for securely hanging clothes up
 - Ensure the privacy of the user.
 11. To minimise the risk of clean clothing coming into contact with contaminated, dirty or wet, work-soiled clothing, separate secure storage for clean clothing and contaminated work wear shall be provided. This separated storage area should allow wet clothing to be hung up to dry during the course of the working day and, consequently, should be well ventilated.
 12. First aid rooms shall contain a first aid box with enough equipment to cope with the number of people on site.
 13. All welfare facilities shall have sufficient temporary bases and foundations where the ground bearing capacity necessitates and shall be sufficient to carry all loads (including live and weather loads) imposed by the site offices.
 14. Shelters shall be in accordance with the Smoke Free Regulations and any other applicable law and standards.

8. Car Parking

1. Car parking shall be of a minimum of size of 18 m² per 10 number FTE's requiring office accommodation including access roads / circulation space. An additional visitor space shall be provided of minimum size of 18 m²
2. A hardcore parking area shall be provided for all operatives with one parking space provided for every 3 operatives.

9. Signage

1. A site compound scheme information board is to be erected at the site compound entrance. This design shall be in accordance with the overseeing organisation's guidance on visual identity and include the following information as a minimum:
 - Scheme title
 - Scheme description

10. Security

1. The Contractor shall take all reasonable measures to prevent trespass or unauthorised access to the works and theft from or malicious damage to the works.
2. The Contractor shall report details of any breach of security measures to the *Overseeing organisation*.
 - The report shall initially be oral immediately on becoming aware of an incident. Written confirmation of all such oral reports giving date, time and action taken shall be provided to the *Overseeing Organisation* within 24 hours after the initial oral report of any incident.
 - The Contractor shall maintain a log of all breaches of security which shall be available on request.
3. The Contractor shall maintain the level and modes of security provision in accordance with Appendix 1/71.

4. The Contractor shall maintain a register of both personnel working on the site and visitors to the site. This register shall be available to the *Overseeing Organisation* on request. The Contractor shall provide all personnel, including sub-contractors and other contractors and personnel of the Designer and *Overseeing Organisation* with suitable security passes which shall include photographs.
5. The Contractor shall provide visitors with temporary passes. Visitors shall only enter the site when in possession of a temporary pass and shall at all times be accompanied by a person holding a full security pass.
6. Tool stores and storage containers shall be a minimum 20ft length and be lockable.
7. Security control rooms / kiosks shall be a minimum of 1200 wide x 2400mm length x 2250mm high, with at least one sliding window, lockable door, fixed window, ceiling light and switch, plug socket and wall mounted heater.
8. Security systems / intruder alarms & fire alarms will be installed by registered installers and shall comply with all applicable British Standards.
9. CCTV systems shall have a minimum resolution of 1080p, 6no cameras and a minimum 14 day playback (either hard drive or cloud storage based).

11. Miscellaneous Equipment

1. N.B. – The specifications stated below are for pricing purposes only. All plant and equipment must be adequate for the works being undertaken specific to each site / Work Order and comply with all relevant standards and applicable law. The operation of any equipment must be in full compliance with health and safety standards and manufacturers' instructions with adequate maintenance and safe working practices in place. Operators and banksmen must be suitably trained and qualified.
2. Telehandlers shall have a minimum lift height of 6m and a minimum lifting capacity of 2500kg.
3. Mobile elevating work platform (MEWP), articulating boom lift, minimum reach height 10m.
4. Overhead power line avoidance including cable goalposts and height restriction warnings shall be in accordance with HSE document GS6.
5. Floodlights shall have LED light heads and have a minimum 3m lantern height and deliver a minimum of 40,000 lumens.
6. Aluminium steel adjustable site stairs shall have a double handrail on both sides, horizontal treads with lock mechanism with 880mm tread 680mm compliant with EN 12811.

SERIES 1700
STRUCTURAL CONCRETE

1780 AR Concrete Testing – General Requirements

1. Concrete testing shall be carried out as specified in the Scheme Work Order or as directed by the Overseeing Organisation and additionally for concrete bridge decks exposed prior to re-waterproofing or joint replacement as described below.
2. Surface half-cell testing shall be carried out as soon as possible after a section of deck concrete is exposed and sufficiently clean. The results from the surface half-cell testing will be used by the Overseeing Organisation to determine the locations for the further site testing required in the Contract.
3. In areas selected by the Overseeing Organisation the upper surface of concrete bridge deck shall be tested by surface half-cell testing in accordance with Clause 1785AR. At the end of each day the results of the half-cell testing shall be made available to the Overseeing Organisation in accordance with Clause 1785AR. Not later than 24 hours after receipt of the results from a day of surface half-cell testing the Overseeing Organisation shall notify the Contractor in writing of the required locations for further testing in the area covered by that session's half-cell testing.
4. The site testing that will be required following surface half-cell testing shall be as follows:
 - (i) Dust sampling in accordance with Clause 1783AR
 - (ii) Cover meter survey in accordance with Clause 1786AR
 - (i) Carbonation testing in accordance with Clause 1787AR
5. The Contractor shall allow for carrying out the total number of tests required in the Scheme Work Order. The location of these tests will be determined as described in sub-Clauses 1 and 2 of this Clause.
6. Laboratory testing shall be carried out on samples selected by the Overseeing Organisation. The following laboratory tests will be required.
 - (i) Chloride testing on dust samples and cores in accordance with Clause 1784AR
 - (ii) Cement content testing in accordance with Clause 1782AR
7. The results of the chloride sampling will be supplied to the Overseeing Organisation as soon as they become available. Not later than 48 hours after receipt of the results the Overseeing Organisation shall notify the Contractor in writing of any concrete repairs that may be required in the area covered by the chloride results submitted.

1781 AR Removal of Cores from Concrete Structures

- 1 The position of reinforcement near the face from which cores are to be removed shall be located by use of a cover meter prior to commencement of coring operations.

2 Cores shall be removed by use of a diamond tipped coring tool with an outside diameter of 50mm, 75mm or 100mm, or as specified by the Overseeing Organisation. Cores shall be positioned such that reinforcement in the structure is avoided. Orientation of the drilling shall be perpendicular to the concrete surface. The length of core to be removed shall be instructed by the Overseeing Organisation.

3 Cores shall be marked with a unique reference and a record shall be kept of the position on the structure from where the cores were removed. After drilling cores shall be washed clean with fresh water and surface dried with paper towels. Cores shall be wrapped in polythene.

4 Core holes shall be reinstated with an approved proprietary polymer modified low shrinkage cementitious repair mortar. Before reinstatement all debris, mud and standing water shall be removed to leave each core location clean.

5 On completion of extraction of individual cores requested by the Overseeing Organisation, the Contractor shall deliver all cores to the Overseeing Organisation at his site offices.

6 The location of cores required by the Overseeing Organisation are as detailed in the Scheme Work Order or as directed by the Overseeing Organisation.

1782 AR Cement Content Testing

1 Cement content shall be determined from cores or dust samples removed from the structure by use of material not used in tests to determine chloride content.

2 Cement content shall be determined in accordance with the method described in BS 1881--124.

1783 AR Sampling Concrete for Chlorides by Percussive Drilling

1 The location of holes shall be marked on the structure. Prior to drilling a cover meter shall be used to locate the position of reinforcing steel. Some adjustment of the location may be necessary to avoid steel.

2 The orientation of the drilling shall be perpendicular to the concrete surface. A masonry drill bit 20mm diameter with unworn flutes is to be used.

3 The following procedure shall be adopted for collecting dust samples:

- Drill into the concrete to a depth of 5 mm.
- Blow out the dust from the hole using compressed air and also surface around and discard this surface sample, collect samples from the following depths as specified in the Scheme Work Order: 5 mm-30 mm, 30 mm-55 mm and 55 mm-80 mm and then in 25 mm increments as directed by the Overseeing Organisation.
- Blow out the hole between each successive depth of sampling. Encourage the drilling dust to the surface by withdrawing the drill frequently.
- Collect the dust by brushing onto a piece of paper and funnel into a sample bag, 10 g minimum is required for each sample.
- The sample bag shall be clearly labelled with location, depth, and structure of origin.
- The numbering sequence is to be agreed with the Overseeing Organisation.

4 Drill holes shall be cleaned by blowing out with compressed air and reinstatement of holes shall be carried out with an approved proprietary polymer modified cementitious repair material.

1784 AR Chloride Content Testing

- 1 Chloride content shall be determined from the dust samples and cores removed from the structure. Cores shall be sawn into 25 mm lengths and the chloride content of each 25 mm length shall be determined separately in order to show the chloride gradient through the core.
- 2 Chloride content shall be determined in accordance with the method described in BS 1881--124.
- 3 The results of chloride content testing shall be reported in terms of total percentage chloride content by weight of cement.

1785 AR Half-Cell Testing

Surface Potential Measurement

- 1 Half Cell potential surveys shall be carried out in accordance with standard ASTM C876. The electrical continuity in the reinforcement shall be checked prior to commencement of reading. This shall be achieved by drilling through the concrete to the surface of the reinforcement cleaning the reinforcement to bright metal and the connection made using a self-tapping screw. (The drill hole may be widened using a hammer and chisel to facilitate attachment). Electrical continuity is established if a stable resistance reading of less than 1 ohm is achieved.
- 2 Measurements of electrode potential shall be made on a grid as identified on the Contract Drawings agreed with the Overseeing Organisation.
- 3 The voltages measured shall be recorded in millivolts and shall be tabulated with data as to the location of the reading. The numerical recording is to be done in duplicate and a set made available to the Overseeing Organisation at the end of each day of recording or earlier if requested by the Overseeing Organisation.
- 4 In addition results shall be presented in the form of an equipotential contour plot with contours at 50mV intervals.
- 5 Breakouts in the concrete made to facilitate electrical connection to reinforcement shall be reinstated using an approved proprietary polymer modified cementitious repair mortar.

1786 AR Cover meter Survey

- 1 The concrete cover to the outermost reinforcement in each direction shall be determined using an electromagnetic cover meter. Every bar within the metre grid shall be, where possible, located, and marked on the concrete surface. Each bar will be located by a continuous movement, back and forth, of the cover meter sensor. The direction of the sensor movement will be perpendicular, generally, to the reinforcement considered. The cover shall be checked in the one metre grid intervals marked out for the half cell testing, or as agreed or directed by the Overseeing Organisation.
- 2 The cover meter shall be used in accordance with the Manufacturer's instructions and the recommendations of BS 1881-204.
- 3 Calibration of the cover meter shall be carried out on Site by drilling at one location on the deck exposing the reinforcement and direct measurement of the cover. All holes formed for

this purpose shall be reinstated using an approved proprietary polymer modified cementitious repair mortar.

4 All Site measurements shall be recorded and reported direct depth measurement in mm and a set made available to the Overseeing Organisation at the end of each session of recording. In addition results shall be reported in the form of a cover contour plot.

1787 AR Carbonation Testing

1 Carbonation testing shall be carried out at locations marked by the Overseeing Organisation and utilizing core and percussive holes drilled by the Contractor.

2 The test method for determination of carbonation depth shall be in accordance with BS EN 14630.

3 All traces of drilling dust shall be cleaned from the hole using a paint brush and compressed air.

4 A freshly broken surface of concrete shall be produced by breaking the edge of the hole in at least two places around the circumference using a hammer and a 12 mm cold chisel.

5 The broken samples shall be sprayed immediately with phenolphthalein solution. The perpendicular depth of the interface between the magenta colouration and the uncoloured concrete from the surface of the concrete shall be measured.

6 The minimum depth, the maximum depth and the mean depth from each of the two broken surfaces shall be recorded. The results shall be recorded to the nearest mm.

1788 AR Acceptable Companies for Testing Work

1 All sampling and testing shall be carried out by a specialist testing firm or laboratory accredited by UKAS for laboratory testing.

SERIES 2000
WATERPROOFING FOR CONCRETE STRUCTURES

2070 AR Replacement of Bridge Deck Waterproofing

1 The existing surfacing shall be removed by cold-milling (planing) in accordance with Clause 709.

2 The existing bridge deck waterproofing and/or protective layer comprising the last 30 mm above the concrete substrate shall be carefully removed using hand tools, smooth bladed mechanical scrapers or similar, avoiding damage to the concrete.

In exceptional cases for particularly difficult materials, the use of mechanical scabbling, mini planers or other mechanical tools and/or liquid gas cooling may be permitted provided that method statements are submitted for approval before these techniques are used.

3 The final removal of the remaining waterproofing and/or primer to expose the concrete substrate shall be by recoverable abrasive blast cleaning systems. 'Open' blast cleaning will not be permitted except on vertical surfaces or intricate details.

4 Prior to application of the new waterproofing, the deck concrete shall be examined by the Overseeing Organisation for testing and/or concrete repairs (in accordance with the requirements of Series 5700). Typically the defects to be repaired shall include the following:

- (i) removal of chloride contaminated concrete where considered necessary by the Overseeing Organisation and/or corrosion delaminated concrete;
- (ii) removal of surface defects such as screed marks and footprints;
- (iii) removal of formwork/false work anchors from the original construction which have inadequate cover;
- (iv) sealing of cracks >0.25 mm;
- (v) repairs to, or forming of fillets, and chases to facilitate waterproofing.

5 The replacement waterproofing system shall be in accordance with Clauses 2001 to 2003, and be installed in accordance with Clause 2005.

SERIES 2100
BRIDGE BEARINGS

2170 AR Re-bedding of Bearings - Preparation

1. Temporary support and jacking procedure for the deck beams shall be as shown on the Drawings.
2. The existing bedding material and any packing shims shall be broken out along with the adjacent concrete in accordance with the Work Order.
3. The whole bearing assembly shall be clamped to the bottom flange of the deck beam once sufficient existing bedding material has been removed from underneath the sides of the base plate to enable clamps to be fitted. The method of clamping shall be subject to the approval of the Overseeing Organisation.
4. The underside and finally covered faces of the bearing base plate shall be thoroughly cleaned by high pressure water jetting to remove all adherent material and detrimental contamination. The Contractor shall exercise all due care in preparing the bearings for re-bedding so as to avoid any damage to the structure.
5. Any oil or grease in the vicinity of the new bearing plinths shall be removed with an approved degreasing compound which shall then be rinsed off with clean water.
6. All loose particles of concrete, rust and any dust shall be removed by using a mains pressure water jet, properly filtered oil free airline or other approved method.

2171 AR Re-bedding of Bearings - Casting of Bearing Plinths

1. The method of placing bedding mortar in bearing plinths shall be proved by site trials. The exposed surface of each plinth shall be homogenous, free from excessive air holes, voids, segregation and other defects.
2. The jacks shall not be unloaded until the bedding mortar has reached the compressive strength specified (see Appendix 26/2).
3. Vertical movement of each beam shall be measured and recorded during the unloading of the jacks. The bearing plinths shall be deemed to be satisfactory if the vertical movement during unloading does not exceed 0.30 mm. If the vertical movement exceeds 0.30 mm then unloading shall be stopped and the Overseeing Organisation informed.
4. Following approval of a plinth by the Overseeing Organisation the clamps holding the bearing base plate to the deck beam shall be removed. The voids in the plinth left by the clamps shall be made good with bedding mortar.

SERIES 2300
BRIDGE EXPANSION JOINTS AND SEALING OF GAPS

2370 AR Replacement and Maintenance of Bridge Deck Expansion Joints

1 Replacement, repair and alterations to expansion joints shall be instructed by the Overseeing Organisation. Such work shall comply with the requirements of Clauses 2301 to 2304 and CD 357 - Bridge expansion joints . It may comprise replacement of a complete joint or essential maintenance of a joint where complete or partial replacement is not considered necessary.

2 Existing joints (including transition strips) shall be carefully broken out or unbolted and removed. The adjacent carriageway, hard shoulder, hardened verges and central reservations shall be saw cut to provide neat vertical edges. The location of any existing services or ducts shall be determined prior to breaking out or saw cutting and measures shall be taken to protect them.

3 Existing flashings and sealants shall be removed. Where instructed by the Overseeing Organisation, existing intact water bars may be retained. Existing galvanised plates in buried joints shall be set aside for possible re-use.

4 The existing surfacing and additional protective layer adjacent to the expansion joint shall be removed to expose the waterproofing membrane. The membrane shall then be removed by scraping, scabbling and/or vacuum abrasive blast cleaning to prepare the existing concrete.

5 Existing holding down bolts shall be protected, if required for installation of the proposed replacement joint. If they are not required they shall be removed or ground flush with the surface of the deck concrete.

6 The concrete substrate shall be examined by the Overseeing Organisation for defects. Where required, testing shall be carried out and concrete repairs undertaken in accordance with Series 1700.

7 If the joint is not to be completely replaced, material and components shall form the same system as the existing joint.

8 Where instructed vertical drain holes shall be installed adjacent to expansion joints. The drain holes shall comprise a down pipe fixed into holes cored through the superstructure of minimum internal diameter 40 mm and a conical entry funnel with cap to allow water to enter the funnel but prevent blocking of the waterway by the surfacing. The cap and funnel shall be covered with a sheet of permeable membrane prior to surfacing.

9 All debris arising from the works shall be removed off Site.

2371 AR Asphaltic Plug Joints

Installation

1 All joints shall be of a Permitted Joint System in accordance with CD 357.

2 The joints shall be installed in accordance with the manufacturer's instructions which shall comply with the terms of the Registration.

As-built Records

- 3 The Contractor shall maintain and provide as-built record drawings of the work carried out. They shall include the depth and width of the waterproofing and sealing system provided at each joint location and details of the sub-surface drainage system installed.
 - 4 Each batch of materials delivered to Site shall have a Certificate of Compliance.
-

SERIES 2400 BRICKWORK, BLOCK WORK AND STONWORK

2470 AR Repointing of Brickwork

- 1 Brickwork joints to be repointed shall be ground out to a depth of between 10 mm and 15 mm to give adequate key. All unsound mortar at a greater depth than this shall be removed until sound mortar is encountered. Apparatus used for grinding out shall be fitted with a depth gauge to allow control of rake out depth.
- 2 All detritus shall be removed by low pressure water jetting.
- 3 Mortar designation (i) (see Clause 2404) shall be used for repointing.
- 4 Repointing for depths up to 15 mm may be carried out by trowel or injection techniques. For depths exceeding 15 mm injection techniques shall be used.

SERIES 5700
CONCRETE REPAIRS

5750 AR: Welding of Reinforcement

Note that site welding of reinforcement shall only be carried out for concrete repair work if the Scheme Work Order indicates it is permitted in contract-specific Appendix 57/2.

Welding Procedures

1. The Contractor shall submit written welding procedures for approval, for all welding operations. Items to be included in the procedure shall be in accordance with BS EN ISO 17660-1:2006 and this Appendix. A separate procedure shall be submitted for each joint type to be welded.

The procedure shall include the method of treating defective areas, (e.g. grinding), and visual and magnetic particle inspection of the prepared areas in accordance with paragraph 27 of this Appendix.

Replacement reinforcement shall match the uncorroded diameter and type of the affected bar and shall be agreed with the Principal Designer. All additional reinforcement shall be high yield or to match existing type. All high yield reinforcement bars shall conform to BS 4449:2005+A3:2016 (Grade B500B or B500C) and BS EN 10080:2005 and shall be cut and bent in accordance with BS 8666:2005. The bars shall be obtained from a firm holding a valid CARES (or fully equivalent scheme) certificate of approval. All welding procedures and welders shall be subject to approval trials in accordance with BS EN ISO 17660-1:2006 and this Appendix.

The welding procedure shall be based upon the actual chemical composition and mechanical properties of the existing and replacement parent metal to be welded. The procedures shall also take due account of any restrictions that prevail at the welding site.

2. The full chemical composition of each type and diameter of existing reinforcement to be welded shall be determined by the contractor. Tests to determine the chemical composition shall be carried out, close to the weld, on two samples of each type and size of existing reinforcement taken at a rate of not less than two samples for each pier at locations to be agreed with the Principal Designer from an area of concrete to be repaired. Testing shall be carried out by a UKAS (NAMAS) accredited laboratory. The results from these chemical tests shall be submitted to the Provider in support of the contractor's welding procedures. The procedures shall be reviewed in light of the chemical composition tests, with particular attention given to the carbon equivalent content.

Chemical composition testing of new reinforcement bars proposed as replacement for existing corroded bars is also required. This testing should be carried out unless the traceability of the bars is comprehensive, reliable and the rebar manufacturer/supplier can provide evidence of ladle analysis. Acceptable documentation should show that the bars comply with BS 4449, and the bars are made of non-alloy steel as defined by the limiting values of alloying metallic elements in Table 1 of BS EN 10020.

Further sampling and testing may be required, as directed by the Provider.

3. The size of all test pieces, and the location from which they are cut from the existing reinforcement shall be approved by the Provider prior to their removal. Removal of the

test pieces shall be carried out in such a manner that the cut edges are free of hardened edges, cracks and rough or uneven profiles.

4. The types of manual Metal Arc electrode to be used in all welding procedure trials shall be determined by the contractor, and subject to the approval of the Provider, to suit the chemical compositions of the existing and the additional reinforcement.

Consumables shall comply with BS EN ISO 2560:2009 and shall be chosen so that the tensile strength of welds shall be at least as high as the specified characteristic tensile strength given in BS 4449:2005+A3:2016 when butt welding high yield reinforcing bars and to BS EN 10025-3:2019 and BS 4482:2005 when butt welding or fillet welding the existing mild steel reinforcing bars.

5. Directly before welding, the material surface in the joint area shall be free of rust or other oxides, paint, grease, scale, remains from sandblasting, moisture and other contaminants which would have a detrimental effect on the quality of the weld.

Preheat temperature shall be determined in accordance with BS EN 1011, but shall not be less than +10°C. Reference should be made to EN ISO 13916 for measurement of preheat temperature. Preheating shall be undertaken according to the applicable welding procedure specification and applied during welding, including tack welding and welding of temporary attachments, including run-on and run-off plates.

The butt weld size shall provide a joint with a tensile capacity at least as high as the relevant replacement reinforcing bar with strengths given in BS 4449:2005+A3:2016 (Grade B500B or B500C) and BS EN 10080:2005 for high yield reinforcement and BS 4482:2005, BS EN 10060:2003 and BS EN 10080:2005 for the existing mild steel reinforcement.

Approval and Trials of Welding Procedures

6. The written procedure shall be approved by the Provider prior to commencing approval trials. Where the results of procedure approval trials already exist, these may be submitted to the Provider for approval. The results of procedure approval trials submitted for consideration to the Provider should be recent e.g. within the last 2 years. The written method for each fundamental welding position shall be separately approved, except that a written procedure approved in the overhead position shall also include approval for all other positions, except vertical down welding.
7. All procedure approval trials shall be witnessed by the Provider or nominated representative. Alternatively, a competent, independent inspecting body or authority may be employed by the contractor subject to approval of the Provider.
8. The trial for the welding procedure for replacement reinforcement shall consist of test pieces of steel reinforcement. A minimum of three test welds shall be carried out as described below, by any of the approved welders as directed by the Provider. Each test piece shall consist of two 300mm lengths of reinforcement bar. At least one bar for the series of tests shall be cut from existing reinforcement in accordance with paragraph 3 of this Appendix, and at a location to be approved by the Provider. It shall be from an area of concrete which is due to be repaired. All other reinforcement for the tests shall comply with BS 4449:2005+A3:2016. The weld to be tested shall be the butt joint of the bars welded end to end. The diameter of the bars to be welded shall be compatible, and shall be treated and fixed in position, in accordance with paragraph 23 of this Appendix.

The trials for the welding procedure for repair of existing reinforcement shall consist of a minimum of three test pieces welded in the vertical and horizontal positions. Each test piece shall be a 300mm length of reinforcement bar cut out from existing reinforcement in an area of concrete to be repaired at a location approved by the Provider.

In addition to the above requirements, the trial for the welding procedure for replacement reinforcement shall consist of steel reinforcement within the proposed model beam as described in the Repair Trial drawing. The type and number of shear link reinforcement weld test trials to be undertaken on the model beam is also shown on the drawing. In the case of butt welds, the weld to be tested shall be the butt joint of the bars welded end to end. The diameter of the bars to be welded shall be compatible, and shall be treated and fixed in position, in accordance with paragraph 23 of this Appendix.

9. Welding shall be in accordance with the approved welding procedure. Testing and acceptance levels shall be in accordance with BS EN ISO 17660-1:2006 and this Appendix. Backing plates shall be removed before mechanical tests are carried out.

Non-destructive testing shall include:

100% Visual Inspection

100% magnetic particle inspection in accordance with BS EN ISO 9934-1:2016

Acceptance limits shall be as specified in BS EN ISO 5817: 2014, level B, except for imperfection types as follows: excess weld metal, excess convexity, excess throat thickness and excessive penetration, for which level C shall apply.

NDT operators shall be qualified and approved, in accordance with paragraph 31 of this Appendix.

Hardness testing shall be performed on the macro-section, in accordance with BS EN ISO 9015-1:2011, and shall include at least one traverse of the weld section covering the parent metal and heat-affected zones on each side of the weld, as well as the weld metal. The maximum permitted hardness shall be 350HV10 is referenced in BS EN ISO 6507-2 (Vickers Hardness Test).

10. The results of all testing shall be assessed against the requirements of this Appendix. The results of the tests and the assessment shall be given to the Provider at least 7 days in advance of incorporation of the welding procedure in the Works and shall include descriptions of the nature of any defects detected during testing. The welding procedure shall not be acceptable if they fail to meet the specified acceptance levels.

Welder Approval

11. The contractor shall satisfy the Provider of his welder's ability to make sound welds. All welders shall be approved in accordance with BS EN ISO 17660-1:2006 and this Appendix. Where the results of welder approval trials already exist, these may be submitted to the Provider for approval. All welders shall be approved for each fundamental position to be welded in production, except as permitted in Table 7 of BS EN 287-1:2004 (refer to Table NA 1 of BS EN ISO 17660-1:2006) for which reinforcement butt welds shall be considered as plate welds.
12. Welder approval trials shall consist of test pieces of steel reinforcement. Each candidate will be required to perform two test welds for approval. Each test piece shall consist of two 300mm long sections of 16mm diameter high yield steel reinforcement bar. The welds to be tested shall be the butt joint of the bars welded end to end; a typical fillet weld and a

typical double fillet weld as defined on the scheme drawing. The bars to be welded shall be treated and fixed in position in accordance with paragraph 23 of this Appendix.

In addition to the above requirements, each welder shall perform test butt joint welds on shear links within the model beam and test lap welds on shear links within the model beam as specified on the Repair Trial drawing.

All welder approval trials shall be witnessed by the Provider or nominated representative. Alternatively, a competent independent inspection body or authority may be employed subject to the approval of the Provider.

13. Where additional existing reinforcement is to be used for welder approval trials, test pieces shall be removed in accordance with paragraph 3 of this Appendix.
14. Testing and acceptance levels shall be in accordance with BS EN ISO 17660-1:2006 and this Appendix. Backing plates shall be removed before mechanical tests are carried out.

Hardness testing shall be performed on the macro-section, in accordance with BS EN ISO 9015-2:2011, and shall include at least one traverse of the weld section covering the parent metal and heat-affected zones on each side of the weld, as well as the weld metal. The maximum permitted hardness shall be 350HV10.

The tensile strength shall not be less than the specified characteristic strength of the parent material as specified in BS 4449:2005+A3:2016 (Grade B500B or B500C) and BS EN 10080:2005 for high yield reinforcement and BS 4482:2005, BS EN 10060:2003 and BS EN 10080:2005 for the existing mild steel reinforcement. The number of tensile test pieces shall be in accordance with Table 3 of BS EN ISO 17660-1:2006.

Where radiographic examination is used to approve a welder, it shall be performed in accordance with BS EN ISO 17636-2:2013, with acceptance levels in accordance with BS EN ISO 17660-1:2006. The results of radiography shall be reviewed and endorsed by a competent independent body.

NDT operators shall be qualified and approved in accordance with paragraph 31 of this Appendix. A list of the testing requirements is given in Appendix 1/5 "Testing to be carried out by the contractor".

15. The result of the test and the assessment shall be given to the Provider at least 7 days prior to the welder commencing on the works. The welder shall not be acceptable if he fails to meet the specified acceptance levels.
16. Changes not affecting welder approval, as specified in BS EN ISO 9606 or equivalent shall be modified as follows:
 - (a) a change in grade or type of reinforcing bar
 - (b) a change in weld metal composition
 - (c) a change from a basic to a rutile covered electrode, but not the converse.

Production Welding

17. All welding shall be carried out in accordance with BS EN ISO 17660-1:2006 and this Appendix, using the manual metal arc process.

All welding, shall be carried out strictly in accordance with the approved welding procedures, due to the NDT requirements given in Clause 27-30 it is not necessary to carry out a production weld test (as specified in BS EN ISO 17660-1:2006, Section 12) before welding can commence.

18. Manual metal arc electrodes shall be stored, baked and handled in accordance with the manufacturer's recommendations. Drying ovens shall be provided with a means of measuring the oven temperature.

The type of manual metal arc electrode used shall not be varied from that approved by the Provider during approval testing of the relevant welding procedure.

19. All welding plant shall comply with the requirements of BS EN ISO 17660-1:2006. In addition, all welding plant shall be equipped with voltage and current measuring equipment. Alternatively, additional equipment shall be provided to measure these parameters.
20. The welders and welding procedures used for production welding shall be the same as those used in the welder and procedure trials, and shall not be varied without the prior written consent of the Provider.
21. Areas of existing reinforcement prepared for repair shall be visually and magnetic particle inspected in accordance with paragraph 27 of this Appendix.
22. Existing reinforcement to be repaired or replaced shall be cut out and all welds shall be orientated to permit NDT in accordance with paragraph 28.
23. Reinforcement shall be securely held in position by mechanical means or tack welds. Where tack welds are to be incorporated into the joint, the weld size shall be similar to that for the root pass. Where necessary, the extremities of the tack welds shall be feathered to facilitate proper fusion. All cracked tack welds shall be completely removed.
24. Preheat temperature shall not be less than the minimum temperature recorded during welding of the appropriate procedure approval test pieces.
25. The contractor shall take precautions to avoid stray arcing between electrode or electrode holder and the work piece or adjacent bars. Welding return leads shall be connected to the work piece by means that prevent damage by sparking. Reinforcement damaged by arc strikes shall be reported to the Provider. The contractor shall rectify such damage in accordance with a procedure to the approval of the Provider.
26. All slag and spatter shall be removed from the weld and adjacent surfaces and backing plates shall be removed from all production welds prior to inspection.
27. 100% of welds undertaken by each welder shall be tested as follows:
 - (i) Visual inspection;
 - (ii) Magnetic Particle Inspection in accordance with BS EN ISO 9934-1:2016.

Acceptance limits shall be as specified in BS EN ISO 5817:2014, except for imperfection types as follows: excess weld metal, excess convexity, excess throat thickness and excessive penetration, for which level C shall apply.

Testing and inspection of a weld shall not be carried out until 2 hours after the weld has been completed.

28. Unless described otherwise in Cl. 28 c) of this appendix, 10% of all welds undertaken by each welder shall be subjected to either:
- a) radiography testing in accordance with BS EN ISO 17636-2:2013 with acceptance levels in accordance with BS EN ISO 17660-1:2006 or
 - b) ultrasonic testing in accordance with BS EN ISO 17640:2018, with acceptance levels in accordance with BS EN ISO 5817:2014. Scanning patterns shall be such as to ensure full coverage of the weld and heat affected zones.

Frequency of testing for each welder shall be not more than every two weeks unless otherwise agreed with the Provider. The orientations and locations of welds to be tested shall be representative of the orientations and locations of all welds completed since the previous testing and shall be agreed with the Provider.

- c) 100% of main longitudinal reinforcement butt welds shall be subjected to ultrasonic testing as described above.

Where ultrasonic testing is used all surfaces to be examined shall be sufficiently smooth and free from scale and slag. Welds shall be ground flush to facilitate testing. Ribbed reinforcement shall be ground flush for a distance of 75mm from the edge of the weld. Ultrasonic testing operators shall be qualified to PCN Level 2 or equivalent.

29. Any weld deemed to have failed when tested in accordance with paragraph 28 shall be cut out and re-executed and retested in accordance with paragraph 27, 28 and 30. The frequency of the testing specified in paragraph 28 shall be subsequently increased to 20% of all welds undertaken by the welder whose weld has failed. For each subsequent failure this percentage shall be increased by 10%. If 30% is reached then the welder is required to be retrained and repeat his qualification.
30. 10% of all welds undertaken by each welder shall be hardness tested by a suitable portable metal hardness tester, approved by the Provider. The hardness of the weld metal and heat affected zone shall not exceed 350HV10. Operators shall be suitably trained in the use of the equipment. Frequency of testing for each welder shall be not more than every two weeks, unless otherwise agreed with the Provider. The orientations and locations of welds to be tested shall be representative of the orientations and locations of all welds completed since the previous hardness testing and shall be agreed with the Provider.
31. All non-destructive testing operators shall be qualified, as a minimum to CSWIP/PCN level 2, or equivalent. A copy of the NDT operators qualifications shall be submitted to and approved by the Provider prior to the operator being allowed to commence work.
32. All welds containing unacceptable defects shall be rectified and retested. The contractor shall submit and obtain approval of his repair procedure prior to any remedial work being performed. The repaired area shall be re-tested to at least the same standard as was used to detect the original defect.
33. The results of all testing shall be assessed against the requirements of this Appendix. The results of the tests and assessments shall be submitted within 48 hours of completion of the testing. Welds shall not be acceptable if they fail to meet the specified acceptance levels.

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

Clause No. (Etc.)	Alterations to be made
Appendix F	See page 28 for details of amendment.
Appendix H	See page 30 for details of amendment.

APPENDIX F ADDENDUM**PUBLICATIONS REFERRED TO IN THE SPECIFICATION**

The following list, as modified and extended by the Contract-specific minor alterations in Appendix 0/2 (if any), is an addendum list of the publications to which reference is made in the Specification:

1. BRITISH STANDARDS

(Published by The British Standards Institution)

	Specification Clause/Table/ Appendix
BS EN ISO 4618:2014 Glossary of paint and related terms	1976
BS 4019 Rotary core drilling equipment	3301

2. DEPARTMENT OF TRANSPORT (NATIONAL HIGHWAYS) PUBLICATIONS

(Published by the National Highways)

	Specification Clause/Table/ Appendix
(i) B	
CD 226 - Design for new pavement construction	App 80/1
CD 236 - Surface course materials for construction	App 7/1
CD 109 - Highway link design	App 1/17
CD 354 - Design of minor structures	App 1/26 App 12/5 App 13/1 App 13/2
CD 357 - Bridge expansion joints	2370 AR App 23/1
CG 300 - Technical approval of highway structures	172 AR App 12/5 App 25/4
CS 126 - Inspection and assessment of roadmarkings and road studs	App 12/5
CS 551 - Drainage surveys	App 80/1
GG 115 - Requirements for works on the hard shoulder and road side verges on high speed dual carriageways	App 1/17
GG 184 - Specification for the use of Computer Aided Design	App 14/1
LA 117 - Landscape design	
TA 101 - Traffic signalling systems	App 12/5
TD 101 - Traffic signalling systems	App 12/5
TM 101 - Traffic signalling systems	App 12/5

TS 101 - Traffic signalling systems	App 12/5
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3. MISCELLANEOUS

**Specification
Clause/Table/
Appendix**

IEC 60529:2001	Degrees of Protection provided by enclosures consolidated edition incorporating Amendment No 1 "Code of Practice for the use of High Pressure Water Jetting Equipment" published by Water Jetting Association, Thames Innovation Centre, 2 Veridion Way, Erith, Kent DA18 4AL (Tel 020 8320 1090) www.waterjetting.org.uk	Appendix 1/26 1771
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APPENDIX H ADDENDUM

QUALITY RECORDS

The following is an addendum list of the quality records required by the Specification:

STRUCTURAL CONCRETE

C	1773.15	Delivery and storage - provision of records and certificates.
C	1773.16	Delivery and storage – provision of records and certificates.
C	1773.17	Approval tests - supply test certificates.
C	1773.23	Delivery and storage - provision of records and certificates.
B	1773.29	Provision of information - submit certificates.
B	1773.33	Approval tests - supply test certificates.

BRIDGE EXPANSION JOINTS AND SEALING OF GAPS

B	2372.1	Plug joints - provide information and certificates.
C	2372.4	Materials - provide information and certificates.

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

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 Specification for Highway Works with those not adopted marked "Not Used" or "N/U". For each Scheme Work Order, those identified by the letters T or C shall be completed by the Tenderer or Contractor respectively.

Additional Requirements may be included in the Scheme Work Order

Guide to types of Numbered Appendices - who compiles/completes

Symbol

- (T) Tenderer completes and returns with Tender
- (C) Contractor completes and returns to Overseeing Organisation
- (I) For Contractor's Information Only

List "B" is a list of Numbered Appendices devised for the Contract.

