Highways England Company Limited

Concrete Roads Framework - Reconstruction

SPECIFICATION

CONTENTS AMENDMENT SHEET

Amend. No.	Revision No.	Amendments	Initials	Date
0	0	Tender Issue	SJW	04/08/2020
1	1	Remove the Appendix 7/2 as it is not applicable.	SJW	21/09/2020
2	1	Add concrete repair processes to Appendix 7/14.	SJW	21/09/2020
3	1	Add requirement to use MMA in the Appendix 12/3.	SJW	21/09/2020
4	1	Change the text Scope to Scheme Budget Value in the Appendix 0/1	SJW	25/09/2020

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 contract specific items:

(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;

(iii) The contract specific Numbered Appendices listed in Appendix 0/3.

Appendix 0/4 contains a list of the 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 the 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 contract specific 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 contract specific Appendix shall be deemed to refer to the corresponding Substitute Clause number or contract specific 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 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 respective editions current on the date on which the Final Tender Submission shall be submitted.

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 of 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 further 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 Scope.

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.

16 The Contractor shall discuss with the Project Manager the implementation of Asset or Pavement Efficiency within the Scope. Link to the Asset or Pavement Efficiency Toolkit: https://prezi.com/view/SVQprRqpf7SkYGfKWLeR/. Please note that this link should be opened in Google Chrome as it will not work in Internet Explorer.

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, 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
2000	1, 3 to 4F	May 2001

Series / Appendix	Page Number	Publication Date
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	May 2018
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

Clause No (etc.)	Title	Written on Page No
170AR	Facilities, Welfare Facilities, Equipment and Security	8

Additional Clauses, Tables and Figures

Clause No Title & Written Text

SERIES 100 PRELIMINARIES

170AR Facilities, Welfare Facilities, Equipment and Security

1 Scheme Budget value exceeding £150,000

1.1 For Schemes with a Scheme Budget value exceeding £150,000 OR more than one supplier, Site Establishment may be required to be provided by the General Civil Engineering, Concrete Repairs and Strengthening Treatments or Reconstruction, Resurfacing, Road Lighting & Electrical Works, and Road Restraint Systems or Temporary Traffic Management Lot Contractor at the discretion of the *Project Manager*. These facilities, welfare facilities, equipment and security will be provided for the use of the Overseeing Organisation and other organisations involved in the delivery of the scheme.

1.2 Highways England will typically instruct, the General Civil Engineering or Temporary Traffic Management Lot Contractor, however, on occasions another Supplier may be required to provide the facilities.

1.3 At the pricing stage the *Client* will furnish the Contractor with the total number of Full Time Equivalent (FTE), in order that they can accurately identify the most appropriate rates to calculate the provision of the facilities, Welfare facilities, equipment and security.

1.4 When instructed, the Contractor will 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.

2 Duration of Time Facilities are Required

2.1 All facilities are to be provided a minimum of one week before site works begin and two weeks after handover or until all works (including as built handover package) have been completed, whichever is longer.

3 Office and Equipment

3.1 Offices shall be of 8 m^2 per person (FTE) including work space, storage space, circulation areas, kitchens and toilets.

3.2 Meeting Rooms shall be of a minimum of 12m^2 for up to 10 FTE, with 2 m^2 per FTE thereafter.

3.3 All offices are to have locks with keys supplied, for each person using the office.

3.4 Office and welfare to be fully serviced with electricity (mains or generator) and water (mains or tank) facilities.

3.5 The following equipment will 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

3.6 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.

3.7 Broadband Fibre Optic or 4G Internet connection with wireless router, capable of supporting up to eight users at a time.

3.8 Networked printing and photocopying facilities (capable of A3 colour prints & copies).

3.9 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.

3.10 Fire extinguishers and fire safety precautions shall be provided and maintained as required by the Fire Authority.

3.11 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.

3.12 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.