List 'A': List of Numbered Appendices Referred to in the Specification for Highway Works

Used / Not Used	Completed By	Appendix No.	Title
			INTRODUCTION
Used	I	0/1	Contract-specific Additional, Substitute & Cancelled Clauses, Tables and Figures Included in the Contract
Used	I	0/2	Contract-specific Minor Alterations to Existing Clauses, Tables and Figures included in the Contract
Used	I	0/3	List of Numbered Appendices Referred to in the Specification and included in the Contract
Used	I/C	0/4	List of Drawings Included in the Contract
Not Used		0/5	Special National Alterations of the Overseeing Organisation of Scotland, Wales or Northern Ireland
			PRELIMINARIES
Used		1/1	Temporary Accommodation and Equipment for the Overseeing Organisation
Not Used		1/2	Vehicles for the Overseeing Organisation
Not Used		1/3	Communication System for the Overseeing Organisation
Not Used		1/4	Working and Fabrication Drawings
Used	I/C	1/5	Testing to be Carried out by the Contractor
Not Used		1/6	Supply and Delivery of Samples to the Overseeing Organisation
Used	I	1/7	Site Extent and Limitations on Use
Not Used		1/8	Operatives for the Overseeing Organisation
Used	I	1/9	Control of Noise and Vibration
Used		1/10	Structures to be Designed by the Contractor
Not Used	I/C	1/11	Structural Elements and Other Features to be Designed by the Contractor
Used		1/12	Setting Out and Existing Ground Levels
Used	I	1/13	Programme of Works
Used	I	1/14	Payment Applications
Not Used		1/15	Accommodation Works
Used		1/16	Privately and Publicly Owned Services and Supplies
Used	I/C	1/17	Traffic Safety and Management
Used	I/C	1/18	Temporary Diversions for Traffic
Used	I/C	1/19	Routing of Vehicles
Used	I/C	1/20	Recovery Vehicles for Breakdowns
Used	I/C	1/21	Information Boards
Used		1/22	Progress Photographs
Used	I/C	1/23	Risks to Health and Safety from Materials or Substances
Used	I/C	1/24	Quality Management System
Used	I	1/25	Temporary Closed Circuit Television (CCTV) System for the Monitoring of Traffic
Used	I	1/26	Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Road Works (TASCAR)
Used	I	1/27	Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Road Works (TASCAR) – Particular Requirements
Used	I/C	1/71	Security of Site
			SITE CLEARANCE
Used		2/1	List of Buildings etc. to be Demolished
Not Used		2/2	Filling of Trenches and Pipes
Used	I/C	2/3	Retention of Material Arising from Site Clearance
Used	I	2/4	Explosives and Blasting
Not Used	C	2/5	Hazardous Materials

List 'A': List of Numbered Appendices Referred to in the Specification for Highway Works (continued)

Used / Not Used	Completed By	Appendix No.	Title
			FENCING AND ENVIRONMENTAL BARRIERS
Used	I/C	3/1	Fencing, Gates and Stiles
			ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)
Used	I/C	4/1	Road Restraint Systems (Vehicle and Pedestrian)
Used	I/C	4/2	Information Required to Demonstrate Compliance of Road Restraint Systems to BS EN 1317-1, BS EN 1317-2, BS EN 1317-3, BS EN 1317-5 and DD ENV 1317-4:2002
			DRAINAGE AND SERVICE DUCTS
Used	I/C	5/1	Drainage Requirements
Used	I/C	5/2	Service Duct Requirements
Used	I/C	5/3	Surface Water Channels and Drainage Channel Blocks
Used	I/C	5/4	Fin Drains and Narrow Filter Drains
Used	I/C	5/5	Combined Drainage and Kerb Systems
Used		5/6	Linear Drainage Channel Systems
Used	I/C	5/7	Thermoplastics Structural Wall Pipes and Fittings
			EARTHWORKS
Used	I/C	6/1	Requirements for Acceptability & Testing etc. of Earthworks Materials
Used		6/2	Requirements for Dealing with Class U2 Unacceptable Material
Used	I/C	6/3	Requirements for Excavation, Deposition, Compaction (Other than Dynamic Compaction)
Not Used		6/4	Requirements for Class 3 Material
Used		6/5	Geotextiles Used to Separate Earthworks Materials
Used	I/C	6/6	Fill to Structures & Fill Above Structural Foundations
Used	I/C	6/7	Sub-formation & Capping & Preparation & Surface Treatment of Formation
Used	I/C	6/8	Top soiling
Used	I/C	6/9	Earthwork Environmental Bunds, Landscape Areas, Strengthened Embankments
Used	I/C	6/10	Ground Anchorage's, Crib Walling and Gabions
Not Used		6/11	Swallow Holes & Other Naturally Occurring Cavities & Disused Mine Workings
Used		6/12	Instrumentation & Monitoring
Not Used		6/13	Ground Improvement
Not Used		6/14	Limiting Values for Pollution of Controlled Waters
Used		6/15	Limiting Values for Harm to Human Health and the Environment
			ROAD PAVEMENTS – GENERAL
Used	I/C	7/1	Permitted Pavement Options (Sheets 1,2 & 3)
Not Used	I/C	7/2	Excavation, Repair and Reinstatement of Existing Surfaces
Not Used		7/3	Surface Dressing Sheets 1 & 2
Not Used	I/C	7/4	Bituminous Sprays
Not Used		7/5	In Situ Recycling: the Remix and Repave Processes
Used		7/6	Breaking Up or Perforation of Existing Pavement
Used	I/C	7/7	Slurry Surfacing Incorporating Microsurfacing
Not Used		7/8	NOT USED
Not Used	I/C	7/9	Cold-Milling (Planing) of Bituminous Bound Flexible Pavement
Not Used		7/10	NOT USED
Used		7/11	Over banding and Inlaid Crack Sealing Systems
Not Used		7/12	Arrester Beds

List 'A': List of Numbered Appendices Referred to in the Specification for Highway Works (continued)

Used / Not Used	Completed By	Appendix No.	Title
			ROAD PAVEMENTS – GENERAL (Continued)
Not Used		7/13	Saw-Cut and Seal Bituminous Overlays on Existing Concrete Pavements
Not Used		7/14	Preparation of Jointed Concrete Pavements Prior to Overlaying and Saw-Cut and Seal of Bituminous Overlay
Not Used		7/15	Saw-Cut, Crack and Seat Existing Jointed Reinforced Concrete Pavements
Not Used		7/16	Cracking and Sealing of Existing Jointed Un-reinforced Concrete Pavements and Hydraulically Bound Mixture (HBM) Bases
Not Used		7/17	Cracking Plant and Equipment Progress Record
Not Used		7/18	Site Specific Details and Requirements for Cold Recycled Bitumen Bound Material
Not Used		7/19	Site Specific Details and Requirements for Recycled Cement Bound Material
Not Used		7/20	NOT USED
Not Used		7/21	Surface Dressing – Recipe Specification
Not Used		7/22	Repair to Potholes
			ROAD PAVEMENTS - CONCRETE AND CEMENT BOUND MATERIALS
Not Used		10/1	Plant and Equipment for the Construction of Exposed Aggregate Concrete Surface
			KERBS, FOOTWAYS AND PAVED AREAS
Used	I/C	11/1	Kerbs, Footways and Paved Areas
Used	I/C	11/2	Access Steps
			TRAFFIC SIGNS
Used	I/C	12/1	Traffic Signs : General
Used	I/C	12/2	Traffic Signs : Marker Posts
Used	I/C	12/3	Traffic Signs : Road Markings and Studs
Not Used		12/4	Traffic Signs : Cones, Cylinders, FTD's & Other Traffic Delineators
Used	I/C	12/5	Traffic Signs : Traffic Signals
Not Used		12/6	Traffic Signs : Special Sign Requirements on Gantries
			ROAD LIGHTING COLUMNS AND BRACKETS
Used	I/C	13/1	Information to be Provided When Specifying Lighting Columns and Brackets
Used	I/C	13/2	Columns and Bracket Data Sheets 1 and 2
Used	I/C	13/3	Instructions for Completion of Column & Bracket Data Sheet
Not Used		13/4	Information to be Provided When Specifying CCTV Masts
Not Used		13/5	Typical CCTV Mast Data Sheet
Not Used		13/6	Instructions for Completion of CCTV Mast Sheets
Not Used		13/7	Information to be Provided When Specifying Cantilever Masts
Not Used		13/8	Typical Cantilever Masts Data Sheets 1 and 2
Not Used		13/9	Instructions for Completion of Cantilever Masts Data Sheets
			ELECTRICAL WORK FOR ROAD LIGHTING AND TRAFFIC SIGNS
Used	I/C	14/1	Site Records
Used	I/C	14/2	Location of Lighting Units & Feeder Pillars
Not Used		14/3	Temporary Lighting
Used	I/C	14/4	Electrical Equipment for Road Lighting
Used	I/C	14/5	Electrical Equipment for Traffic Signs
			MOTORWAY COMMUNICATIONS
Used	I/C	15/1	Motorway Communications
Not Used		15/2	Cable Duct Requirements

List 'A': List of Numbered Appendices Referred to in the Specification for Highway Works (continued)

Used / Not Used	Completed By	Appendix No.	Title
			PILING AND EMBEDDED RETAINING WALLS
Not Used	I/C	16/1	General Requirements for Piling and Embedded Retaining Walls
Not Used		16/2	Precast Reinforced and Pre-stressed Concrete Piles and Precast Reinforced Concrete Segmental Piles
Not Used	I/C	16/3	Bored Cast-in Place Piles
Not Used	I/C	16/4	Bored Piles Constructed using Continuous Flight Augers and Concrete or Grout Injection through Hollow Auger Stems
Not Used		16/5	Driven Cast-in Place Piles
Not Used	I/C	16/6	Steel Bearing Piles
Not Used		16/7	Reduction of Friction on Piles
Not Used	I/C	16/8	Non-Destructive Methods for Testing Piles
Not Used		16/9	Static Load Testing of Piles
Not Used		16/10	Diaphragm Walls
Not Used		16/11	Hard/Hard Secant Pile Walls
Not Used		16/12	Hard/Soft Secant Pile Walls
Not Used		16/13	Contiguous Bored Pile Walls
Not Used		16/14	King Post Walls
Not Used	I/C	16/15	Steel Sheet Piles
Not Used		16/16	Integrity Testing of Wall Elements
Not Used		16/17	Instrumentation for Piles and Embedded Walls
Not Used		16/18	Support Fluid
			STRUCTURAL CONCRETE
Used	I/C	17/1	Schedule for the Specification of Designed Concrete
Used	I/C	17/2	Concrete – Surface Protection Systems
Used	I/C	17/3	Concrete - Surface Finishes
Used	I/C	17/4	Concrete - General
Used	I/C	17/5	Buried Concrete
Used	I/C	17/6	Grouting and Duct Systems for Post-tensioned Tendons
Used	I/C	17/7	Precast Concrete Elements
Used	I/C	17/8	Post-installed Anchors and Reinforcing Bar Connections
			STRUCTURAL STEELWORK
Used	I/C	18/1	Requirements for Structural Steelwork
			PROTECTION OF STEELWORK AGAINST CORROSION
Used	I/C	19/1	Form HA/P1 (New Works) Paint System Sheet
Not Used		19/2	Requirements for Other Works
Used	I/C	19/3	Form HA/P2 Data Sheet
Used	I/C	19/4	Form HA3 Paint Sample Despatch List, sheets 1 & 2
Used	I/C	19/5	General Requirements
			WATERPROOFING FOR CONCRETE STRUCTURES
Used	I/C	20/1	Waterproofing for Concrete Structures
			BRIDGE BEARINGS
Not Used		21/1	Bridge Bearing Schedule

List 'A': List of Numbered Appendices Referred to in the Specification for Highway Works (continued)

Used/Not Used	Completed By	Appendix No.	Title
			PARAPETS
Not Used		22/1	Parapet Schedule
			BRIDGE EXPANSION JOINTS AND SEALING OF GAPS
Used	I/C	23/1	Bridge Deck Expansion Joint Schedule
Used	I/C	23/2	Sealing of Gaps Schedule (Other than in Bridge Deck Expansion Joints)
			BRICKWORK, BLOCK WORK AND STONEMWORK
Used	I/C	24/1	Brickwork, Block work and Stonework
			SPECIAL STRUCTURES
Not Used		25/1	Requirements for Corrugated Steel Buried Structures
Not Used		25/2	Requirements for Reinforced Soil and Anchored Earth Structures
Not Used		25/3	Requirements for Pocket Type Reinforced Brickwork Retaining Wall Structures
Used	I/C	25/4	Environmental Barriers
Not Used		25/5	Requirements for Buried Rigid Pipes for Drainage Structures
			MISCELLANEOUS
Not Used		26/1	Ancillary Concrete
Used	I/C	26/2	Bedding Mortar
Used	I/C	26/3	Cored Thermoplastic Node Markers
Not Used		26/4	NOT USED
Not Used		26/5	NOT USED
Not Used		26/6	NOT USED
Not Used		26/7	NOT USED
Used	I/C	26/8	Foamed Concrete for Structures
			LANDSCAPE AND ECOLOGY
Used	I/C	30/1	General, sheets 1, 2 &3
Used	I/C	30/2	Weed Control
Used	I/C	30/3	Control of Rabbits and Deer
Used	I/C	30/4	Ground Preparation
Used	I/C	30/5	Grass Seeding, Wildflower Seeding and Turfing
Used	I/C	30/6	Planting, sheets 1 & 2
Not used		30/7	Grass, Bulbs and Wildflower Maintenance
Not used		30/8	Watering
Not used		30/9	Establishment Maintenance for Planting
Not used		30/10	Maintenance of Established Trees and Shrubs
Not used		30/11	Management of Water bodies
Used	I/C	30/12	Special Ecological Measures
			MAINTENANCE PAINTING OF STEELWORK
Used	I/C	50/1	FORM HA/P1 (MAINTENANCE) PAINT SYSTEM SHEET
Not Used		50/2	REQUIREMENTS FOR OTHER WORK
Used	I/C	50/3	FORM HA/P2 PAINT DATA SHEET
Used	I/C	50/4	FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 1 and 2.
Not Used		50/5	GENERAL REQUIREMENTS
			CONCRETE REPAIRS
Used	I/C	57/1	Repair Product - Requirements
Used	I/C	57/2	Requirements for Reinforcement
Used	I/C	57/3	Execution of Concrete Repairs
Used	I/C	57/4	Sprayed Concrete
Used	I/C	57/5	Concrete Injection
Used	I/C	57/6	Contractor Investigation of Concrete Condition

Used	I/C	57/7	Requirements for Galvanic Anodes
			TRENCHLESS INSTALLATION OF HIGHWAY DRAINAGE AND SERVICE DUCTS
Used		80/1	Trenchless and Minimum Dig Techniques
Used		80/2	Specific Requirements for Rehabilitation Techniques

List 'B' gives the list of Contract-specific Numbered Appendices devised for the Contract

Volume No.	Appendix No.	Appendix Title
1	1/71	Security of the Site
1	12/70	Cable and Cable Core Identification

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

1 Contract-specific Drawings Supplied to Each Tenderer

Drawing Number	Title
None	

2 Brought into the Contract by Reference

Unless otherwise stated in the Scheme Work Order, all of the Highway Construction Details published by The Stationery Office as Volume 3 of the Manual of Contract Documents.

2 Standard Drawings

2(i) Supplied to Each Tenderer

Drawing No.	Title	Volume No.
None		

2(ii) Inspected by Tenderers

Drawing No.	Title	Aspect required if not whole Drawing
None		

2(iii) Brought Into the Contract by Reference

The current (at tender issue date) relevant Highway Construction Detail published by The Stationery Office (formerly HMSO) as Volume 3 of the Manual of Contract Documents for Highway Works are brought into the Contract by reference.

APPENDIX 1/1: TEMPORARY ACCOMMODATION AND EQUIPMENT FOR THE OVERSEEING ORGANISATION

1. Accommodation for the Overseeing Organisation ~~will~~ shall be provided in accordance with 174AR

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

- 1 The Contractor shall be responsible for carrying out the testing in accordance with the tests described in Volume 1 Specification for Highway Works and its own quality plan as accepted under this contract. Detailed testing schedule can be found in Series NG 0100, Table NG1/1, , Volume 2 Notes for Guidance on the Specification for Highway Works.
- 2 Results from the tests shall be made available on request to the Overseeing Organisation.

APPENDIX 1/7: SITE EXTENT AND LIMITATIONS ON USE

1. Extent of the Site.

The extent of the site shall be as defined in the Work Order.

2. Limitations on the Use of the Site.

The Contractor's use of any area of the site will be limited by the requirements of Clause 117 Traffic Safety and Management and the following conditions:

- (i) The safety zone specified in Chapter 8 of the Traffic Signs Manual shall be maintained between the edge of any traffic lane and the works, constructional plant or materials.
- (ii) The provision of areas to accommodate all principal offices, messes, stores, laboratories or workshops required under the Contract or otherwise by the Contractor shall be the responsibility of the Contractor. No principal offices, messes, stores or workshops shall be sited within the trunk road or other highway boundaries.
- (iii) All areas outside the limits of the site which are used or occupied by the Contractor shall be restored to their original condition on completion of the Works. Such restoration shall include any necessary reinstatement, re-soiling, seeding or planting.
- (iv) No area of the Trunk Road shall be used for parking of vehicles used by or on behalf of the Contractor. The Contractor shall not obstruct any lane, road junction vehicular or pedestrian access which has not been closed to traffic
- v) The Contractor shall allow for any working areas within the boundaries of the highway to be used by vehicles requiring to stop in an emergency. The Contractor shall inform the Overseeing Organisation and the Police of the name(s) and telephone number(s) of a responsible person(s) who can be contacted at any time in an emergency.
- vi) The Contractor, his agents, servants or workmen shall not erect nor allow his sub-contractors their agents, servants or workmen to erect within the Site any advertisement without the prior written approval of the Overseeing Organisation. Should any advertisement be erected without such approval the Overseeing Organisation shall have power to order in writing the Contractor to remove it forthwith. If the Contractor shall fail to comply with such order within 24 hours of its delivery to him, the *Overseeing Organisation* shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be borne by the Contractor and shall be recoverable from him by the *Client* or may be deducted by the *Overseeing Organisation* from any monies due or which become due to the Contractor.
- vii) All advertisements, approved under the previous sub-clause, within the site shall be removed not later than the Completion Date, unless the Overseeing Organisation approves in writing any advertisement to remain for a further period.

3. The Contractor, or any agent or servant in his employ shall not give any information concerning the Works for publication in the press or radio, television or cinema screen or publicly accessible media elsewhere without the written approval of the *Overseeing Organisation*.
4. The Contractor shall prevent trespass by his own or his sub-contractor's employees onto any property adjoining the site.
5. The Contractor shall ensure that no steps, ladders or other plant are left accessible so as to permit unauthorised access to the works.
6. The Contractor shall maintain the site in a clean and tidy state by removing rubbish, demolished concrete and other debris arising from the works to a tip off site. All materials and plant for the works shall be stored neatly. On completion of the works the Contractor shall remove all surplus materials and leave the site in a clean and tidy condition.
7. All traffic restrictions and traffic control required to carry out any necessary remedial works shall be to the standard required for the main works and all traffic control costs required for such remedial works shall be borne by the Contractor;
8. The programming of any remedial works required after the actual Completion Date shall be agreed with the Overseeing Organisation before commencement of those works;
9. All goods vehicles used by the Contractor or his Subcontractors in connection with the contract shall display the vehicle licence disc relevant to the goods operator's licence under which the vehicle is operated or, in the absence of an operator's licence disc, shall carry documentation giving the operator's licence number, name and address.

APPENDIX 1/9: CONTROL OF NOISE AND VIBRATION**Noise**

- 1 The measures indicated within this appendix are provided as a guide; however it is for the Contractor to decide whether to seek the Local Authority's formal consent to his proposed methods of work and to the steps he proposes in order to minimise noise.
- 2 The noise levels (see Note (i) below) scheduled below for periods outside the normal working hours will only be permitted when consent has been given to exceptional working.
- 3 The ambient noise level, Leq (see Note (ii) below) from all sources when measured 2.0 m above the ground 1 m from the facade of any occupied building shall either not exceed the appropriate level given in the Schedule or not exceed by more than 3dB(A) the existing ambient noise level, Leq (see Note (iii) below), at the building measured over the same period, whichever level is the greater. The maximum sound level at any building due to the Contractor's operations shall not exceed the level given in the Schedule. Exceptionally, the Contractor may be given permission to carry out works which exceed the noise levels in the Schedule, provided that 14 days' notice of the date and timing of these works is given to the Overseeing Organisation and the Contractor demonstrates that he intends to take all reasonable measures to mitigate the noise nuisance. After consultations with the Local Authority and any other interested bodies a decision will be given within 14 days of receipt of the notice.

Schedule		Total Noise Levels at Occupied Building		
Period	Hours	Ambient Noise Level. Leq measured 1 m from the façade of any occupied building dB(A)	Period of Hours over which Leq is applicable	Maximum Sound Level (see Note (iv) below) measured at the building; dB(A)
Mondays to Fridays	0700 - 0900	65	2	70
Mondays to Fridays	0900 - 1900	75	10	85
Mondays to Fridays	1900 - 2200	65	3	70
Saturdays	0700 - 0900	65	2	70
Saturdays	0900 - 1300	75	4	85
Saturdays	1300 - 2200	65	9	70
Sundays	0700 - 0900	50	2	55
Sundays	0900 - 1700	65	8	70
Sundays	1700 - 2200	50	5	55
Nights	2200 - 0700	50	9	55

Notes:

- (i) Noise levels relate to free field conditions. Where noise control stations are located 1m from facades of buildings, the permitted noise levels can be increased by 3 dB(A).

- (ii) The ambient noise level, Leq, is the total Leq from all the noise sources in the vicinity over the specified period. (Sampling time to be minimum 5 minutes duration).
 - (iii) The existing ambient noise level, Leq, is the total Leq from all the noise sources in the vicinity over the specified period prior to the commencement of the works. (Sampling time to be minimum of 20 minutes duration).
 - (iv) Maximum sound level is the highest value indicated on a sound level meter which meets the requirements of BS EN 61672 Parts 1 and 2 Type 1 or 2 set to SLOW response and frequency weighting A or on an integrating - averaging sound level meter to BS EN 61672 Parts 1 and 2
- 4 Without prejudice to the generality of the Contractors' obligations under Clause 109 Noise Control, the Contractor shall comply with the following requirements:
- (i) The Contractor shall provide and use items of plant and equipment that have been specifically designed or modified to reduce the noise of normal operations. Items of plant and equipment shall be maintained in good and effective working order so that extraneous noises from mechanical vibration, creaking, squeaking etc. shall be reduced to a minimum.
 - (ii) All vehicles and mechanical plant shall be fitted with effective exhaust silencers maintained in good working order.
 - (iii) All compressors shall be "sound reduced" models fitted with properly lined and sealed acoustic covers kept closed whenever the machines are in use. All ancillary pneumatic tools shall be fitted with mufflers of the type recommended by the manufacturers.
 - (iv) Machines in intermittent use shall be stopped in the periods between uses.
 - (v) The Sound levels shall be monitored by methods set out in Annex B of BS 5228.
 - (vii) The Contractor shall adhere to the codes of practice for construction and piling given in BS 5228.
- 5 The Contractor shall furnish such information as may be required by the Overseeing Organisation in relation to noise levels emitted by plant or equipment used or installed on the site or which the Contractor intends to use or install on the site.
- 6 The Contractor shall afford all facilities to enable the Overseeing Organisation to carry out such noise monitoring as may be required, including the temporary cessation of works required for the monitoring of the "existing ambient noise level".
- 7 The responsible Authorities for Environmental matters are detailed in the Scheme Work Order.

Vibration

- 8 The Contractor shall comply with BS 6472:2008 Evaluations of Human Exposure to Vibration in Buildings (1Hz-80Hz). Any vibration monitoring carried out shall also be in compliance with BS 6472:2008.

APPENDIX 1/10: PERMANENT WORKS TO BE DESIGNED BY THE CONTRACTOR

1. Foundations for planted lighting columns
2. ~~The Contractor shall design temporary structures to suit his methods of work for containment of demolition and construction of new elements. The Contractor shall design any other temporary structures required to suit his methods of work.~~

APPENDIX 1/12: SETTING OUT AND EXISTING GROUND LEVELS

- 1 Any Ground Levels or Setting Out details shall be as included in the Work Order.

APPENDIX 1/13: PROGRAMME OF WORKS

1. The Contractor shall provide the Programme of Works, in accordance with the Conditions of Contract in a form of a bar chart produced as a result of a 'critical path analysis'. It shall show the level of detail appropriate to each stage of the Works and all activities and restraints, each of which shall be given a short title. All events shall be numbered and annotated with earliest and latest event dates.

The programme is to be supplied on paper and electronically in Adobe Acrobat format.

The Programme provided under this Appendix is additional to the programme information required under Appendix 1/17.

The schedule of constraints will be provided within the Scheme Work Order.

APPENDIX 1/14: PAYMENT APPLICATIONS

The payment applications submitted to the Overseeing Organisation shall be in accordance with the Conditions of Contract.

APPENDIX 1/16: PRIVATELY AND PUBLICLY OWNED SERVICES AND SUPPLIES

1. The Contractor shall make arrangements in accordance with the quality plan as part of this contract with the Statutory Undertakers and others concerned, for the co-ordination of his work with all work which needs to be done by them or their contractors concurrently with the Works.
2. Disconnected apparatus shall be removed by the Contractor only with the prior consent of the Authority concerned.
3. The form to be used when working near GPU apparatus below:

**Method Statement “Suggested Format” for
Working in Accordance with H&S Guidance**

Note GS6

(Avoidance of Danger from O/H Electric Lines)

Site Location _____

GPU Site Visit Date _____

GPU Report

Cable Voltage _____

Height Above Ground _____

Minimum Clearance _____

Maximum Working Height Restriction _____

Site Engineer in Charge _____

Foreman/Charge hand _____

Banks man _____

Machine Operator _____

Plant to be used _____

Description of Work _____

Safety Precautions to be taken _____

Signed _____

Date _____

**When complete please Fax to Severn Incident Centre on
FAX 0XXXX XXXXXX ☎ 0XXXX XXXXXX**

APPENDIX 1/17: TRAFFIC SAFETY AND MANAGEMENT

1 Submission of Traffic safety and Management Proposals

- 1.1 The Contractor's proposed method statement, prepared after consultation with all statutory police or other authority concerned, for implementation of traffic management shall be submitted to the Overseeing Organisation a minimum of 7 days before the date on which the traffic management system is to be installed. The installation of the traffic management system shall then proceed only in accordance with the planned sequence.
- 1.2 Proposals shall include:
- Position of traffic signals, traffic signs and road markings
 - Width of lanes
 - Working areas
 - Safety Zones
 - Temporary works details
 - Site access and egress layouts (standards shall be appropriate for traffic flows and speeds)
 - De-restriction/speed limit signs at the end of the works as appropriate
- 1.3 The Contractor shall provide the Overseeing Organisation with a report on the traffic management at the end of each week. The report shall include:
- details of all traffic management (including reference to which Chapter 8 layout was in use) in place during that week, including times when it was installed, removed and when changes were made
 - a record of traffic management inspections made by the Contractor
 - the name of the approved traffic management inspector
 - any traffic accidents reported, and details of them
 - a record of any damage to the traffic management, and when damage was repaired

2 Traffic Safety and Management Requirements

- 17.1 The Contractor shall be responsible for the design and implementation of all traffic management measures required under Clause 117 having regard to Appendix 1/17 and the following requirements.
- 17.2 The works shall be carried out in accordance with the traffic management proposals submitted by the Contractor to the Overseeing Organisation .
- 17.3 Any reference to the "Police" shall be read as "Police/National Highways Traffic Officer" as applicable.
- 17.4 The Contractor shall comply with the requirements and recommendations of the following publications:
- Highways England's Managing Network Occupancy Performance Requirement
 - & Notes for Guidance on 'Safety at Road works'
 - Highways England's Speed Limit Enforcement at Road works: Guidance and Best Practice which offers advice on procedures to follow when carrying out this activity. The Contractor shall take this guidance into account when planning major schemes where the speed limit is to be enforced.

- Highways England's Safety Camera Partnership Guidance (Highways England involvement) 2006/07" provides guidance on working with partnerships operating speed cameras.
 - GG 115 - Requirements for works on the hard shoulder and road side verges on high speed dual carriageways.
- 17.5 The alignment of the traffic lanes and the crossovers shall comply with the requirements of CD 109 Highway Link Design
- 17.6 Restrictions on the phasing and timing of works shall be as stated in the Scheme Work Order, including embargo periods and details of events resulting in additional restrictions.
- 17.7 Traffic data to be used for the design of traffic management shall be as stated in the Scheme Work Order.
- 17.8 Traffic shall not be diverted until after the approval of each stage by the Overseeing Organisation. No personnel or items of plant (other than required for the signing and coning operations) shall enter a newly closed carriageway traffic lane until such time as the traffic has been satisfactorily diverted and approval to commence work given by the Overseeing Organisation. The Contractor shall not alter traffic management measures during the peak traffic periods defined in the Scheme Work Order.
- 17.9 The Contractor's attention is drawn to the need to assess the risks and develop and operate safe working practices when vehicles and plant are reversing on Site, whether or not they are on part of the highway. Rule 129 of The Highway Code 1993 is relevant but the Contractor's practices and procedures should take account of the different conditions, which will obtain on Site. The reversing and positioning of vehicles to a specific operation or item of plant shall only be undertaken under the direction of a designated marshall or banks man who escorts the vehicle whilst reversing. The Contractor shall erect signs at each works access to inform drivers of this requirement that all such reversing of vehicles shall be undertaken under the direction of the designated marshall. The Contractor shall supply details of the proposed sign to the Overseeing Organisation for approval. The Contractor shall comply with the requirements of Appendix 1/9 regarding the control of noise.
- 17.10 Where the circumstances are not covered by the Traffic Signs Manual, these publications and the drawings, the Contractor shall submit proposals for dealing with such situations to the Overseeing Organisation for approval. Compliance with this Clause shall not relieve the Contractor of any other obligations and liabilities under the Contract and under the relevant provisions of the Highways Acts.
- 17.11 The Contractor shall not commence any permanent work which affects the public highway until all traffic safety measures necessitated by the work are fully operational and have been approved by the Overseeing Organisation. In addition, before any work is carried out within the boundaries of the highway and before any vehicles or plant are parked on the Highway, other than those used for setting up traffic management systems, arrangements shall be made with the Overseeing Organisation's Maintenance Manager and with the Police, all of whom shall be kept informed of the programming of the works in advance.
- 17.12 In the event of an accident occurring on the trafficked lanes, in the vicinity of the site, the Police may direct operations. The Contractor shall provide replacements for and properly reinstate to the original approved layout, as necessary, all signs, cones, cylinders, bollards, barriers and lights when directed by the Police. The Contractor shall

- ensure that sufficient stock of spare signs and cones etc. is always available to make good all reasonably foreseeable damage to the traffic control system. The Overseeing Organisation may also direct the Contractor to assist in the removal of debris, to restore the road surface to a serviceable condition, to reinstate safety fencing and anchorage's, for all of which a full record of plant, labour and materials shall be submitted to the Overseeing Organisation within 24 hours.
- 17.13 The Contractor shall note that the highway will be open to traffic, though in restricted capacity, during the whole period that the works are in progress. Without prejudice to the other provisions of this Contract the Contractor must ensure that no actions by them or their employees or sub-contractors or suppliers or haulers or their employees are executed in such a manner as to constitute hazards or safety risks to traffic or themselves.
- 17.14 The Contractor shall ensure all working areas are clear of grit and salt. The Contractor shall reset all disturbed cones, cylinders, lamps and signs and clear all snow and ice moved onto the working areas arising as a result of gritting and ploughing operations.
- 17.15 No area of carriageway shall be re-opened until a safe surface, free from debris and of sufficient skidding resistance, is available for traffic. All ironwork and steps in construction shall be ramped. The maximum amount that ironwork may be proud of the adjacent carriageway area for temporary ramping is 50 mm and all ramps shall have an incline of not exceeding 10%.
- 17.16 The Contractor shall liaise with the relevant local authority and provide assistance in respect of access for refuse collection to properties bounding the site (one day per week).
- 17.17 Vehicular and Pedestrian access to side roads, accesses and to all properties shall be maintained unless otherwise directed in the Scheme Work Order.
- 17.18 Pedestrian walkways shall be provided where required by the Scheme Work Order. The Contractor shall maintain pedestrian crossing points or provide and sign in accordance with TSM Chapter 8, safe alternative crossing point(s). Walkways may be existing footways or specifically barriered walkways. Temporary walkways shall be 1.5m wide or more where possible. Footways less than 1.5m wide will only be permissible for short lengths with passing places at either end, and with the agreement of the Overseeing Organisation. The footway width shall be free from obstructions, such as barrier feet, ice, mud, sand etc. or anything which may cause injury to pedestrians. The walkways shall be suitably signed to enable pedestrians to negotiate themselves past the works. The Contractor shall ensure that any pedestrians having difficulty using the walkways is suitably aided.
- 17.19 Bus stops shall be temporarily relocated to a suitable site to the approval of the Overseeing Organisation when the Contractor's working restricts their use. The Contractor shall erect temporary bus stop signs and notices to bus users, when the temporary bus stops are in operation. Where a bus stop is to be closed, the contractor shall erect the appropriate signs informing bus users of the closure and provide the necessary safe unobstructed diversion route to the next bus stop. The Contractor shall notify the Bus Companies listed in the Scheme Work Order of the dates and details of the bus lay-by closures, the position of the temporary bus stops and of the diversions that are required.
- 17.20 The Contractor shall notify the Overseeing Organisation of his requirement to shut down any traffic signals a minimum of 7 days before the date on which the signals will

be shut down. The contractor shall supply and erect temporary signs to TSRGD no P7019 at the locations described in the Scheme Work Order when the signals are not in use.

17.21 Temporary Signing, Road Markings and Studs:

- The Contractor is to supply and erect/fix all the signs, cones, temporary road studs and markings required, for the Works in accordance with Chapter 8.
- Existing permanent traffic sign faces shall be masked by an opaque material, approved by the Overseeing Organisation, when not required or when giving conflicting information to drivers or as directed by the Overseeing Organisation.
- All signs shall be in Class 1 reflective material and shall be regularly cleaned.
- Signs shall be mounted 2.1 m high over footways and 1.5m high elsewhere. The Contractor is to submit his proposals for the affixing of signs to the Overseeing Organisation 7 days prior to the commencement of these works. Temporary signs to be attached to existing lighting columns shall be fixed so as not cause any damage to the protective coating of the column.
- All conflicting road markings shall be removed or obscured with black self-adhesive line material or black paint whilst temporary working is in operation.
- The contractor shall design, erect, maintain and remove appropriate diversion and information signs in accordance with Traffic Signs Manual Chapter 8 and Traffic Signs Regulations and General Directions 2016 for the closure of any roads, junctions or accesses.
- The Contractor shall ensure that the traffic control system of signs, cones, cylinders, bollards, barriers, lights and other related temporary traffic management equipment is continuously inspected and, where necessary, immediately properly reinstated. The Contractor shall provide on-site, operatives and appropriate vehicles for the exclusive purpose of carrying out continual inspection (i.e. 24 hours per day, 7 days per week) of the traffic safety and control systems from commencement to completion of works. The Contractor shall ensure that the traffic control system of signs, cones, cylinders, bollards, barriers, lights and other related temporary traffic management equipment is clean and fit for its intended purpose on initial deployment, and shall be regularly maintained in such a condition from commencement to completion of works. Any cleaning activities shall be undertaken by personnel in a place of relative safety.

17.22 Traffic Management 'Convoy System':

- Where the proposed works will leave insufficient space to provide a minimum 0.5m wide Safety Zone, then a 10mph speed restriction shall be applied by a Temporary Traffic Regulation Order. In order to physically enforce the speed restriction order, the Contractor shall use a convoy system as described below to escort vehicles through the works.
- The *Overseeing Organisation* will arrange for a temporary 10mph speed restriction order to allow the contractor to safely complete the works by the use of a 10mph convoy system to escort vehicles through the works. The Contractor shall allow time for the implementation of the Order in accordance with paragraph 3 below.
- A written 'method of work' statement that includes traffic management layouts with a programme of works shall be submitted to the Overseeing Organisation for approval seven days prior to the proposed date of installation. Convoy working arrangements shall comply with Chapter 8 Traffic Signs Manual.
- 'STOP/GO' boards and operators should be available for use where directed by the Overseeing Organisation.

- Failure to achieve the lane widths detailed in Chapter 8 will require the 'convoy system' to remain in operation until such time as the through lane width is achieved.
 - The convoy escort vehicles shall be appropriate vehicles in either white or yellow and have a tight turning circle to turn round in carriageway if required. They should have good visibility with wing mirrors on both sides, have hazard lamps and an amber roof mounted 'flashing' beacon. Class 2 retro-reflectorised signs reading 'Convoy Vehicle' on the front and 'Convoy Vehicle - No Overtaking' to the rear (or mounted back-to-back below the flashing beacon). They should also have side mounted reflective transfers reading 'Convoy Vehicle' and no other wording or markings.
- 17.23 Where 'lane closure' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1
- 17.24 Where 'Narrow Lanes' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1 Section D6.3
- 17.25 Where 'Contra-flow' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1 Section D6.4
- 17.26 Where 'Hard shoulder closure' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1 Section D6.10
- 17.27 Where 'Carriageway Closure' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1 Section D6.20
- 17.28 Where 'Medium Duration Inspection Stop' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1 Section D3.31
- 17.29 Workforce crossing carriageway and live lane working
- The Contractor is to eliminate carriageway crossing and live lane working in accordance with National Highways policy
 - Where it is deemed that a carriageway crossing or live lane working is unavoidable this is to be notified to the Project Manager
 - The Contractor is to submit a fully populated live carriageway crossing and live lane working data entry sheet each month by Working Day 4 (WD4) along with the near misses data entry sheet to the Overseeing Organisation.
- 17.30 Emergency, Accident or Other Incident
- The Contractor is to carry sufficient stocks of materials manufactured for use as a diesel lift in the event of spillages in the trafficked lanes;
 - The Contractor is to remove debris and restore the road surface to a serviceable condition;
 - The Overseeing Organisation, its representatives and the traffic safety nominee appointed by the Overseeing Organisation and notified to the Contractor shall have the unqualified right to instruct the Contractor's workmen and/or Sub-Contractors on any matters relating to traffic safety and control during an emergency, accident or other incident.
 - The Contractor should seek the advice of the Overseeing Organisation with regard the requirements for gritting and snow ploughing operations.

17.31 Site Safety, Working Areas and Safety Zones:

- Working areas and safety zones shall be as defined in Chapter 8 of the Traffic Signs Manual.
- Vehicles may only enter or leave the working area at the designated entry or exit points and shall do so in the direction of the traffic flow.
- Site traffic shall only be allowed to travel in either direction on a length of carriageway that has been completely closed to public traffic. In all other cases, site traffic shall comply with the Road Traffic Regulations.
- A method of merging Site Traffic with Public Traffic shall be agreed prior to commencement. These arrangements may only be amended with the agreement or at the direction of the Overseeing Organisation

17.32 Recovery Vehicles are required whenever specified in Appendix 1/20

17.33 Temporary lighting is required whenever specified in the Scheme Work Order

1 Traffic Safety and Control Officer (TSCO)

1.1 The responsibilities of the Traffic Safety and Control Officer are to ensure that all traffic requirements are met which shall include liaison with the Overseeing Organisation and the Police concerning the following matters:

- Control of entry and exit of the works site traffic onto the carriageway in general use.
- For controlling the safe working of plant, machinery and operatives immediately adjacent to the carriageway open to traffic.
- Inspection and maintenance of all equipment described, arranging duties for watchmen so that the site is patrolled and inspected at all times and equipment attended to as required and for dealing with traffic in emergencies including notifying the Police immediately of any accidents and emergencies.
- To notify the Contractor's Agent and of any deterioration of safety precautions, including any part of the Traffic Management Scheme, traffic signs and carriageway road surface.
- The setting up and maintenance of an Emergency Traffic Route, as follows, and ensuring that the emergency services are kept aware of the current route at all times.

The Contractor shall provide and maintain at all times an Emergency Route of minimum width 2.4 metres as follows:

- A delineated route through the entire length of the carriageway which is for use by the Police, Emergency services and maintenance vehicles;
- The route shall also be available as a diversion route for traffic in the interests of road safety, e.g. during serious accidents;
- Site vehicles may only use the emergency route as a means of access from one part of the site to another, but shall give priority to emergency vehicles;
- Where the route follows normal carriageway lanes, cones shall be maintained at 9m intervals with road danger lamps 18m intervals at all times.
In other circumstances:-
- where the route deviates from the normal carriageway alignment, it shall be delineated with cones and road danger lamps at 3m intervals between points 50m outside the limits of the divergence, laid to a minimum radius of 50m on its inside edge;

- where excavations, stock piles, parked plant etc. are adjacent to the route, the cones and road danger lamps shall be maintained at 1.5m intervals. Where excavations, stock piles, parked plant etc. are adjacent to the route, the cones and road danger lamps shall be maintained at 1.5m intervals.
- Monitoring, with the assistance of sufficient mobile personnel and of sufficient other suitable and appropriate aids, the flow of traffic within the area and within the period defined for the operation of the vehicle recovery service;
- Ensuring that, within 5 minutes of the occurrence of an incident, as defined below, resulting in stationary vehicle(s) on a highway open to the public, the incident is reported to the vehicle recovery service;
- Recording and logging all incidents and all movements of recovery vehicles and, when called, all movements of the emergency services. For the purposes of this Appendix, an “incident” is defined as a shed load, vehicle breakdown, vehicle abandonment or traffic accident, whether or not the latter involves personal injury.

1.2 The Traffic Safety and Control Officer shall be in 24 hour contact with all recovery vehicles by a radio system and in addition by land line or mobile telephone system.

2. Temporary Traffic Regulation Orders and other Statutory Orders

4.1 Details of Temporary Traffic Regulation Orders previously applied for are as specified in the Scheme Work Order.

4.2 Notice required by the Overseeing Organisation to arrange for:

- Amending or making temporary traffic orders12 weeks
- Authorising of non-prescribed signs.....4 weeks
- Authorising temporary traffic signals2 week

5 Crossovers

5.1 The alignment of crossovers shall comply with the requirements of CD 109 Highway Link Design and Traffic Signs Manual Chapter 8 Part 1 Section D6.5

5.2 The location of crossovers is detailed in the Scheme Work Order.

5.3 Requirements for the removal of crossovers is detailed in the Scheme Work Order.

6 Driver Information Signs

6.1 Driver Information Signs to the Traffic Signs Regulations and General Directions 2016 as detailed below shall be erected in accordance with Clause 117.

- Sign 7001.3 WORKFORCE IN ROAD SLOW to be erected before any member of the workforce crosses a live carriageway
- Sign 7002A shall read “MAJOR ROAD WORKS ON”.
- Sign 7003.1 shall read “WORK STARTS HERE dd mm FOR xx WEEKS”.
- Sign 7004 shall read “Replacing worn out road” or similar as detailed in the Scheme Work Order.
- Sign 7005 shall read “Delays possible until dd mm”.
- Sign 7006 to be located at the end of road works in each direction.
- Sign 7006.1 to be located approximately 50m after all end Datums on all Type A traffic management layouts and in appropriate locations on exit slip roads.

6.2 The dd (date), mm (month) and xx (number) are to be agreed with the Overseeing Organisation.

6.3 See Traffic Signs Manual Chapter 8, Volume 1, Table B for the sizes of these signs.

7 Temporary Speed Limit Cameras

7.1 Refer to Appendix 1/27

APPENDIX 1/18: TEMPORARY HIGHWAYS FOR TRAFFIC

1. Diversion Routes

Temporary highways are to be agreed with the Overseeing Organisation and any other affected organisations.

APPENDIX 1/19 - ROUTEING OF VEHICLES

1 Permitted Access Routes to and from the Site

- 1.1 The Contractor, sub-contractors and suppliers shall not use routes other than those on A and B roads without the prior consent of the Local Highway Authority. Routes shall avoid residential areas where possible.
- 1.2 Access and egress from the site shall only be from properly signed entrances/ exits in accordance with Chapter 8 of the Traffic Signs Manual 2006.

2 The Use of the Permanent Works by construction traffic

- 2.1 The Contractor shall ensure that construction plant and traffic does not over-run any areas of new footway following the laying of the surfacing course. Any areas damaged during subsequent construction operations shall be reinstated to the satisfaction of the Project Manager prior to completion of the works.
- 2.2 The Contractor shall ensure construction traffic does not deposit mud and other debris on the public highway and shall take all necessary measures to prevent this occurring at site entrances and exits.

APPENDIX 1/20: RECOVERY VEHICLES FOR BREAKDOWNS

1 Recovery vehicles to be provided

- 1.1 Recovery vehicles are required whenever specified in the Scheme Work Order.
- 1.2 Heavy recovery vehicles:
 - (i) 1 No. heavy recovery vehicles shall be provided in accordance with Clause 120.46.
- 1.3 Light Recovery Vehicle:
 - (i) 1 No. light recovery vehicle shall be provided in accordance with Clause 120.47.

2 Locations for Recovery Vehicles

- 2.1 The recovery vehicles shall be positioned on site for 24 hours a day 7 days a week whenever traffic management is in operation. In principle the recovery vehicles shall be located up stream of the works in each direction.
- 2.2 Recovery vehicles and operatives' private vehicles shall be stationed clear of the carriageway and/or hardstrip on a hard standing. No detritus shall be brought onto the carriageway by the recovery vehicles.
- 2.3 The Contractor shall be responsible for the provision, maintenance and removal of all necessary hardstandings and Recovery Station Cabin designated as the Vehicle Recovery Control Centre complete with toilet/washing facilities at each site.
- 2.4 Use of caravans will not be permitted at the recovery stations.
- 2.5 The Contractor shall also be responsible for the erection, maintenance and removal of all necessary traffic management at these locations.

3 Limits of Service

- 3.1 The vehicle recovery service is to be limited to those vehicles requiring assistance within the traffic management system. In most cases, that shall be between the "500m prior to the initial taper and the "end of works" sign on each carriageway, unless otherwise detailed in the Scheme Work Order. Any broken down or accident damaged vehicles on the operating carriageway of the trunk road or on the slip road diversion routes shall be removed immediately clear of the works or off the trunk road at an interchange.
- 3.2 No charge shall be made to the owner or driver of a vehicle so assisted for this service. All drivers so assisted shall be informed by means of a hand-out leaflet supplied by the Contractor that the tow is free to a point clear of the length of the trunk road on which special traffic management arrangements are in operation and that the recovery vehicle is not able to provide a tow to a garage for repairs as it has to remain stationed on the motorway or trunk road to deal with further incidents. Copies of the leaflet are to be supplied to the Overseeing Organisation for approval prior to the Commencement of the works.
- 3.3 Drivers shall also be informed that they should make their own arrangements for further assistance. A prominent notice shall be displayed at all times on each recovery vehicle provided with this Contract to this effect, clearly stating that the service is FREE and that the recovery vehicle cannot complete the tow to any further destination.
- 3.4 If for any reason, the recovery of a vehicle is likely to take an excessive amount of time the recovery operative shall inform the Traffic Safety Officer.
- 3.5 In the event of a stranded motorist failing to co-operate with the instructions of the recovery operative(s), the operative(s) should withdraw to their vehicle and contact the Traffic Safety Officer.

4 Locations for Vehicle Removal

- 4.1 Broken down, accident-damaged or abandoned vehicles shall be removed to a suitable location off the motorway, either at the next junction or another point as agreed with the Overseeing Organisation and the police. The location shall have provision for drivers to contact their own recovery or the Contractor shall provide such provision. Drivers are to be informed that they shall make their own arrangements for further assistance. Vulnerable motorists and their vehicle are to be dropped off at a suitable safe location with access to a telephone. Such locations are to be agreed with the Overseeing Organisation prior to Commencement of Works.
- 4.2 Disposal of abandoned or accident damaged vehicles where the owner cannot be contacted shall be arranged with the police and local authority. The Contractor is to provide the secure compound except for situations where the police advise alternative arrangements.

5 Communication System

- 5.1 The communication system shall be operational at all times that recovery vehicles are required.
- 5.2 A secondary 'back up' system shall also be provided for communications with the Police/Regional Control Centre.
- 5.3 Provision shall also be made for communication between the recovery vehicles and the recovery base station.

APPENDIX 1/21: INFORMATION BOARDS

The Contractor shall provide the Scheme information boards in accordance with Traffic Signs Manual Chapter 8 part 1, D4.15 and the Overseeing Organisation's requirements on visual identity.

APPENDIX 1/22: PROGRESS PHOTOGRAPHS

The Contractor shall provide Progress Photographs as detailed within the Work Order.

APPENDIX 1/23: RISKS TO HEALTH AND SAFETY FROM MATERIALS OR SUBSTANCES

(i) Restrictions in relation to working practices.

Work shall be curtailed where wind causes spreading of hazardous deposits.

Dust, Fumes and Smoke

The Contractor shall not cause excessive dust, fumes or smoke from the following operations:

- (i) Removal of Thermo-plastic white lines
- (ii) Milling bituminous surfacing
- (iii) Sweeping of pavements

The free floating dust shall be kept to a minimum and if required by the Overseeing Organisation shall be dampened with water sprays.

Plant shall be sited and screened where necessary to minimise dust emission to adjoining areas.

All stockpiles shall be covered to prevent the generation of dust.

The Contractor shall take all measures necessary to prevent spillage on to roads adjoining the site and in wet weather shall prevent mud from the site being carried on to the highway.

Other measures shall be as detailed in the Scheme Work Order.

(ii) Measures to be taken to protect members of the public.

Measures to be taken to protect members of the public shall include those scheduled below. Adequate warning signs shall be provided.

Substance	Hazard	Operation	Special Measures
Phenolic, alkyd and acrylated rubber paints	Harmful/flammable	Coating to steel	Erect signs, barriers and screens to protect from overspray. Restrict access until dry.
Bitumen joint sealing compounds		Sealing joints	Site pre heaters away from public. Restrict access during use and until set.
Cementitious mortars and grout	Irritant	Grouting, bedding concrete repair	Restrict access during application and until set
Concrete	Irritant	General construction	Restrict access during application and until set
Dust generated during cutting of concrete	Irritant	Cutting cement products	Restrict access during cutting.
Concrete curing agents	Flammable/harmful	Curing Concrete	Restrict access during use and until dry.
Silane	Harmful	Surface impregnation of concrete	Restrict access, erect screens to protect public

Dust generated during the cutting of hard woods	Harmful	Cutting/sanding	Restrict access during cutting/sanding operations
Epoxy based points	Flammable/harmful	Coatings to street lights	Erect signs, barriers and screens to protect from overspray. Restrict access until dry.
Galvanising Paints	Flammable/harmful	Coatings to parapets etc.	Restrict access during application
Asphaltic materials - Coated road stone	Harmful	Highway construction	Restrict access during laying and until set.
Thermoplastic	Harmful	Line marking	Site pre-heaters well away from public, restrict access during application and until dried.
Cement	Irritant	General Construction	Restrict access during mixing and application until dried
Bitumen	Harmful	Tack coat, Bridge Deck Waterproofing	Restrict access during application and until set.
Treated timber	Low	Fencing, environmental barriers	Restrict access if timber wet and when cutting or sanding
Dust generated during the cutting of soft woods	Low	Fencing, environmental barriers	Restrict access during cutting/sanding operations
Dust generated during the cutting of macadams and asphalts	Low	Cutting	Restrict access while cutting
Siliceous material	Low	Earthworks	Damp down, control operations and site traffic
Dust generated during milling/planing	Harmful	Milling/Planing	Restrict access during milling/planing operations
Flying debris	Harmful	Excavation, milling, hydrodemolition, etc.	Restrict access, erect screens
High Pressure Water	Harmful	Hydrodemolition	Restrict access, erect screens to work areas and hosing to protect public from jets. Emergency plan for equipment failures
Spray, waste water	Low	Hydrodemolition	Adequate screening, water seals on overhead gantries, etc. Emergency plan for seal failures etc.
Acrylic Based Membrane	Harmful	Sprayed Waterproofing	Restrict access, erect screens to protect public

In the case of sprayed bridge deck waterproofing systems and concrete surface impregnation effective barriers or screens are to be erected to prevent drift of material onto trafficked lanes or areas used by pedestrians. When adjacent traffic stops, such operations should cease until five minutes after traffic has started flowing again.

Additional measures to be taken to protect members of the public are scheduled in the Scheme Work Order.

(iii) Monitoring to be undertaken by Contractor.

The Contractor shall monitor fumes produced adjacent to public areas. All proprietary products shall be used strictly in accordance with the manufacturer's instructions.

APPENDIX 1/24: QUALITY MANAGEMENT SYSTEM

1 The Contractor shall institute and operate a quality management system complying with BS EN ISO 9001:2015 and Clause 104. The quality management system shall be described in a Quality Plan that shall be submitted to the Overseeing Organisation for acceptance.

The Quality Plan shall cover the following items:

- (i) (i) Contractor's organisation and management
- (ii) Contractors competency management system
- (iii) (ii) Contractor's method statements and construction procedures
- (iv) (iii) Contractor's construction quality control
- (iv) Supplier's Quality Plans (for each of the quality management schemes listed at Appendix A)

2 Quality Plans shall conform with the requirements tabulated in this Appendix, as follows:

CONTRACTOR'S ORGANISATION AND MANAGEMENT

This section of the Quality Plan shall include:

1. Definition of the Contract and its documentation.
2. The organisation of the Contract, including the line of command and communication between parties involved in the Contract.
3. Names, roles, responsibilities and authority of principals and key personnel.
4. Control of liaison and meetings with third parties.
5. Identification of the Contractor's own staff responsible for overseeing each major activity.
6. The main Contractor's control of sub-contracts.
7. Document control.
8. Programme for submission of method statements and Suppliers' Quality Plans.

The Quality Plan shall identify procedures (which may be a part of the Contractor's general procedures) that cover the topics listed below. Copies of these procedures shall be made available to the Overseeing Organisation on request.

9. The quality plans for sub-contractors and suppliers of work, goods and materials which are the subject of quality management schemes.
10. Procedure for the preparation, review and adjustment of programmes for the effective progression of the works and the recording of this.
11. Control and approval of purchases of materials.
12. Control of off-site activities (where appropriate).
13. Procedures for the regular review and recording by the Contractor of the quality of the works.
14. Control of personnel selection, based on their care, skill and experience.
15. Management review/audits to monitor and exercise adequate control over the implementation of the quality plan.
16. Any other relevant item.

CONTRACTOR'S METHOD STATEMENTS AND CONSTRUCTION PROCEDURES

This section of the Quality Plan shall include:

1. Detailed method statements for each major activity whether directly controlled or subcontracted.

The method statements shall identify hold points and invoke:

- works instructions
- quality control procedures
- compliance testing/inspection requirements
- and work acceptance procedures

for all activities that might affect the quality of the permanent and temporary works.

2. Identify the relevant construction procedures in the Contractor's own Quality Management System (and provide copies on request).

CONTRACTOR'S CONSTRUCTION QUALITY CONTROL

This section of the Quality Plan shall include:

1. Statement of the Contractor's organisation for quality control.

The quality plan shall identify procedures (which may be a part of the Contractor's general procedures) that cover the topics listed below. Copies of these procedures shall be made available to the Overseeing Organisation on request.

2. Arrangements for "receiving" and "in-process" testing.
3. Control of test laboratories.
4. Control of test, measuring and inspection equipment.
5. Document control.
6. Procedure for monitoring and recording the inspection, test and approval status of the constructed/installed work.
7. Procedures for tests and inspections for the purpose of the Contractor certifying that prior to covering up, each part of the Works are complete and conforms to the Contract.
8. Procedure for the review of work submitted for review but not accepted as conforming to the Contract.
9. Procedure for the collation of quality records as identified in BS EN ISO 9001:2015, and provision or copies when requested by the Overseeing Organisation.

SUPPLIERS' QUALITY PLANS

The Quality Plan shall include:

1. Definition of the product or service to be provided.
2. The organisation of the supplier describing the line of command and stating the name of the senior manager responsible for the contracted work and the name of the supplier's on-site management representative. Contact addresses, telephone numbers, etc., shall be provided.
- 3.* Identification of the relevant parts of the supplier's quality system relevant to the product or service being provided. (Copies to be provided to the Overseeing Organisation on request.)
4. The control of personnel selection (at works and on site), including special requirements for skilled personnel e.g. certification of welders, training of operatives, experience requirements etc.

Specific procedures for the following:

- 5.* Receipt and examination of certificates of conformity and test results for purchased products.
- 6.* Product identification and traceability.
- 7.* Handling, storage, packaging and delivery to Site and storage and handling on Site.
8. Quality records.

Items marked * Where available and appropriate, copies of the supplier's quality system/general procedures may be acceptable.

3 Items i) and iii) of the Quality Plan shall be submitted to the Overseeing Organisation for acceptance not later than 21 days after award of the Work Order.

The Contractor shall submit other parts of the Quality Plan prior to the commencement of any related work or activity and to a timetable included in item i).

APPENDIX 1/25: TEMPORARY CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM FOR THE MONITORING OF TRAFFIC

1. Requirements for Temporary Closed Circuit Television (CCTV) system:
 - 1.1. The Contractor shall supply, install, maintain, and subsequently remove the temporary closed circuit television (CCTV) system, as specified in Clause 125 (SHW), for the entire period that traffic management is required, to accommodate works where recovery vehicles are necessary and, in addition where narrow lanes are to be employed.
 - 1.2. 1no. CCTV camera unit shall be provided for each monitored lane.
 - 1.3. CCTV shall be operational for the hours of operation of the traffic management unless agreed otherwise with the Overseeing Organisation.
2. Camera(s) for the Temporary Closed Circuit Television System shall be located in accordance with manufacturer's specifications.
3. The monitoring station shall be equipped with a monitoring screen capable of being switched between all cameras and a recording/playback facility.
4. The CCTV System shall be installed and tested before the works to be monitored commence. It shall operate continuously throughout the duration of the works.
5. If the Contractor wishes to fix cameras to existing structures technical approval will be required from the maintaining authority. It shall be the Contractor's responsibility to secure any such approvals.

TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROAD WORKS (TASCAR) – PARTICULAR REQUIREMENTS

Temporary Automatic Speed Camera System (TASCAR)

Where required in contract specifics, a Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) shall be provided in accordance with those requirements in SHW, any relevant contract specific Appendices and take note of any update in requirements as appropriate through normal SES updating processes that occur.

The Contractor shall be responsible for the design, installation, commissioning, maintenance and removal of the Home Office Type Approval (HOTA) system installed in accordance with requirements. Early engagement with the Enforcement Authorities (EA) for the region is essential by those responsible and should include Regional Enforcement Coordinators (REC), this engagement shall take place prior to selecting a camera supplier. There is a CHE Memo that requires a process for the cameras on the selected sites.

APPENDIX 1/71: Security of the Site

General

1. The Contractor shall provide these security requirements when required under 174AR Temporary Accommodation, Equipment and Security.
2. The security measures adopted by the Contractor shall, as a minimum, consist of the following:
 - The Contractor shall appoint a Security Co-ordinator who shall make all arrangements necessary for site security. The Security Co-ordinator shall have one or more nominated deputies. The Contractor shall provide the Overseeing Organisation with the names of this co-ordinator and his nominated deputies and with telephone numbers or details of other means by which they or one of them can be contacted at any time. The Security Co-ordinator or his nominated deputy shall be on the Site at all times during working hours and shall be readily available to deal with matters related to site security.
 - Security fencing and gates shall be provided around the perimeter of the working areas. The precise location of the fencing and gates shall be agreed with the Overseeing Organisation on site. The security fencing shall as a minimum be 1.8 m high chainlink as detailed in the Highway Construction Details Drawing H11.
 - The Contractor shall ensure that steps, ladders or other plant that could be used to gain access to the works are not left accessible outside working hours.
 - Outside of working hours scaffolding and steelwork accessible from ground level shall have security fencing erected around its perimeter to prevent unauthorised access.
3. The provision of these security measures does not relieve the Contractor of his obligations under the Contract.
4. The Contractor will ensure that security personnel are provided outside of working hours, i.e. during evenings and weekends.
5. The Contractor shall provide security cover from commencement of the Works until completion of the Works unless otherwise agreed with the Overseeing Organisation.

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

1. Any buildings / Structures etc. requiring demolition will be identified within the Work Order.

APPENDIX 2/3: RETENTION OF MATERIALS ARISING FROM SITE CLEARANCE

1. Unless otherwise stated in the Work Order, all materials from site clearance to be disposed to an appropriate and licenced tip off site.

APPENDIX 2/4: EXPLOSIVES AND BLASTING

1. Explosives shall not be used.

APPENDIX 3/1: FENCING, GATES AND STILES

Details of fencing shown on Highway Construction Details drawings H1 to H48.

APPENDIX 4/1: ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)

1 Location:

1.1 Vehicle Restraint Systems

(i) The location, Containment Level, Impact Severity Level (ISL), Working Width Class (W), Vehicle Intrusion Class (VI), setback, maximum height that allows the required visibility, and the Length of Need requirements for safety barriers, removable barrier sections (gates) and transitions are shown in the Scheme Work Order.

(ii) The location, Containment Level, Impact Severity Level (ISL), and Working Width Class (W), Vehicle Intrusion Class (VI), setback, maximum height that allows the required visibility, and the Length of Need requirements for vehicle parapets are shown in the Scheme Work Order.

(iii) The location, Containment Level, Impact Severity Level (ISL), and Working Width Class (W), Vehicle Intrusion Class (VI), setback, maximum height that allows the required visibility, and the Length of Need requirements for vehicle/pedestrian parapets are shown in the Scheme Work Order.

(iv) The location, Performance Class, Impact Severity Level (ISL), Permanent Lateral Displacement Zone (PLDZ – D.x.y.) Characteristic, Exit Box Class (Z), setback, and maximum height that allows the required visibility requirements for terminals are shown in the Scheme Work Order.

(v) The location, Performance Level, Type of *Crash cushion (R or NR)*, Directional or bi-directional, Impact Severity Level (ISL), setback, Vehicle Redirection Zone Class (Z), Permanent Lateral Displacement Zone (PLDZ – D.x.y) Characteristic and maximum height that allows the required visibility requirements for crash cushions are shown in the Scheme Work Order.

1.2 Pedestrian Restraint Systems

(i) The location for pedestrian parapets and pedestrian guardrails are shown in the Work Order - see also Table C.1 of BS 7818.

1.3 Anti-glare Screens

(i) The location for anti-glare screens are shown in the Scheme Work Order and shall conform to Clause 412 and any requirements given in the Scheme Work Order.

1.4 Rigid Safety Barrier

The location, type and dimensions of rigid safety barrier are to be shown in the Scheme Work Order and shall be designed and installed in accordance with the manufacturer's installation manual, CD 377 (Requirements for Road Restraint Systems), CD 127 (Cross-sections and headroom), any other relevant section(s) of the Design Manual for Roads and Bridges, and any contract specific requirements.'

2 Testing

- 2.1 The Contractor shall supply details of proposed Vehicle Restraint Systems in accordance with Clauses 401, 402, and 403.
- 2.2 The Contractor shall provide testing equipment and carry out testing in accordance with Clauses 404, 406, 407, 409, and 410 and Appendix 1/5 as appropriate.

3 Temporary Safety Barriers

Temporary Safety Barriers shall be provided in accordance with Clause 401 and 405 at locations as defined in the Scheme Work Order.

APPENDIX 4/2: INFORMATION REQUIRED TO DEMONSTRATE COMPLIANCE OF ROAD RESTRAINT SYSTEMS TO BS EN 1317-1, BS EN 1317-2, BS EN 1317-3, DD ENV 1317-4:2002 AND BS EN 1317-5

Details of the vehicle restraint systems proposed by the Contractor shall be submitted to the Overseeing Organisation at least four weeks before the commencement of vehicle restraint system work for acceptance with the following supporting information. Where a Declaration of Performance is required to be submitted this is as required by the Construction Products Regulation (EU No. 305/2011) (CPR) and the relevant harmonised standard.

Safety Barriers (excluding vehicle parapets).

A Declaration of Performance demonstrating compliance with the contract requirements for the essential characteristics plus additional documentation to show compliance with the other requirements in the contract specific specification.

For Vehicle Parapets.

- a. A Declaration of Performance demonstrating compliance with the contract requirements for the essential characteristics plus additional documentation to show compliance with the other requirements in the contract specific specification.

The Contractor shall provide evidence that demonstrates that the declared performance was achieved in testing, in accordance with BS EN 1317 Parts 1 and 2 and that the test vehicle did not in any way touch or take advantage of structures which will not be present on the final bridge installation; that is, if the vehicle dropped down behind the bridge installation, it did not touch soil or other supporting devices, or any other feature.

For Crash Cushions

- a. Declaration of Performance demonstrating compliance with the contract requirements for the essential characteristics plus additional documentation to show compliance with the other requirements in the contract specific specification.

For the maintenance and repair of Legacy Safety Barriers, as described in sub-Clause 402.1

Documentation showing compliance with and operation of the Quality Management requirements of Clause 104 and associated quality management schemes listed in Appendix A. This shall include the quality plans required in sub-Clause 104.5 which shall make specific reference to the management of the vehicle restraint operations and all associated operations. The documentation shall identify quality management procedures for each vehicle restraint activity for each system included in the works.

For legacy systems documentation showing compliance with the Safety Barrier Systems Drawings such as those detailed in the Non Proprietary Safety Barrier Systems Rev 1 drawings or out with the National Highways network guidance should be sent from the appropriate Overseeing Organisation.

For Vehicle Parapets and Combined Vehicle / Pedestrian Parapets constructed as bespoke.

- a. Documentation showing compliance with BS 6779-2 as amended by this Series and CD 377 (DMRB 2.2.8).

For Combined Vehicle / Pedestrian Parapets

- a. Declaration of Performance demonstrating vehicle containment achieves compliance with the contract requirements for the essential characteristics plus additional documentation to show compliance with the other requirements in the contract specific specification.

Documentation showing compliance with BS EN 1317-5 and BS 6779-1 as amended by this Series 400 and CD 377 (DMRB 2.2.8) for pedestrian containment.

For the pedestrian containment aspects documentation as per the requirements of sub-Clause 401.4. Where such documentation has previously been submitted to the Overseeing Organisation and the system has been listed as described in sub-Clause 104.20 further submission of this documentation may not be necessary. Where the Contractor proposes to use such systems the Contractor shall confirm the relaxation of these documentation requirements with the Overseeing Organisation.

The Contractor shall provide evidence that demonstrates that the declared performance was achieved in testing, in accordance with BS EN 1317 Parts 1 and 2 and that the test vehicle did not in any way touch or take advantage of structures which will not be present on the final bridge installation; that is, if the vehicle dropped down behind the bridge installation, it did not touch soil or other supporting devices, or any other feature.

For Transitions between vehicle restraint systems

- a. Documentation showing compliance with and operation of the Quality Management requirements of Clause 104 and associated quality management schemes listed in Appendix A, as required in sub-Clause 401.3 paragraph (iv)(a).

Documentation demonstrating compliance with DD ENV 1317-4 and the contract performance requirements.

Documentation as per the requirements of sub-Clause 401.4. Where such documentation has previously been submitted to the Overseeing Organisation and the system has been listed as described in sub-Clause 104.20 further submission of this documentation may not be necessary. Where the Contractor proposes to use such systems the Contractor shall confirm the relaxation of these documentation requirements with the Overseeing Organisation.

For Terminals to vehicle restraint systems

- a. Documentation showing compliance with and operation of the Quality Management requirements of Clause 104 and associated quality management schemes listed in Appendix A, as required in sub-Clause 401.3 paragraph (iv)(a).

Documentation demonstrating compliance with DD ENV 1317-4 and the contract performance requirements.

Documentation as per the requirements of sub-Clause 401.4. Where such documentation has previously been submitted to the Overseeing Organisation and the system has been listed as described in sub-Clause 104.20 further submission of this documentation may not be necessary. Where the Contractor proposes to use such systems the Contractor shall confirm the relaxation of these documentation requirements with the Overseeing Organisation.

For motorcyclist protection systems

- a. Documentation to confirm compatibility with the associated VRS and to demonstrate compliance with other specification requirements.

Where specified in sub-Clause 401.3 the following information shall be provided to the Overseeing Organisation. Where required the Contractor shall complete the proforma included in contract specific Appendix 4/2.

Test report in accordance with either BS EN1317-2:2010, Annex A or BS EN 1317-3:2010, Annex A or DD ENV 1317-4:2002, clause 7.8.

Video/high speed film of test annotated showing date, test number and performance class.

Still photographs of complete installation including anchorage points.

Still photographs of vehicle before and after impact.

Full drawings of tested items.
Certification from the manufacturer that the item tested complies with the drawings supplied.
Certificate from a test house accredited in accordance with the requirements of sub-Clause 105.4.

Additional information, which will be required prior to installation.

1. Manufacturer's specification.
2. Installation drawings.
3. Manufacturer's installation instructions including foundation requirements and test methods to verify their performance.
4. Manufacturer's repair and maintenance manual.
5. Certificate of compliance with the Quality Management Scheme 1 for the Manufacture of Fencing Components. See Note 1.
6. Compliance with the Quality Management Sector Scheme 2 - Supply and Installation of Fences:
 - (i) Sector Scheme 2B/10 for Vehicle Restraint Systems. See Note 1.
7. Certificate of compliance for the Quality Management Sector Scheme 5 for the Manufacture and Installation of Bridge Parapets and Cradle Anchorages. See Note 2: (11/06)
 - (i) Sector Scheme 5A/10 for the Manufacture of Parapets for Road Restraint Systems; and (11/06)
 - (ii) Sector Scheme 5B/10 for the Installation of Parapets for Road Restraint Systems. (11/06)
8. Nominal loads (direct forces, moments and co-existent shears) to be transferred from the parapet to the structure or foundation. See Notes 1 & 2.

Notes:

1. Items 5 and 6 are required for safety barrier systems and transitions
2. Items 7 and, 8 are required for vehicle parapets. See also Note 1 under Sector Scheme B in Appendix A of the Specification for Highway Works. (11/06)

SUBMISSION FOR COMPLIANCE WITH BS EN 1317-1, BS EN 1317-2, BS EN 1317-3 and DD ENV 1317-4:2002 TYPE OF VEHICLE RESTRAINT SYSTEM: CONTAINMENT PERFORMANCE CLASS/PERFORMANCE LEVEL/PERFORMANCE CLASS (*): TEST REPORT NUMBER: (Test of) Test Type: (Primary/Complementary Test) (*): TEST NUMBER: TEST DATE: (*) delete as appropriate			
COMPANY NAME: CONTACT: ADDRESS: Tel: / Fax: / E-mail: PRODUCT NAME:			
Initial submission documents to be supplied for consideration of Initial Type Test (ITT).			
Item	Comment	Item Received (Y or N)	Date requested
1	Test report		
2	Video/high speed film		
3	Still photographs		
4	Still photographs		
5	Drawings		
6	Certification from the manufacturer		
7	Confirmation from test house		
Additional information, which will be required on acceptance of initial type test prior to installation.			
8	System specification		
9	Installation details		
10	Installation procedures		
11	Maintenance Manual		
12	Certificate of compliance		
13	Certificate of compliance		
14	Certificate of compliance		
15	Support loads		
Notes: 1. All documents, which are not in English, will have to be translated. If they are in a language other than French or German the promoter will be required to supply a full translation. 2. Items 12 and 13 are required for safety barrier systems and transitions. 3. Items 14 and 15 are required for vehicle parapets. See also Note 1 under Sector Scheme B in Appendix A of the Specification for Highway Works. (11/06)			
Signature:		Name:	
Date:			

SUBMISSION FOR COMPLIANCE WITH BS EN 1317-1, BS EN 1317-2 and DD ENV 1317-4:2002 TYPE OF VEHICLE RESTRAINT SYSTEM: Safety Barrier, Vehicle Parapet or Transition (*) CONTAINMENT PERFORMANCE CLASS/LEVEL(*) TEST REPORT NUMBER: (Test of) Test Type: (Primary/Complementary Test) (*) TEST NUMBER: TEST DATE: (*) delete as appropriate						
COMPANY NAME: CONTACT: ADDRESS: Tel: / Fax:/ E-mail: PRODUCT NAME:						
			Specified	Actual	Satisfactory (Yes or No)	Compliance
BS EN 1317-1, Table 1	Vehicle Details	Impact Conditions				
		Total vehicle mass (kg) (± ...)			
		Speed (kmh)	..... (0, +7%)			
		Angle (degrees)	..... (-1, + 1.5)			
		Centre of Gravity				
		Vertical height (m)	..... (± 10%)			
		Longitudinal (m)	..... (± 10%)			
		Lateral (m)	±			
	Model					N/A
BS EN 1317-2, clause 4.2	Vehicle Restraint System (VRS) Behaviour	1) The VRS shall contain and redirect the vehicle without breakage of principal longitudinal elements of the system. 2) No major part of the VRS shall become totally detached or present an undue hazard to other traffic, pedestrians or personnel in a work zone. 3) Elements of the VRS shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into the passenger compartment that can cause serious injuries are not permitted. 4) Ground anchorages and fixings shall perform according to the design of the VRS.				
BS EN 1317-2, clause 4.3	Vehicle Behaviour	1) The centre of gravity (CG) of the vehicle shall not cross the centreline of the deformed system. 2) The vehicle shall remain upright during and after impact, although moderate rolling, pitching and yawing are acceptable. 3) The vehicle shall leave the VRS after impact, so that the wheel track does not cross a line parallel to the initial traffic face of the VRS, at a distance A (2.2 m) plus vehicle width + 16% of the length of the vehicle within a distance B (10 m) from the final intersection (break) of wheel track with the initial traffic face of the VRS.				
BS EN 1317-2, clause 5.3.2	Installation	1) The length of the VRS shall be sufficient to demonstrate the full performance characteristics of the system. 2) If the VRS has to develop tension, end anchorages shall be provided in accordance with the VRS specification. Post foundation shall meet the design specification.				
BS EN 1317-2, clause 4.4	Severity Indices	SPECIFIED		ACTUAL		
		THIV Limit 33 km/h		THIV	..... km/h	
		PHD Limit 20 g		PHD	..... g	
		ASI Limit 1.4		ASI	.....
BS EN 1317-2, clause 5.7, Figure 3	Photo-graphic coverage	1) Photographic coverage shall be sufficient to clearly describe behaviour and vehicle motion during and after impact. 2) High speed cameras shall be operated at a minimum of 200 frames per second and stills. 3) As recommended in clause 5.7 and Figure 3.				
	Drawings	Drawings included				
					N/A = Not Applicable	
FULLY COMPLIES WITH STANDARD: BS EN 1317-1, BS EN 1317-2, DD ENV 1317-4:2002						
Signature:				Name:		
Date:						

SUBMISSION FOR COMPLIANCE WITH BS EN 1317-1 and BS EN 1317-3 TYPE OF VEHICLE RESTRAINT SYSTEM: Crash cushion (Redirective [R] or Non-redirective [NR](*)) TEST REPORT NUMBER: TEST TYPE: (Primary/Complementary Test) (*) PERFORMANCE LEVEL: VELOCITY CLASS: (Test of) TEST NUMBER: TEST DATE: (*) delete as appropriate						
COMPANY NAME: CONTACT: ADDRESS: Tel: / Fax: / E-mail: PRODUCT NAME:						
			Specified	Actual	Satisfactory (Yes or No)	Compliance
BS EN 1317-1	Vehicle Details	Impact Conditions				
		Total vehicle mass (kg) (± ...)			
		Speed (kmh)	..... (0, +7%)			
		Angle (degrees)	..... (-1, +1.5)			
		Centre of Gravity				
		Vertical height (m)	..... (± 10%)			
		Longitudinal (m)	..... (± 10%)			
		Lateral (m)	±			
		Model				N/A
BS EN 1317-3, clause 6.2	Crash Cushion Behaviour	1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into, the passenger compartment that could cause serious injuries are not permitted. 2) No major element of the crash cushion, having a solid mass greater than or equal to 2.0kg, shall become totally detached, unless this is required by the working of the crash cushion. No major element of the crash cushion shall impede the path of adjacent traffic. The final position of the detached element shall be considered to determine the displacement classification.				
BS EN 1317-3, clause 6.3	Vehicle Behaviour	1) The vehicle shall remain upright during and after the collision although yawing and moderate rolling and pitching are acceptable. The post-impact trajectory of the test vehicle shall be controlled by means of the exit box shown in Figure 2 and specified as detailed in Tables 11 and 12.				
BS EN 1317-3, clause 7.3.2	Installation	1) The installation of the crash cushion for the test shall comply with the structural design details and the on-road system details as given in the design specification.				
BS EN 1317-3, clause 5.4 and Table 4	Impact Severity Levels	SPECIFIED Level A: THIV ≤ 44km/h (Tests 1, 2 & 3) THIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.0 Level B: THIV ≤ 44km/h (Tests 1, 2 & 3) HIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.4 Levels A & B: PHD ≤ 20 g	ACTUAL			
BS EN 1317-3, clause 7.7, Figure 4	Photo-graphic coverage	1) High speed cameras and/or high speed video cameras shall be operated at minimum of 200 frames per second. 2) Stills 3) As recommended in clause 7.7 and Figure 4.				
	Drawings	Drawings included				
					N/A = Not Applicable	
FULLY COMPLIES WITH STANDARD: BS EN 1317-1 and BS EN 1317-3						
Signature:			Name:			
Date:						

SUBMISSION FOR COMPLIANCE WITH BS EN 1317-1 and DD ENV 1317-4:2002 TYPE OF VEHICLE RESTRAINT SYSTEM: Terminal PERFORMANCE CLASS: (Test of) Test Type: (Primary/Complementary Test) (*) TEST TYPE NUMBER: TEST NUMBER: TEST DATE: (*) delete as appropriate						
COMPANY NAME: CONTACT: ADDRESS: Tel: / Fax:/ E-mail: PRODUCT NAME:						
			Specified	Actual	Satisfactory (Yes or No)	Compliance
BS EN 1317-1, Table 1, DD ENV 1317-4: 2002, clauses 7.4 and 7.5	Vehicle Details	Impact Conditions Total vehicle mass (kg) (± ...) Speed (kmh) (0, +7%) Angle (degrees) (-1, + 1.5)				
		Centre of Gravity Vertical height (m) (± 10%) Longitudinal (m) (± 10%) Lateral (m) ±				
		Model				N/A
DD ENV 1317-4: 2002, clauses 5.4 and 5.5.2	Terminal Behaviour	1) Elements of the terminal shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into, the passenger compartment that could cause serious injuries are not permitted. 2) No major part of the terminal shall become totally detached and come to rest outside the permanent lateral displacement zones defined in clause 5.4. 3) Anchorages and fixings shall perform to the terminal design specifications and other specified requirements as listed in the test report.				
DD ENV 1317-4: 2002, clause 5.5.3	Vehicle Behaviour	1) The vehicle shall not overturn, although rolling, yawing and moderate pitching may be accepted. For the Performance Class P1 rolling onto a side may be accepted. (11/06) 2) The exit box values for the specified test are as defined in Figures 5.6 and 7 (as appropriate).				
DD ENV 1317-4: 2002, clause 7.3.2	Installation	1) The terminal shall conform to the structural design details and with the system installation details as given in the design specification of the manufacturer.				
DD ENV 1317-4: 2002, clause 5.5.4 and Table 5	Impact Severity Classes	SPECIFIED Level A: THIV ≤ 44km/h (Tests 1, 2 & 3) THIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.0 Level B: THIV ≤ 44km/h (Tests 1, 2 & 3) HIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.4 Levels A & B: PHD ≤ 20 g	ACTUAL			
DD ENV 1317-4: 2002, clause 7.7 and Figure 7	Photo-graphic coverage	1) Photographic coverage shall be sufficient to describe clearly terminal and vehicle motion during and after impact. 2) High speed cameras and/or high speed video cameras at a minimum of 200 framer per second. 3) Stills.				
	Drawings	Drawings included				
					N/A = Not Applicable	
FULLY COMPLIES WITH STANDARD: BS EN 1317-1 and DD ENV 1317-4:2002						
Signature:			Name:			
Date:						

APPENDIX 5/1: DRAINAGE REQUIREMENTS

- 1 Plastic Pipes:
 - (a) Ultimate pipe stiffness (STES) in excess of 1400 N/m² when tested in accordance with BS 4962.
 - (b) Resistance to impact complying with BS 4962 except that the striker used in the test shall have a mass of 1kg and a 25mm hemispherical radius.
- 2 Joints in surface water drains shall be watertight.
- 3 Existing land drains severed by the works are to be connected into the drainage system in accordance with Cl. 511.

4 Covers to Chambers and Gullies including replacement of covers, gratings.

5 Covers to chambers and gullies to be used on this Contract shall comply with BS EN 124 as follows:

Chambers

- 6 BS EN 124 Ref D400 comprising: Ductile heavy duty, double triangular, three point suspension, non-rocking cover suitable for trunk roads. Opening to be square. Minimum size 600x600 mm.
- 7 When situated in the carriageway or other paved surface, the Polished Skid Resistance Value is to be no less than the adjacent surfacing. PSRV for chamber covers shall comply with CS 228.
- 8 Where chamber cover levels are to be increased the maximum number of brick layers shall be three. Increases in excess of this shall be carried out in chamber rings.

Gullies

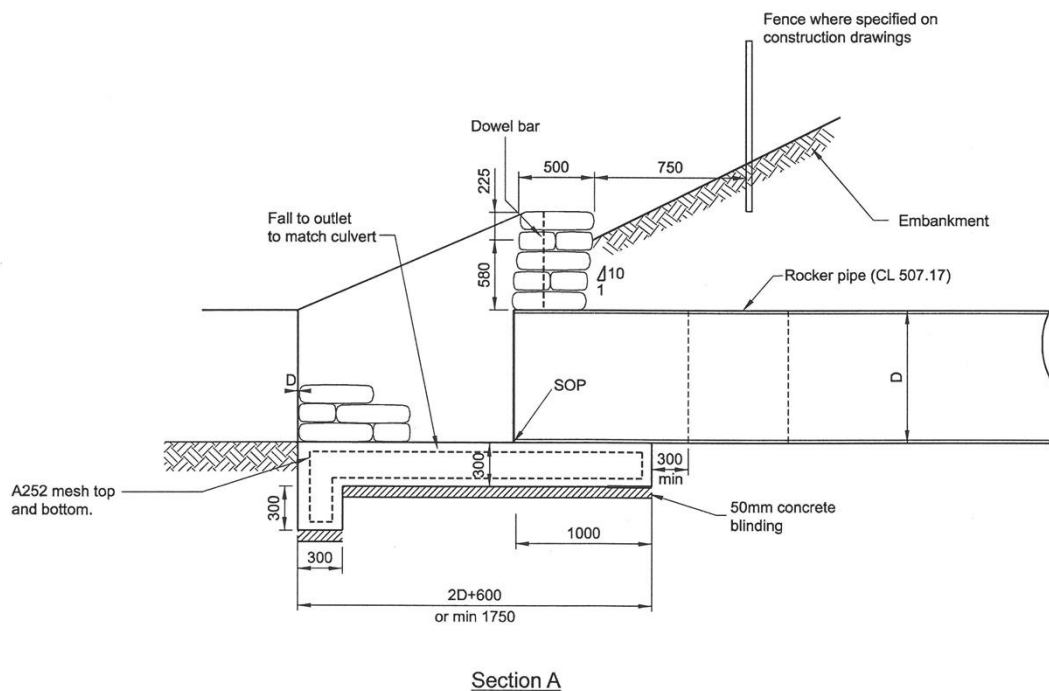
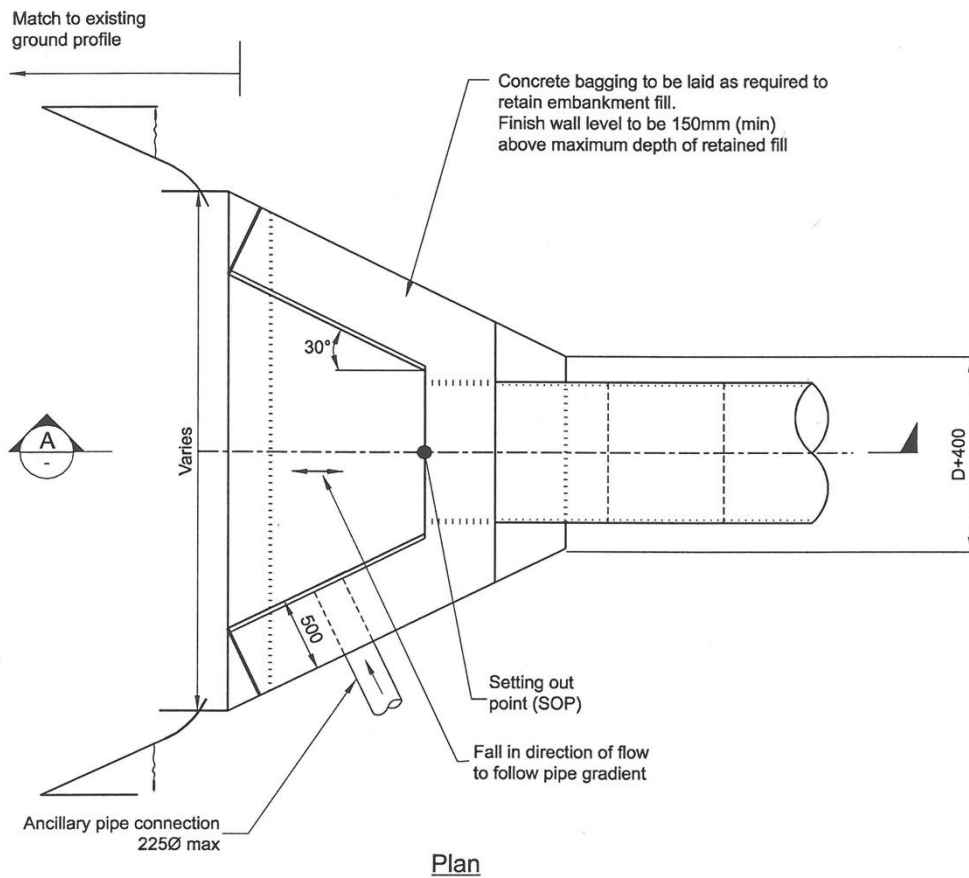
- 9 BS EN 124 Ref D400 suitable for trunk roads comprising: double triangular two piece (as two triangular segments), non-rocking gully grating with minimum waterway area 1230 cm². Minimum size of grating shall be 440 mm x 400 mm.
- 10 Where covers and gratings are being adjusted or replaced, they shall be bedded using a proprietary quick setting high strength mortar in accordance with clause 507.18

Cleaning of Existing Drainage Systems

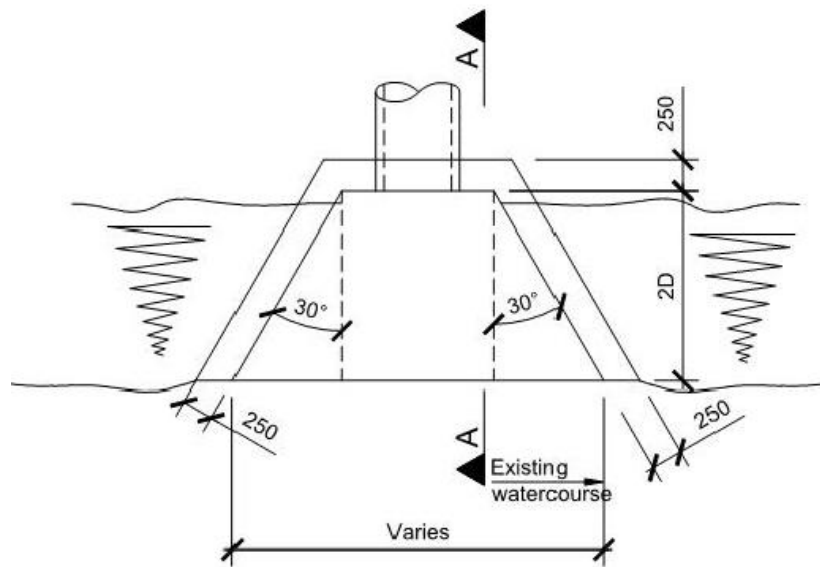
11. Existing drainage systems to be cleared are shown in the Scheme Work Order.
12. All new and existing carrier, foul and filter drains and linear drainage but excluding all fin and narrow filter drains shall be surveyed by Closed Circuit Television (CCTV) and records handed over to the Overseeing Organisation.
13. During the progress of the Works all existing chambers, gullies and rodding eyes shall be kept clean and free from obstruction. On completion of the whole of the Works, all new and existing chambers, gullies and drains including verge/surface water drains and filter drains excluding all fin and narrow file drains shall be flushed from end to

- end with water and left free from obstructions. Catchpit chambers shall be left clean and free from silt.
14. The Contractor shall comply with Clause 516 for any Combined Drainage and Kerb System which is installed. The Contractor shall perform a Load Test on the installation at a frequency of a minimum of 1 test and not less than 1 test per 1000m of each type and source. The Contractor shall supply certification of compliance to the Overseeing Organisation.
 15. The Contractor shall comply with Clause 517 for any Linear Drainage System which is installed. The Contractor shall perform a Load Test on the installation at a frequency of a minimum of 1 test and not less than 1 test per 1000m of each type and source. The Contractor shall supply certification of compliance to the Overseeing Organisation.
 16. The Contractor shall comply with Clause 518 for any Thermoplastic Structured Wall pipes and fittings used. The Contractor shall supply certification of compliance to the Overseeing Organisation.
 17. Connections between new and existing pipes shall use proprietary joints/sleeves. Saddled connections may be made for pipes no larger than 150mm diameter. Before connecting new drains into existing drainage runs trial pits should be dug to ascertain the exact level of the existing pipe.
 18. A functioning drainage system (permanent or temporary) shall be in place before any operational drainage features are removed or modified.
 19. Headwall construction details as provided in the figures below. Location details to be provided as part of the Scheme Work Order. For all pipelines terminating in headwalls, the nearest joint to any headwalls shall be not more than 500mm from the back face of the headwall and shall not be restricted by any concrete. Between this and the next joint, the length of the articulated pipe shall be agreed on site with the Overseeing Organisation.