3.13 Boot cleaning facilities shall be provided outside the door.

4 Welfare facilities

4.1 Welfare facilities shall be of:
- 2 m^2 per person for messing facilities (split breaks should be considered)
- 1 m^2 per person for drying rooms
- sufficient toilets and washbasins for those expected to use them

4.2 Chemical / Portaloo should only be considered when mains facilities are not possible

4.3 All welfare facilities shall have suitable locks with a keys and shall be kept secure at all times.

4.4 All welfare facilities shall be cleaned daily.

4.5 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

4.6 Toilet facilities clean, well-lit and ventilated facilities. To help achieve this walls and floors should preferably be tiled (or covered in suitable waterproof material) to make them easier to clean

4.7 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 possible
- For female employees, a means of disposing of sanitary dressings
- Facilities with hot and cold running water
- Enough soap or other washing agents
- A basin large enough to wash hands and forearms
- Showers where necessary e.g. for particularly dirty work.

4.8 Drying / Changing facilities shall be provided if the work activity involves wearing specialist clothing, i.e. wet-weather gear.

4.9 Drying / Changing facilities shall:
- Be readily accessible
- Contain - or nominated 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.

4.10 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.

5 Car Parking

5.1 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

5.2 A hardcore parking area shall be provided for all operatives with one parking space provided for every 3 operatives.

6 Signage

6.1 A Site Compound Scope Board is to be erected at the site compound entrance. This design shall include the following information as a minimum:
- Scheme title
- Scheme description
- Highways England approved logo

7 Security

7.1 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.

7.2 The Contractor shall report details of any breach of security measures to the *Client*.
- 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 *Client* 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.

7.3 The Contractor shall maintain the level and modes of security provision in accordance with

Appendix 1/71.

7.4 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 *Client* on request. The Contractor shall provide all personnel, including sub-contractors and other contractors and personnel of the Designer and *Client* with suitable security passes which shall include photographs.

7.5 Security passes shall be carried at all times while on the site and shall be made available for inspection when so requested. 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.

APPENDIX 0/3: LIST OF CONTRACT SPECIFIC 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 set of Scope, those identified by the letters T or C shall be completed by the Tenderer or Contractor respectively.

Additional Requirements may be included in the Scope

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
			SHW SERIES 000 INTRODUCTION
Used	I	0/1	Contract specific Additional, Substitute and Cancelled Clauses, Tables and Figures Included in the Contract
Not Used		0/2	Contract specific Minor Alterations to Existing Clauses, Tables and Figures Included in the Contract
Used	I	0/3	List of contract specific 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 Organisations of Scotland/Wales/Northern Ireland
			SHW SERIES 100 PRELIMINARIES
Used	I/C	1/1	Temporary Accommodation and Equipment for the Overseeing Organisation
Used	I/C	1/2	Vehicles for the Overseeing Organisation
Not Used		1/3	Radio 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
Used	I/C	1/6	Supply and Delivery of Samples to the Overseeing Organisation
Used	I	1/7	Site Extent and Limitations on Use
Used	I/C	1/8	Operatives for the Overseeing Organisation
Used	I	1/9	Control of Noise and Vibration
Not Used		1/10	Permanent Works to be Designed by the Contractor
Not Used		1/11	Temporary Works Design
Used	I	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	I	1/16	Privately and Publicly Owned Services and Supplies
Used	I/C	1/17	Traffic Safety and Management
Used	I/C	1/18	Temporary Highways for Traffic
Used	I/C	1/19	Routeing of Vehicles
Used	I/C	1/20	Recovery Vehicles and Operation for Breakdowns
Used	I/C	1/21	Information Boards
Used	I/C	1/22	Progress Photographs
Used	I/C	1/23	Risks to Health and Safety
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 Roadworks (TASCAR)
Used	I	1/27	Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) – Particular Requirements
Used	I/C	1/71	Security of Site
			SHW SERIES 200 SITE CLEARANCE
Used	I/C	2/1	List of Buildings etc. to be Demolished
Used	I/C	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
Used	I/C	2/5	Hazardous Materials
Used	I/C	2/6	Site Clearance Environmental Requirements
			SERIES 300 FENCING
Not Used		3/1	Fencing, Gates and Stiles
			SERIES 400 ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)
Used	I/C	4/1	Road Restraint Systems (Vehicle and Pedestrian)