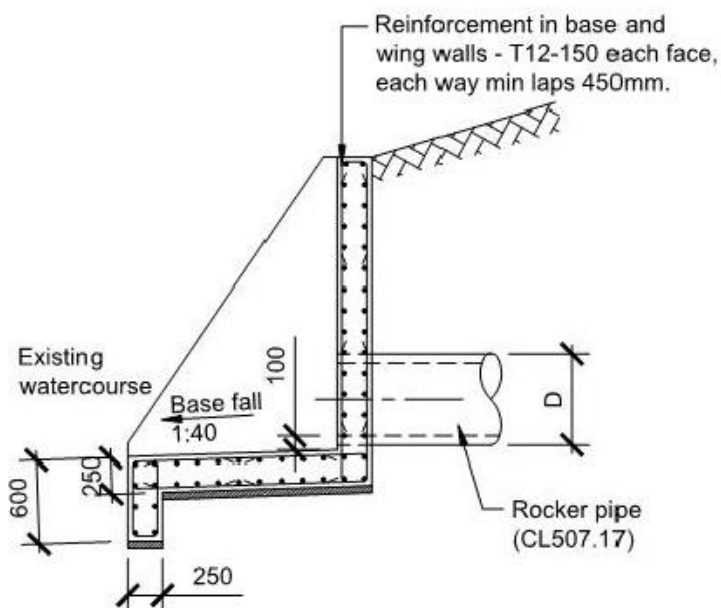
Headwall – Concrete Bagging
(Typical detail. Scheme specific details to be issued)



Headwall - Concrete



Plan

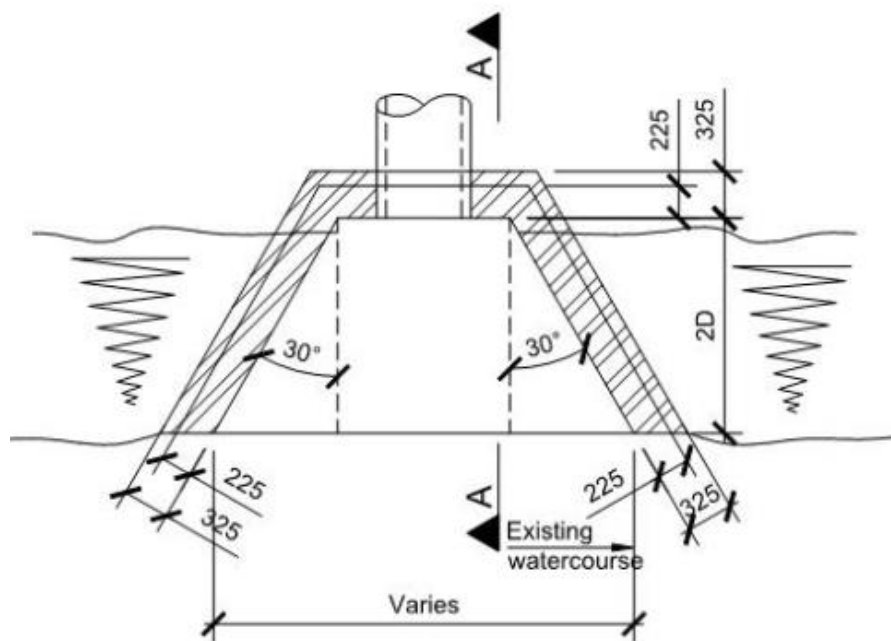


Section A-A

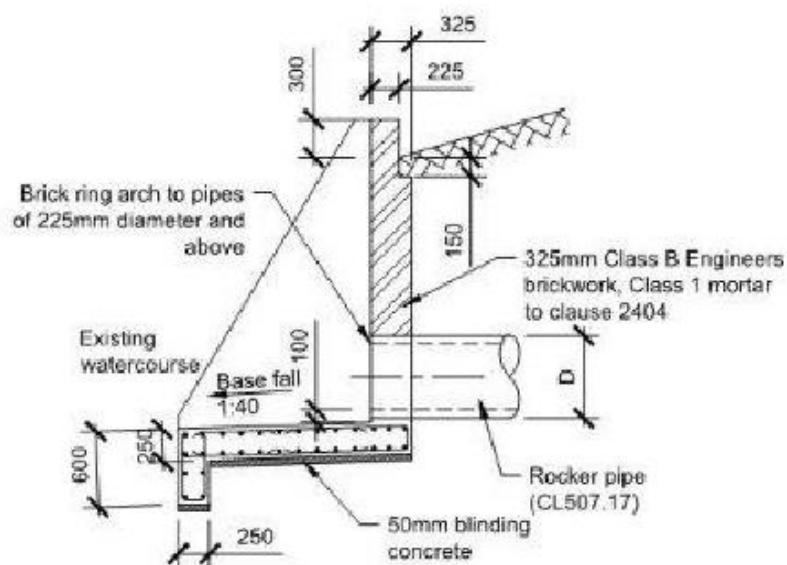
Notes:

- Mass concrete headwalls are to be the same thickness as shown for reinforced concrete headwalls unless instructed otherwise by the Overseeing Organisation

Brick Headwall

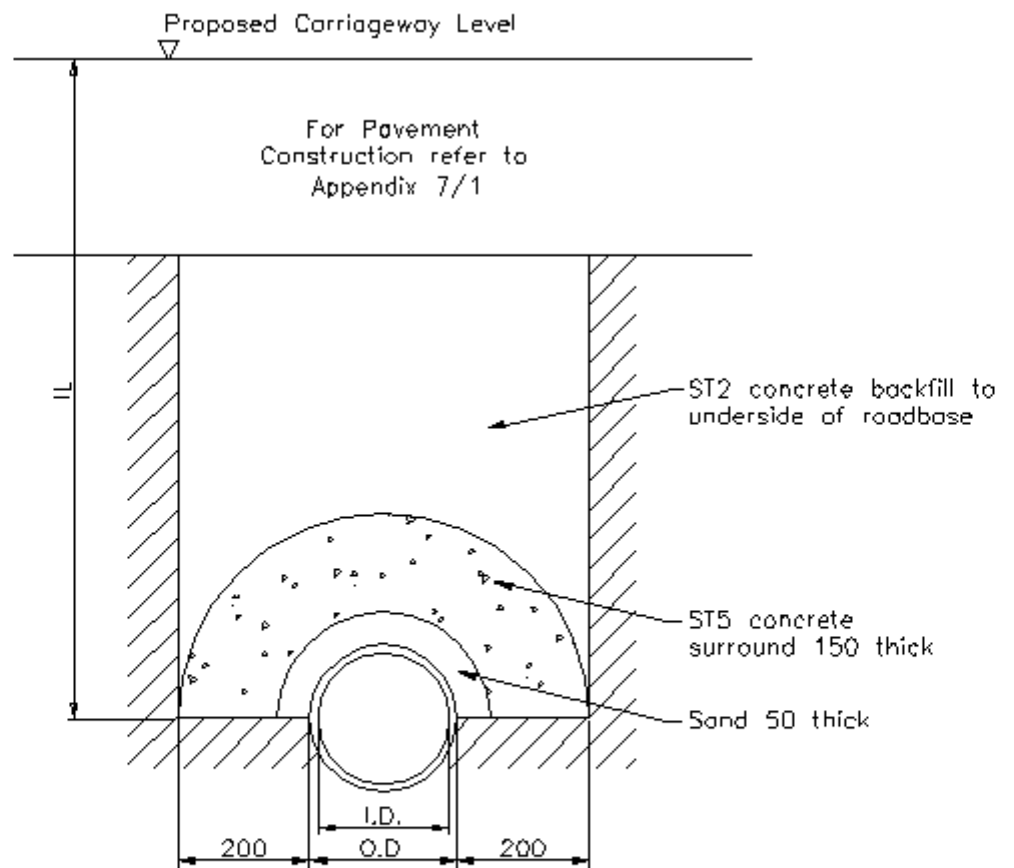


Plan



Section A-A

20. The detail for the concrete protection to existing drains, service ducts or service mains is given below.



Detail Of Concrete Protection to Existing Drains, Service Ducts or Service Main

SCHEDULE OF PIPE/BED COMBINATIONS - CARRIER DRAINS

Pipe Dia. (mm)	Pipe Group No.	Vitrified Clay					Precast Concrete			Unplasticised PVC		
		L	95	120	160	200	L	M	H	Nominal Diameter		
										(mm)	(in)	
150	5				A,S, B,F, N	A,S, B,F, N				S	160	6
150	11				Z	Z				Z	160	6
225	5				A,S, B,F, N	A,S, B,F, N	A,S, B	A,S,B ,F		S		9
225	11				Z	Z	Z	Z		Z		
300	5				A,S, B,F, N	A,S, B,F, N	A,S, B	A,S,B		S	315	12
300	11				Z	Z	Z	Z		Z		
450	5			A,S, B,F,N	A,S, B,F, N			A,S,B	A,S, B, F	S		
450	11			Z	Z			Z	Z	Z		
600	5	A	A,S, B					A,S,B	A, S, B, F	S		
600	9	Z	Z					Z	Z	Z		
700	5		A,S, B					A,S, B	A,S,B	S		
700	9		Z					Z	Z	Z		

Trench and bedding details shown on drawing HCD F1.

SCHEDULE OF PIPE/BED COMBINATIONS - FILTER DRAINS

Pipe Dia. (mm)	Pipe Group No.	Vitrified Clay			Precast Concrete				Unplasticised PVC		
		S	ES	SS	S/L	ES	M	H	Nominal Diameter		
									(mm)	(in)	
150	1	G,H,I, J,K,L, M	G,H,I, J,K,L, M	G,H,I, J,K,L, M	G,H,I, J,K,L, M			G,H,I, J,K,L, M	G,H,I,J, K,L,M	160	6
225	1	G,H,I, J,K,L, M	G,H,I, J,K,L, M	G,H,I, J,K,L, M	G,H,I, J,K,L, M			G,H,I, J,K,L, M	G,H,I,J, K,L,M		9
300	1	G,H,I, J,K,L, M	G,H,I, J,K,L, M	G,H,I, J,K,L, M	G,H,I, J,K,L, M			G,H,I, J,K,L, M	G,H,I,J, K,L,M	315	12

Trench and bedding details shown on drawing HCD F2.

Pipe schedule

Information to be provided as part of the Scheme Work Order

Chamber Schedule

Information to be provided as part of the Scheme Work Order

Gullies

Gullies are shown on HCD F13.

APPENDIX 5/2: SERVICE DUCT REQUIREMENTS

1. Details of duct construction are shown on drawing number HCD I1 and I2.
2. Cross carriageway ducts shall be provided in the locations shown in the Work Order.

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

1. Details of surface water channel and drainage channel block construction are shown on the HCD B and F Series.
2. The location and dimensions of surface water channels and drainage channel blocks are to be as shown in the Scheme Work Order.

APPENDIX 5/4: FIN DRAINS AND NARROW FILTER DRAINS

1. The Contractor is to determine the type of fin drain to be used. They will be either Type 5, 6 or 7 as detailed on HCD F18. Narrow filter drains shall be Type 8.
2. Locations of fin drains or narrow filter drains are to be installed in accordance with the relevant HCD or as specified in the Work Order.
3. The maximum permissible apparent pore opening size O_{90} of the geotextile is 0.15mm.
4. The permeability of the geotextile shall be scheme specific and as described in Appendix 5/4.
5. Where applicable, the D15 particle size for the Type 8 narrow filter drain shall be 0.1 mm.
6. The long term in-plane flow for the fin drain shall be $5 \text{ ls}^{-1}\text{m}^{-1}$.
7. The maximum pipe diameter shall be 100 mm.
8. The permeability of granular material in narrow filter drains shall be greater than $1 \times 10^{-4}\text{ms}^{-1}$.

APPENDIX 5/5: COMBINED DRAINAGE AND KERB SYSTEMS

Combined Drainage and Kerb Systems

- 1 The combined drainage and kerb system units shall have a minimum void cross-sectional area of 0.070 m² (equivalent to a 300 mm diameter pipe). Further information showing the locations of access points, silt traps and outfalls, as well as any additional hydraulic design parameters, for the combined drainage and kerb systems will be provided as part of the Scheme Work Order
- 2 Profile of system to match type HB or SP kerb.
- 3 System to permit lateral entry of surface water from the channel either continuously or at intervals not exceeding one metre.
- 4 The system shall be suitable for its intended purpose. The Contractor shall provide evidence of such suitability.
- 5 Units shall be in accordance with BS EN 1433 Class D, unless specifically identified otherwise in the Scheme Work Order. Class C units may only be installed in locations which are protected from direct traffic loading, e.g. in areas behind safety barriers. Units lower than Class C are not permitted. Type I units (BS EN 1433) of monolithic construction will not be used in locations exposed to severe or continuous impacts and loading. These locations and Site Specific Requirements will be identified as part of the Scheme Work Order.
- 6 Where units are being installed as replacements for existing units, the hydraulic capacity will not be less than that of the existing units.
- 7 The system shall have access units compliant with BS EN 1433 Load Classification D400. Access fittings are to be installed at maximum 50 m spacings, and at all terminals, sumps and outlets. The maximum spacing for shallow systems on bridges shall be 20 m centres.
- 8 Proprietary systems shall be installed in accordance with manufacturer's specification and recommendations.
- 9 Joints between units comprising the system, and between the channel and units, shall be watertight. Joints between bridge deck waterproofing and component parts passing through the waterproofing shall be watertight. Sealants shall be compatible with the waterproofing system.
- 10 The system shall be cleaned out by high pressure water jetting or other appropriate means on completion of the Works. The system shall be left clean and free from all obstructions.
- 11 Outfalls shall be trapped and be provided with an access cover.

APPENDIX 5/6: LINEAR DRAINAGE CHANNEL SYSTEMS

1. Details of Linear Drainage Channel Systems are detailed in the Work Order

APPENDIX 5/7: THERMOPLASTICS STRUCTURAL WALL PIPES AND FITTINGS

Information to be provided by the Contractor

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 518.15):

- 1 Technical drawings showing dimensions and tolerances including sealing rings and weight per metre, together with properties, as specified in sub-Clause 518.3 and 518.5.

Material specification, as required in sub-clause 518.2:

Table 1: Unplasticised polyvinyl-chloride (PVC-U)

Property	Test method reference	Specification
Tensile Properties	BS EN ISO 6259, BS EN ISO 527-1	
Vicat	BS EN 727	
Longitudinal reversion	BS EN 743	
K-value	BS EN 922:1995	
PVC content	BS EN 1905:1999	
Density	ISO 1183, ISO 4451	
Heat Reversion	ISO 12091:1995	
Effects of heating (injection moulded fittings only)	BS EN 763	

Table 2: Polyethylene (PE)

Property	Test method reference	Specification
Tensile Properties	BS EN , ISO 6529 BS EN ISO 527-1	
Oxygen induction time	EN 728	
Melt Flow Rate	BS EN ISO 1133	
Density	BS EN ISO 1183-3, ISO 4451	

Melt Flow Rate	ISO 4440	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN 763	

Table 3: Polypropylene (PP)

Property	Test method reference	Specification
Tensile Properties	BS EN ISO 6529 BS EN ISO-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133	
Density	BS EN ISO 1183-3, ISO 4451	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN 763	

APPENDIX 6/1: REQUIREMENTS FOR ACCEPTABILITY AND TESTING ETC. OF EARTHWORKS MATERIALS**Classification of existing materials**

- 1 All materials excavated on site shall be classified Class U1 unless stated otherwise below; acceptable limits are given in Table 6/1

Table 6/1: SHW Material Limits

SHW Material	Imported/Site Won	Use
Class 1A,1C,2A,2B,2C,	Imported	Backfill to be used in the construction of embankment disused drain runs and/or other excavations under the verge or other areas of the soft estate.
Class 5A,5B	Site Won/Imported	Topsoil
Class 6A,1A	Imported	Backfill to counterfort drain
Class 6C	Imported	Starter layer for gabion wall
Class 6I,6J,6F5,7C,7D	Imported	Backfill to strengthened embankment
Class 6N,6G	Imported	Backfill behind and within gabion wall

- 2 The following material shall be classified as hard material:
 - Existing bituminous pavement/footway layers
 - Existing masonry/dry stone walls
 - Existing kerbs and foundations
 - Rock requiring the use of breakers for excavation

Special Requirements for Determining Acceptability

- 3 The Contractor will carry out such tests as necessary to provide sufficient information to determine the classification and acceptability of materials at the point of deposition for imported materials or point of excavation for site won materials. The minimum testing requirements are given in Appendix 1/5. The Contractor will classify the material and advise the Project Manager of his results, and provide his testing data and laboratory data to confirm his classification within 3 working days or receipt of the test results.

APPENDIX 6/2: REQUIREMENTS FOR DEALING WITH CLASS U1B AND U2 UNACCEPTABLE MATERIAL

General

- 1 The standards that apply to the disposal of contaminated materials shall be those applicable at the time of disposal. The Contractor shall obtain all necessary consents from local or national authorities as legislation and regulation requires.
- 2 Unacceptable Class U2 material as defined in the Specification for Highway Works, Clause 601 shall be removed from the works unless otherwise agreed with the Overseeing Organisation and the relevant authority (e.g. Environment Agency, Local Authority etc.).
- 3 The Contractor is responsible for keeping records of the location, volumes, extent, nature and test results for all Class U2 materials. The Contractor shall keep the Overseeing Organisation informed of any Class U2 materials on a daily basis.
- 4 There are no existing pre-agreed requirements with the authorities for disposal of material from site. The Contractor shall liaise with the local Waste Control officer regarding possible locations for disposal of Class U2 material.
- 5 Requirements for Disposal of all Unacceptable and Unsuitable Materials arising from the Works:
 - (i) The Contractor shall be responsible for the disposal of any unacceptable material arising from the Site. Such arisings may only be disposed of in an authorised tipping facility which has a current Waste Management Licence as required by the current Environmental Protection Act requirements.
 - (ii) The Contractor shall ensure that full written details of all transfers of waste and Waste Transfer Notes are kept and copies shall be passed to the Overseeing Organisation.
 - (iii) Where the Contractor sub-contracts the disposal of material the above conditions shall apply to the sub-contractor. The Contractor shall be responsible for checking Waste Transfer Notes/Waste Management Licences and making copies available to the Overseeing Organisation.

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

General Information

- 1 Refer to Work Order for Excavation, Deposition and Compaction Details.

Excavation

- 2 The adequacy of the extent of excavation on site will be checked and confirmed by the Overseeing Organisation.
- 3 Blasting is not permitted as an alternative to normal excavation methods.
- 4 Faces of cuttings which are to receive topsoil shall have measures carried out in accordance with Clause 603.7 as appropriate.
- 5 Excavation in Rock
 - (i) Rock cuttings in the execution and completion of the works shall consist of any slope in rock material, whether excavated as part of the Contract, or pre-existing as a natural rock outcrop.
 - (ii) The finished rock cut profile shall be designed and engineered to exploit the natural fissures and character of the rock to create an irregular but stable profile of a textured and natural appearance. Where directed concrete buttresses shall be formed against excavated rock surfaces.
 - (iii) Excavation techniques adopted shall not compromise the stability of the rock slopes, or lead to increased risk to the road infrastructure or to the general public.
 - (iv) 'Rockhead' means the junction between sound rock and overlying material.
 - (v) 'Sound/ more competent Rock' refers to any lithological solid material of sedimentary, igneous or metamorphic origin with weathering grade less than or equal to moderately weathered (in accordance with the description contained within the Code of Practice for Ground Investigations, BS 5930:1999+A2:2010). The Contractor shall ensure that the material overlying the rockhead in the execution and completion of the Works shall be excavated to form a stable slope, in the short term.
 - (vi) The use of masonry infill to make the cutting face stable is permitted as detailed in Clause 603. Details of use are given on the Standard Earthwork Details Drawings.

Scaling of the Cut Face

- 6 The exact extent of slope stabilisation/remediation will need to be confirmed on-site by a suitably qualified engineering geologist/geotechnical engineer, once vegetation clearance works have been completed under the supervision of an ecologist.
- 7 On completion of cutting back/re-profiling the exposed rock face should be manually scaled from the break in slope to the toe, under the direction of the Overseeing Organisation. During the scaling operation, all loose/eroded material, scree and vegetation should be removed as follows;

The light scaling of the exposed rock face using hand tools from a Mechanical Elevating Works Platform (MEWP) and/or rope access as required; and the heavy scaling of the exposed rock face by long reach machine or compressed air, as required. The MEWP shall be utilised, to allow systematic coverage of the face, with works commencing at the slope crest and working down to the toe. The Contractor shall advise of his preferred methodology, for approval by the Overseeing Organisation, prior to the commencement of works.

Deposition

- 8 Embankment infilling will be constructed evenly over their full width and their fullest possible extent unless otherwise detailed on the Construction Drawings and the Contractor will control and direct constructional plant and other vehicular traffic uniformly over them. Damage by constructional plant and other vehicular traffic will be made good by the Contractor with material having the same characteristics and strength as the material had before it was damaged.
- 9 Benching shall be provided in the following situations:
 - (i) against the side slopes of the existing carriageway, normally 1(v):2(h), after topsoil has been removed.
 - (ii) on existing ground where the slope of the ground exceeds 1(v):5(h), after topsoil has been removed.
- 10 The maximum bench height shall be 1 m, and the orientation of the cross fall of the benching shall have a 1(v):10(h) fall in the downhill direction of the natural slope on which it is cut. The width of benches varies according to the slope and shall be determined on site.

Compaction

- 11 Compaction of backfill will be in accordance with Table 6/4 and Clause 612.

Counterfort Drains

- 12 Counterfort drains shall comprise lined trenches of maximum depth 3 m and minimum width 0,9 m backfilled with SHW Class 1A, 6A, 6I or 6F2.
- 13 A geotextile separator shall be used to line the counterfort drain in accordance with Appendix 6/5.

Additional Drainage Measures

- 14 Where shown on the drawings 150 mm diameter unperforated carrier pipes shall be incorporated into embankments as a conduit for drainage measures upslope.
- 15 Where shown on the drawings 150 mm diameter perforated pipes shall be incorporated into embankments.
- 16 All drainage pipes shall discharge into existing embankment toe drainage ditches via a headwall structure, including scour protection for unlined ditches.
- 17 Type A or B filter material shall be incorporated as required.

APPENDIX 6/5: GEOTEXTILES USED TO SEPARATE EARTHWORKS MATERIALS

- 1 Separator geotextiles should be placed in accordance with Clause 609 with a minimum overlap between adjacent sheets / strips of 300 mm.
- 2 The separator geotextile shall be of non-woven thermally bonded manufacture and meet the following minimum requirements.

Minimum Requirements for Separator Geotextile

Mechanical Properties				Hydraulic Properties			
Parameter	Test Method	Unit	Minimum Value	Parameter	Test Method	Unit	Minimum Value
Tensile Strength	BS EN ISO 10319: 2015	kN/m	8.0	Pore Size Mean AOS	BS EN ISO 12956: 2010	µm	75 (±20)
CBR Puncture Resistance	BS EN ISO 12236: 2006	N	1500	Permeability (H ₅₀)	BS EN ISO 11058: 2010	l/m ² /s	90
Cone Drop	BS EN ISO 13433: 2006	mm	38				

- 3 The contractor shall provide all relevant certification demonstrating compliance of the proposed geotextile to the Supervisor for approval prior to its placement.
- 4 Specification for Root Barrier Membrane (Appendix 2/3 para 6)

Properties	Unit Value	Test Data	Standard
CONSTRUCTION			
Raw material	Polymer ID		Polyethylene
MECHANICAL PROPERTIES			
Tensile Strength (machine direction)	N(FMAX)	191	EN ISO 10319
Puncture Resistance	N (FMAX)	150	EN ISO 12236
PHYSICAL PROPERTIES			
Grammage	Gsm	220	EN 965
Thickness	micron	345	D EN 964-1
HYDRAULIC PROPERTIES			
Water Vapour Permeation	g/m ² /24hrs		Water impermeable <1.0 (max

APPENDIX 6/7: SUB-FORMATION AND CAPPING AND PREPARATION AND SURFACE TREATMENT OF FORMATION

Preparation

- 1 Preparation and surface treatment of formation and sub-formation shall be carried out only after completion of sub-grade drainage and unless otherwise agreed by the Supervisor immediately prior to laying capping or sub-base.

Capping Material

- 2 The Contractor will be required to determine the suitability of the road formation on site to suit the on-site conditions. All arrangement shall be approved in advance by the Overseeing Organisation and the Contractor will provide all necessary calculations in support of his application.
- 3 If testing of formation on site in relation to CBR and other methods of testing, as detailed in the relevant Appendix, are found on site to be lower than expected then the Contractor will provide to the Overseeing Organisation proposals for a re-design of the relevant areas of road formation and sub-formation for his approval, this may include the requirement for a Capping and sub-base design as opposed to the illustrative sub-base only design, in which case the relevant clauses in the MCHW specification will be followed.

APPENDIX 6/8: TOPSOILING

- 1 Topsoil shall be stripped and stored in accordance with BS 4428 Section 2.5 and with LD 117 soil shall be spread in accordance with LD 117. Excavated topsoil should be kept separate from excavated sub-soil. Do not remove the topsoil from below the spread of trees.
- 2 Sufficient topsoil to reinstate the areas stripped shall be stored at a designated area adjacent to the site, wherever possible, with locations agreed with the Overseeing Organisation. Excess material shall be removed from site.
- 3 Should insufficient quantities and the quality of site derived topsoil not meet requirements, then topsoil Class 5B to BS 3882, General Purpose Grade shall be imported. The quality of site derived topsoil and any imported topsoil shall be reviewed with the Overseeing Organisation prior to placement.
- 4 The requirement of Clause 618.3 will apply.
- 5 The Contractor will prevent topsoil from being compacted, becoming adulterated with subsoil, rubbish, stone or hardcore, being contaminated with petrol, lime, cement or other injurious substances. He will remove from site any adulterated or contaminated topsoil and replace it with approved imported topsoil as necessary. Impacted top soil is not permitted for any other purpose.
- 6 The earthworks outline will be graded to smooth flowing contours to achieve tolerances specified for the finished level of topsoil, finished levels after settlement has occurred, are to be tied in with adjoining soil areas. All stone, wood and other hard material over 50 mm in any dimension will be removed.
- 7 Final topsoil grading, preparation and seeding operations shall be carried out in accordance with the requirements of the Specification for Highway works, Series 3000 Landscape and Ecology, as applicable.
- 8 Multiple handling of topsoil shall be minimised.

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

Earthwork Environmental Bunds

- 1 Not used

Landscape Areas

- 2 Not used

Strengthened Earthworks

Soil nails

British Standards

- 3 Materials and workmanship shall conform to the BS EN 14490:2010 Execution of special geotechnical works – Soil nailing.

Reinforcing Element

- 4 The soil nails shall be either solid steel bars complying with BS EN 10080, or hollow bars manufactured from steel tubing which has been cold rolled to EN 10219 (all parts), to form a standard ISO rope thread profile. The bar shall have nominal dimensions (OD & ID) as shown on the construction drawings provided in the Work Order, in compliance with the approved design.
- 5 The bar shall be galvanized to EN ISO 1461 over its full length.

Joints & Couplings

- 6 The corrosion protection of couplers shall be compatible with that of the reinforcing element.
- 7 Installation of the couplers will not involve any method which requires removal or damage to the nails. The couplers will exceed the ultimate strength of the nail by not less than 20 %. The couplers will enable direct end to end bearing between each rod.

Grout

- 8 Unless otherwise approved by Overseeing Organisation, grout for the nails shall comprise a neat cement grout consisting of a pumpable mixture of Portland cement and water and can achieve a cube strength of 40 N/mm² in 28 days. Cubes shall be made and tested in accordance with BS EN 12390-2. The water cement ratio shall not exceed 0.45 to reduce the loss of grout into the surrounding ground. The grout shall not be subject to bleeding in excess of 2 % after 3 hours. Admixtures that can control, bleed or retard setting of the grout shall be used only when approved in writing by the Overseeing Organisation. Their use shall be strictly according to the manufacturer's instructions.

Facing System

- 9 The double twist hexagonal woven steel wire mesh shall have the following

properties:

- (i) Mesh aperture – 80 mm
- (ii) Mesh Wire Diameter – 2.7 mm (BS EN 10218-2 & BS EN 10223-3)
- (iii) Corrosion protection – Zinc galvanised coated to EN 10244-2 Class A (245g/m²) with an extruded PVC wall thickness of 0.5 mm.

- 10 The top and bottom edges of the mesh will be held down using proprietary fixings.
- 11 The head plates shall be carbon steel conforming to BS 4449 or other equivalent European national Standard and be protected against corrosion according to the requirements of BS 5493. The minimum characteristic yield strength of the steel head plate is to be 550 N/mm² after 60 years, conforming to BS 4449 or other equivalent European National standard. They shall be hot dip galvanised according to BS EN ISO 1461 or other equivalent European National standard.
- 12 Head plates shall be installed following completion of the facing system and shall be pretensioned by tightening the permanent nut and wedge washers by applying a torque to achieve a nominal load of 10 kN.
- 13 Head plates and locking nuts shall be of the dimensions as shown on the Construction drawings.

Execution

- 14 A detailed Method Statement shall be submitted to the Overseeing Organisation at least 10 days prior to installing the first soil nails or carrying out associated earthworks. The Method Statement shall provide details of:
 - Method of nail installation
 - Method of forming the facing
 - Method of connecting the nails to the facing
 - Methods of performing field tests including grout and soil nail installation checks
 - Method of assessing damage to protective coating
 - Grouting procedures
 - Temporary support (if required)
 - The time after installation that the nails are considered to be fully operational
 - Form of the test records
- 15 Soil nails and other materials covered by this specification shall be supplied to site at such times as to not hinder or delay the execution of the works. Soil nails shall be delivered to site in an undamaged condition and shall not be damaged by site handling or storage.
- 16 Holes for soil nails shall be drilled to the depth, diameter, alignment and position shown on Construction Drawings. The hole positions shall be agreed with Supervisor on site. The maximum permitted deviation of the drill holes from the specified alignment shall be +2.5 degrees, unless otherwise approved by the Overseeing Organisation.
- 17 The Contractor will propose the drilling method. The method shall not promote mining and loosening of the soil at the perimeter of the drill hole or fracture soils with weak stratification planes by use of high pressures.

Grouting

- 18 Mixing equipment shall be used that produces a grout of homogeneous consistency and shall be capable of providing a continuous supply to the injection equipment. The injection equipment shall be capable of continuous operation at a constant delivery pressure. The injection equipment shall include a system for re-circulating the grout during pauses in the grouting operation.
- 19 Grouting of drilled holes shall be carried out using hydrostatic, gravitational or pressure grouting. Where groundwater is encountered in the hole the grout shall be tremmied. Where pressure grouting is used the grout shall be injected at a pressure sufficient to maintain circulation at all times, with a small amount of grout visible at the mouth of the boreholes. Grout shall be injected slowly and progressively until the hole is completely filled without separation and clean grout at the required consistency is seen to run from the top of the hole.

Records

- 20 The Contractor shall maintain Records of Construction in accordance with Clause 10 of BS EN 14490.

Sacrificial Testing

- 21 Sacrificial nails are to be tested at the locations and loads specified.
- 22 Each test nail shall be grouted in place as per the regular production grouting process. After grouting, the nail shall not be loaded until the minimum specified grout strength of 40 N/mm² has been achieved.
- 23 Soil nail testing shall be undertaken by incrementally loading and unloading the nail over a minimum of two cycles. During the first loading cycle the maximum load shall correspond to the design working load for the particular soil nail. The second load cycle shall achieve the maximum load.
- 24 The loading stage shall be achieved in a minimum of 5 load increments to the fully loaded state for that cycle. Each increment of load shall be no greater than 20 % of the maximum load to be applied. The unloading stage for both cycles shall be achieved in a minimum of three decrements to the fully unloaded state. During and after the application of each increment or decrement of load the nail movement shall be measured and recorded to the nearest 0.1 mm with respect to an independent fixed reference point. The load applied through the hydraulic equipment shall be monitored with a pressure gauge or other approved measuring device.

Production Testing

- 25 Production nails are to be tested to 1.5 times the required working load.
- 26 Soil nail testing shall be undertaken by incrementally loading and unloading the nail over a single cycle.
- 27 The loading stage shall be achieved in a minimum of 5 load increments to the fully loaded state for that cycle. Each increment of load shall be no greater than 20 percent of the maximum load to be applied. The unloading stage for both cycles

shall be achieved in a minimum of three decrements to the fully unloaded state. During and after the application of each increment or decrement of load the nail movement shall be measured and recorded to the nearest 0.1 mm with respect to an independent fixed reference point. The load applied through the hydraulic equipment shall be monitored with a pressure gauge or other approved measuring device.

Load/Displacement Monitoring

- 28 For each load increment, the displacement should be measured at the following increments until the displacement is less than 0.5mm between two consecutive readings:
- 1 minute, 2, 3, 4, 5, 6, 10, 15, 20 and 60 minutes
- 29 The following minimum load hold periods are required:
- For the maximum test load – 10 min
 - For intermediate test loads – 1 min

Pullout Test Acceptance Criteria

- 30 The performance of the nails shall be deemed acceptable if the creep rate at maximum proof load is less than 2 mm per log cycle of time.

Test Records

- 31 The Contractor shall keep daily records of the soil nails installed. Copies of these shall be submitted to the Overseeing Organisation within two days following the installation. The records shall show:
- Date of installation
 - Grid and area reference for each soil nail
 - Position, length and inclination of each soil nail
 - Hole diameter, bar type and size
 - Nature of ground encountered
 - Any groundwater encountered
 - Obstructions and delays or unforeseen ground conditions
 - Results and graphs of any tests carried out
 - Any readings from relevant instrumentation
 - Volume and mix of grout and cubes taken.
 - Torque force applied to the soil nail
 - Number and type of tests carried out
 - Readings from relevant instrumentation
- 32 The form of the test records shall be agreed with the Overseeing Organisation in the Contractor's Method Statement.

Reinforced Earthwork

- 33 The geogrid soil reinforcement shall have a current British Board of Agrément (BBA) certificate for Roads and Bridges or equivalent, demonstrating suitability for use in highways structures with a minimum 60 year design life.

Standards

- 34 The following standards and codes in their latest edition shall be particularly applied to work covered by this specification where applicable; together with any further standards or codes as described within the approved Specification for the approved reinforced soil wall system.

Steel Mesh Facing Units

- 35 BS4483:2005 -Steel fabric for the reinforcement of concrete
- 36 BS EN ISO 1461:2009 -Hot dip galvanized coatings on fabricated iron and steel articles

Geogrid Reinforcement

- 37 ISO 2602:1980 Statistical Interpretation of Test Results
- 38 BS EN ISO 9001:2015 Quality Systems – Model for Quality Assurance in production, design and development installation & servicing
- 39 BS 2782-4 Methods of Testing Plastics. Part 4: Chemical Properties
- 40 GRI GG2 -87 Geogrid Junction Strength
- 41 BS EN ISO 10321:2008: Geotextiles – Tensile Test for Joints-Seams by Wide-Width Method
- 42 BS EN ISO 10319:2015: Wide-Width Tensile Test
- 43 BS EN ISO 13431:1999 Geotextiles and geotextiles-related products. Determination of tensile creep and creep rupture behaviour

Soils

- 44 BS 1377:1990 Moisture Density Relationship for Soils, Standard Method
- 45 BS 1377:1990 Gradation of Soils
- 46 BS 1377:1990 Atterberg Limits of Soil
- 47 BS 1377:1990 Shear Box Test
- 48 BS 3882:2015 Specification for topsoil

Materials

- 49 The slope system, if required, will comprise a structural steel mesh facing units steel braces, approved face liner, uniaxially orientated high density polyethylene (HDPE) geogrids and a high efficiency mechanical connection between facing and primary geogrid.

Steel Mesh Facing

- 50 Steel mesh should be welded high tensile steel mesh type structural fabric, manufactured in accordance with BS 4483:2005
- 51 Where specified the steel mesh facing will be galvanised in accordance with BS EN ISO 1461: 2009 with a minimum mean coating of 85 µm.
- 52 Mesh shall be supplied to site cut and bent to the required dimensions and angle.

Geogrid Reinforcement

- 53 The primary reinforcing element shall be a geogrid manufactured in accordance with a Quality Management System which complies with the requirements of BS EN ISO 9001:2015.
- 54 The reinforcing element shall be a geogrid manufactured from High Density Polyethylene (HDPE) sheet, oriented in one direction so that the resulting ribs shall have a high degree of molecular orientation, which is continued through the integral transverse bar.
- 55 The long term creep rupture strength PC (Ultimate Limit State), for a design life of 120 years, shall be 20.71 kN/m and 21.10 kN/m for 60 years at a mean temperature of 10 °C. This shall be determined by application of standard extrapolation techniques to creep data obtained in accordance with BS EN ISO 13431:1999 and shall be a lower bound value. Values shall be based on a geogrid family lineage of a minimum 100,000 hour of continuous creep testing.
- 56 The minimum geogrid roll width shall be 1.3 m.
- 57 Any site joints in the reinforcement roll length shall be capable of carrying 100% of the geogrid Long Term Creep Rupture Strength. If required by the Overseeing Organisation, the Contractor shall provide evidence of this.
- 58 The geogrid 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, shall be non-biodegradable and shall have a minimum of 2% finely divided carbon black, as determined by BS 2782-4, Method 452B 1993, to inhibit attack by ultraviolet light.
- 59 In compliance with the approved design, the geogrid shall have an independent test certificate proving performance, resistance and durability etc for its required design life from a recognised independent test authority.
- 60
- 61 The product and / or its labelling shall be CE marked, together with the Certification Body Number and the FPC (factory production control) number. 'Accompanying Documentation' indicating the relevant testing 'declared values', should be available on request.

Face to geogrid connection

- 62 The connection between the steel mesh facing units and the geogrid shall be a continuous mechanical connection. The full width of geogrid is connected to the horizontal portion of the facing unit using a HDPE bodkin. Friction only connection

will not be allowed.

Face Liner

- 63 To establish a grass cover to the finished structure by dry seeding, the inside face of the steel mesh should be lined with a species rich lawn turf.
- 64 A black needle punched geotextile manufactured from 100% virgin polypropylene in compliance with the following specification shall be used to separate the turf from the topsoil layer. The liner shall be manufactured in accordance with a Quality Management System which complies with the requirements of BS EN ISO 9001.

Polymer	100% virgin black polypropylene
Thickness (mm) under 2 kPa according to BS EN ISO 14453:2000	3.50
Unit weight (gm-2)	400
Maximum Tensile Strength (kN/m) according to BS EN ISO 10319:2015	
MD	16
TD	32
Elongation at Maximum Tensile Strength(%) according to BS EN ISO 10319:2015	
MD	110
TD	75
Puncture Resistance (CBR) according to BS EN ISO 12236:2006	
Maximum Force (kN) (5)	3.5
Maximum Displacement (mm) (6)	67
Metal Detector test for broken needles	YES
Roll size (m)	2.1 x 50
Roll weight (kg)	44

Infill Soil

- 65 The imported granular fill soil material shall comply with the specification for 6l material. This preferred material should be well graded crushed and granular, not sub- rounded.
- 66 A 100 m thick layer of site won topsoil shall be placed immediately behind the face liner at lift heights compatible with the structural fill compaction. This is continued up to the level of the next layer of reinforcement in tandem with the structural fill material. The topsoil should be consolidated by hand tamping or 'heeling-in' and not over compacted.

Construction

Excavation

- 67 Contractor shall excavate to the lines and grades shown on the Construction Drawings. The Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted granular material.
- 68 Contractor shall ensure all surrounding structures are protected from the effects of

any excavation. Excavation support, if required, is the responsibility of the Contractor.

Foundation Preparation

- 69 Following the excavation, the foundation soil shall be examined by the Supervisor to assure actual foundation soil strength meets or exceeds the design bearing strength. Soils not meeting the required strength shall be removed and replaced with additional compacted granular material as directed by the Overseeing Organisation.
- 70 Foundation soil shall be proof rolled and compacted to 95% standard Proctor density and inspected by the Overseeing Organisation prior to placement of the steel facing units and reinforced fill.

APPENDIX 6/10 GROUND ANCHORAGES AND GABIONS

1 Ground anchorages

General

- 1 Permanent ground anchors are required as indicated by the Construction Drawings
- 2 Anchor installation lengths (including fixed and free), angles and working loads are all presented on the Construction Drawings.
- 3 Detailed proposals for the following shall be submitted to the Overseeing Organisation along with all manufacturer's literature on the proposed ground anchors prior to commencement of the anchoring activities.
 - (i) Type, tendon, diameter, grade of steel (including chemical composition), E value of steel, guaranteed ultimate tensile strength, make and source.
 - (ii) Free and fixed end anchorage details. (Note that all anchors shall be restressable).
 - (iii) Primary grouting, material, mix design, method of placing and mixing.
 - (iv) Secondary grouting, materials, mix design, method of placing and mixing.
 - (v) Corrosion protection of anchor, anchor head, materials (including long term performance). Double corrosion protection is required for all anchors.
 - (vi) Drill hole, diameter, length, method of drilling.
 - (vii) Method of testing integrity of drill hole i.e. grout/water test.
 - (viii) Storage and handling methods for all elements of anchor.
- 4 The stressing head and bearing plate shall be assembled to + 10 mm concentrically with the tendon and positioned not more than 2.5° from the tendon axis.
- 5 All materials, construction (including drilling and grouting), testing and reporting shall be in accordance with BS EN 1537 except where the requirements conflict with this Specification in which case the requirements of this Specification shall take precedence.

Materials

- 6 Nut sizes shall comply with BS 3410:1961.
- 7 Bearing plates shall be designed in accordance with BS EN 1993-1-1 + NA. They shall be of steel complying with grade S275 (BS EN 10025).
- 8 Spacers shall be provided in the fixed anchor length anchors at maximum spacing of 2 m. The spacers shall not be compressible or inhibit grout flow, and allow the effective penetration of grout to provide an adequate bond.
- 9 Bearing plates shall be bedded on an approved mortar. Before applying the mortar bedding, the surface area shall be cleared of all loose or deleterious material.
- 10 Bedding mortar thicknesses shall not exceed 10% of the plate width nor 15 mm in thickness. The design bearing stress shall not exceed 30% fcu (28 day strength) at the normal working force in the tendon.

- 11 Proprietary double corrosion protected ground anchors shall be fabricated in a factory to the specified pre-determined design lengths. Under no circumstances shall the pre-fabricated length of the anchors be modified on site.
- 12 Under no circumstances shall the anchors be welded, flame cut or otherwise affected by heat.

Drill holes and grouting
- 13 Only water shall be used as drilling fluids.
- 14 During drilling the Contractor shall maintain a driller's record, for each drill hole as per clause 1.5.
- 15 Adequate precautions shall be taken to maintain the cross section of all drill holes and to prevent the ingress of soil and water until anchor tendons are installed and grouting has been successfully completed. Drill holes lengths shall be over drilled if necessary by up to 1 m to accommodate any loose material that may fall into the hole during construction.
- 16 All temporary linings shall be removed in such a manner that no defect or damage will be sustained by anchorages and no damage is caused to adjacent structures.
- 17 Before grouting, drill holes shall be thoroughly flushed with water to remove any residual drilling matter before the anchor is inserted. The grout shall be introduced to the bottom of the hole to displace any water and to ensure that the tendon is completely encased with grout.
- 18 Following installation of the anchors any remaining unfilled length of drill hole shall be grouted up with a cement grout.
- 19 Grout shall not be placed in air temperatures below 2 °C, or grout temperatures below 5 °C.
- 20 The Contractor shall carry out regular grout bleed tests. The grout shall not be subject to bleeding in excess of 2% after 3 hours or 4% maximum, when measured at 18 °C in a covered cylinder approximately 100mm diameter with a height of grout of approximately 100 mm, and the water shall be reabsorbed by the grout during the 24 hours after mixing.
- 21 Admixtures may be used with the agreement of the Overseeing Organisation and shall be applied strictly in accordance with the manufacturer's instructions.
- 22 Viscosity shall be read daily using a viscometer, flow cone or flow meter.
- 23 The grout mix shall reach a minimum unconfined compressive strength of 40 N/mm² after 28-days from sample manufacture, cured and tested in accordance with BS EN 12390-3:2009.
- 24 The total sulphate content shall not exceed 4% (m/m) SO₃ of cement in the grout. The sulphate content, expressed as SO₃, shall be calculated from all sources as determined by the tests described in BS EN 13139:2002, BS EN 13055:2016, BS EN 450-1:2012 and BS EN 196-2:2013.
- 25 The total chloride content of the grout shall not exceed 0.1% of the cement.

Stressing

- 26 Ground anchors shall not be stressed to the prestress values indicated on the Drawings until the primary grouting agent has achieved a minimum strength of 40 N/mm² as proved by cube strength tests.
- 27 Tendon grips in the anchor head shall not reduce tendon strength by more than 8% in accordance with BS EN 13391:2004
- 28 The design of the hydraulic jack shall permit tendon elongation to be measured to an accuracy of +1 mm throughout the stressing of the anchorage..
- 29 When a load cell and pressure gauge are used together during stressing, the instruments shall be recalibrated if the difference between them exceeds 5% and cannot be eliminated by recentering or reseating the equipment.
- 30 Pressure gauges shall as a minimum comply with Class 2 of BS EN 837-1:1998 and shall be supplied with a calibration certificate. Pressure gauges shall be calibrated after every 100 stressing or after 30 days whichever is the sooner.

Stressing Procedure

- 31 No tendon shall be stressed beyond 80% of the characteristic strength (Ultimate Tensile Strength) or 95% of the characteristic 0.1% proof strength (Yield Strength) at any time.

2 Ground anchorages - Rock Dowels and Bolts

- 32 Rock dowels and bolts may be required to stabilise rock cut slopes, refer to the Drawings for details.
- 33 Location, length, orientation and working load of the rock dowels and bolts shall be provided on site by the Overseeing Organisation in order to locally stabilise the rock cutting.
- 34 Rock bolt and dowel tendons shall be manufactured to comply with BS 6744. The dowels and bolts shall be bonded to sound rock either by an approved two part polyester resin grout or grout to the same requirements detailed in Appendix 6/12 Drill holes and Grouting. Bearing plates shall be made of 15 mm thick stainless steel, Grade 304, BS EN 10088-2:2014 and should be capable of being installed obliquely to the rock bolt or dowels. Bearing plates shall be bedded on a thin layer of approved mortar so that the plate bears evenly on the rock. Prior to applying the mortar bedding the area of rock shall be cleared of all loose debris.
- 35 The nut shall be stainless steel and be either a locking nut or nut with locking washer. Rock dowels and bolts shall be tightened up until firmly secure against the bearing plate. Rock dowels and bolts may be tensioned either by torque wrenches or by hydraulic jacks, whichever method is adopted regular recalibration of the equipment shall be undertaken.
- 36 The following information shall be recorded.
 - (i) Bolt or dowel No., length, orientation
 - (ii) Location
 - (iii) Date drilled and installed

- 37 Up to 5% of all rock dowels and bolts shall be check loaded by a hydraulic jack taken up to 1.5 x working load and held for 1 minute.

2 Gabions

- 38 Gabions for cutting or embankment toe retention shall be galvanised mesh wire having a minimum diameter 3 mm and PVC coating of mean wall thickness 0.5 mm, or powder coated welded mesh gabions of minimum diameter 3mm. Mesh size shall be appropriate to the particle size of the infill stone. Joints shall be laced or C-clipped and straining wires provided at 2 intermediate levels per 1m height. Clips and lacing wires shall have a tensile strength and durability at least as high as that of the gabion mesh.

- 39 Gabions will be constructed by filling and placing by hand in a manner similar to that achieved by “Dry Stone Dyking”. Gabions shall be placed and installed in line with manufacturers recommendations, with careful infilling by hand to ensure a uniform rock face to a maximum incline of 6 degrees to the vertical. On submission of alternatives the Overseeing Organisation will provide amendments and additions where necessary to Table 6/1 and the Appendix.

- 40 Gabions, wire mesh and all lacing, edging, stiffening / bracing wires and components, shall achieve a design life of 120 years which has been certified in accordance with BBA; certificate to be provided.

- 41 The gabion wall is to be founded on mass concrete classification ST4 or compacted granular fill..

3 Rock fall netting

- 42 Rock fall netting should be installed across the whole cut face.

- 43 Wire mesh, all lacing, clips, stiffening wire and component pins, facing plates, connections and anchorage cables - in compliance with the approved rockfall netting design - shall achieve a design life of 60 years, which has been certified in accordance with BBA; certificate to be provided

APPENDIX 6/12 INSTRUMENTATION AND MONITORING

1. General

- 1 Locations are to be monitored during the construction works as directed by the Supervisor:
- 2 Instrumentation shall be installed at locations and to the details shown on the Monitoring Drawings, or as directed by the Overseeing Organisation.
- 3 All surveying and reading of instrumentation to monitor the Works shall be carried out by the Contractor in accordance with the requirements of this specification and following method statements to be developed by the Contractor as agreed with the Overseeing Organisation prior to the works.
- 4 The Contractor shall refer to the SOR for the range of values to be monitored by the instrumentation, and take this into account during selection of instrumentation, the installation details of the instrumentation and associated logging equipment and cabling.
- 5 All instruments shall be installed in a timely manner to ensure that sufficient time is allowed in order to demonstrate the adequate and correct installation and functioning of the instruments, and to ensure that adequate baseline readings are obtained and that any anomalies are resolved. In particular, the porewater pressure in a piezometer shall equalise with the existing surrounding groundwater pressures before construction can commence.
- 6 Instrumentation and boreholes for instrumentation shall be set out and installed to within 100mm of the locations shown on the Drawings. The elevation of the ground shall be recorded to the nearest 10mm.
- 7 All boreholes for instrumentation shall be within a permitted deviation of 1 in 75 from the vertical and shall finish within ± 100 mm of the required base elevation. The Overseeing Organisation may require verticality testing during the works.
- 8 The Contractor shall locate and set out the positions of the instrumentation on site and review and agree the positions with the Overseeing Organisation prior to any installation of equipment.

2 Piezometers

Standpipe Piezometers

- 9 Standpipe piezometers for monitoring groundwater levels shall be installed in boreholes as directed by the Overseeing Organisation.
- 10 The monitoring of these standpipe piezometers shall include measurement of water level above/ below ground level, and the conversion of these readings to water levels in elevation above Ordnance Datum (mAOD).
- 11 Standpipe piezometer details shall be in accordance with Section 9 of the 'UK Specification for Ground Investigation 2nd Edition: 2011' as published by Thomas Telford.

3 Vertical Inclinometers

- 12 Vertical inclinometers shall be installed as directed by the Overseeing Organisation.
- 13 The vertical inclinometers shall measure lateral ground movements. The inclinometer system shall comprise a probe, fitted with guide wheels and containing accelerometers, connected by a graduated cable to a digital readout unit. The accelerometers shall enable lateral deviation between the probe axis and the vertical plane to be recorded. Measurement of deviation and depth shall be used to compute the lateral position of the installed casing from true vertical.
- 14 The detail at the top of the inclinometer tube shall be such as to allow measurement of horizontal movement by survey equipment. The Contractor shall propose a methodology for this and a scope and frequency of horizontal movement shall be agreed with the Overseeing Organisation.
- 15 The instruments shall comply with the following minimum specifications:
- (i) Range: 30° of vertical
 - (ii) Resolution: ±0.1 mm
 - (iii) Accuracy: ±5 mm/30m (within 3° of vertical)
 - (iv) Temperature range: -10 °C to +50 °C
 - (v) Casing size: 50 to 90 mm
- 16 All other requirements to be as specified by the instrument manufacturers and as agreed with the Overseeing Organisation.

4 Frequency of Monitoring and Reporting

- 17 The monitoring of standpipe piezometers shall be carried out on a weekly basis, prior to excavation. Then daily basis during excavation and three weekly basis for 6 months after completion of the excavation, or as otherwise agreed with the Overseeing Organisation. All results shall be reported to the Overseeing Organisation on the same day as surveyed.
- 18 The monitoring of vertical inclinometers shall be carried out at a minimum frequency of once every two weeks prior to excavation, on a daily basis during the excavation and monthly after excavation for 6 months unless otherwise as agreed with the Overseeing Organisation. All results shall be reported to the Overseeing Organisation on the same day as surveyed.

5 Protection and Maintenance of Instruments

- 19 The Contractor shall take all necessary precautions to protect the instruments and maintain the instruments in good working order after installation and commissioning. For all instruments which project through and above ground level, special precautions shall be taken to provide protection from vehicles and plant, including substantial and readily visible barriers at a distance of 750 mm around each instrument, or as otherwise shown on the Earthworks Drawings. Heavy compaction equipment shall not approach within 1.5 m of projecting instruments, or as otherwise required to avoid damage as agreed with the Overseeing Organisation. Damaged instruments shall be replaced or repaired by the Contractor immediately.

6 Labelling and Marking of Instruments

- 20 All instruments shall be labelled with their reference number at the location where the readings or measurements are taken. The labelling shall be permanent, using methods or materials to be agreed with the Overseeing Organisation.

7 Boreholes for Instruments

- 21 Boreholes for instrumentation shall be drilled/bored to generate stable holes of the required diameter to the required base elevation to suit the instrumentation to be installed. Boreholes shall be cased to their full depth unless strata are sufficiently competent for the borehole to stay open.
- 22 The proposed method of forming the instrumentation borehole shall be submitted by the Contractor for approval by the Overseeing Organisation. The casing diameter shall be selected to suit individual instrument types and requirements. The initial casing diameter shall be sufficiently large to ensure that the borehole can be completed to its required base diameter, scheduled depth and elevation.
- 23 Detailed written borehole logs shall be kept for all instrumentation boreholes. As a minimum the borehole log shall record:
- (i) Borehole unique number.
 - (ii) *Overseeing Organisation* name.
 - (iii) Site name.
 - (iv) Contractor's name.
 - (v) Driller's details.
 - (vi) Co-ordinates of borehole.
 - (vii) Ground elevation.
 - (viii) Date and time started, date and time finished.
 - (ix) Type of equipment and technique used to form borehole.
 - (x) Borehole diameter/s.
 - (xi) Casing depths, elevations and details.
 - (xii) Final depth and elevation of the base of the borehole.
 - (xiii) Records of groundwater.
 - (xiv) Type of drilling fluid.
 - (xv) Geotechnical description of soils encountered (in accordance with BS 5930:2015 with depth to, and elevation of, each stratum).
 - (xvi) Instrumentation type and reference numbers.
 - (xvii) Details of backfilling.

APPENDIX 6/15: LIMITING VALUES FOR HARM TO HUMAN HEALTH AND THE ENVIRONMENT**1 General**

- 1 Chemical acceptance criteria will determine whether a material is acceptable for use within the scheme from any on- or off-site source or if it is to be classed as U1B (unacceptable but non-hazardous) or U2 (unacceptable and hazardous). Class U1B may be rendered acceptable for use in the permanent works by treatment, or alternatively (as for Class U2) disposed off site as appropriate.

Potential Sources of Contamination within Earthwork Materials**1 Assessment Criteria**

- 2 Imported materials shall be tested at a frequency of 1 in every 2500 m³ and the results shall be compared to values stated in Appendix 6/15. If the material falls outside the acceptance criteria then it shall be classified as U1B and shall be dealt with in accordance with Appendix 6/2.
- 3 The reused Made Ground materials, used as surface cover i.e. topsoil and subsoil materials, placed within top 0.5 m of final development level shall comply with acceptance criteria set out in Table 6/15A. These materials shall also comply with minimum requirements for topsoil and subsoil in relation to phytotoxicity and suitability as a growing medium.
- 4 Materials exhibiting visual or olfactory evidence of contamination can be reused within the scheme subject to meeting acceptance criteria set out in Table 6/15A or 6/15B.
- 5 Materials containing asbestos containing materials shall not be reused within the scheme
- 6 All other site won materials do not require testing.

Table 6/15A Class 1UB classification limits in relation to human health (top 0.5m from the final development level)

Determinand	Unit	Acceptance Criteria
Arsenic	mg/kg	32
Cadmium	mg/kg	10
Chromium (III)	mg/kg	3,000
Chromium (VI)	mg/kg	4.3
Copper	mg/kg	2,330
Lead	mg/kg	370
Mercury (elemental)	mg/kg	1
Mercury (inorganic)	mg/kg	170
Mercury (methyl)	mg/kg	11
Nickel (MS)	mg/kg	130
Zinc (MS)	mg/kg	3,750
Cyanides	mg/kg	5.5
Asbestos	[-]	no fibres present

Determinand	Unit	Acceptance Criteria
PAH		
Naphthalene	mg/kg	1.5
Acenaphthylene	mg/kg	170
Acenaphthene	mg/kg	210
Fluorene	mg/kg	160
Phenanthrene	mg/kg	92
Anthracene	mg/kg	2,300
Fluoranthene	mg/kg	260
Pyrene	mg/kg	560
Benzo[a]anthracene	mg/kg	3.1
Chrysene	mg/kg	6
Benzo[b]fluoranthene	mg/kg	5.6
Benzo[k]fluoranthene	mg/kg	8.5
Benzo[a]pyrene	mg/kg	0.83
Indeno[1,2,3-cd]pyrene	mg/kg	3.2
Dibenzo[a,h]anthracene	mg/kg	0.76
Benzo[g,h,i]perylene	mg/kg	44
TPH		
Total Petroleum	mg/kg	5000
Aliphatics >C5 - C6	mg/kg	30
Aliphatics >C6 - C8	mg/kg	73
Aliphatics >C8 - C10	mg/kg	19
Aliphatics >C10 - C12	mg/kg	93
Aliphatics >C12 - C16	mg/kg	740
Aromatics >C5 - C7	mg/kg	65
Aromatics >C7 - C8	mg/kg	120
Aromatics >C8 - C10	mg/kg	27
Aromatics >C10 - C12	mg/kg	69
Aromatics >C12 - C16	mg/kg	140
Aromatics >C16 - C21	mg/kg	250
Aromatics >C21 - C35	mg/kg	890

- 7 The acceptance criterion for total petroleum hydrocarbons has been set at 5000 mg/kg with the speciation of target values for the more sensitive hydrocarbon fractions, as detailed in Table 6/15A.
- 8 All earthworks materials (site won and imported) placed below 0.5 m below the final ground level shall meet the acceptance criteria set out in Table 6/15B.

Table 6/15B Class 1UB classification limits in relation to human health (below 0.5m of the final development level)

Determinand	Unit	Acceptance Criteria
Arsenic	mg/kg	640
Cadmium	mg/kg	230
Chromium (III)	mg/kg	30,400
Chromium (VI)	mg/kg	35
Copper	mg/kg	2,330
Lead	mg/kg	370
Mercury (elemental)	mg/kg	26
Mercury (inorganic)	mg/kg	3,600
Mercury (methyl)	mg/kg	1,800
Nickel	mg/kg	130
Zinc	mg/kg	3,750
Asbestos	[-]	No asbestos containing materials present
Naphthalene	mg/kg	200
Benzo[a]pyrene	mg/kg	14
Total Petroleum	mg/kg	5,000

APPENDIX 7/1: PERMITTED PAVEMENT OPTIONS**1 Permitted Pavement Options – Schedule 1**

Schedule 1: Permitted Pavement Options			
Drawing Ref:	Area	General Requirements	Permitted Pavement Option
Refer to Scheme Work Order			

2 General Requirements – Schedule 2

Schedule 2A: General Requirements		
Grid for checking surface levels of pavement courses	Longitudinal Dimension	10.0m
	Transverse Dimension	2.0m
Surface Regularity	Category of Road:	A
Interval for measurement of longitudinal regularity		As Table 7/2
Interval for measurement of transverse regularity		Each wheel track
Surface texture is required. Measurement of surface texture shall be in accordance with clause 921 as revised by IAN 154/12.		

3 Permitted Construction Materials – Schedule 3

Schedule 3: Permitted Construction Materials		
Pavement Layer	Material Ref (s)	Thickness (mm)
Surface Treatment	HFS1	

4 General Requirements for Construction Materials – Schedule 4

Schedule 4: General Requirements for Construction Materials	
Clause	Requirement

5 Requirements for Construction Materials – Schedule 5

Schedule 5: Requirements for Construction Materials			
Material Ref.	Clause	Description	Requirement
HFS1	924	High Friction Surfaces	Type Classification: Type 1 Minimum declared PSV category in accordance with BS EN 13043, clause 4.2.3 = PSV68 Maximum AAV in accordance with BS EN 13043, clause 4.2.4.= AAV10 Colour: Varies

			<p>Where thin wearing course is to be covered by high friction surfacing (HFS), the contractor shall reduce the texture of the area of the thin wearing course system to between 1 and 2 mm as measured by the sand patch test. This may be achieved by any suitable means, as detailed in CD 236. Where the surfacing is to be trafficked prior to the application of HFS, 3mm grit shall be applied and rolled in to provide enhanced short-term skid resistance, as detailed in CD 236.</p> <p>If the wearing course is opened to traffic before High Friction Surfacing is laid, the Contractor shall erect temporary road signs as approved by the Overseeing Organisation.</p>
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6 Thin Surface Course Systems: Information to be provided by the Contractor

The Contractor shall provide the following information with his tender:

- (i) The declaration of performance for the thin surface course system.
- (ii) The declaration of performance for the aggregate(s) used in the thin surface course system.
- (iii) The Installation Method Statement as required in sub-Clause 942.13.
- (iv) SIPT documentation as required in sub-Clause 942.29.
- (v) If regulating material is to be used, evidence of its deformation resistance either independently or in combination with the Thin Surface Course System

7 Modified Binder and Mixture Data Requirements

The following data shall be provided to the Overseeing Organisation for modified binders as required in sub-Clauses 937.4 and 943.4. The data should not be more than 12 months old. A table in which the binder data may be recorded is given at the end of this section.

For work carried out for the National Highways, a copy of the results should be handed to the Overseeing Organisation, to be forwarded to: Pavement Engineering Team at National Highways, Woodlands, Manton Lane, Manton Industrial Estate, Bedford, MK41 7LW.

I. Binder Samples

Bituminous binders shall be sampled according to BS EN 58. For modifiers blended with the other component materials of the mixture at the mixer a simulated binder shall be prepared. Such modifiers are generally less intimately mixed with the bitumen and less well dispersed throughout the mixture than when pre-blended. Evidence that the simulated binder offers the same performance as the binder produced when the modifier is added at the mixer shall be provided.

II. Penetration

Binder penetration at 25 °C (BS EN 1426), 100 g 5 seconds for the binders as supplied, after hardening in the Rolling Thin Film Oven Test (RTFOT) in accordance with BS EN 12607-1, and after RTFOT and Ageing in the Pressure Ageing Vessel at 85 C (PAV85) in accordance with BS EN 14769.

III. Product Identification Test and Rheological Properties

Results for the binder(s) proposed shall comprise rheological data for each binder in the form of complex shear (stiffness) modulus (G^*) and phase angle (δ delta) determined in accordance with BS EN 14770 for binder as supplied, after RTFOT and after RTFOT BS EN 12607-1 and PAV85 Ageing in accordance with BS EN 14769.

IV. Storage Stability Test

All binders shall be stored strictly in accordance with the manufacturer's instructions. Polymer modified binders claimed to remain homogeneous in storage without agitation shall be tested for storage stability in accordance with BS EN 13399. The mean of the differences in softening point between the top and bottom samples, of not less than five pairs of such samples shall not exceed

5 °C. Manufacturers of pre- blended modified binders shall state what precautions are necessary to ensure that adequate homogeneity is maintained during storage.

V. Photomicrograph

A typical photomicrograph of the modified binder and binder using ultra-violet or other technique to provide maximum contrast of the polymer structure to the binder before modification shall be supplied together with details of sample preparation techniques. A photomicrograph is intended only to indicate the presence of a polymer modifier in the binder and should not be used as an indicator of performance. Guidance on the interpretation of photomicrographs is given in BS EN 13632 Visualisation of polymer dispersion in polymer modified bitumen.

VI. Cohesion

Vialit Pendulum cohesion test curve of the binder, in accordance with BS EN 13588 for the binder as supplied, after RTFOT BS EN 12607-1, and after RTFOT and PAV85 Ageing in accordance with BS EN 14769.

VII. FRAASS Brittle Point

FRAASS brittle point measured using BS EN 12593 shall be provided on the binder as supplied, after RTFOT and after RTFOT and PAV85 Ageing in accordance with BS EN 14769.

Summary of binder data

Manufacturer of Binder:	Product name		
Binder type:		Batch ref:	
Binder source:			
Softening point difference in storage stability test			
Test	Supplied binder	After RTFOT	After Ageing
Penetration at 25 °C 0,1 mm (100g and 5 secs)			
Penetration at 5 °C 0,1 mm (200g and 60 secs)			
Vialit pendulum cohesion see Clause 939 maximum peak value J/cm ²	#	#	#
Product identification test	#	#	#
Complex shear (stiffness) modulus (G*) and phaseangle (δ) data. See Clause 928			
Fraass brittle point			
Other properties the Contractor considers useful			

Where indicated with # the Contractor shall attach a graphical output to this schedule.

8 Mixture Data Requirements

The following data should be provided to the Overseeing Organisation for materials designed in accordance with Clause 901.17 and Clause 929 in respect of the proposed mixture.

For work carried out for the National Highways, a copy of the results should be handed to the Overseeing Organisation, to be forwarded to: Pavement Engineering Team at National Highways, Woodlands, Manton Lane, Manton Industrial Estate, Bedford, MK41 7LW.

I. Saturation Ageing Tensile Stiffness (SAT S) ratio – as described in Clause 953.

APPENDIX 7/2: EXCAVATION AND REINSTATEMENT OF EXISTING SURFACES

1. Milled surfaces that are to receive live traffic shall not be greater than 50 mm below the adjacent running lane.
2. Typical trench reinstatement details are shown on HCD Drawing No K4.
3. Where a trench is excavated through an existing road pavement reinstatement shall consist of 50 mm wearing course (with 14/20 chippings) to Clause 911, 60 mm binder course to Clause 905 or 906 and 240 mm base to Clause 929 (Type 1 reinstatement). Where the existing surface is to be overlaid, reinstatement shall consist of 300 mm base to Clause 929 (Type 2 Reinstatement).
4. Planed areas shall be overlaid within 14 days.
5. Planings material removed from the carriage shall be the property of the Contractor.

APPENDIX 7/6: BREAKING UP OR PERFORATION OF REDUNDANT PAVEMENT

General Information

1. Refer to Work Order for detail of Breaking Up or Perforating Redundant Pavements..

APPENDIX 7/7: SLURRY SURFACING INCORPORATING MICROSURFACING

1	Location:	Refer to Scheme Work Order
2	Traffic count:	The central reserve will not be trafficked
3	Traffic speed:	N/A
4	Category of site	N/A
5	Description of existing surface	new binder layer material
6	Thickness of Slurry Surfacing:	3 mm
7	Guarantee period:	2 years
8	Minimum declared PSV of coarse aggregate:	60
9	Maximum AAV of coarse aggregate	12
10	Preparation and masking requirements	protection of ironwork and the concrete or steel safety fence elements
11	Definition of colour required	Red
12	Surface finish required	transverse brushing
13	Minimum macrotexture depth at end of guarantee period	minimum 1 mm
14	Maximum texture depth after 4 weeks trafficking	N/A
15	Maximum percentage decrease in macrotexture initially measured and at the end of the guarantee period	40%
16	Category of area defects (% area affected) acceptable	8%
17	Category of linear defects (m per 100 m) acceptable	1
18	Class of transverse regularity	Class 0
19	Class of longitudinal regularity	Class 0
20	Special restrictions laying only permitted between	minimum road surface temperature 4 °C and maximum of 40 °C

APPENDIX 7/7: SLURRY SURFACING INCORPORATING MICROSURFACING (Continued)

SHEET 2: Information to be provided by the Contractor:

- 1 A copy of BS EN ISO 9001 certificate showing at least the name of the Company, the name of the certification body and the reference number and date of the certificate. A copy of the relevant part of the company Quality Assurance (QA) document showing the appropriate scope (Slurry Surfacing and Sector Scheme) and limitations of the certification. The Overseeing Organisation may wish to inspect all or any of the Company's QA documentation as part of the vendor assessment system and may wish to satisfy himself on the nature of the QA systems of the Company's material suppliers.
- 2 Declaration of performance for the slurry surfacing in accordance with BS EN 12273
- 3 Design Proposal for Slurry Surfacing for each location and target binder content with tolerances.
- 4 Estimated Design Life of the Slurry Surfacing for each location.
- 5 A method statement for each site or group of similar sites showing how it is proposed to carry out the works in conformance with the specification. *[Contractors will be expected to commit enough resources to carry out the proposed design; the type and age of the Slurry Surfacing Machine should be detailed].*
- 6 Proposed performance categories of the coarse aggregate together with statements of properties including target grading, declared PSV and AAV.
- 7 Proposed performance categories of the fine aggregate including target grading and other constituents together with statements of properties.
- 8 Proposed binder declaration of performance. For work carried out for the National Highways, a copy of all the data should be handed to the Overseeing Organisation, to be forwarded to: Pavement Engineering Team at National Highways, Bedford Office.
- 9 Proposals for traffic control and aftercare for each site and reaction times for: carrying out remedial measures; sweeping; and site visits with the Overseeing Organisation.
- 10 Contingency plans in the event of any breakdown of plant or failure of the Slurry Surfacing.
- 11 An 'As Built Manual' as specified.
- 12 If available any other data provided in order to assist the Overseeing Organisation to assess the technical merits of the Design Proposal:
 - (i) Test method for binder content.
 - (ii) Test for thickness of Slurry Surfacing.
 - (iii) Traffic ability time, including method of test.
 - (iv) Wheel tracking test results at 45 °C or 60 °C or other suitable measure of the ability of the proposed system to resist deformation and flow.
 - (v) Water sensitivity test results from the test used by BBA/HAPAS thin surfacing Guidelines Document or from wet wheel tracking (whichever is available).
 - (vi) Permeability test carried out on the system, if it is claimed that the process seals the existing surface together with the method of test.

- (vii) Accelerated ageing test results in accordance with the appropriate BBA/HAPAS test. Amendment - November 2004 A22
- (viii) Bond test results using the BBA/HAPAS test on either a bituminous or a concrete substrate as appropriate to the site or Bond Coat binder BBA/HAPAS certificate.
- (ix) Shaking Abrasion test results.
- (x) Slurry surfacing mix cohesion.
- (xi) The results of any other tests or other data the Contractor considers would assist the Overseeing Organisation in assessing the technical merit of the Design Proposal.

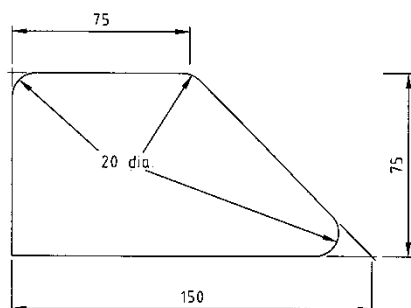
APPENDIX 7/11: OVERBAND AND INLAID CRACK SEALING SYSTEMS

1. The BBA/HAPAS Grade Classification shall be: as specified in the Scheme Work Order
2. The minimum PSV of the source aggregate for chippings shall be: as specified in the Scheme Work Order

APPENDIX 11/1: KERBS, FOOTWAYS AND PAVED AREAS

Kerbs, Edgings and Channels

- 1 Precast concrete kerbs, edgings and channels shall be designated in accordance with BS EN 1339. They shall be laid and bedded in accordance with clause 1101. The thickness of the concrete bed and surround shall be not less than 150 mm.
- 2 Extruded asphalt kerbing shall be to the dimensions shown below.



Paved Area Type 1

- 1 Formation to be treated with weed killer prior to reconstruction. (HE Environmental Team are to be consulted regarding the suitability and approval for an appropriate treatment)

25 mm	AC 6 dense asphalt surface course 100/150. to Clause 909
75 mm	AC 20 dense binder 100/150 rec. to Clause 906
150 mm	Sub base to Clause 803 Type 1

Footway Type 1

- 1 Formation to be treated with weed killer prior to reconstruction. (HE Environmental Team are to be consulted regarding the suitability and approval for an appropriate treatment)

25 mm	AC 6 dense asphalt surface course 100/150. to Clause 909
75 mm	AC 20 dense binder 100/150 rec. to Clause 906
150 mm	Sub base to Clause 803 Type 1

Flag and Block Paving

- 1 Concrete flag, concrete block and clay paver elements shall be natural coloured and rectangular in shape. Concrete flags shall be 50 mm thick and concrete blocks/clay pavers 80 mm thick.
- 2 Mortar bedding shall be 10 mm thick (nominal).

APPENDIX 11/2: ACCESS STEPS

General

- 1 Access steps to feeder pillars, communications cabinets, traffic counter cabinets, ice prediction installations and the like should conform to the requirements of the latest issue of MCX drawings contained in HCD Volume 3.

APPENDIX 12/1: TRAFFIC SIGNS: GENERAL

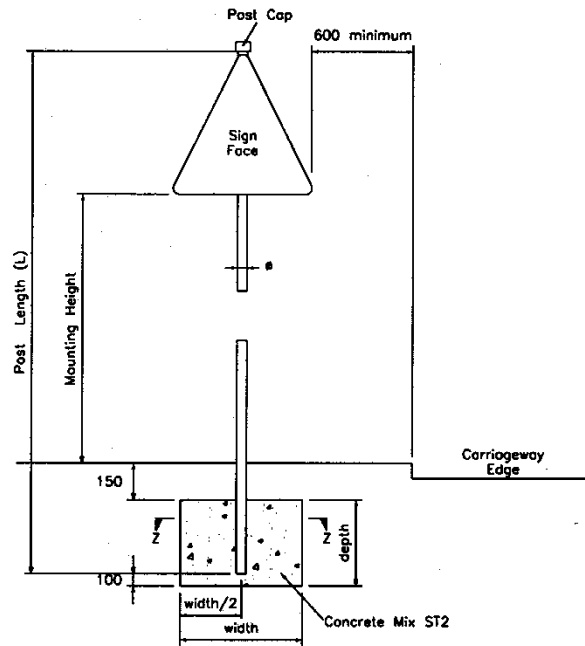
- 1 The location of traffic signs and bollards are shown in the Scheme Work Order. The actual location is to be agreed on site with the Overseeing Organisation.
- 2 Retroreflective Sign face material - sign faces manufactured using glass bead sheeting;
 - (i) BS EN 12899-1:2007 Class RA2
 - (a) Sign face sheeting shall comply with the following as appropriate
 - (b) Table 1 Class CR1 Chromaticity & luminance for Retroreflective signs
 - (c) Table 4 Class RA2 Coefficient of retroreflection
 - (d) Table 16 Class NR1 Chromaticity & luminance for Non retroreflective signs
 - (e) 4.1.1.5 Durability;
 - (f) Clause 7.2.1 Retroreflective signs
 - (g) Clause 7.2.2 Non-retroreflective signs
 - (h) Clause 7.2.2 Impact resistance
- 2.2 All Grey backboards shall be non-reflective.
- 2.3 All signs should have a dew resistant film applied, where manufacturing processes permit, the total sign face will be overlaid with the dew resistant film, otherwise the dew resistant film shall be applied to all retro-reflective text, symbols and borders.
- 2.4 Where dew resistant sign face materials are specified, the sign face should be coated with a water-soluble coating to afford protection to the Dew Resistant surface during manufacture and installation. The coating shall be removed by flushing with clear water after installation of the sign.
- 3 Additional Information
 - 3.1 No verge sign under 10 m² shall be manufactured from extruded aluminium plank.
 - 3.2 Steel constructions and steel mounting elements shall conform to BS EN 1993-1-1.
 - 3.3 All plate signs shall be sheet aluminium in accordance with BS EN 1999-1-1.
 - 3.4 The sign face sheeting and any screen printing inks, coloured overlay films and non retroreflective sheeting should carry a minimum 12 year warranty, be from a single sheeting supplier and supported by the sheeting suppliers written traffic sign warranty.
 - 3.5 Where any sign face material applied in accordance with a manufacturer's application and fabrication procedures fails in terms of its guaranteed performance levels during the first three quarters of its warranty period, the manufacturer shall be liable for returning the sign to its original effectiveness.

- 3.6 Signs taken down from site and re-erected on new posts shall have their faces cleaned immediately prior to the completion date. The construction team is required to follow the cleaning recommendations of the sign face supplier to ensure that cleaning methods and material do not cause damage.
- 3.7 The sign face material manufacturer's instructions regarding transportation; storage, erection and cleaning shall be adhered to.
- 3.8 The Contractor shall prepare and submit a fabrication drawing for each sign to the Overseeing Organisation for approval. Sign manufacture shall not commence until the Overseeing Organisation's approval has been received.
- 3.9 The Contractor shall provide and fix the sign identification numbers to the schedule provided in the Scheme Work Order.
- 3.10 Posts shall not protrude above the top of the sign unless supporting an external luminaire, in which case the protrusion shall be kept to a minimum.
- 3.11 Typical post foundation details are shown below.
- 3.12 All traffic signs mounted on a singular tubular steel post or lighting column shall be attached using anti-rotational clips.
- 3.13 Where passively safe posts are identified in the schedule the Contractor shall obtain the details of the design of posts and pre-cast foundations from the Manufacturer. The pre cast foundation is to be installed in accordance with manufacturer's recommendations. All Passively safe posts shall be non-energy absorbing category NE and speed class 100 kph in accordance with BS EN 12767. Passively safe posts may satisfy any of the four occupant safety levels specified in Table 5 of BS EN 12767. Where signs are mounted on passive sign posts, the minimum mounting height shall be 1800 mm.
- 3.14 All sockets formed in foundations shall be flush to the top of the foundation and the method used to form the socket shall be approved by the Overseeing Organisation.
- 3.15 Each individual sign shall have a label in accordance with BS EN 12899-1:2007
- 3.16 Where signs are to be temporarily, fully or partially covered over, this shall be in accordance with Clause 1209.4 of the Specification and only upon agreement with the Overseeing Organisation.
- 3.17 Two keys per locked traffic sign housing or feeder pillar shall be provided.
- 3.18 For illuminated signs the electrical equipment shall be enclosed in an integral base housing of inside diameter not less than 130 mm. The central access opening shall face away from the carriageway. Entry to the interior of such compartments shall be by means of a weatherproof door having tamper-resistant key fastenings of a type acceptable to the Highway Authority. Six keys shall be supplied to the Highway Authority for each type of lock. The door opening shall be not less than 100 mm x 400 mm unless agreed otherwise and shall afford easy access. The lower edge of the door shall be positioned so that, when the post is installed as intended, it is not less than 300 mm above ground level.
- 3.19 An internal baseboard of dimensions not less than 80 mm x 300 mm x 12 mm manufactured from substantially non-hygroscopic and rot-resistant material shall be

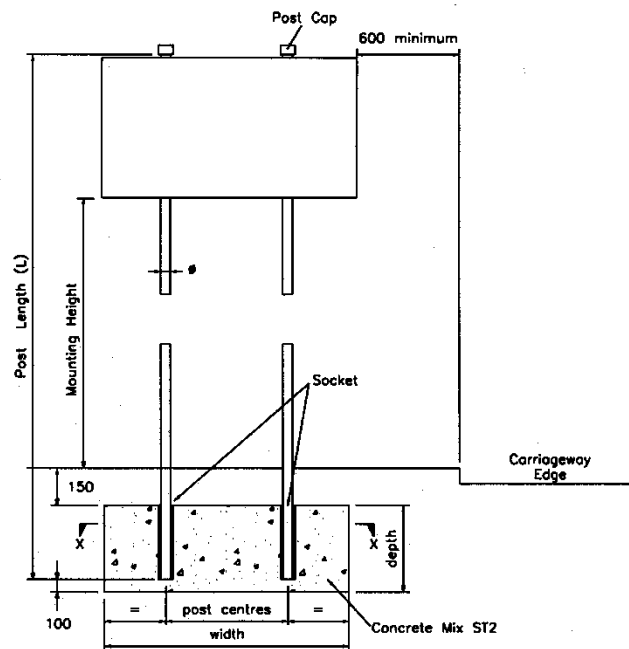
fixed in the box and an earthing screw or bolt shall be provided. The distance from the face of the baseboard to the inside front of the housing shall be of sufficient size to allow installation of a suitable cut out. A suitable cable entry shall be provided below ground level.