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

Used / Not Used	Completed By	Appendix. No.	Title
			SERIES 400 ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN) (Continued)
Used	I/C	4/2	Information Required to Demonstrate Compliance of Road Restraint Systems to BS EN 1317-1, BS EN 1317-2, and DD ENV 1317-4:2002
			SERIES 500 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	I/C	5/6	Linear Drainage Channel Systems
Used	I/C	5/7	Thermoplastics Structural Wall Pipes and Fittings
Not Used		5/8	Maintenance Plans or Soakaways
			SERIES 600 EARTHWORKS
Used	I/C	6/1	Requirements for Acceptability and Testing etc. of Earthworks Materials
Used		6/2	Requirements for Dealing with Class U1B and Class U2 Unacceptable Materials
Used	I/C	6/3	Requirements for Excavation, Deposition, Compaction (Other than Dynamic Compaction)
Not Used		6/4	Requirements for Class 3 Material
Used	I/C	6/5	Geotextiles Used to Separate Earthworks Materials
Not Used		6/6	Fill to Structures and Fill Above Structural Foundations
Used	I/C	6/7	Sub-formation and Capping and Preparation and Surface Treatment of Formation
Used	I/C	6/8	Topsoiling
Not Used		6/9	Earthwork Environmental Bunds, Landscape Areas, Strengthened Embankments
Not Used		6/10	Ground Anchorages, Crib Walling and Gabions
Not Used		6/11	Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings
Not Used		6/12	Instrumentation and Monitoring
Not Used		6/13	Ground Improvement
Not Used		6/14	Limiting Values for Pollution of Controlled Waters
Used	I/C	6/15	Limiting Values for Harm to Human Health and the Environment
			SERIES 700 ROAD PAVEMENTS – GENERAL
Used	I/C	7/1	Permitted Pavement Options (Schedules 1, 2, 3, 4 and 5)
Not Used		7/2	Excavation, Trimming and Reinstatement of Existing Surfaces
Not Used		7/3	Surface Dressings - Performance Specification (Sheets 1, 2 and 3)
Used	I/C	7/4	Bond Coats, Tack Coats and Other Bituminous Sprays (Sheets 1, 2 and Binder Data Sheet)
Used	I/C	7/5	In Situ Recycling: The Remix and Repave Processes
Used	I/C	7/6	Breaking Up or Perforation of Existing Pavement
Not Used		7/7	Slurry Surfacing Incorporating Microsurfacing (Sheets 1, 2 and 3)
Not Used		7/8	NOT USED
Used	I/C	7/9	Cold-Milling (Planing) of Bituminous Bound Flexible Pavement
Not Used		7/10	NOT USED
Not Used		7/11	Overband and Inlaid Crack Sealing Systems
Not Used		7/12	Arrester Beds
Used	I/C	7/13	Saw-Cut Crack and Seal Bituminous Overlays on Existing Jointed Concrete Pavements
Used	I/C	7/14	Preparation of Jointed Concrete Pavements Prior to Overlaying and Saw-Cut and Seal of the Bituminous Overlay
Used	I/C	7/15	Saw-Cut, Crack and Seat Existing Jointed Reinforced Concrete Pavements

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

Used / Not Used	Completed By	Appendix. No.	Title
			SERIES 700 ROAD PAVEMENTS – GENERAL (Continued)
Used	I/C	7/16	Cracking and Seating of Existing Jointed Unreinforced Concrete Pavements and CBM Bases
Used	I/C	7/17	Cracking Plant and Equipment Progress Record
Not Used		7/18	Site Specific Details and Requirements for Cold Recycled Bitumen Bound Material
Used	I/C	7/19	Back-Analysis of Falling Weight Deflectometer (FWD) Measurements Made on Concrete Pavements Treated By Fractured Slab Techniques
Not Used		7/20	NOT USED
Not Used		7/21	Surface Dressing - Recipe Specification (Sheets 1, 2 and Binder Data Sheet)
Used	I/C	7/22	Repair to Potholes
Used	I/C	7/23	Site Specific Details and Requirements for Recycled Cement Bound Material
			SERIES 1000 ROAD PAVEMENTS - CONCRETE AND CEMENT BOUND MATERIALS
Not Used		10/1	Plant and Equipment for the Construction of Exposed Aggregate Concrete Surface
			SERIES 1100 KERBS, FOOTWAYS AND PAVED AREAS
Used	I/C	11/1	Kerbs, Footways and Paved Areas
Not Used		11/2	Access Steps
			SERIES 1200 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
Used	I/C	12/4	Traffic Signs: Cones, Cylinders, FTD's & Other Traffic Delineators
Not Used		12/5	Traffic Signs: Traffic Signals
Not Used		12/6	Traffic Signs: Special Sign Requirements on Gantries
			SERIES 1300 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	(Specification for Highway Works) Typical Lighting Column 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	(Specification for Highway Works) 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	(Specification for Highway Works) Typical Cantilever Masts Data Sheets 1 and 2
Not Used		13/9	Instructions for Completion of Cantilever Masts Data Sheets
			SERIES 1400 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
Used	I/C	14/3	Temporary Lighting
Used	I/C	14/4	Electrical Equipment for Road Lighting
Used	I/C	14/5	Electrical Equipment for Traffic Signs
			SERIES 1500 MOTORWAY COMMUNICATIONS
Used	I/C	15/1	Motorway Communications
Used	I/C	15/2	Cable Duct Requirements
Not Used		15/3	Requirements of the Telecommunications Services Provider
			SERIES 1600 PILING AND EMBEDDED RETAINING WALLS
Not Used		16/1	General Requirements for Piling and Embedded Retaining Walls