3.20 All existing signs that are to remain are to be checked to ensure that sufficient working width can be achieved between the sign and any new road restraint system. Where the required working width cannot be achieved the contractor shall relocate the sign to achieve working width.

3.21 Where mounted above the gantry, gantry signs shall have a light spill 'skirt' fitted to fill the gap between the bottom of the sign and the gantry frame constructed as part of the grey backboard as shown on the series 1200/GS drawings. This skirt will typically be 400 mm although reference should be made to the 1800 series contract drawings for the exact dimensions and mounting arrangement as it may be greater in certain locations.



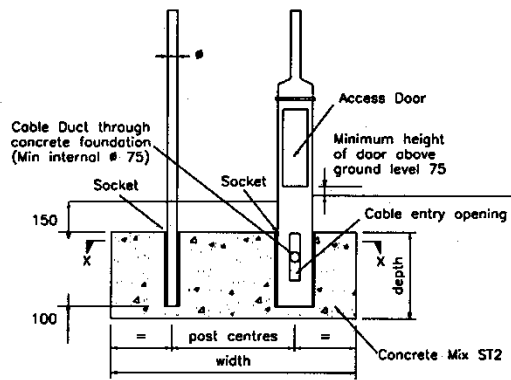
**POST FOUNDATION DETAIL FOR UNLIT
SIGN ON SINGLE POST**



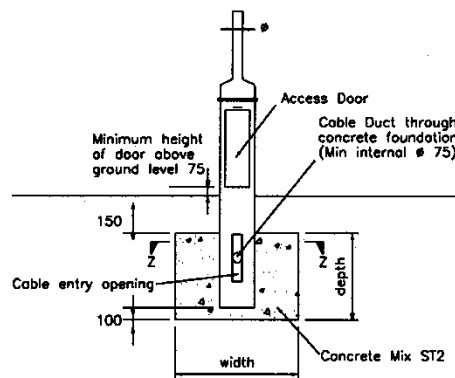
**POST FOUNDATION DETAIL FOR UNLIT
SIGN ON DOUBLE POSTS**

Notes

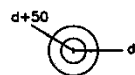
1. Sockets shall be cleaned out prior to erection of posts.
2. Sockets are to be packed with well compacted sharp sand after insertion of post and capped with a 50mm layer of ST1 concrete.



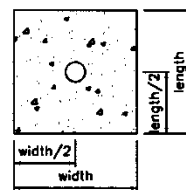
POST FOUNDATION DETAIL FOR LIT SIGN ON DOUBLE POSTS



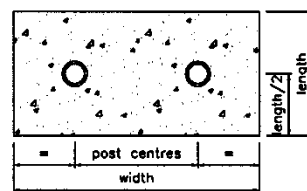
POST FOUNDATION DETAIL FOR LIT SIGN ON SINGLE POST



PLAN OF POST SOCKET



SECTION Z-Z



SECTION X-X

Notes

1. Sockets shall be cleaned out prior to erection of posts.
3. Sockets are to be packed with well compacted sharp sand after insertion of post and capped with a 50mm layer of ST1 concrete.

APPENDIX 12/2 TRAFFIC SIGNS: MARKER POSTS

Hazard marker posts shall be as detailed on HCD drawings E1, E2, E3, E4 and E5.

APPENDIX 12/3 TRAFFIC SIGNS: ROAD MARKINGS AND STUDS

1 A minimum skid resistance of 55 is required for all permanent road markings.

2 Permanent Road Markings – General

2.1 White road markings shall comply with the following:

1.1.1 Proposed road markings to comply with:- Regulations: TSRGD 2016

1.1.2 Performance Standard: - BS EN 1436:2007+A1:2008 (Road marking materials - Road marking performance for road users).

1.1.3 Thermoplastic material. Product Standard:- BS EN 1871:2000 Road marking materials – Physical properties;

1.1.4 Component Standard:- BS EN 1423:2012 Road marking materials - Drop on materials - Glass beads, anti-skid aggregates and mixtures of the two; BS EN 1424:1998 Road marking materials - Premix glass beads.

1.1.5 Road markings shall have the following minimum standard of performance for the duration of their functional life (as defined in BS EN 1436:2007+A1:2008)

1.2 White markings

Property	BS EN 1436 Reference	Requirement	Value
Colour	Table 6	White	x,y co-ordinates given
Luminance Factor	Table 2	Class B3	0.4
Skid Resistance	Table 7	Class S3	55
Retro reflectivity	Table 3, Classes of R_L for dry markings	Class R3	150

1.3 When there is a requirement of enhanced visibility for road markings during wetness the following retro-reflectivity performance shall be specified:-

Retro reflectivity	Table 4, Classes of R_L for road markings during wetness	Class RW3	≥ 50
Retro reflectivity	Table 5, Classes of R_L for road markings during rain	Class RR3	≥ 50

1.4 Unless otherwise stated, road markings shall not be laid more than 6mm thick.

1.5 The length and width of the road markings shall be as specified in the Scheme Work Order in accordance with Traffic Signs Regulations and General Directions 2016 with a permitted tolerance as shown in Table below

Dimension shown in the diagrams	Allowable tolerance
3 m or more.	Up to 15% greater than or 10% less than the specified dimensions.
300 mm or more, but less than 3 m	Up to 20% greater than or 10% less than the specified dimensions
50 mm or more, but less than 300 mm	Up to 30% greater than or 10% less than the specified dimensions.

- 1.6 Temporary road markings when laid on permanent carriageways shall be removable and shall be Departmental Type Approved.

2. Temporary removal of road markings

- 2.1 Road markings shall only be removed by scabbling technique.

3. Temporary removal of road studs

- 3.1 Removal of existing road studs shall be carried out without damage to the road surface and with a minimum of residue.

4. Road Studs

- 4.1 Locations will be specified in the Scheme Work Order.
- 4.2 The Contractor shall provide details of the proposed reflecting road studs together with a copy of the statutory type approval certified for each type for approval by the Overseeing Organisation.
- 4.3 All road studs on a public road in the UK must fully comply with the Traffic Signs Regulations and General Directions 2016 (TSRGD) Regulation 10 (Height of road markings and size of studs fitted with reflectors, retroreflecting material or a light) and Direction 7 (Studs that provide illumination).
- 4.4 All road studs shall be laid in accordance with manufacturer's specifications.

APPENDIX 12/5 TRAFFIC SIGNS: TRAFFIC SIGNALS

A Permanent Traffic Signals

1. Scheme Specific Requirements

1.1 The following information is detailed in the Scheme Work Order

- Location of all permanent traffic signals including crossings
- Location of all permanent traffic signals ducting, chambers and sockets
- Staging, duct schedules and loop schedules
- All operations information

2. General Requirements

2.1 All control and traffic signal equipment must also comply and be in accordance with the following:

- The Traffic Signs Regulations and General Directions 2016;
- Electricity at Work Regulations 1989;
- The Health and Safety at Work Act 1974;
- Construction Design and Management Regulations;
- The Zebra, Pelican and Puffin Pedestrian Crossing Regulations and General Directions 1997;
- Road Traffic Signal Systems, The Traffic Signs Manual (BS EN 50556:2018) and
- IEE Regulations for Electrical Installations (BS 7671).
- BS EN 12368:2015 Traffic Control Equipment

2.2 Traffic Signal works shall be installed by a Sector 8 approved Contractor and in accordance with current Department for Transport (DfT) Specifications, Regulations and Advice notes relating to traffic signals and associated equipment including urban traffic control (UTC) and MOVA.

2.3 All control and signal equipment must comply with the latest standards and specifications and be type approved in accordance with TRG0600. Documentation supporting this is to be provided in the handover documentation.

2.4 National Highways and TRL technical specifications include and are not limited to the following:

- TA 101, TD 101, TS 101 & TM 101: Traffic Signal Systems;
- TR 2206A: Specification for Road Traffic Signals;
- TR 2500A: Specification for Traffic Signal Controller (and all Appendices);
- TR25**;
- MCE 0108C: Siting of Inductive Loops for Vehicle Detecting Equipment at Permanent Road Traffic Signal Installations;

- MCH 1542: Installation Guide to MOVA;
- TRL publications relating to MOVA control; and
- MCH 1514 Code of Connection.
- TSM Chapter 6

3. Controller Details

- 3.1 The microprocessor-based controllers are to be extra low voltage (ELV) and shall be fully compliant with European standard TR2500A (and all its appendices) in every respect.
- 3.2 The traffic signal controllers shall be any equipment approved to the European standard TR2500A, approved by the DfT, National Highways and designed for the control of vehicles, pedestrians, cyclists and equestrians on the public highway and will include the following facilities:-
- MOVA;
 - Loop detector monitoring;
 - Full lamp monitoring;
 - Red lamp monitoring;
 - Signal dimming;
 - Cable less linking;
 - Master time clock of the mains type with crystal synchronisation;
 - Extra Low voltages on all push buttons;
 - All push button units are to be fitted with tactile devices and audible; and
 - The controller shall be constructed such that it is capable of extension to accommodate stage and phase equipment additional to that initially specified
- 3.3 Vehicular traffic signal heads to be of the LED type compatible with an extra low voltage controller (ELV).
- 3.4 Where MOVA is required, the Contractor shall inform the Overseeing Organisation prior to equipment ordering as to the type of MOVA control unit and its version which will be installed on this scheme.
- 3.5 MOVA datasets will be supplied by the Overseeing Organisation, however the Contractor is to allow for assistance and input into the MOVA design and validation.
- 3.6 MOVA and OMU units will be housed within the controller cabinet and include capabilities for reporting the following: -
- Signal lamp faults;
 - Vehicle detector and push button faults;
 - Traffic controller status and timings; and
 - Acting as a communications interface between the controller and the in station
- 3.7 The controllers shall be provided with 2 No. maintenance sockets that will remain unused by the controller or ancillary equipment.
- 3.8 The controllers shall be provided with an external DFM lamp facility for indicating detector and lamp monitoring faults. Controllers are to be installed so that the DFM

lamp may be readily seen from the carriageway and such that all normal maintenance and checking can be readily carried out without encroachment on the carriageway by equipment or personnel.

- 3.9 The controllers shall be capable of muting the audible signal using the controller's internal time switch facility.

4. Remote Monitoring Operation

- 4.1 For existing traffic signal installations that have remote monitoring functionality, the new controllers will use the same type of remote monitoring communications as currently exist at that location.
- 4.2 The OMU/MOVA units shall be fully compatible with the Overseeing Organisations existing remote monitoring instation. The OMU's supplied shall be compatible with the Overseeing Organisation's existing remote monitoring in-station.
- 4.3 It is a requirement that the communication link between the OMU/MOVA units and the Overseeing Organisation's instation are functioning prior to switch on of the new traffic signal installation.
- 4.4 For existing traffic signal installations, the SIM cards in the existing remote monitoring stations are to be relocated and reused in the new units.
- 4.5 Specific requirements will be included in the Scheme Work Order

5. Power Supply

- 5.1 The Contractor is responsible for all works associated with maintaining, reusing and providing any new power supplies to the traffic signal controllers/MECs, including all cabling, fuses, isolators, etc. from where the Electricity Company terminates their supply within the feeder pillar.
- 5.2 The Contractor will be responsible for liaising and raising any orders with the Electricity Company for any disconnections, reconnections and new connections and the provision of the necessary certification to the Electricity Company and liaise with them to ensure an electric supply to the controller is completed to meet the agreed programme of works.
- 5.3 Any new feeder pillars are to be constructed from 3mm Grade 304 stainless steel with a 12mm external grade plywood fully treated backboard fitted with twin tri-head locks, 6mm brass earth stud on pillar and door with 500mm earth strap and hazard warning labels to BS5378. The pillars are to have a hinged door with IP55 seal and fitted with cast stainless steel block hinges. The feeder pillar housing the main supply shall be capable of accepting the stainless steel distribution board.
- 5.4 The Contractor is responsible for ensuring the size of each of the feeder pillars are large enough to accommodate all the equipment required.
- 5.5 Warning and identification labels are to be provided within each feeder pillar, including identification of the location of where the power supply is taken from for future maintenance purposes.
- 5.6 Earth bonding of cable armouring is not to be achieved by the use of "Jubilee Clips".
- 5.7 Phase and neutral cables are to be double sheathed.
- 5.8 Further feeder pillar arrangement guidance will be provided by the Overseeing Organisation.

- 5.9 An 8 way stainless steel distribution board fitted with tri-head lock, brass removable gland plate and tested to IP44 is to be installed within the feeder pillar.
- 5.10 Three outgoing supplies from the feeder pillar are to be provided to feed the traffic signal controller and adjacent disconnection system with the spare supplies used for any future ancillary equipment which may be installed at a later date.
- 5.11 Suitable power cables (16 mm XPLE/SWA/PVC 3 core cable unless Contractor determines that another rating is required by the IEE Regulations) are to be run through the ducting system from the feeder pillar containing the incoming supply to the controllers and MEC cabinets. These power cables shall be laid in the separate duct (coloured black) to the traffic signal cables.
- 5.12 Regulatory signs shall be separately fused.

6. Signal Posts

- 6.1 Pole mounted signal equipment shall have a minimum of 450mm horizontal clearance from vertically above the kerb edge.
- 6.2 For pole mounted signals a minimum clearance between the lower edge of the signal assembly (including any regulation signs) and the footway or verge shall be 2.3 metres, this shall be increased to 2.4 metres wherever cyclists may be present.
- 6.3 All poles shall comply with BS EN 40-1, 3 & 6, BS EN 12899-1, including Guidance Notes PD 6547, CS 126, CG 300, CD 354 and , BS EN 12767.
- 6.4 The passively safe signal posts supplied shall meet the structural requirements of BS EN 12899-1 and meet the following performance classes, in accordance with BS EN 12767:2007 and also be CE marked:
- Impact Speed: 100 kph;
 - Energy Absorption Category: NE; and
 - Occupant Safety Level: 2.
- 6.5 The design of the poles will include the wind loading factors as stated in the BS EN 40 and BS EN 12899. Plus the Administrative Area is a factor included n as part of the locality as described in PD 6547 Table A.1.
- 6.6 4 m and 6 m signal poles shall have a 114 mm root conifying outwards above ground to 145 mm.
- 6.7 Columns shall be manufactured from a 6000 series aluminium alloy to the following specification: - alloy to be used: EN AW - 6060 Temper: T66.
- 6.8 Poles shall be extruded in one piece to form a continuously parallel tube or conical shape having no welds or joins within the construction.
- 6.9 Poles shall be reinforced at door level by a CE certified welded press stressed reinforcement profile according to BS EN-40-3-3 item 5.6 that fits snugly into the column tube and contributes to the strength of the column for both tension and torsion.
- 6.10 An aluminium reinforcement profile shall consist of an extruded profile and shall be inserted around the door opening. This profile will be robot welded using an inert gas (MiG) to the back of the column together with the mounting rail. This reinforcement profile will give a 5+ reinforcement rating.
- 6.11 Door opening size is to be 500 mm x 100 mm, situated at low level. The door and base compartment shall seal to at least IP44. All doors shall be flush finish to the outside

- diameter of the pole, and shall be complete with two sliding door locks situated at each end (top and bottom) of the door. The lock shall be constructed from an aluminium cast piece Alloy GD-ALMg9; with a stainless steel M8 threaded bolt complete with triangular, hex-bolt or elliptical anti vandal lock head (Alulock) and a stainless steel L profile bar that secures the door in place. The lock shall include a stainless steel spring and a stainless steel plate to prevent the ingress of water and dirt into the column void through the mechanism thus creating a (IP44) seal.
- 6.12 The column shall be fitted with an extruded Aluminium channel rail.
 - 6.13 Stainless Steel earthing terminals shall be provided on the signal pole body in the door aperture area and the inside of the column door, size M8 set bolts complete with Stainless steel washers and nuts (two of each).
 - 6.14 Poles shall be supplied natural brushed satin finished and shall have no other exterior coating other than its natural state. Anodising or powder coating can be used where specifically instructed.
 - 6.15 Tall signal poles are to be hinged near the base and aligned to allow the poles to be lowered to avoid the use of a mobile elevated working platform (MEWP) and traffic management when undertaking maintenance.
 - 6.16 The column shall display a means of identification by way of engraving to comply with CE and Annex ZA (EN40-6) and form part of a quality assured process e.g. ISO 9001. Information to be displayed includes: CE mark, article number, order number and date of manufacture.
 - 6.17 Poles shall be open packed and crated during transport and storage to prevent damage to their finish.
 - 6.18 Unpacked poles shall not be stored directly on the ground that may cause abrasions or scoring to their surface. Where lifting equipment is required, fabric or other nonabrasive straps should be used. The packaging shall be left in place to protect against surface damage as long as possible. Poles stored outside shall always be stored without a plastic sleeve or cover to avoid staining.
 - 6.19 A copy of the completed data sheet for each pole type shall be provided to the Overseeing Organisation prior to commencement of installation.
 - 6.20 All calculations and drawings to be supplied by the manufacturer to the Overseeing Organisation prior to acceptance.
 - 6.21 The traffic signal posts shall be supplied with post caps, post head terminating assemblies, including supports for the signal cables, base plates where required and all necessary mounting accessories.
 - 6.22 Any signal pole located in the verge will need to be surrounded by a 3 m hardstanding area to aid the placing the ladders to gain access to the equipment located at the top of the signal pole.
 - 6.23 All traffic signal pole locations are to be agreed on Site between a representative of the Overseeing Organisation and the Contractor before the pole chambers are installed
 - 6.24 A schematic plan is to be included with the pole termination cabinets indicating pole numbers, position and phase.
 - 6.25 Electrical connections to the equipment located on the poles are to be housed near the base rather than the top of the pole. Access to the low level electrical connections will via a low level door. The electrical terminations are to be housed within a suitable traffic signal termination enclosure designed to IP65 with vented top cap to ensure the enclosure remains free from condensation.

- 6.26 Where existing traffic signal poles need to be temporarily relocated the Contractor is to ensure that temporary arrangements and traffic signal foundations are safe and sufficient.

7. Traffic Signal Pole Retention Sockets

- 7.1 All traffic signal poles will have a traffic signal pole housing unit at its base. These shall be cast iron and provided with a cast iron duck foot base. The duck foot swivel bend shall be rotated in the direction of the adjoining chamber before pouring the concrete foundation.
- 7.2 Access chambers/draw pits shall be surrounded with 150 mm of ST3 concrete and mounted on a 100 mm deep ST3 concrete base with a 225 mm round plastic pipe set into the base.
- 7.3 This pipe is to be a minimum of 200 mm in depth; 14 mm clean gravel infill 200mm in depth is then to be laid into the base of the pipe to act as a soakaway. The drainage tube shall be allowed to drain freely.
- 7.4 Required depth and size of foundation for the signal poles to be determined and provided by the signal pole manufacturer.

8. Electrical Disconnection System

- 8.1 All traffic signal poles (including half height poles) are to be separately cabled and connected to the electrical disconnection system.
- 8.2 The system will be housed within the MEC cabinets adjacent to the controllers to house all isolation equipment.
- 8.3 Monitoring units and power supplies to be 3U rack mounted within the MEC, isolation units to be DIN rail mounted also within the MEC cabinet.
- 8.4 Disconnection shall be achieved in under 0.4 seconds in accordance with BS EN 12767.
- 8.5 System is to include a self-checking system, with an output to indicate system malfunction.
- 8.6 In normal operation the system shall give a visual indication that it is operational, heartbeat or similar.
- 8.7 If the system is activated it shall provide a positive visual indication of this and also indicate the location.
- 8.8 The isolation will be so designed that on impact all LV and ELV live and neutral circuit conductors are disconnected from the signal pole, together with any sensor voltages.
- 8.9 The system shall be capable of isolating up to 30 signal cores per signal pole simultaneously.
- 8.10 It shall not be possible to re-energise a circuit that has been tripped.
- 8.11 Isolation units to be rated at 3A unless otherwise indicated.
- 8.12 The system will provide outputs to indicate
- (a) Activation by impact
 - (b) Activation by signal equipment failure
 - (c) Isolation system malfunction

(d) Isolation system power failure

- 8.13 The isolation system shall also be capable of isolating a whole signal pole due to a signal equipment fault. This facility is to be switchable by pole.
- 8.14 The sensor is to be a mechanical device operated by inertia of greater than 10G. Upon trip activation the power to the sensor is to be removed.
- 8.15 The sensors are to be mounted by the most appropriate means, ideally behind the base door if available.
- 8.16 The location of the sensors is to be agreed with the Overseeing Organisation before installation.
- 8.17 The cabling to the sensors is to be run in separate ducts to the LV cables, using orange PVC sheathed SWA 2 core 2.5 mm cable, traffic signal loop feeder cable.
- 8.18 The sensor cable is to be terminated using a CET cable gland or equivalent, with the armouring being taken to earth.

9. Traffic Signal Heads

- 9.1 Traffic signal heads to be of the LED type and compatible with the extra low voltage (ELV) traffic signal controller supplied.
- 9.2 Sighting screens and backing boards with a minimum 50 mm wide class 1 reflective edging strip shall be supplied and fitted to all signals.
- 9.3 Traffic signal heads including the use of green arrow aspects and twin head installations shall be DfT type approved and shall comply with BS EN 12368:2006 and shall be in accordance with the diagrams in The Traffic Signs Regulations and General Directions 2016 published by Her Majesty's Stationary Office (SI 2002 No. 3113).
- 9.4 Signal heads shall be constructed so as to allow full lamp monitoring of the red, amber and green aspects via the integral lamp monitoring facilities of the TR2500A approved traffic signal controller.
- 9.5 Pedestrian signal heads shall be of the LED type, DfT type approved, shall comply with BS EN 12368:2015 and shall comply with diagram 4003.1 (near sided signals) of SI 2002 No. 3113.
- 9.6 Push button units for pedestrians shall be DfT type approved and shall conform to either diagram 4003 (far sided pedestrian signals) or 4003.1 (near sided pedestrian signals) of SI 2002 No. 3113. All push buttons will be fitted with DfT type approved rotating tactile devices.
- 9.7 All push button units shall have their legends printed in English, extra low voltage and shall include an audible signal (which shall be capable of being muted).
- 9.8 All signal posts are to be numbered as indicated in the Scheme Work Order.
- 9.9 Photoelectric cells and dimming mechanism for the ELV controller are to be provided.
- 9.10 The photocells are to be located in a position furthest away from overhead lighting units, tree or other obstructions. In this case the Signals Contractor shall select appropriate locations to ensure the correct operation of the solar cell.
- 9.11 All entry points into signal heads for cables shall have a secure and permanent watertight seal.

10. Vehicle Detection

- 10.1 Loops shall be installed in accordance with Series 1200 and Series 1400 of the Specification for Highway Works and to MCE0100 and MCE0108 specifications.
- 10.2 Detector loops are to be cut only after the road markings have been laid.
- 10.3 Detector loops shall have a minimum cover of 65 mm in flexible construction, 25 mm in concrete, which shall be backfilled with bituminous sealant.
- 10.4 Each vehicle detection loop is to be fed into the ducting system via a carriageway loop chamber with a 100 mm diameter duct laid underneath the kerb from the carriageway loop chamber to the nearest footway access chamber.
- 10.5 Self-tuning detectors as currently approved by DETR shall be supplied and installed in the controller cabinet and MEC cabinets.
- 10.6 Where loops, as indicated on the attached drawings are located where the cable run would be in excess of 250 m from the controller cabinet then, an allowance shall be made to provide the necessary equipment and site the detectors externally in lockable pedestals adjacent to the loop site.
- 10.7 The approximate positions of the loops have been indicated on the drawings. The final position of all loops will be determined and agreed on site between the Contractor and the Overseeing Organisation or his representative.
- 10.8 Detector packs shall be correctly set for sensitivity and presence for the various loop types specified. The pack frequency shall be set to prevent 'cross talk', and shall conform fully to the manufacturers technical advice note for the detector packs in this respect.
- 10.9 The total length of slot cutting stated in the tender will be considered as final and any claim for additional slot cutting will not be accepted unless necessitated by site instruction or errors on the drawing.
- 10.10 Slot cutting operations shall be discussed and approved by the Overseeing Organisation in advance of commencement of work at the site. The exact location of loops on site shall be approved by the Overseeing Organisation.
- 10.11 The Contractor should indicate any price variations should it be necessary to undertake slot cutting works at the weekend or outside normal working hours. The Contractor shall provide a Method Statement of Works to be agreed with the Overseeing Organisation prior to any slot cutting works.
- 10.12 The Contractor shall be responsible for cleaning the highway of any residue resulting from the slot-cutting operation. The Contractor shall provide the Overseeing Organisation prior to commissioning a completed Inductive loop and Earth loop Impedance Installation test certificate detailing each loop, post and controller.
- 10.13 Certain operations which cannot be avoided will result in the existing traffic signal detection loops being removed and the junctions operating without detection until new loops have been replaced. These unavoidable operations whereby the loops are removed shall be kept to a minimum and the time from when the loops are removed to being recut shall be kept to a minimum. When these operations are carried out, the Contractor shall provide alternative means of detection for the X loops and queue loops, such as microwave vehicle detection (MVD). When this occurs the layout and detection requirements of the existing controllers shall be agreed, reconfigured and tested before these operations are undertaken. The Overseeing Organisation will require adequate advanced time before these operations are to be undertaken in order to complete, agree and test the revised controller configuration

11. Cables

- 11.1 The Contractor shall supply and install all ducts fitted with one draw cord per duct. It is the responsibility of the Traffic Signal Contractor to reuse this cord as necessary. Draw cords are to be left in place following the completion of the cable installation.
- 11.2 All cables shall be installed in ducts.
- 11.3 Each pole and each loop shall be separately cabled (including half height poles).
- 11.4 All cable core terminations at post caps and all cables within access chambers shall be marked in accordance with Appendix 12/70 (Cable and Cable Core identification).
- 11.5 A minimum of 4 spare cores shall be provided at each pole.
- 11.6 Cables shall be steel wired armoured multi-core colour coded.
- 11.7 All cables (except loop cable) shall be orange and embossed 'Traffic Signals'.
- 11.8 The installation and termination of cables shall be in accordance with the recommendations of TSM Chapter 6.
- 11.9 Lamp circuit cables shall not serve more than one-signal pole and lamp circuits and loop feeder not be within the same multi-core cable other than between the controller and MEC cabinets.
- 11.10 Where applicable LV (low voltage) and ELV (extra low voltage) supplies shall be separately cabled.
- 11.11 A separate neutral shall be supplied for each signal head, push button unit and on crossing detector.
- 11.12 Loop and loop feeder cable shall be jointed in roadside chamber in accordance with the 1200 series of the DfT specification for Highway Works (1994).
- 11.13 The Traffic Signal Contractor shall use the reusable type of joint when jointing the detector loop cable to the loop feeder cable.
- 11.14 Cables shall be marshalled into chambers adjacent to the bases of the controller cabinets or miscellaneous equipment cabinets.
- 11.15 In multi-core cable 25% (minimum 4) spare cores shall be included. Unused cores shall be terminated to earth at all locations.
- 11.16 No joints shall be permitted in the cables except at termination of the loop and feeder cables.
- 11.17 Reusable type of joints shall be used when jointing detector loop cable to loop feeder cable (bottle joint) to IP68 Cat 1 and BS EN ISO 9001:2015.
- 11.18 Cabling plans shall be submitted to the Overseeing Organisation for approval prior to installation. All cables shall be clearly marked at the controller and in the footway access chambers and correspond to the cable identification table, to be completed and provided by the Contractor.

12. Testing

- 12.1 Prior to commissioning the following tests shall be carried out by the Traffic Signal Contractor in accordance with the current IEE regulations (BS 7671), recommendations TSM Chapter 6:
 - (a) Insulation resistance test.
 - (b) Mains connection polarity check.
 - (c) Earth loop impedance and ELCB test (if fitted), in accordance with the IEE regulations

- (d) Earth continuity test.
 - (e) Residual Current Device test.
- 12.2 The above test results and the following certificates shall be completed by the Contractor and shall be made available to the Overseeing Organisation prior to commissioning.
- (a) The traffic signal installation electrical test certificate in accordance with BS 7671.
 - (b) The certificate of detector performance that shall be completed at the time of the loop installation, in accordance with the Specification for Highway Works clause 1218.
- 12.3 Testing shall be carried out in accordance with BS 7671 and the Series 1200 of the Specification for Highway Works.
- 12.4 To avoid the possibility of damage to electrical circuits all cable and electrical supply testing shall be completed before the signal controller is installed and connected.
- 12.5 The Contractor shall allow for Factory acceptance testing (FAT) of the signal installation prior to installation on site. This shall be clearly identified in the Contractors programme of works.
- 12.6 At the FAT the controllers shall be fitted with the MOVA units (where such is part of the works as defined in the Scheme Work Order).
- 12.7 The Overseeing Organisation will require attendance at the FAT and a minimum notice period of 14 days shall be provided.
- 12.8 This testing will be carried out at the Contractors/Sub Contractors premises.
- 12.9 Datasets shall be downloaded by the Contractor in advance of the tests and these shall be downloaded to the units at FAT. The function of stage force and replies shall be demonstrated using switches (computer simulation or otherwise) and using MOVA detector inputs.
- 12.10 Site acceptance will be in accordance with the recommendations in TSM Chapter 6.
- 12.11 Traffic signal equipment will be commissioned in the presence of a member of staff from the Overseeing Organisation, Local Highway Authority (where applicable) and/or their representative.
- 12.12 The Contractor will provide a Traffic Signal Engineer, Controller Technician and an Installer to assist in witnessing and carrying out such test that may reasonably be required to demonstrate the safe and satisfactory performance of the installations.
- 12.13 The Contractor shall supply calibrated instrumentation and equipment to enable the commissioning to be carried out.
- 12.14 Additional special conditioning and commissioning associated with the junctions will be required to facilitate MOVA operation and fall back to vehicle activation (VA).
- 12.15 Signal faces, including push button units and tactile cones, which are installed prior to switch-on shall be bagged (not required on upper heads on tall poles).
- 12.16 The Contractor will be responsible for supply and maintenance of coverings of non-illuminated signal heads. They shall be suitably designed opaque hoods capable of being tied or zip fastened in order that they can be released during site acceptance testing.
- 12.17 Following commissioning of new traffic signals the existing traffic signals shall be switched off and the new traffic signals switched on.

- 12.18 Once the traffic signals have been commissioned and validated a new prom will be required to be installed within the controllers. To install the new prom the traffic signal junctions will need to be switched off and the Contractor will need to provide the necessary traffic management to undertake the changing of the prom. It is envisaged the Overseeing Organisation will allow the prom changes to be undertaken after 20:00 hours during a weekday period. The Contractor shall allow within his programme for undertaking the prom changes together with all traffic management required. The time period for changing the prom could be up to 6 months after the traffic signals are commissioned and the Contractor should allow for the prom changes to be undertaken on three separate occasions (at each location) during the 6 month period after the traffic signals have been commissioned.
- 12.19 The Contractor shall respond to faults that occur following final commissioning.
- 12.20 On completion of the whole installations, and to the satisfaction of the Overseeing Organisation, the installations are to provide 30 days continuous fault free service before full acceptance of the installation will be granted.
- 12.21 The 30 days fault free period will start once all the installations have been completed, tested and fully commissioned. Faults shall be attended to within 2 hours following notification by the Overseeing Organisation and rectified within 1 working day.
- 12.22 The Overseeing Organisation shall take responsibility for attending and the repair of faults associated with the equipment once it has operated fault free for a continuous period of 30 days.
- 12.23 The Contractor shall allow for the free repair or replacement of any defective parts of the traffic signal equipment supplied for a period of 12 months following commissioning of the traffic signal installations.
- 12.24 All returned parts shall be repaired / replaced and returned to the Overseeing Organisation free of any charge within 2 weeks from receipt of the faulty components.

13. Handover Documentation, Training and Spares

- 13.1 Handover Documentation will be in accordance with the recommendations in TSM Chapter 6 and in accordance with MCH 1349.
- 13.2 A minimum of two electronic copies of the handover documentation shall be provided to Overseeing Organisation.
- 13.3 All appropriate documents including test certificates are to be supplied by the Contractor prior to issue of the completion certificate.
- 13.4 The handover documentation shall include a full technical description of the traffic signal controllers.
- 13.5 An indicative outline of an MCH 1349 Traffic Signal Installation table of contents is detailed below. The exact requirements shall be agreed with the Overseeing Organisation

Section No.	Section Description
1	Taking over certificate
2	TR2500
3	Controller specification
4	BS 7671 electrical inspection certificate

5	Factory Acceptance Test Sheets
6	Site Acceptance Test Sheets
7	Handbooks
8	Manuals
9	As Installed Drawings
10	Design Specification
11	MOVA design details and dataset
12	Road Safety Audit
13	Wireless linking configuration and manual
14	Passively safe poles & disconnection system
15	Remote Monitoring System configuration
16	Warranties
17	GSM Telephone Number
18	Highways Act 1980 Section 4 Agreement
19	Miscellaneous
20	CDM H&S File

Table 12/5/13: Indicative Table of Contents MCH 1349

- 13.6 The Contractor shall provide 2 No. logbooks (at each controller) for the purpose of logging all visits to the installation. All documentation contained within the traffic signal controller cabinets shall be contained in a splash proof re-sealable wallet and securely fixed to each controller.
- 13.7 A manufacturer's one (1) year warranty for parts and labour on all signal equipment, including the electrical disconnection system for the passive poles shall be provided by the Contractor.
- 13.8 The Contractor shall provide a spare traffic signal controller for each one used under this scheme where this requirement is stated in the Scheme Work Order.

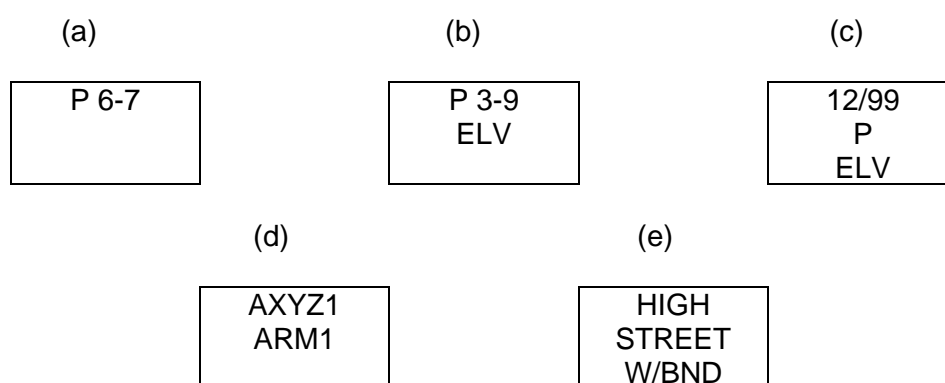
APPENDIX 12/70: CABLE AND CABLE CORE IDENTIFICATION

The Contractor shall ensure that all cable and cable cores in traffic signal installations are identified by the same method and code.

1. Traffic Signals Cable Identification

- 1.1 All cables entering any equipment housing shall be identified by a 'Pull-Tite' tag fixed around the inner sheath immediately above the Steel Wire Armouring (SWA) termination gland.
- 1.2 The tag shall be marked, using an approved waterproof, indelible black marker pen, in the following manner:-
- (a) Low Voltage Signal Cables – The tag shall be red and shall be marked with the numbers on the post, serviced by the cable.
 - (b) Extra Low Voltage Cables (Pedestrian Push Buttons, etc) – The tag shall be yellow and shall be clearly marked with the post number serviced by the cable, in addition the letters ELV shall be added.
 - (c) Extra Low Voltage Cables (Linking Cables) – The tag shall be yellow and shall be marked with the site reference number of the linked equipment and in addition the letters ELV shall be added.
 - (d) Loop Feeder Cables – One side of the yellow tag shall be marked with the detector and arm designation. The other side of the tag shall give the location of the loop.

Examples:



2. Identification of Cable Cores

- 2.1 All individual cable cores in cables used in a traffic signal installation shall be identified using coloured PVC grip type markers as shown below. The markers shall be positioned on the core adjacent to the termination point in such a way that they can be read easily. The markers shall be of a type that cannot be removed without the removal of the core from its terminal.
- 2.2 The three identification markers used shall be:-

- (a) First Marker – Numbered markers indicating post numbers. These will be colour coded in accordance with the international resistor colour code. The numbers shall indicate the post fed by that cable, i.e. the next post to which the cable runs.
- (b) Second Marker – Legend markers indicating the function of the core as shown below. These shall be colour coded as follows:

LV Live conductor	Red with black text
LV Neutral conductor	Black with white text
LV Spare conductors	Brown with black text
ELV All conductors	Yellow with black text

- (c) Lettered markers indicating the phase of the core (White with black text)

Notes

- (i) Where the address of the other end of a cable is the controller the first marker shall be omitted.
- (ii) Functions not covered by the above shall be written onto blank markers with an approved pen.
- (iii) All spare cores to be labelled to and from locations.

APPENDIX 13/1: INFORMATION TO BE PROVIDED WHEN SPECIFYING LIGHTING COLUMNS AND BRACKETS

1. Specific requirements for lighting columns and brackets shall be detailed in the Work Order and be in accordance with BS EN 40. General requirements are as stated below.
2. Lighting columns shall be steel or aluminium and with either circular or multi-faceted cross section, with continuously tapering or parallel form above any base compartment and should be as slender as possible. Stepped columns are not acceptable.
3. The column design should be based on the requirements of the latest revision of PD 6547 and BS EN 40.
4. Passive safe lighting columns shall be provided, where necessary, in accordance with the latest revision of BS EN 12767. The BS EN 12767 passive safe impact class, performance level and occupant safety level will be stipulated in the Work Order.
5. The foundation types are to be planted or flange plate. The Contractor shall design the structure and foundations for both planted lighting columns and flange plate in accordance with CD 354. For flange plate columns this includes anchorages and attachment systems.
6. Lighting columns shall be planted to a depth as calculated by reference to CD 354 and in accordance with manufacturer's instructions. For planted column types the soil types in accordance with CD 354 shall be Poor unless otherwise stated in the Work Order.
7. Lighting columns installed within embankments shall have a bespoke retaining solution that will be identified in the Work Order.
8. Protection system for steel columns shall be G2a unless otherwise stated in the Work Order.
9. The root section of passive safe columns shall be protected in accordance with Series 1900.
10. Columns when erected shall have the door opening in a position agreed by the Overseeing Organisation but this shall generally be parallel to the bracket on the side of the column away from the direction of approaching traffic so that an operator working on the column will be facing on-coming traffic.
11. Column reference numbers will generally be 75mm height black characters on a class RA2 reflective white background mounted at a height of 2m unless otherwise stated in the Work Order. One maintenance number shall be provided for any single arm column, at an angle of 45° to traffic.
12. Column cable entry slot shall be 75mm wide. A minimum of one 90° bend preformed duct with a minimum internal diameter of 75mm shall be provided in foundations as appropriate.
13. The earthing of lighting columns shall be in accordance with BS 7671.
14. Appendix 13/2 data sheets shall be submitted by the Contractor and in the timescales set out in the Work Order.

Appendix 13/2: 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)

Column Material

Material Design Strength (N/mm²)

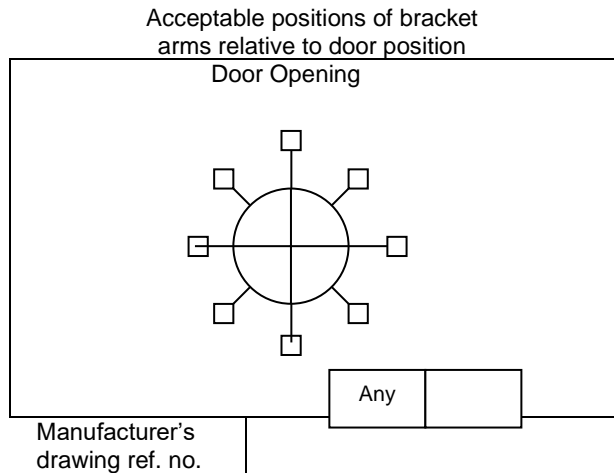
No. of door openings

Door opening size – Height (mm)

Door opening size – Width (mm)

Height (mm)	Width (mm)	Depth (mm)
<input type="text"/>	<input type="text"/>	<input type="text"/>

Cross section of base compartment



Corrosion protection (steel columns only) – basic system type (sub-Clauses 1911.9 and 1911.10)

Reference Wind Velocity $V_{ref,0}$ as defined in BS EN 40-3-1 m/s

Details of signs and attachments allowed for in the design Area (mm²), Eccentricity (mm), Height

- additional sacrificial steel thickness, above that needed in the design, from the bottom of the column to at least 250mm above the anticipated ground level (mm)

Part B Foundation Design

Planted base Planting depth (m)

Soil Type Factor G		
630	390	230
<input type="text"/>	<input type="text"/>	<input type="text"/>

Diameter of concrete surround (if any)

Flange plate	Bolt hole centres (mm)	Bolt Hole diameter (mm)	Design load / bolt (N)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

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.

Appendix 13/2 – Typical Lighting Column and Bracket Data Sheet 2

Part C Acceptable Luminaires

Luminaire: Maximum Characteristics

		Terrain Categories as defined in BS EN 40-3-1			
Luminaire Max Wt	Maximum Windage Area (m ²) for Terrain Categories as defined in BS EN 40-3-1				
Luminaire Connection					
Diameter	Length				

Single Arm
Bracket
Column:

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

Bracket Projection (m)	Ref No.	Drawing No.	Material		Luminaire Fixing Angle	Luminaire Connection		Luminaire Maximum Wt	Maximum Windage Area (m ²) for Terrain Categories as defined in BS EN 40-3-1				
			Grade	Design Strength (N/mm ²)		Diameter (mm)	Length (mm)						

Arm Bracket
Column:

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

Projection (m)	Ref	Drawing No.	Material		Luminaire Fixing Angle	Luminaire Connection		Luminaire Maximum Wt	Maximum Windage Area (m ²) for Terrain Categories as defined in BS EN 40-3-1				
			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 Departmental Standard CD 354 and the Specifications.

Signed on behalf of the Contractor:.....Date.....

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

General

1. When information is not required a dash shall be inserted in the appropriate boxes.
2. Where a Data Sheet is amended it shall be given a new revision number with a date.
3. The revision numbers shall be consecutive letters of the alphabet, commencing with "A".
4. The date of the revision shall agree with the date of the Contractor's signature.
5. The column, or bracket material shall be steel.
6. 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.
7. All relevant entries shall be made on the Data Sheet before the document is certified by the Contractor.

Column Data

8. The column nominal height shall be as specified.
9. The number of door openings shall agree with the manufacturer's drawing.
10. The cross-section of the base compartment shall be indicated by a dimensioned diagram/sketch.
11. The acceptable position 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.
12. Where concrete is necessary around the planted base in accordance with sub-Clauses 1305.3 and 1305.4 the minimum diameter shall be entered.
13. For flange bases all forces and moments used in the design of the foundations, anchorages and attachment system shall be given.
14. The corrosion protection system used on the column when new shall be recorded. Where additional steel is provided for sacrificial purposes the amount shall be recorded.
15. The signs and attachments surface area, eccentricity from the centre line of the column to the centre of area of the sign and height above ground level to the centre of area of the sign shall be stated.

Bracket Data

16. The luminaire 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 columns sections.

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

APPENDIX 14/1: SITE RECORDS

1. As-built drawings shall be produced by the Contractor in accordance with GG 184 Specification for the use of Computer Aided Design for each Work Order. The Contractor shall provide drawings in both DWG and PDF. The number of copies will be as stated in the Work Order.
2. The as-built drawings shall include inserts to a larger scale when layouts are complex.
3. The as-built drawings shall include cable wiring schematic drawings and standard detail drawings.
4. If during construction the longitudinal location measurements have to be related initially to contract chainages the Contractor shall convert them to refer to permanent highway features such as bridge abutments or marker posts when these are defined.
5. The exact handover requirements shall be as stated in the Work Order.

APPENDIX 14/2: LOCATION OF LIGHTING UNITS AND FEEDER PILLARS

1. The location of lighting units and feeder pillars will be as shown in the Work Order.
2. The Contractor shall be responsible for liaison and co-ordination with the Distribution Network Operator (DNO) for the supply connections to the new feeder pillars unless otherwise stated in the Work Order.

APPENDIX 14/4: ELECTRICAL EQUIPMENT FOR ROAD LIGHTING

General Requirements

1. Specific requirements for road lighting electrical equipment for road lighting shall be detailed in the Work Order. General requirements are stated below.
2. BS 5489-1 lighting class requirements shall be as stated in the Work Order.
3. The Contractor shall provide details of the equipment which he proposes to use in the Construction Works and shall submit the information in accordance with timescales identified in the Work Order.
4. The luminaires shall be compatible with the columns and brackets offered in Appendix 13/2 and the information shall include the lamp type and wattage and luminaire circuit wattage.
5. PECU socket to be either 7 PIN NEMA or SR located by the luminaire manufacturer in the canopy unless otherwise specified in Work Order.

Specific Requirements for LED Light Sources

6. The luminaires shall be designed, manufactured and tested in accordance with the essential requirements of:
 - BS EN 60598-1, Luminaires, General requirements and tests;
 - BS EN 60598-2-3, Luminaires, Particular requirements. Luminaires for road and street lighting;
 - BS EN 62031, LED modules for general lighting, safety specifications;
 - BS EN 55015 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment;
 - BS EN 61547, Equipment for General Lighting Purposes – EMC Immunity Requirements;
 - BS EN 61000-3-2, Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase);
 - BS EN 61000-3-3, Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection;
 - BS EN 62471, Photo biological safety of lamps and lamp systems and shall be rated with a photobiological hazard (RG classification) RG0 or where not available RG1.
7. The luminaires shall be designed, manufactured and tested in accordance with the requirements of:

- BS EN 62262, Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code) And shall meet a rating of at least IK08 for the whole luminaire (including the housing, gear canopy and glass cover);
 - BS EN 60529, Degrees of protection provided by enclosures (IP Code). And shall meet a rating of at least IP66 for the whole luminaire (including the housing, gear canopy and glass cover).
8. The luminaire shall be fully compliant with all relevant European/British standards and EC Directives as required to demonstrate full compliance with the CE Directive and be clearly marked accordingly.
 9. Luminaires shall be designed for LED light sources only. Luminaires originally designed to be used with conventional light sources and subsequently modified or updated to accommodate LED light sources will not be accepted.
 10. The Correlated Colour Temperature (CCT) of LED light source shall be no cooler than 4,300 Kelvin. The exact CCT temperature will be stated in the Work Order.
 11. All LED life extrapolations shall be based upon the Illuminating Engineering Society (IES) standard LM-80 provided by the LED source manufacturer.
 12. The LED source manufacturer shall use a valid method for projecting LM 80, or equivalent, with test results to LM-80 based on recommended operating conditions.
 13. Long term life projections shall be developed in accordance with the Illuminating Engineering Society (IES) recommendations contained in TM-21 or equivalent using data obtained in accordance with LM-80.
 14. The luminaires shall be suitable for operation within ambient temperatures between -20°C and +35°C.
 15. The minimum performance requirements of the luminaire shall be L90B10 at 100,000hrs across the full range of outputs when subjected to a luminaire outside ambient temperature of 25°C.
 16. All testing and certification, including lifetime projections shall have been undertaken with the luminaires mounted within a controlled environment at an ambient operating temperature of +25°C with the LED chipset installed within the luminaires.
 17. Any testing undertaken, or data acquired at lower temperatures, or based upon LED manufacturer's lifetime projections calculated at a nominal LED junction temperature (T_j) shall not be used to demonstrate compliance with any of the minimum requirements herein.
 18. Luminaires shall be EC, WEEE and RoHS compliant.
 19. LED luminaires shall be suitable for connection to a single-phase electrical supply with a nominal voltage of: 230Vac +10% to -6% at 50Hz.
 20. The luminaire shall provide a connection facility for the main incoming supply cable.
 21. The luminaire housing shall be constructed from die cast corrosion resistant marine grade aluminium alloy in accordance with: BS EN 1676:2010 + BS EN 1559-1:2011 +

BS EN 1559-4:2015 LM6 (BS EN 1706:2010 / EN AC-44100) and be powder coated conforming to appropriate European standards.

22. The closing catch, hinges, exposed screws and other fixings shall be manufactured from a corrosion resistant material and protected in a manner commensurate with the luminaire housing.
23. The luminaire shall incorporate a robust bracing arrangement that shall securely support the canopy when open.
24. The luminaire shall be available with mounting spigots that accommodate the following requirements as a minimum:
 - Side-entry mounting 32mm to 60mm
 - Post-top mounting 60mm to 76mm
25. When mounted, the luminaire shall be capable of facilitating each of the following tilt settings as a minimum:
 - Side entry tilt angle -5°, 0°, +5°
 - Post top tilt angle 0°, +5°
26. Luminaire maximum upward light output ratio (ULOR) shall be a maximum of 0% when mounted in a horizontal position. The luminaire shall be available with optics with a minimum glare classification of G4.
27. The colour rendering index (CRI) shall be a minimum of: Ra 70.
28. The initial Colour Temperature tolerance shall be no more than: 5-step MacAdam Ellipse.
29. All luminaire shall be installed in accordance with the manufacturer's instructions and shall be fitted with an appropriate safeguarding solution to negate the luminaire becoming detached from the column.

LED Drivers

30. LED drivers shall comply with the following standards:
 - BS EN 61000-3-2, Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
 - BS EN 61000-3-3, Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
 - BS EN 61347-1, Lamp control gear. General and safety requirements.
 - BS EN 61347-2-13, Lamp control gear. Particular requirements for DC or AC supplied electronic control gear for LED modules.
 - BS EN 61000-4-5, Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.

31. All LED drivers shall incorporate Constant Light Output (CLO) technology.
32. The LED driver components shall be integral to the luminaire housing and mounted within a driver compartment separated from the LED module.
33. Access to the driver compartment shall be via a hinged opening canopy that shall be secured when in the closed position via a robust closing catch that facilitates tool-less operation.
34. The drivers shall include Surge Immunity and be capable of withstanding multiple surges of up to 8kV in differential mode, up to 6kV in common mode and up to 10kV single pulse.
35. A maximum drive current of 1,000mA shall be adhered to for all luminaires unless stated in the Work Order.
36. The LED drivers shall have terminals which are shrouded and indelibly marked to indicate all wiring connections and operating voltages.
37. The LED drivers shall be fitted with an automatic re-setting thermal cut out.
38. The LED drivers should achieve a power factor of ≥ 0.9 when operated at full load.
39. The LED drivers shall have a minimum operational lifetime of 100,000 hours with a minimum of 90% survival during this period.
40. All drivers shall be CE certified and marked.
41. The LED driver shall be capable of linear multi-stage dimming using variable drive currents.
42. The driver shall be pre-programmable to a set dimming regime if necessary. If a CMS enabled driver is specified, then remote configuration shall also be supported.

Feeder Pillars

43. Feeder pillars shall be galvanised with either single or double door and 5mm minimum steel thickness. The feeder pillar physical dimensions shall be selected to accommodate the switch gear and associated electrical apparatus required for the road lighting in the Work Order.
44. As a minimum, the feeder pillar shall contain but is not limited to:
 - an incoming supply;
 - space for energy meter;
 - isolation;
 - enclosures;
 - circuit protection (with spare ways);
 - CMS equipment;
 - an LED light;
 - RCD protected three-pin socket; and
 - warning labels.

45. Other equipment requirements (such as heaters and thermostats) for feeder pillars shall be stated in the Work Order.
46. Feeder pillars shall be suitably sized for the equipment described in the Work Order and with a clear area of at least 25% of the backboard available for future installation of control equipment.
47. The feeder pillar shall be fixed to a concrete base with suitable drainage and be provided by the Contractor and shall have a hard standing surrounding the feeder pillars shall be provided using a single row of 600mm by 600mm paving slabs.
48. Provision shall be made in the base of each feeder pillar for the termination of the incoming supply cable and associated metering arrangements where this is provided by the Distribution Network Operator. The meter shall be positioned to be clearly visible for reading and access.
49. Where required the Contractor shall provide a suitable number of 25 to 35 sq millimetre PVC/PVC cable tails each of at least 2 metres long to allow for connecting into the service cut-outs of the Distribution Network Operator.
50. Feeder pillars shall be adequately earthed in accordance with BS 7671.
51. Preparation and protection of surfaces of steel shells and bases shall be as specified in accordance with the Work Order.
52. All earthing of the internal fittings and cable glands shall all be made off inside the enclosures so that there are no earthing conductors outside these enclosures with the exception of the door and pillar case bonding.
53. A copy of the agreed and completed as-built layout and schematic drawings as detailed in the Work Order shall be encapsulated and fixed to the inside of the feeder pillar doors.
54. Where possible all internal wiring of the feeder pillars shall be fabricated off-site and the feeder pillar shall have a CE mark and Declaration of Conformance.
55. For feeder pillars the maintenance number is to be mounted on an aluminium plate with a minimum corner radius of 10mm and fixed to the pillar facing traffic using 5mm stainless screws and washers and Nylock nuts.

Fuses

56. All fuses in columns shall be to BS 88 and rating as shown in the table below:

LED		
Light Output	6.6klm to 35klm	36klm to 52klm
Voltage	230v	
Fuse Rating (Amps)	6	10

Underground and Ducted Cables and Cable Joints

57. All cables and cable joints to have 3 core copper conductors XLPE/SWA/XLPE and in accordance with Series 1400 of the MCHW.
58. The cable distribution arrangement shall be in a loop-in loop-out arrangement rather than use a breech joint type arrangement adjacent to the column unless otherwise stated in the Work Order.
59. No underground jointing will be allowed unless specified within the Work Order.

Passive Disconnection Systems

60. Where passively safe columns are used, it is necessary to ensure that all associated circuits disconnect within 0.4seconds. This shall be achieved either through circuit design, or a third-party physical/electronic disconnection system. Requirements will be stated in the Work Order.

Chambers

61. Chambers shall be in accordance with MCX 0815 Type A, B, or C ~~or D~~ and as ~~outlined in the~~ per Appendix 15/2 of the supplementary information (as outlined in each of the Works Orders) ~~Work Order~~.
62. Chamber lids that are behind safety barriers shall be a Type B, those not located behind safety barriers shall be Type D unless otherwise identified in the Work Order.

Earth Electrodes

63. Earth electrodes shall be copper clad steel of 16mm minimum diameter housed in an inspection chamber (concrete type) with aluminium bronzed bodied cable clamp and phosphor bronze screw.
64. All earth rods and installations shall conform to BS 7430, and shall be tested by the approved method as stated in BS 7671 the IET Wiring Regulations.

Central Management Systems (CMS) and Dimming during Darkness

65. National Highways Central Management Systems (CMS) have developed a method of operation to monitor and control the road lighting on the strategic road network. The method of operation facilitates dimming operation based on real live traffic data using the MIDAS network and permitting a more dynamic method of operation.
66. MoRLiCS operation is limited to only parts of the National Highways strategic road network and the requirements for facilitating connection into either the MoRLiCS CMS systems will be identified in the Work Order.
67. Notwithstanding this and as a minimum all LED lighting units to be installed on the National Highways strategic road network to be equipped with 7 PIN NEMA or System Ready (SR) sockets that will be MoRLiCS compatible to facilitate future connection.
68. LED drivers shall be capable of dimming having DALI 1.0 or 2.0 digital standard (IEC 60929) functionality and be capable of factory set dimming profiles.

69. The exact dimming profiles will be stated in individual Work Orders and as a minimum shall be capable of having up to a minimum of five changes in state during the period of darkness.

APPENDIX 14/5: ELECTRICAL EQUIPMENT FOR TRAFFIC SIGNS

1. The positioning of equipment within the base compartment of posts shall be as described in the Work Order.
2. Requirements for wiring and installation of components within posts and Lit Sign Units shall be as described in the Work Order.
3. Traffic sign luminaires shall comply with BS EN 12899-1, Appendix 12/1 and the following:
 - For externally illuminated signs the mean illuminance (Class E) and uniformity of illuminance (Class UE) shall be in accordance with BS EN 12899-1 National Annex NA.2 Table NA.1 and as stated in the Work Order;
 - For internally illuminated signs the mean luminance (Class L) and uniformity of luminance (Class U) shall be in accordance with BS EN 12899-1 National Annex NA.2 Table NA.1 and as stated in the Work Order; and
 - External lighting luminaires shall be correctly positioned to meet the luminance requirements of the sign.
4. Photobiological hazard shall be RG0 or where not available RG1.

APPENDIX 15/1: MOTORWAY COMMUNICATIONS

Specification documents required are available from TSS Plans Registry, Bristol, Tel: 01173 728270 or email Tss_plans_registry@highways.gov.uk.

They can also be accessed via the portal:
<https://tssplansregistry.highwaysengland.co.uk/login.asp>

1 Detector Loops

1.1 Loop Detector Installations to be installed in accordance with drawings MCX 0592, Sheets 1-4 inclusive, MCX 0594 Sheets 1-4 inclusive and Highway Construction Drawings G1 – G32 inclusive.

APPENDIX 16: PILING AND EMBEDDED RETAINING WALLS

Details will be included in Work Order

APPENDIX 17/1: SCHEDULE FOR THE SPECIFICATION OF DESIGNED CONCRETE

Information to be provided as part of the Scheme Work Order based on the below

Requirement	Schedule		
Designed Concrete Ref / Location in the works			
Intended Working Life of Structure			
Nominal Cover to Reinforcement			
Applicable Exposure Classes (Excluding DC-class)			
DC-class (where appropriate)			
Compressive Strength Class of Concrete			
Minimum Cement Content (kg/m ³)			
Maximum Free Water/Cement Ratio			
Required Group or Type and Class of Cement or Combination (where a DC-class has not been specified)			
Maximum Aggregate Size, mm			
Chloride Content Class			
For Lightweight Concrete, the Density Class or Target Density			
For Heavyweight Concrete, the Target Density			
Consistence Class (Contractor to confirm)			
Special Type or Class of Cement or Combination			
Required Source/Special Type of Aggregate			
Maximum Cement Content (kg/m ³)			
Required Admixture			
Air Entrainment Required [YES/NO]			
Minimum or Maximum Temperature of Fresh Concrete °C			
Sampling and Testing			
Requirements to Control Early Thermal Cracking or Other Requirements			

APPENDIX 17/2: CONCRETE – SURFACE PROTECTION SYSTEMS

Information to be provided as part of the Scheme Work Order based on the below

1. Schedule of areas where surface protection systems are to be applied, including structure reference, description and location of structural elements to receive surface protection, type of surface protection system (hydrophobic impregnation/anti-graffiti/anti-carbonation coatings) and extent of surface protection systems (e.g X meters above ground level across full width of abutment, or as shown on drawings etc.)
2. Special requirements or constraints for the application of surface protections systems
3. For each type of surface protection system product, performance requirements for the essential characteristics of the product for its intended use (which are to be demonstrated by the Declaration of Performance and CE Marking in accordance with the Product Standard
4. Requirements for refractive index testing and trial panels

APPENDIX 17/3: CONCRETE – SURFACE FINISHES

Information to be provided as part of the Scheme Work Order based on the below

1. Requirements for trial panels
2. Requirement for contract specific surface finishes
3. Positions where internal ties are permitted (other than in rebates) for Class F4 finishes
4. Locations where a regular pattern of formwork joints is unnecessary

APPENDIX 17/4: CONCRETE – GENERAL

Information to be provided as part of the Scheme Work Order based on the below

- 1 (12/14) Requirements for concrete if different from the requirements of sub-Clause 1701.1
- 2 (12/14) Details of any parts of the structure to be constructed in accordance with an execution class other than Execution Class 3 [1701.4]
- 3 (12/14) Additional requirements when using special technologies, other materials or innovative designs [See NG 1701.4]
- 4 (12/14) Whether the use of cements or combinations other than to Clause 1702.1 is permitted
- 5 (12/14) Requirements for aggregates if different from the requirements of sub-Clause 1702.2
- 6 (12/14) Requirements for admixtures if different from the requirements of sub Clause 1702.3
- 7 (12/14) Requirements for sampling and testing if different from the requirements of sub-Clause 1707.1. Whether identity testing is required, the identity test rates and, if not restricted to cases of doubt or random spot checks, type of tests, volume of concrete and number of tests [Guidance is given in 1707 and NG 1707]. [Cross-reference should be made and tests should be scheduled in contract specific Appendix 1/5 and/or contract specific Appendix 1/6 as appropriate]
- 8 (12/14) Requirements for construction joints [1710.1]
- 9 (12/14) Whether retarding agents may be used [1710.1]
- 10 (03/20) Requirements for permanent formwork or special formwork including load testing requirements [1710.2(iv), 1710.3, NG 1710.2(ii) and NG 1710.3] [Cross-reference should be made and tests should be scheduled in contract specific Appendix 1/5 and/or contract specific Appendix 1/6 as appropriate]
- 11 (12/14) Details of parts of the structure for which a curing class other than 3 is to be used [1710.5(i)]
- 12 (12/14) Details of any special curing requirements. [1710.5(i)]
- 13 (12/14) Locations requiring stainless steel wire other than those described in sub-Clause 1714.1
- 14 (12/14) Whether welding of reinforcement other than steel fabric reinforcement is permitted including details and location [1717.1]
- 15 (12/14) Requirements for time of stressing if different from the requirements of sub-Clauses 1724.3 and 1724.4
- 16 (12/14) Requirements for protection of prestressing tendons [1725.1]
- 17 (12/14) Requirements for inspection and testing of structures and components [1701.5, 1701.6 and 1727.1] [Guidance is given in NG 1701.5, NG 1701.6 and NG 1727. Tests should be scheduled in contract specific Appendix 1/5 and/or contract specific Appendix 1/6]
- 18 (12/14) Details of parts of the structure that require an independent/third party inspection by an organisation different from that which executed the works [1701.6 and NG 1701.6]. Details of who is to procure such inspection and Overseeing Organisation's requirements for approval
- 19 (12/14) Details of tighter or additional tolerances, required for aesthetics, durability, fit or special structures [1728 and NG 1728]
- 20 (12/14) Additional requirements for stainless steel reinforcement [1712.6 and NG 1712.2. If stainless steel reinforcement is required the compiler must as a minimum specify the chemical grade of stainless steel required]
- 21 (03/20) Requirements for differential deflection and vibration monitoring in the formation of continuity joints in bridge decks [1710.9(ii) and NG 1710.9(ii)]
- 22 (03/20) Requirements for phased removal of concrete in the formation of continuity joints in bridge decks [1710.9(iii) and NG 1710.9(iii)]

APPENDIX 17/5: BURIED CONCRETE

Information to be provided as part of the Scheme Work Order based on the below

[Note to compiler:

The following information should be completed for each structure, or group of structures, and applies only for buried concrete or partially buried concrete, i.e. with one or more faces in contact with natural or disturbed ground or imported backfill.]

(12/14)

<p>STRUCTURE NAME OR LOCATION</p> <p><i>[a separate appendix should be provided for each structure or location with varying conditions or design constraints – identical conditions and constraints may be grouped together in one appendix]</i></p>	
<p>ACEC CLASS FOR SITE</p> <p><i>[derived from Table A.2 of BS 8500-1]</i></p>	
<p>DESIGN CHEMICAL CLASS</p> <p><i>[derived from the ACEC class determined by assessment of ground conditions, together with the hydraulic gradient due to groundwater and adjusted as necessary by reference to the footnotes to Table A.9 of BS 8500-1 and NG 1704.11(i) for increase in concrete quality when used as an Additional Protective Measure]</i></p>	
<p>OTHER REQUIREMENTS AND DESIGN CONSTRAINTS</p> <p><i>[e.g. Any restrictions on cement or combination group, other concrete restrictions, site constraints, limitations on drainage, Additional Protective Measures required etc]</i></p>	

APPENDIX 17/6: GROUTING AND DUCT SYSTEMS FOR POST-TENSIONING TENDONS

Information to be provided as part of the Scheme Work Order based on the below

(12/14) NG SAMPLE CONTRACT SPECIFIC APPENDIX 17/6: GROUTING AND DUCT SYSTEMS FOR POST-TENSIONED TENDONS

(12/14) REQUIRED INTENDED USE:

[Note to compiler – state here the required intended use of the prestressing system]

(12/14) PERFORMANCE REQUIREMENTS:

[Note to compiler: state here any performance requirement for the intended use of the system, to be demonstrated by CE marking and Declaration of Performance for the characteristics covered by the relevant harmonized technical specification/ETA of the product. See sub-Clauses 1711.1 and NG 1711.1]

(12/14) TENDON REFERENCE:

[Note to compiler: complete this for each different group or type of tendons]

(12/14) GROUT DEFINITION:

Grout type:	Grout
Maximum water/cement ratio:	[0.30-0.40]

(12/14) REQUIREMENTS FOR TRIALS/TESTS:

Full-scale grouting trials required: [Yes/No]

Drawing Reference:

[Note to compiler: full details including trial element size, concrete grade, cover to reinforcement and tendons, reinforcement and tendons details, location of cuts and requirements for testing and investigation should be defined on drawing]

Time at which trials are to be carried out (days before planned use in the permanent works): [56 days]

[Note to compiler: Testing requirements to prove protection against ingress of contaminants are given in Section 8 of the Concrete Society Technical Report 72 'Durable Post-tensioned concrete structures']

Duct assembly tests required	[Yes/No]
Required duct assembly testing pressure:	[0.01 N/mm ²]
Minimum duct wall thickness as manufactured:	[2.0 mm] [4.0 mm for external tendons]
Minimum duct wall thickness after tensioning:	[1.5 mm]
Minimum duct to concrete ultimate bond length:	[50-100 diameters]
Additional testing requirements	[-]

(12/14) REQUIREMENTS FOR DUCT SYSTEM:

Distance beyond crests to next vent: *[Horizontally, to the point where the duct is half the diameter lower than at the crest, or 1 m, whichever is the lesser]*

Maximum vent spacing	[15 m]
Minimum vent height above highest point	[500 mm]
Other requirements	[-]

Requirements for Grouting:

Maximum rate of grouting of ducts	[10 m/min]
Minimum volume of grout expelled after visual test	[5 litres]

[Note: Default values shown in brackets]

APPENDIX 17/7: PRECAST CONCRETE ELEMENTS

Information to be provided as part of the Scheme Work Order based on the below

(12/14) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 17/7: PRECAST CONCRETE ELEMENTS**

[Note to compiler: Include here:]

- 1 (12/14) Details of any precast element not conforming to a Product Standard or BS EN 13369 [1710.8(i)]
- 2 (12/14) For each type of precast product, reference to the relevant Product Standard or BS EN 13369 as appropriate [1710.8(ii)]
- 3 (12/14) For each type of precast product, performance requirements for the essential characteristics of the product (which are to be demonstrated by the Declaration of Performance and CE marking in accordance with the Product Standard) [1710.8(ii) and NG 1710.8(ii)]
- 4 (12/14) For each type of precast product, reference to relevant drawings and other technical data prepared by the designer and, where all of part of the design is undertaken by the manufacturer, reference to all information necessary for design [Guidance is given in NG 1710.8(ii)]
- 5 (12/14) For each type of precast product, list of the minimum technical data to be provided with the CE marking stating the required method of CE marking and labelling as defined in Annex ZA of the relevant Product Standard [Guidance is given in NG 1710.8(ii)]
- 6 (12/14) References to documents and drawings which show the lifting scheme and support points for precast concrete elements, including constraints during handling and storage instructions [1710.8(iv)(b) and (iv)(c)]
- 7 (12/14) Requirements for assembly and erection of precast concrete elements [1710.8(iv)(e)]
- 8 (12/14) Requirements for jointing and completion works of precast concrete elements [1710.8(iv)(g) and NG 1710.8(iv)(g)]

APPENDIX 17/8: POST-INSTALLED ANCHORS AND REINFORCING BAR CONNECTIONS

Information to be provided as part of the Scheme Work Order based on the below

(03/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX
17/8: POST-INSTALLED ANCHORS AND
REINFORCING BAR CONNECTIONS**

(03/20)

[Note to compiler: Where reinforcing bar connections are specified [1729.1, 1729.3, NG 1729.1 and NG 1729.3], include here:]

Characteristic	Value
Type of fixing	<i>[reinforcing bar connection]</i>
EAD	<i>[NG 1729.4]</i>
Position of fixing(s)	<i>may include reference to specific drawings [1729.5 and NG 1729.4]</i>
Safety Criticality	<i>[NG 1729.4]</i>
Restrictions on cutting through reinforcement within the base material	<i>may include reference to specific drawings [1729.6(ii) and NG 1729.4]</i>
Minimum bond strength including reduction factor	<i>where determined [NG 1729.5]</i>
A maximum amplification factor for anchorage length	<i>where determined [NG 1729.5]</i>
Required fire reaction class	<i>where determined [NG 1729.5]</i>
Any additional requirements on bond strength at higher temperatures	<i>[NG 1729.5]</i>
Strength class of base material concrete	<i>[NG 1729.5]</i>
Maximum chloride content of the base material concrete	<i>[NG 1729.5]</i>
Temperature range of the base material in service	<i>[NG 1729.5]</i>
Required material of reinforcing bar	<i>[1729.8 and NG 1729.5]</i>
Anchorage length	<i>[NG 1729.5] where determined – may include reference to specific drawings</i>
Bar diameter	<i>[NG 1729.5] where determined</i>
Number and location of test bars	<i>[1729.11 and NG 1729.9] may include references to specific drawings. Cross-reference should be made and tests should be scheduled in contract specific Appendix 1/5 as appropriate</i>
Requirements on magnitude of proof test load	<i>[1729.11 NG 1729.9] i.e. min 1.1 times design tensile action etc.</i>
Requirement for sacrificial fixings	<i>[NG 1729.9]</i>

[Note to compiler: Where anchors are specified [1729.1, 1729.3, NG 1729.1 and NG 1729.2], include here:]

Characteristic	Value
Type of fixing	[bonded anchor or mechanical anchor]
EAD	[NG 1729.4]
Position of fixing(s)	may include reference to specific drawings [1729.5 and NG 1729.4]
Safety Criticality	[NG 1729.4]
Restrictions on cutting through reinforcement within the base material	may include reference to specific drawings [1729.6(ii) and NG 1729.4]
Whether base material is assumed to be cracked or uncracked	[NG 1729.6, NG 1729.7 and NG 1729.8]
Seismic action category	if relevant [NG 1729.6, NG 1729.7 and NG 1729.8]
Temperature range of the base material in service	insert if bonded anchor [NG 1729.6, NG 1729.7 and NG 1729.8]
Durability classification	[NG 1729.6, NG 1729.7 and NG 1729.8]
Strength class of base material concrete	[NG 1729.6, NG 1729.7 and NG 1729.8]
N_{Ed} , V_{Ed} (ULS)	insert if loads on individual anchor have been calculated [NG 1729.6 and NG 1729.7]
N_{Ed} , V_{Ed} (SLS)	insert if loads on individual anchor have been calculated [NG 1729.6 and NG 1729.7]
N_{Ed}^* , V_{Ed}^* (ULS)	insert if loads on group of anchors have been calculated - may include reference to specific drawings [NG 1729.8]
N_{Ed}^* , V_{Ed}^* (SLS)	insert if loads on group of anchors have been calculated - may include reference to specific drawings [NG 1729.8]
Admissible displacements at SLS	[NG 1729.6, NG 1729.7 and NG 1729.8]
Thickness of concrete base material	may include reference to specific drawings [NG 1729.6, NG 1729.7 and NG 1729.8]
Edge distances	may include reference to specific drawings [NG 1729.6, NG 1729.7 and NG 1729.8]
Spacing between anchors	may include reference to specific drawings [NG 1729.6, NG 1729.7 and NG 1729.8]
Diameter of anchor	may include reference to specific drawings [NG 1729.6, NG 1729.7 and NG 1729.8]
Minimum and maximum embedment lengths	may include reference to specific drawings [NG 1729.6, NG 1729.7 and NG 1729.8]
Is design to account for a missing fixing?	insert if loads on group of anchors have been calculated [NG 1729.8]
Layout of anchors	insert if loads on group of anchors have been calculated - may include reference to specific drawings [NG 1729.8]
Baseplate thickness	may include reference to specific drawings [NG 1729.6, NG 1729.7 and NG 1729.8]
Additional requirements related to resistance for fire	insert, if relevant, for mechanical anchors [NG 1729.7 and NG 1729.8]
Additional design requirements	[1729.1, 1729.3, NG 1729.1 and NG1729.2]

APPENDIX 18/1 REQUIREMENTS FOR STRUCTURAL STEELWORK

1. The specification for structural steelwork is Series 1800 of the Specification for Highway Works. An Appendix 18/1 shall be prepared by the Contractor for each separate task for acceptance by the Overseeing Organisation. The Appendix 18/1 shall use the Series NG 1800 sample contract specific appendix

Characteristic	Value
Number and location of test anchors	<i>[1729.11 and NG 1729.9] may include references to specific drawings Cross-reference should be made and tests should be scheduled in contract specific Appendix 1/5 as appropriate</i>
Requirements on magnitude of proof test load	<i>[1729.11 and NG 1729.9] i.e. min 1.1 times design tensile action etc.</i>
Requirements for sacrificial fixings	<i>[NG 1729.9]</i>

APPENDIX 19/1: FORM HA/P1 (NEW WORKS) PAINT SYSTEM SHEET

**(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P1 (NEW WORKS) PAINT SYSTEM SHEET**

Sheet No: 1

1. SCHEME TITLE: STRUCTURE NO: GRID REF:				
2. DATE OF ISSUE OF DOCUMENTS:				
3. ENVIRONMENT AND ACCESSIBILITY: Inland and Difficult				
4. REQUIRED DURABILITY OF SYSTEM: MAJOR MAINTENANCE after 15 YEARS NO MAINTENANCE up to 8 YEARS MINOR MAINTENANCE after 8 YEARS		5. COLOUR OF FINISH		
6. PAINT SYSTEM TO BE APPLIED OVER: AREA REF: AREA DESCRIPTION: PROTECTIVE SYSTEM TYPE: (i.e. I, II, etc.):				
7. DETAILS	1 st Coat	2 nd Coat	3 rd Coat	4 th Coat
Registered Description Item No. and Colour Date Registered Brand Name and Manufacturer's Ref. No Data Sheet No. Where applied How applied Min dry film thickness (mdft) Max local dft (See Cl. 1914.7) Estimated total volume of paint likely to be used. (litres) 'A' type testing required? (YES/NO) (See Cl 1912.3) 'B' type testing required? (YES/NO) (See Cl 1912.9)				
8. STRIPE COAT DESCRIPTION (Including Item No. and colour) Shop: Site:		9. PAINT MANUFACTURER'S OFFICIAL STAMP:		
10. Mdft (□m) NOTE: The minimum total dry film thickness of the paint system, neglecting primers and sealers under 30 microns, shall be 15% greater (to the nearest 25 microns) that the sum of the mdfts of the individual paint coats.		11. APPROVED BY: DATE:		

Manufacturer's General
Recommendations :

APPENDIX 19/4: FORM HA/P3 PAINT SAMPLE DISPATCH LIST SHEETS 1 & 2

**(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P3 PAINT SAMPLE DISPATCH LIST: SHEET 1**

Contract

Title.....

Structure Name Structure No.

Overseeing Organisation Name: National Highways

Supervising Firm.....

Supervising Firm's Representative Name Tel no.

Painting Inspection Firm.....

Samples Despatched From..... (Note 1) Date Despatched.....

Inspector's Name Tel no.

Inspector's Signature

Samples: (Numbered A1, A2 etc. or B1, B2 etc.) (Note 2)

<i>Sample No</i>	Item No	Manufacturer's Reference No	Batch No	Colour BS 4800 reference (Note 3)	Sp.G. (Notes 4 and 5)

Paint Manufacturer

APPENDIX 19/4

(SPECIFICATION FOR HIGHWAY WORKS) FORM HA/P3 PAINT SAMPLE DISPATCH LIST: SHEET 2

INSPECTOR to complete Form HA/P3 and to forward single copies to each of the following within 24 hours of dispatch of samples by the Contractor to DERA

- | | | | |
|----|---|----|---|
| 1. | ESG
Coatings Team
Derwent House
Bretby Business Park
Ashby Road
Burton on Trent
Derbyshire DE15 0XD | 2. | National Highways
Paint Specialist
Safety Engineering and Standards
Piccadilly Gate
Store Street
Manchester M1 2WD |
|----|---|----|---|

INSPECTOR to forward Form(s) HA/P1 Paint System Sheet(s) with the first Form HA/P3 to both addresses.

INSPECTOR to select "A" samples and to ensure that manufacturer's labels on tins comply with specification.

INSPECTOR to take and mark each "B" sample tin with Item No. manufacturer's name and brand reference No, batch No, sample No and colour (NOTE 2).

CONTRACTOR to CLIP DOWN LIDS of all tins and to pack, address and dispatch samples. In addition to address, **CONTRACTOR** to label each case (or tin sent loose): "HA (State structure name) and DATE (date of dispatch as noted above)".

Notes

1. State whether from shop or site (give name and address).
1. Batch samples comprising unopened tins to be marked A1, A2, etc. Control samples in 0.5 litre tins to be marked B1, B2, etc. Samples No to run consecutively, i.e. A1 and B1 onwards.
2. Colour reference to BS 4800 to be given, as stated on Form HA/P1 (New Works) Paint System Sheet, e.g. 18 B 25
3. For "A" samples specific gravity (Sp.G.) to be measured by Inspector from separate tins of the same batch. For "B" samples Sp.G. to be measured by Inspector when taking samples. Samples will be rejected unless Sp.G. is filled in above by Inspector.
4. If Sp.G. differs appreciably from data sheet do not dispatch "A" or "B" samples.

APPENDIX 19/5: GENERAL REQUIREMENTS

Lighting Columns

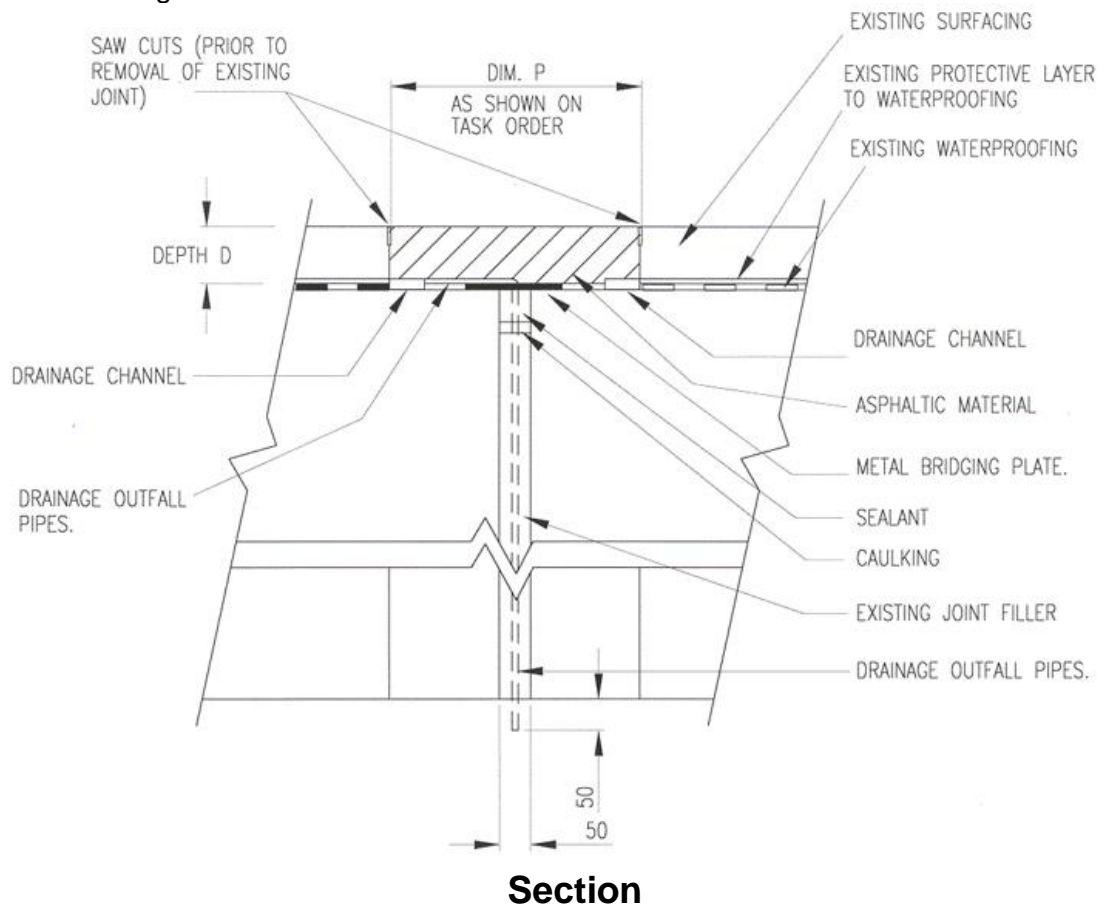
1. The protective system for planted and flange mounted lighting columns with bracket arms shall be G2a and the environmental, accessibility and durability requirements is as described in Sheet 1 of Appendix 19/1.
2. The 'ground level' shall be the actual ground level for each column.
3. The colour of finish shall be as described in the Work Order.
4. Paints for any one system shall be obtained from the same manufacturer.

APPENDIX 20/1 : WATERPROOFING FOR CONCRETE STRUCTURES

1. Proprietary materials will in general be permitted for waterproofing concrete surfaces.
2. Sealing with primer is required prior to the application of tar or bitumen waterproofing.
3. Non-destructive integrity testing of waterproofing will be specified if required in the Scheme Work Order.
4. Existing waterproofing systems for individual structures are as described in the Scheme Work Order.
5. Prior to the re-waterproofing of the whole deck, the adhesion of any repairs to the concrete substrate and the waterproofing membrane to the repair material should be established. They shall be tested in accordance with BS EN ISO 4624:2016 or ASTM D4541-02. The repaired area shall be large enough to completely contain the sample of waterproofing (or the waterproofing shall be cut back within the repair boundaries) so that all tensile load passes to the repaired area. Two tests shall be carried out per deck as directed by the Supervisor and both tests shall achieve an adhesion value of 1 N/mm².
6. To achieve the 2 mm minimum waterproofing depth, the Contractor shall determine the appropriate application rate for the encountered concrete surface texture. When the structure being waterproofed comprises a significant proportion of existing concrete, the Contractor shall have been assumed to have allowed in his tender an extra 25% above the manufacturers normal minimum coverage rates to achieve the required Specification membrane thickness. This allows for the possibility that older structures may have concrete finishes with a texture depth greater than that for a U4 finish.
7. Surfaces shall be prepared and the waterproofing system shall be installed in accordance with the manufacturer's instructions and approved by the Overseeing Organisation.
8. Arises on existing concrete shall be ground down to a 25 mm x 25 mm profile of smooth concrete suitable for the receipt of the waterproofing membrane.
9. 25 mm x 25 mm fillets of repair mortar shall be formed where waterproofing is to be laid in sharp internal angles. The surfaces to receive a fillet shall be scarified, cleaned and pre-soaked with clean water for 2 hours prior to removal of excess water and laying of mortar. Mortar shall be hand trowelled into place and form a smooth surface suitable for receipt of the waterproofing membrane.