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

Used / Not Used	Completed By	Appendix. No.	Title
			SERIES 1600 PILING AND EMBEDDED RETAINING WALLS (Continued)
Not Used		16/2	Precast Reinforced and Prestressed Concrete Piles and Precast Reinforced Concrete Segmental Piles
Not Used		16/3	Bored Cast-in Place Piles
Not Used		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		16/6	Steel Bearing Piles
Not Used		16/7	Reduction of Friction on Piles
Not Used		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		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
			SERIES 1700 STRUCTURAL CONCRETE
Not Used		17/1	Schedule for the Specification of Designed Concrete
Not Used		17/2	Concrete – Surface Protection Systems
Not Used		17/3	Concrete - Surface Finishes
Not Used		17/4	Concrete - General
Not Used		17/5	Buried Concrete
Not Used		17/6	Grouting and Duct Systems for Post-tensioned Tendons
Not Used		17/7	Precast Concrete Products
Not Used		17/8	Post-installed Anchors and Reinforcing Bar Connections
			SERIES 1800 STRUCTURAL STEELWORK
Not Used		18/1	Requirements for Structural Steelwork
			SERIES 1900 PROTECTION OF STEELWORK AGAINST CORROSION
Not Used		19/1	(Specification for Highway Works) Form HA/P1 (New Works) Paint System Sheet
Not Used		19/2	Requirements for Other Works
Not Used		19/3	(Specification for Highway Works) Form HA/P2 Paint Data Sheet
Not Used		19/4	(Specification for Highway Works) Form HA/P3 Paint Sample Despatch List: Sheets 1 and 2
Not Used		19/5	General Requirements
			SERIES 2000 WATERPROOFING FOR CONCRETE STRUCTURES
Not Used		20/1	Waterproofing for Concrete Structures
			SERIES 2100 BRIDGE BEARINGS
Not Used		21/1	Bridge Bearing Schedule
Not Used		22/1	Not Used
			SERIES 2300 BRIDGE EXPANSION JOINTS AND SEALING OF GAPS
Not Used		23/1	Bridge Deck Expansion Joints Schedule
Not Used		23/2	Sealing of Gaps Schedule (Other than in Bridge Deck Expansion Joints)
			SERIES 2400 BRICKWORK, BLOCK WORK AND STONEWORK
Used	I/C	24/1	Brickwork, Block work and Stonework
			SERIES 2500 SPECIAL STRUCTURES
Not Used		25/1	Requirements for Corrugated Steel Buried Structures

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

Used/Not Used	Completed By	Appendix. No.	Title
			SERIES 2500 SPECIAL STRUCTURES (Continued)
Not Used		25/2	Requirements for Reinforced Soil and Anchored Earth Structures
Not Used		25/3	Requirements for Pocket - Type and Grouted - Cavity Reinforced Brickwork Retaining Wall Structures
Not Used		25/4	Environmental Barriers
Not Used		25/5	Requirements for Buried Rigid Pipes for Drainage Structures
			SERIES 2600 MISCELLANEOUS
Used	I/C	26/1	Ancillary Concrete
Used	I/C	26/2	Bedding Mortar
Used	I/C	26/3	Cored Thermoplastic Node Markers
Not Used		26/4 to 26/7	Not Used
Not Used		26/8	Foamed Concrete for Structures
			SERIES 3000 LANDSCAPE AND ECOLOGY
Not Used		30/1	General, sheets 1, 2 &3
Not Used		30/2	Weed Control
Not Used		30/3	Control of Rabbits and Deer
Not Used		30/4	Ground Preparation
Used	I/C	30/5	Grass Seeding, Wildflower Seeding and Turfing
Not Used		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
			SERIES 5000 MAINTENANCE PAINTING OF STEELWORK
Not Used		50/1	(Specification for Highway Works) Form HA/P1 (Maintenance) Paint System Sheet
Not Used		50/2	Requirements for Other Work
Not Used		50/3	(Specification for Highway Works) Form HA/P2 Paint Data Sheet
Not Used		50/4	(Specification for Highway Works) Form HA/P3 Paint Samle Despatch List: Sheets 1 and 2 General Requirements
Not Used		50/5	General Requirements
			SERIES 5700 CONCRETE REPAIRS
Not Used		57/1	Repair Product – Requirements
Not Used		57/2	Requirements for Reinforcement
Not Used		57/3	Execution of Concrete Repairs
Not Used		57/4	Sprayed Concrete
Not Used		57/5	Concrete Injection
Not Used		57/6	Contractor Investigation of Concrete Condition
Not Used		57/7	Requirements for Galvanic Anodes
			TRENCHLESS INSTALLATION OF HIGHWAY DRAINAGE AND SERVICE DUCTS
Not Used		80/1	Trenchless and Minimum Dig 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
To be listed by the Contractor for each Scheme	

2 Standard Drawings

(i) Supplied to Each Tenderer

Drawing No.	Title
To be listed by the Contractor for each Scheme	Privately and Publicly Owned Services & Supplies

(ii) Inspected by Tenderers

Drawing No.	Title	Aspect required if not whole Drawing
To be listed by the Contractor for each Scheme		

(iii) Brought into the Contract by Reference

HCD published by The Stationery Office as Volume 3 of the Manual of Contract Documents for Highway Works contains the following drawings brought into the Contract by reference. Unless otherwise stated below the whole drawing is brought into the Contract.

Drawing No.	Title	Aspect/Alternative(s) required if not whole Drawing
None.		

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

Accommodation for the Overseeing Organisation will be provided in accordance with Clause 170AR.

APPENDIX 1/2: VEHICLES FOR THE OVERSEEING ORGANISATION

Table below is to be completed by the Contractor on a scheme by scheme basis.

Type (as defined below)	Number Required	Period Required	Cleaning Frequency
A			
B			
C			
D			

1 Equipment

Unless stated otherwise in the Scope, all vehicles shall have the following equipment: fire extinguisher, first aid kit, heater and demister, hazard flashing unit, warning triangle, drivers log, full sized spare wheel, fuel filler cap lock, bonnet lock and spare wheel lock, internal and external mirrors, mud flaps, link mats front and rear, mudshield for front and rear brakes, rubber pads for clutch and brake pedals, interior sun visors, gearbox covers, tow rope, towing hooks front and rear, laminated windscreen, wire mesh guards for side, tail, stop and flasher lamps, covers for universal joints, straps suitable for carrying survey equipment.

2 Type "A" SUV/Off-road Vehicle

Maximum CO_2 emissions: 255g/Km.
Minimum carrying capacity: refer to the Scope.
Minimum ground clearance: refer to the Scope.
The vehicle is to be suitable for off-road use and public highway use, have 4-wheel drive, power steering, heavy duty suspension and be supplied in a conspicuous colour.
Additional requirements: refer to the Scope.

3 Type "B" 4 Door Estate Car

Maximum CO_2 emissions: 130g/Km.
Minimum carrying capacity: refer to the Scope.
Minimum ground clearance: refer to the Scope.
Additional requirements: refer to the Scope.

4 Type "C" Car

Maximum CO_2 emissions: 130g/Km.
Minimum carrying capacity: refer to the Scope.
Minimum ground clearance: refer to the Scope.
Additional requirements: refer to the Scope.