APPENDIX 23/1: BRIDGE DECK EXPANSION JOINT SCHEDULE

1. All bridge deck expansion joints shall satisfy the requirements of Standard CD 357 'Bridge Expansion Joints'.
2. For basic types of asphaltic plug expansion joints refer to attached drawing.



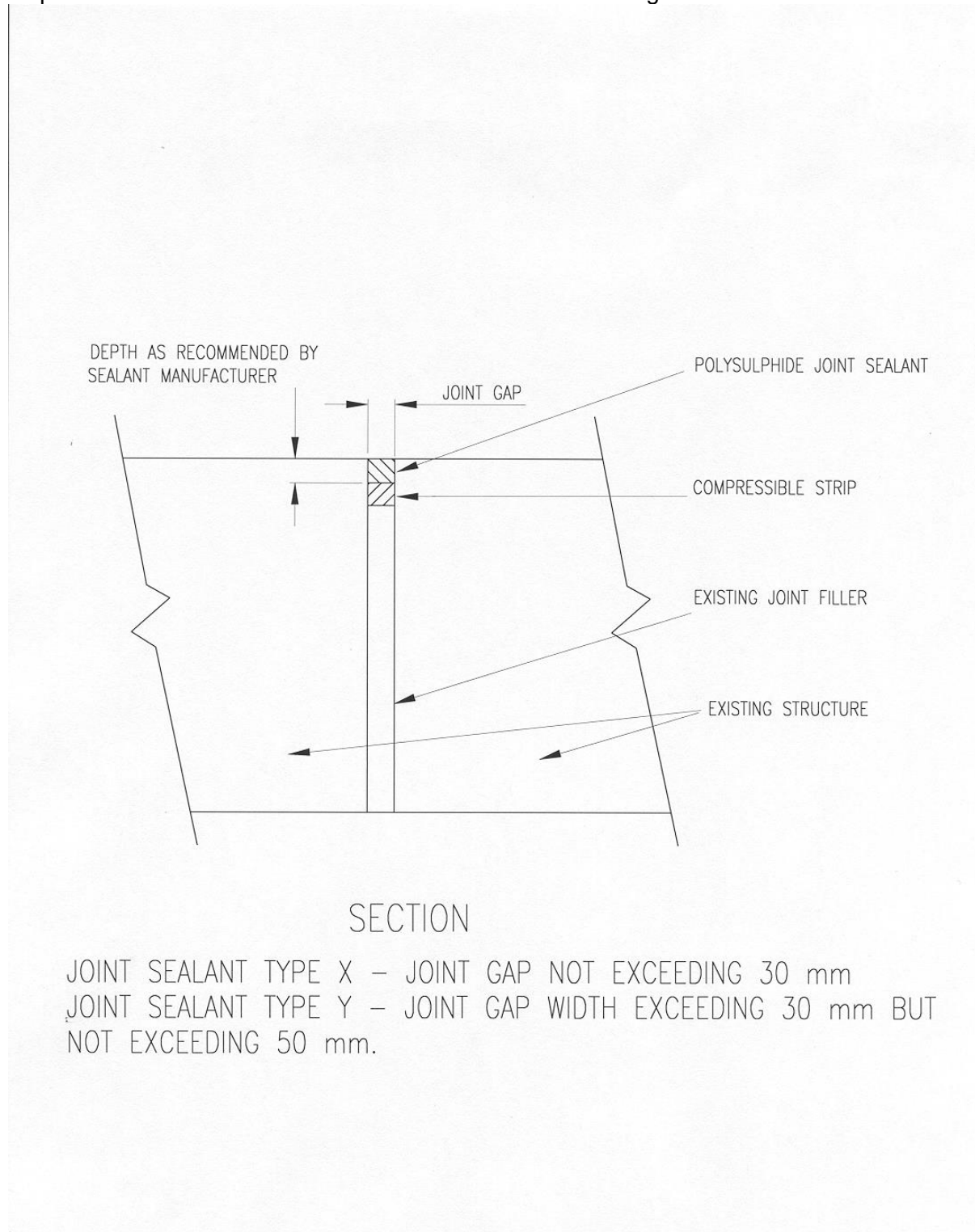
Asphaltic Plug Bridge Deck Expansion Joints

3. For types of expansion joints (excluding asphaltic plug) see table below:

Joint Type (as per CD 357)	Sketch of Joint (as found in CD 357)
Type 3 - Nosing joint with poured sealant	Figure 3
Type 4 – Nosing with preformed compression seal	Figure 3
Type 5 – Reinforced Elastomeric	Figure 4
Type 6 – Elastomeric in metal runners	Figure 5

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

Gaps shall be sealed in accordance with the attached drawing.



Sealing of Gaps

APPENDIX 24/1: BRICKWORK, BLOCK WORK AND STONWORK

Unless specified otherwise the following shall apply:

1. Mortar shall be designation (ii) comprising Portland cement complying with BS EN 197-1.
2. Bricks shall be clay complying with the particular requirements of BS 3921, BS EN 771-3 and BS EN 772-7.
3. All exposed pointing shall be bucket handle.

APPENDIX 25/4: ENVIRONMENTAL BARRIERS

General

1. Environmental barriers shall comply with the requirements of Specification for Highway Works Clause 2504 (Environmental Barriers), LA 111 Noise and vibration, LD 119 Roadside environmental mitigation and enhancement, and the following additional requirements.
2. All acoustic barriers shall comply with the BS EN 14388 'Road Traffic Noise Reducing Devices: Specifications' that requires barriers to be tested under BS EN 1793-2 to demonstrate the barrier meets the sound insulation performance class stated in the Scheme Work Order and, where absorptive, tested under BS EN 1793-1 to meet the absorption class stated in the Scheme Work Order.
3. All acoustic barriers shall have a Declaration of Performance and be CE marked in accordance with Clause 104.
4. The acoustic barrier shall achieve effective acoustic attenuation and have an appearance which harmonises with the surrounding landscape when viewed from either side.
5. The height and location of the barriers will be provided as part of the Scheme Work Order. Where it is necessary to recess the barrier, that height shall be maintained. Further to Clause 2504(2), the levels/profile of the barriers shall be agreed with the Overseeing Organisation but shall be vertical and of a consistent design throughout the entire length of the scheme with a smooth flowing appearance.
6. Stepping of panels shall not be permitted.
7. Transition between different height barriers shall be raked at a slope not exceeding 1:10 by raking up the lower specified height to meet the higher height.
8. Where barriers adjoin other structures the end panel shall be raked down to match the height of the adjacent structure.
9. Where environmental barriers meet with an environmental bund the top of the barrier shall follow the level of the carriageway. Where gravel board is required, this shall follow the slope such that the barrier appears to disappear into the bund. The barrier shall then terminate at a height not exceeding 500mm above finished ground level. At no point should the combined height of the barrier and bund be less than the height specified.
10. Where timber is used, the colour of timber preservative treatment shall be a natural brown. Exact shade to be agreed.
11. Post colour shall be natural brown.
12. Where shown in the Scheme Work Order, environmental barriers shall be badger-proofed by the fixing of steel wire woven mesh in accordance with HCD drawing no H46 (Type 3) to the outer face of the barrier.
13. Further to Clause 2504(15), the Contractor shall submit to the Overseeing Organisation a design to be assessed. All technical approvals shall be made in accordance with CG 300, and shall include consideration of the appearance and

standards of workmanship. The additional information submitted with the design, check certificates (and if required, completed AIP form), shall include the details listed in Clause 2504.15 (iii). Sample panels of barrier shall be erected in accordance with Clause 2504.15 (i).

Timber

1. Where timber is used, all timber components shall receive preservative treatment prior being fabricated. The Site cutting and drilling of timber after the preservation treatment specified in Clause 311 shall not be permitted for constant height sections of barrier, including those on sloping ground.
2. For raking sections of barrier, minimal further working after preservation will be permitted subject to the freshly exposed parts being brushed over with two coats of preservative (Clause 311(2)) before being fitted into position. Components which have dead knots will not be permitted.
3. Paint containing non-toxic constituents shall be used where painted surfaces are adjacent to fields.

Fixtures/Fittings

1. Further to Clause 2504(15)(v), where bolt fixings are used, the bolts shall be of neat appearances on both sides of the barrier with no undue exposed shank. All fixings shall be anti-vandal to prevent unauthorised removal.
2. All bolts and washers shall be in austenitic stainless steel to Graded 302 or 304.

DESIGN DETAILS – As Applicable

1. Cappings, rails and gravel boards shall be designed to resist vandalism.
2. Further to Clause 2504(15)(vii), the overlap of cover string and/or rebates shall be a minimum of 25 mm. All vertical boarding shall abut the cappings and gravel boards to produce a panel which is completely gap free at all joints including the posts.
3. All rails shall be permanently fixed to prevent unauthorised removal.
4. The bottom edge of the vertical boarding shall be effectively fixed to the gravel boards, although attention is drawn to the Clause 2504(15)(xi).
5. The design shall ensure that no gaps occur between the vertical boarding and the gravel boards at any time.
6. The design shall ensure that all pieces drain freely and do not collect debris.
7. Posts shall be at maximum 3 m centres.
8. Only one fixing shall be used at each intersection of boards with rails.
9. Posts may be visible from either side of the barrier.

10. All bolt fixings that pass through the width or thickness of timber framing shall be a minimum of 50 mm from the end of the piece.
11. Gates as Clause 2504.15(x) shall be provided at locations to be agreed with the Overseeing Organisation. Gates shall be at a maximum interval of 200m.
12. The gates shall have a clear opening of 1.0m. The gates shall be fitted with a self-closing spring as Clause 2504.15 and shall be fitted with a galvanised latch opening mechanism to allow the gate to be opened on the motorway side.

Design Requirements

1	(i)	Whether it is satisfactory for timber to be sawn (as applicable) (2504.7).		The Site cutting and drilling of timber after the preservation treatment specified in Clause 311 shall not be permitted for constant height sections of barrier, including those on sloping ground.
	(ii)	Treatment required for timber (as applicable) posts (2504.12).		Post to be treated to provide a natural brown finish.
	(iii)	Testing requirements for foundations.	Yes	2 no. Tests required in locations to be agreed with the Overseeing Organisation.
2	(i)	The requirement for the design to comply with CG 300 and the outline Approval In Principle form.	Yes	AIP if applicable.
	(ii)	Whether sample panels are required (2504.15(i)).	No	
	(iii)	Whether posts need to be at same centres in order to combine with safety barriers	No	3.0m maximum.
	(iv)	Whether stepping of panels is permitted (2504.2).		Not Permitted.
	(v)	Whether the contractor is required to design the foundations. Posts and/ other supports (2504.15).	Yes	In accordance with LA 119, Eurocodes and CG300
	(vi)	If applicable, particular requirements for foundations, eg class of concrete.	None	To be proposed by the Contractor.
	(vii)	If applicable, particular requirements for any other supports.		In accordance with the Approval In Principle.

	(viii)	Factors influencing Department aesthetic approval (2504.15).		See para 2 above.
	(ix)	Requirements for materials other than timber, concrete, steel and brickwork (2504.1, 2504.14).	None	
	(x)	Whether access gates are required.	Yes	See para 31 above
	(xi)	If applicable, details of the barrier to be erected to shield the 1m gap provided for access.		Not applicable.
	(xii)	If applicable, details of the barrier to be erected to shield a gap provided for access (2405.15).	None	
	(xiii)	Height of the Barrier		Barrier height to be detailed in the Scheme Work Order
	(xiv)	Inclination of Barrier.		Vertical.
	(xv)	Sound reduction index requirements specified in accordance with BS EN 1793-2 (2504.17).		Category B3, $DL_R \geq 24dB(A)$.
	(xvi)	Sound absorption coefficient requirements specified in accordance with BS EN 1793-1 (2504.18).		Where barriers are absorptive, be at least Category A3.
	(xviii)	Whether testing of acoustic performance is required (2504.16).	Yes	

APPENDIX 26/2: BEDDING MORTAR

- 1 Mortars shall comply with the requirements of clause 2601 of the Specification.
- 2 Resinous mortars:
Resinous mortars shall have the following additional properties:
 - compressive strength after 3 hours to be greater than 40 MPa
 - tensile strength after 3 hours to be greater than 8 MPa
 - low shrinkage after 28 days
- 3 Quick setting mortar:
Quick setting mortar shall contain quick setting cement or approved additive to obtain early mortar hardening and strength.
4. Compressive Strength Requirements
 - (i) Cementitious bedding mortar shall have the following minimum compressive strength requirements in addition to the requirements of Clause 2601.1(i):-
 - (a) 10 N/mm² at 24 hours at 5 °C;
 - (b) 40 N/mm² at 72 hours at 20 °C.
 - (ii) The laboratory approval tests for compressive strength shall be extended to include the production and testing of a total of twelve further cubes in accordance with Clause 2601.4(iv) to prove compliance with the requirements stated in paragraph (i) above.
5. Early Loading Requirements
 - (i) The material may be loaded once it has achieved a compressive strength of 40 N/mm².
 - (ii) The gain in strength of the cementitious mortar shall be monitored by testing cubes cured alongside the work area at ambient temperature. For each pour of mortar four cubes shall be made as specified in Clause 2601.4(iv). The cubes shall be cured for 24 hours in the moulds with the top surfaces covered by polythene sheets. After 24 hours the cubes shall be stripped and either placed in polythene bags which shall be sealed or protected as specified in Clause 2601.3. The cubes shall continue to be stored alongside the work area until required for testing. The cubes shall be crushed in sets of two, at times determined by the Contractor until the compressive strength of both cubes in a set is not less than 40 N/mm².

APPENDIX 26/3: CORED THERMOPLASTIC NODE MARKERS

- 1 Cored Thermoplastic Node Markers shall be positioned in the same locations as the existing nodes. The Contractor shall provide the Overseeing Organisation with exact locations prior to removal of the existing markers.

APPENDIX 26/8: FOAMED CONCRETE FOR STRUCTURES

Information to be provided as part of the Scheme Work Order based on the below

APPENDIX 30/1: GENERAL

1. Notice and liaison requirements detailed in the Scheme Work Order.
2. Use of peat or peat based products not permitted unless specified in the Scheme Work Order.
3. Details of statement of intervals of time at which record forms noting the use of pesticides; nesting and breeding seasons; provision of inspection reports and the intervals of time at which they are required; shall be provided in the Scheme Work Order.
4. Pesticide record and inspection report proforma as per MCHW Notes for Guidance Sample Appendix 30/1 Sheets 2 and 3.

APPENDIX 30/2: WEED CONTROL

1. Location and frequency of application to be provided in the Scheme Work Order.

APPENDIX 30/3: CONTROL OF RABBITS AND DEER

1. Location details and the time period to keep planting enclosures free of rabbits and deer and also the period that damaged plants are to be replaced are given in the Scheme Work Order.
2. Measures to be carried out at any time.
3. Arisings to be spread on site unless specified in the Scheme Work Order.

APPENDIX 30/4: GROUND PREPARATION

1. Location details to be provided in the Scheme Work Order.

APPENDIX 30/5: GRASS SEEDING, WILDFLOWER SEEDING AND TURFING

1. Wildflower planting season will be given in the Scheme Work Order.
2. Immediately prior to sowing the upper 50mm of soil shall be reduced to a fine tilth by use of a chain harrow or other suitable plant.
3. Seed mixture for grass seeding shall be:
 - 60% Dwarf variety Perennial Ryegrass;
 - 35% Slender Creeping Red Fescue;
 - 5% Highland Browntop Bent;

APPENDIX 30/6: PLANTING

1. Plant schedule, planting seasons and properties of the compost to be provided as part of the Scheme Work Order.
2. Provenance Certificate as per MCHW Notes for Guidance SAMPLE APPENDIX 30/6 to be used in compliance with sub-Clause 3006.6
3. 25 no./m² bulbs to be planted per unit area.
4. Planting depths to be 120 mm.

APPENDIX 30/8: WATERING

Details of any Watering required will be provided as part of the Work Order.

APPENDIX 30/9: ESTABLISHMENT MAINTENANCE FOR PLANTING

Details of any Establishment Maintenance for Planting will be provided as part of the Work Order.

APPENDIX 30/12: SPECIAL ECOLOGICAL MEASURES

Details of any Special Ecological Measures will be provided as part of the Work Order.

APPENDIX 50/1: FORM HA/P1 (MAINTENANCE) PAINT SYSTEM SHEET

As per MCHW Notes for Guidance Series 5000. Form HA/P1 from Notes for Guidance Appendix 50/1 is to be completed. Some of the information will be included as part of the Scheme Work Order. The Contractor will also have to complete part of the form.

APPENDIX 50/3

(SPECIFICATION FOR HIGHWAY WORKS) FORM HA/P2 PAINT DATA SHEET

(05/05) BBA HAPAS Road and Bridges Certificate Reference and Date:

Manufacturer :
Item No. :
Registered Description :
Brand Name and Reference No. :
Consistency and Method of Application :
Weight per 5 Litres (kg) :

Specific gravity: Colour:

For two-pack paints: (05/05)

Base: Activator: Mixed components:
Volume Solids % :

For two-pack paints volume solids % for mixed paint: (05/05)

VOC content g/l (mixed) :
Manufacturer's Minimum Dry Film Thickness Range

Recommended lower mdf :
Recommended upper mdf :

Full Application Instructions :

Mix ratio :

Flash Point :

Temperature		5°C	10°C	20°C	30°C
Drying Times (hours)	Surface Dry				
	Hard Dry				
Overcoating Times (hours)	Minimum				
	Maximum				
Pot Life (hours)					

Cleaning Solvent/thinner :

State effects on Drying Times of
Temperatures below 20°C :

Manufacturer's Application Restrictions,
e.g. for Temperatures or Humidity :

Manufacturer's General Recommendations :

#APPENDIX 50/4

(SPECIFICATION FOR HIGHWAY WORKS) FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 1

Contract Title.....

Structure Name.....Structure No.....

Client Name.....(Highways Agency or other company)

Supervising Firm.....

Supervising Firm's Representative Name:..... Tel No.....

Address:.....

Painting Inspection Firm:.....

Samples Dispatched From:..... (Note 1) Date Dispatched.....

Inspector's Name:..... Tel No.....

Inspector's Signature.....

SAMPLES: (Numbered A1, A2 etc. or B1, B2 etc.) (Note 2)					
Sample No.	Item No.	Manufacturer's Reference No.	Batch No.	Colour BS 4800 reference (Note 3)	Sp.G (Notes 4 & 5)

Paint Manufacturer:.....

#APPENDIX 50/4

(SPECIFICATION FOR HIGHWAY WORKS) FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 2

INSPECTOR to complete Form HA/P3 and to forward single copies to each of the following within 24 hours of despatch of samples by the Contractor to Scientifics Ltd:

- | | |
|--|---|
| i. Scientifics Ltd
500 London Road
Derby DE24 8BQ. | ii. (05/05) Highways Agency
Paint Specialist
Safety Standards and Research (SSR)
City Tower
Piccadilly Plaza
Manchester M1 4BE |
|--|---|

INSPECTOR to forward Form(s) HA/P1 Paint System Sheet(s) with the first Form HA/P3 to both addresses.
INSPECTOR to select 'A' samples and to ensure that manufacturer's labels on tins comply with the Specification.

INSPECTOR to take and mark each 'B' sample tin with Item No., manufacturer's name and brand reference No., batch No. sample No. and colour (Note 2).

CONTRACTOR to CLIP DOWN LIDS of all tins and to pack, address and despatch samples. In addition to address, CONTRACTOR to label each case (or tin sent loose): 'HA (State structure name) and DATE (date of dispatch as noted above)'.

Note

- 1 (05/05) State whether from workshop or site (give name and address).
- 2 Batch samples comprising unopened tins to be marked A1, A2, etc. Control samples in 0.5 litre tins to be marked B1, B2, etc. Samples No. to run consecutively, i.e. A1 and B1 onwards.
- 3 Colour reference to BS 4800 to be given, as stated on Form HA/P1 (Maintenance) Paint System Sheet, e.g. 18 B 25.
- 4 For 'A' samples specific gravity (Sp.G.) to be measured by Inspector from separate tins of the same batch. For 'B' samples Sp.G. to be measured by Inspector when taking samples. Samples will be rejected unless Sp.G. is filled in above by Inspector.
- 5 If Sp.G. differs appreciably from data sheet do not dispatch 'A' or 'B' samples.
- 6 Do not use this form and send samples if the client is not the Highways Agency, e.g. for a local authority contract.

Information to be provided as part of the Scheme Work Order based on the below
(02/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/1:
REPAIR PRODUCT – REQUIREMENTS**

[Note to compiler: Include here the following contract specific requirements and details:]

- 1 (02/20) Assumed repair method for each construction activity, reference BS EN 1504 Part 9. [5702.1, 5708.2]
2 (02/20) Contract specific requirements for performance characteristics of repair products. [5703.2(i), 5703.5(i), NG 5703, 5704.2, Table 57/1, 5709.12, 5715.2, 5717.5, Table 57/5, NG 5715, 5717.16, NG 5717, 5721.7, 5721.16]

Description of structure and/or structural element	BS EN 1504 Part 3 strength class of repair product ⊗	Fire class required (BS EN 13501-1) 0	Type of flowable material (F, N) +	Minimum compressive strength of repair product (MPa) *

[Notes to compiler. Notes should be removed from contract specific appendices:]

- (i) Columns should only be included in the table if the performance characteristic is required.
(ii) The requirements should not contradict performance requirements listed in BS EN 1504 Part 3, Table 3 for the required product class.
(iii) ⊗ With reference to Specification Table 57/1 This class should always be specified.
(iv) 0 Fire class in accordance with BS EN 1504 Part 3, sub-clause 5.5 where the possibility of fire damage to a structure under repair is required by a design code of practice or is reasonably foreseeable. See also BS EN 13501 Part 1.
(v) + If a flowable repair material is required, the flowability class should be specified. Otherwise omit column
(vi) * Represented by characteristic compressive strength of the existing concrete to be repaired, taken from the design or as-built contract documentation or measured compressive strength of samples taken from the existing concrete. This value should only be specified if a compressive strength greater than 50 MPa is required. Omit this column if not applicable.]

3 (02/20) Contract specific information provided to assist Contractor in choice of repair product. [5703.2(i), 5703.5(i), Table 57/5, 5717.16, NG 5718, 5721.3, 5721.11]

Description of structure and/or structural element	Compressive strength of existing concrete being repaired. # (MPa)	Static elastic modulus of existing concrete in tension (T) or compression (C) x (MPa)	Galvanic anodes required within repair patches? φ (Yes/No)	Range of electrical resistivity of parent concrete ♣ (Ω•cm)	Minimum strength of repair concrete before loading permitted. Б (MPa)

[Notes to compiler. Notes should be removed from contract specific appendices:

- (i) # Compressive strength of existing concrete. This can be compressive strength taken from either design, contract or as-built drawings, or tested compressive strength.
- (ii) x Static elastic modulus of existing concrete estimated from assumed compressive strength. This could be particularly important for repair to structural elements where repair is in compression and subjected to frequent cycles of transient loading, where repairs are located above trafficked areas. Include only if relevant, otherwise omit column.
- (iii) φ If impressed current or galvanic anode cathodic protection system is proposed for the repaired concrete. Minimum and maximum values of resistivity for the existing concrete should be stated. Declare 'yes' or 'no'. If 'yes' complete column for range of electrical resistivity of existing concrete, and cross reference to contract specific Appendix 57/7.
- (iv) ♣ If repairs to existing concrete precede the installation of a cathodic protection system, allowable resistivity of completed repairs depends on knowing the resistivity of the existing concrete.
- (v) Б Minimum compressive strength required before loading. May be relevant for phased working necessary to limit effect of element weakening during concrete removal, or before waterproofing a deck during a short lane closure. Cross reference to contract specific Appendix 57/3. Add if relevant, if not omit column.]

Information to be provided as part of the Scheme Work Order based on the below
(02/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/2:
REQUIREMENTS FOR REINFORCEMENT**

[Note to compiler: Include here the following contract specific requirements and details:]

- 1 (02/20) Circumstances when a primer or barrier coating is required to be applied to prepared surface of existing or new reinforcement or to structural steelwork. *[5703.2(ii), 5711.3]*
- 2 (02/20) Definition of the limiting corrosion condition of existing reinforcement (typical average section loss) Greater loss of steel in the cross section would require the affected reinforcement bars should be cut out and replaced, or new bars lapped. *[5711.4]*
- 3 (02/20) Schedule of reinforcing bars to be maintained on site or reinforcement bending schedule and lapping requirements. *[5711.5]*
- 4 (02/20) Requirements for steel reinforcement couplers including type, reinforcement diameter, minimum fatigue class. *[5711.7]*
- 5 (02/20) Requirements for lapping of new steel reinforcement to existing reinforcement. *[5711.8]*
- 6 (02/20) Specific requirements for site welding of reinforcement, where it is permitted. *[5711.9]*
- 7 (02/20) Requirements for anchoring of steel reinforcement or dowels including reaction to fire class for any polymer-based reinforcement anchoring product. *[5711.11, table 57/3]*

Information to be provided as part of the Scheme Work Order based on the below
(02/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/3:
EXECUTION OF CONCRETE REPAIRS**

[Note to compiler: Include here the following contract specific requirements and details:]

- 1 (02/20) Notification to Contractor to allow for a known proposal to install impressed current cathodic protection mesh anode within an overlay as part of a separate contract. *[5703.3(ii), 5717.17, 5718.1, 5721.3]*
- 2 (02/20) Any contract specific constraints on the location, extent or depth of repair patches for application of BS EN 1504 Part 1 types (CC, PCC or PC) repair product. *[5704.4, 5716.2]*
- 3 (02/20) Details, including location, of required trial of concrete repair method on the structure or a smaller scale reinforced concrete mock up/model of the structure. *[5707.1, NG 5707.1]*
- 4 (02/20) Depth of existing concrete to be removed relative to surface or to existing rebar or both. *[5709.1]*
- 5 (02/20) List of structural elements that are particularly vulnerable to damage from concrete removal activities and any protection requirements e.g. measures identified during safety risk assessment. *[5709.3]*
- 6 (02/20) Requirements/constraints including hold points for phased removal of existing delaminated or contaminated concrete including minimum strength of concrete repair (cross reference to Appendix 57/1) before progress to adjacent repair areas. *[5702.7, 5709.5, 5709.10, 5709.12, 5709.19]*
- 7 (02/20) List of old high resistivity repairs and description and location of detrimental metal objects to be removed from the existing concrete. *[5709.8, 5718.4, 5718.5]*
- 8 (02/20) List type, extent and depth of defects (shallow blemishes, cracking or damage etc.) in the existing non-delaminated concrete deck surface, and principles of treatment by breakout and reinstatement to be applied prior to applying surface protection systems e.g. deck waterproofing. *[5709.11]*
- 9 (02/20) Requirement for better than an F2 formed surface finish. *[5713.2]*
- 10 (02/20) BS EN 13670 execution class for each element of repair work, if not Class 2. *[5714.1]*
- 11 (02/20) Required surface profile of completed repairs if not the same as existing. *[5714.11, 5717.27]*
- 12 (02/20) Required formed or unformed surface finish on concrete repairs. *[5714.12, 5716.4]*
- 13 (02/20) Required BS EN 13670 curing class for each element to be repaired. *[5714.15]*
- 14 (02/20) Locations where repair concrete or mortar should be applied in only one layer e.g. soffits above live traffic. *[5716.3]*
- 15 (02/20) Minimum cover to reinforcement required for areas where existing cover is low, surface profile of reinstated concrete “blisters” to restore cover to reinforcement, construction depth of repair and description of how repair should be tied into existing concrete. *[5716.6]*
- 16 (02/20) Distribution of cores to prove conductivity, integrity, adhesion and compressive strength of repair areas as part of contract compliance testing. *[5721.5, 5721.6, 5721.7, 5721.8]*
- 17 (02/20) Target adhesion strength of repair mortar material at interface with concrete substrate in accordance with BS EN 1504-10, Table A.3. *[5721.15]*

Information to be provided as part of the Scheme Work Order based on the below
(02/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/4:
SPRAYED CONCRETE**

[Note to compiler: Requirements for proprietary sprayed concrete products should be specified in terms of product classes in accordance with Clause 5704.2.]

- 1 (02/20) Requirement for a particular sprayed concrete application process i.e. dry-spray or wet spray. *[If not completed the Contractor will be free to choose.] [5717.3]*
- 2 (02/20) If a wet-spray application process is specified, the required consistence of the mix in accordance with BS EN 206. *[5717.6, 5717.19]*
- 3 (02/20) Different requirements for size of sprayed concrete test panels. *[5717.9]*
- 4 (02/20) Required inclination of each pre-works sprayed concrete test panels. *[5717.9]*
- 5 (02/20) Samples to be removed from the pre-works sprayed concrete test panels for later testing. *[5717.9]*
- 6 (02/20) Inspection category if not BS EN 14487 Part 1, Category 3. *[5717.21]*
- 7 (02/20) Alternative requirements for formation of construction joints. *[5717.24]*
- 8 (02/20) Description and specification of alternative to as-sprayed concrete finish. *[5715.26]*

Information to be provided as part of the Scheme Work Order based on the below

(02/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/5: CONCRETE INJECTION**

[Note to compiler: Include here the following contract specific requirements and details:]

1 (02/20) Required concrete crack repair method for each structural element reference BS EN 1504 Part 9 (Principle 1, method 1.5, Principle 4, method 4.5 or Principle 4, method 4.6). [5702.1]

2 (02/20) Schedule of characteristics for each crack or group of similar cracks to be injected (structure identification, element reference, location, length, minimum thickness). Example shown below. [5703.5, 5720.3, Table 57/6]

Structure ID	Structural element type	Location	No of crack defects	Range of crack length (mm)	Minimum width of crack (mm)	Maximum width of crack (mm)
<i>e.g. Bridge A</i>	<i>Beam 4</i>	<i>East end</i>	<i>3</i>	<i>300 – 600</i>	<i>0.25</i>	<i>0.75</i>

3 (02/20) The function each injection product should perform – force transmitting filling, ductile filling or swelling-fitted filling in accordance with BS EN 1504 Part 5 should be tabulated for each defect to be treated under references for individual defects or set of defects grouped under a structural element reference number. Example is shown in the table below. [5703.2 (iii), 5720.3, 5720.4, Table 57/6, Table 57/7, Table 57/8]

Function of injection product				Force transmitting filling (F)	Ductile filling (D)	Swelling fitted filling (S)
Performance requirement				(Basic characteristic)	(Basic characteristic)	(Workability characteristic)
Structure ID	Structural element type	Location	No of crack defects	Adhesion by tensile bond strength * (F1 or F2)	Adhesion strength ** (N/mm ²)	Expansion ratio ** (%)
<i>e.g. Bridge A</i>	<i>Beam 2</i>	<i>North end</i>	<i>3</i>	<i>F2</i>	–	–
<i>e.g. Culvert B</i>	<i>Soffit</i>	<i>Middle</i>	<i>6</i>	–		<i>10</i>
<i>e.g. Retaining wall C</i>	<i>Stem</i>	<i>Every 10m</i>	<i>4</i>	–	<i>3.0</i>	–

[Notes to compiler: Notes should be removed from contract specific appendices:]

* required for hydraulic and polymer based products.

** required for polymer based products.

(i) delete injection product function columns if not required.

(ii) remaining performance characteristics are in tables 57/7, 57/8 and 57/9 of the Specification.]

4 (02/20) Additional performance requirements of essential characteristics (reference BS EN 1504 Part 5, Tables 1, 2 or 3) for certain intended uses of injection products (reference BS EN 1504 Part 5, Tables 6, 7 or 8) appropriate to the specified function classification. [5720.4]

Function of injection product	Force transmitting filling (F)			Ductile filling (D)		Swelling fitted filling (S)
Performance requirement	Adhesion by slant shear strength * (N/mm ²)	Glass transition temp.** (°C)	Chloride content *** (%)	Watertightness**	Glass transition temp. ** (°C)	Corrosion behaviour **
Structure ID/ element type/ location						

[Notes to compiler. Notes should be removed from contract specific appendices:

* required for hydraulic and polymer based products.

** required for polymer based products.

*** required for hydraulic based products.

(i) Delete injection product function columns if not required.

(ii) See BS EN 1504 Part 5 tables 6, 7 and 8 for recommended requirement.]

5 (02/20) Requirement for survey of cracks with the Overseeing Organisation to confirm extent of crack treatment. [5720.5]

6 (02/20) Distribution of cores through filled/injected cracks to demonstrate crack filling and bond strength of interface. [5721.9]

7 (02/20) Acceptable minimum percentage filling by volume of crack exposed in core if different from 80%. [5721.17]

Information to be provided as part of the Scheme Work Order based on the below

**(02/20) NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/6:
CONTRACTOR INVESTIGATION OF CONCRETE
CONDITION**

[Note to compiler: Include here the following contract specific requirements and details:]

- 1 (02/20) The location of required investigation.
- 2 (02/20) Requirements for concrete investigation by the Contractor including:
 - i) Physical investigation:
 - (a) The type of defects to be recorded.
 - (b) Extent of concrete sounding to detect delamination
 - ii) Survey by instrument:
 - (a) Reinforcement cover survey.
 - (b) Electrical potential mapping.
 - (c) Concrete resistivity.
 - iii) Intrusive investigation:
 - (a) Location, number, diameter, depth of cores.
 - (b) Location, number, size, depth of trial pits.
 - iv) Laboratory testing:
 - (a) Chloride penetration.
 - (b) Carbonation penetration.
 - (c) Cement content.
 - (d) Other tests.
- 3 (02/20) Requirements for reporting:
 - i) Factual only report.
 - ii) Factual and interpretive report. *[5706.1]*

Information to be provided as part of the Scheme Work Order based on the below
(02/20) **NG SAMPLE CONTRACT SPECIFIC APPENDIX 57/7:
REQUIREMENTS FOR GALVANIC ANODES**

[Note to compiler: Include here the following contract specific requirements and details:]

- 1 (02/20) Requirements for Contractor to design galvanic anode installation. *[5712.10]*
- 2 (02/20) Required service life of galvanic anodes if different from 10 years. *[5712.11]*
- 3 (02/20) Requirements of reference electrodes for monitoring:
 - (i) Type, size, material.
 - (ii) Location. *[5712.12, 5712.18, 5712.36]*
- 4 (02/20) Required spacing of galvanic anodes around the perimeter of repair, if not specified on the drawings. *[5712.24]*
- 5 (02/20) Requirements for monitoring of galvanic anode installation including:
 - (i) Connections.
 - (ii) Junction boxes.
 - (iii) Control boxes.
 - (iv) Terminals for local or remote monitoring. *[5712.29]*

APPENDIX 80/1: TRENCHLESS AND MINIMUM DIG TECHNIQUES

1. All new transverse motorway ducts shall be located as indicated in the Scheme Work Order. Outer sleeves (where applicable) shall be installed by trenchless techniques in accordance with this Appendix.

Trenchless and minimum dig techniques to be used at specific locations are as defined in Specification sub-clause 8002.2

2. The Contractors method statement for installation of ducts by trenchless techniques shall include the following information in addition to that required by Specification sub-clause 8004.2:

- Subcontractor's site staff and organisation
- An assessment of the settlement anticipated and how this will be monitored
- The experience of the subcontractor and his staff with the installation type and the identified ground conditions
- Details of proposed plant sufficient to demonstrate its suitability for achieving the Contract requirements relating to the installation of pipes by trenchless techniques within the noise and vibration limits specified in Appendix 1/9.
- Setting out methods and means of achieving specified tolerances
- Location and construction details of drive and reception pits
- Details of traffic management requirements/proposals
- Method of spoil removal and storage
- Details of the flush, drilling mud, including setting times and if the flush/mud needs to provide lateral restraint for structural integrity of the pipes
- Details of dealing with ground conditions with insufficient lateral restraint
- Method of dealing with ground water and existing drainage flows
- Method of prevention of services clash and services protection. Details on the effect of settlement on services
- Design load for pipes
- Maximum permitted draw and angular deflection for the pipes
- The use and disposal of support fluids, lubricants and drilling fluids
- Risk Assessments
- Access to drive and reception pits
- Details of starter/reception pit temporary works and reinstatements
- Procedures for dealing with obstructions encountered, depth/distance and time encountered, including shallow bedrock
- Procedures for recording the actions/reasons for moving and consequent measures for reinstatement/continued work.
- Details of how the old redundant service is to be decommissioned
- A settlement / heave assessment with particular details of depth and trough width
- Details of the monitoring of the site after drilling
- Emergency procedures
- Geotechnical Certifications

3. The records of installation of pipes by trenchless techniques shall be kept by the Contractor and submitted to the Overseeing Organisation in accordance with Specification sub-clause 8004.5 and shall include the following information:

	Micro Tunnelling & Pipe Eating	Pipe Jacking	Directional Drilling	Thrust Boring	Auger Boring	Pipe Ramming	Impact Molding	Pipe Bursting	Narrow Trenching	Mole Ploughing	Cured in Place Lining	Sliplining
Contract title	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reference of pipe run	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Date of work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Start time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Finish Time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Details of any stoppages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diameter of bore	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pipe material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pipe diameter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint packing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Length installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Main survey checks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soil conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ground water level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Line and level achieved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lubrication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Support fluid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jacking and winch loads, w.r.t. progress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slurry pressures, viscosity, discharge, flow rate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shield roll, pitching, steering adjustment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thrust rate, cutting torque, soil discharge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interval at which measurements should be taken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grout materials and volumes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A description of excavated material shall be provided, including colour, size and shape of the particles and main constituent, including photos of the arising material, launch and reception pits. A bulk sample from each duct to be provided, ideally from a location close to the centre of the duct. Should a different material be encountered during the cross carriageway ducting operation, it shall also be recorded and sampled. Details of groundwater and gases shall also be recorded. The excavation shall be checked for gases daily, before works commence, and the results recorded.

4. Allowable ground movements shall be as specified in sub-Clause 8004.7.

The Contractor shall provide details of survey locations at cross carriageway and slip road crossings. These shall include the level at the top and the bottom of any embankment or cutting within the zone of influence, level at the edge of the carriageway, any ditches, invert level of the duct. This should be done at the final location and if more than one crossing attempt is made the location of these should also be recorded. The details for the latter can just be a level and grid reference. These readings should be to OD and OS grid.

The ground levels should be recorded at the beginning and end of each shift and every four hours during the works and once a day for three days after.

5. Requirements for monitoring of adjacent structures, pavements and services including conditions, line and level surveys and restrictions shall be provided in the Scheme Work Order
6. Details of ground investigations carried out on the site, including results of sampling and testing for contamination, shall be provided in the Scheme Work Order. These include desktop and site investigation reports.

Any geotechnical reports produced in accordance with CD 622 will be included within the Scheme Work Order.

7. Where existing manholes or chambers are used for the installation of the service pipe these shall be reinstated in accordance with Clause 507.
8. The tolerance on alignment of the pipeline shall be in accordance with 8005.10 and 8005.11.
9. Existing drains, chambers or channels are to be connected to new drains, chambers or channels at the locations identified in the Scheme Work Order.
10. In the event of a trenchless technique bore for new transverse ducts being aborted for any reason; the bore shall be grouted up with foamed concrete. Foamed concrete shall have a wet density of 1000 kg/m³ to achieve a minimum design strength of 2 N/mm² at 7 days and shall comply with the following:
- Minimum cement content shall be 330 kg/m³.
 - Base water/cement ratio shall be between 0.5 and 0.6.
 - Sand shall pass a 300 mm sieve with a negligible amount having a diameter greater than 2 mm.
 - Cement shall be CEM I to BS 8500 or Eurocode equivalent

Foaming agent shall be added on site into the truck mixer drum. Mixing time shall be in accordance with the manufacturer's recommendations. The foaming agent shall be

capable of resisting the physical and chemical forces imposed during the concreting process.

11. Sampling and testing required for cured in place lining technique shall be in accordance with Specification sub-clause 8008.4 including requirements detailed in the Scheme Work Order.
12. The Contractor shall carry out a survey of the existing highway drainage at all new transverse ducts to verify the suitability of the proposed levels in accordance with CS 551 – Drainage surveys. The results of the survey shall be provided to the Overseeing Organisation. The contents of CCTV survey reports shall be detailed in the Scheme Work Order

APPENDIX 80/2: SPECIFIC REQUIREMENTS FOR REHABILITATION TECHNIQUES

General

1. Linings shall be installed in continuous lengths between points of access to the pipeline.
2. The pipeline shall be cleared of all silt and debris, and any loose fragments of pipe that could fall onto the liner during installation shall be removed.
3. Heated water shall not be released into surface water systems until it has cooled to air temperature.

Lining Material

4. The design and testing of all lining materials shall be carried out in accordance with Water Industry Specification WIS 4-34-04 and WIS 4-34-06.
5. The cured in place lining shall be in contact with the host pipe for the full length of the installation.
6. Test certificates shall be presented to the Overseeing Organisation to show materials comply with WIS 4-34-04 and WIS 4-34-06.

Lateral Connections

7. Prior to starting the lining operation on the cleaned pipeline the Contractor shall carry out a CCTV survey of the pipe to locate all lateral connections.
8. Lateral connections shall be reconnected to the main pipe in accordance with the requirements of Clause 506.