5 Type "D" Other Vehicle

Maximum CO_2 emissions: 175g/Km.
Requirements: refer to the Scope.

6 Markings

Unless stated otherwise in the Scope, markings and visibility requirements shall be in accordance with SHW Clause 102.

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 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.

3 Where the work involves either reinstatement of sub-base or pavement foundation, the Contractor shall ensure the sub-grade and sub-base layers including the sub-base material are sampled and tested in accordance with SHW Clauses 880 to 885. The Contractor shall submit the sampling and testing records to the Overseeing Organisation for approval prior to undertaking any overlaying work.

APPENDIX 1/6: SUPPLY AND DELIVERY OF SAMPLES TO THE OVERSEEING ORGANISATION

1 The Contractor is to agree with the Overseeing Organisation and complete the table below for samples of materials to be supplied and delivered for testing by Overseeing Organisation.

2 Unless stated otherwise in the Scope, representative samples of materials are to be delivered not less than four weeks before the material is to be used, or longer if such period is required for testing of the material.

Clause No. or Series	Sample Description	Frequency of Sampling	Delivery Location	Comments
803	Type 1 unbound Mixtures (N)	one per day per source	Laying area	Sampling by the Overseeing Organisation
929	Percentage Refusal Density Test (N)	one pair of 150 mm dia. cores every 500 lane metres	Site laboratory store	Core cutting by Contractor
929 and 931	All dense base and binder course materials (N)	one per material type day per source	Laying area	Sampling by the Overseeing Organisation
942	Surface course (N)	one per day per source	Laying area	Sampling by the Overseeing Organisation
1000	Concrete (N)	1 per load	Delivery area	Sampling by the Overseeing Organisation
1212	Permanent road markings (N)	Full set of samples per visit	Laying area	Sampling by the Overseeing Organisation
2404	Mortar (N)	1 per day	Laying area	Sampling by the Overseeing Organisation
2606	Bricks (N)	10 per source	Delivery area	Sampling by the Overseeing Organisation

Notes:

(i) Samples comparable to those specified in this Appendix will be necessary for any equivalent work, goods or materials proposed by the Contractor (refer to SHW Clause 105.6).

(ii) Unless otherwise shown in this Appendix samples of work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.

(iii) Unless otherwise scheduled under Clause 2602 samples of concrete complying with that Clause are not required.

(iv) (N) indicates UKAS or equivalent laboratory accreditation required for sampling.

APPENDIX 1/7: SITE EXTENT AND LIMITATIONS ON USE

1 Extent of the Site

The extent of the site is defined in the Scope.

2 Limitations on the Use of the Site.

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

- 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.

- 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.

- 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.

- 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.

- 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.

- 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 *Client* 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 *Client* from any monies due or which become due to the Contractor.

- 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.

- 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 elsewhere without the written approval of the *Client*.

- The Contractor shall prevent trespass by his own or his sub-contractor’s employees onto any property adjoining the site.

- The Contractor shall ensure that no steps, ladders or other plant are left accessible so as to permit unauthorised access to the works.

- 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.

- The Contractor shall take all reasonable steps to minimise dust nuisance during the Works.

- All existing highways used by vehicles of the Contractor or any of his sub-contractors or suppliers of material or plant, and any new roads which are part of the Works and which are being used by traffic, shall be kept clean and clear of all dust, mud, dirt and other debris deposited by the said vehicles or spreading from the Works.

- The Contractor shall ensure that the existing Highways used by the Contractor, or any of his sub-contractors or suppliers of materials or plant and any new diversion ways which are part of the Works or in the vicinity of the Works, are kept clear of all dust, mud, dirt and other debris which emanate from the Works

- The Contractor shall note that 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.

- The programming of any remedial works required after the actual Completion Date shall be agreed with the Overseeing Organisation before commencement of those works.

- Each goods vehicle 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 1/8: OPERATIVES FOR THE OVERSEEING ORGANISATION

1 The Contractor is to agree with the Overseeing Organisation for the number and function of operatives required by the Overseeing Organisation and complete the table below.

Operatives Required	Duties & Skills	No.	Period Required
Chainman/Driver Driver/Laboratory Operative			

2 For site surveys and setting out, operatives shall be experienced in assisting engineers in such work.

3 For laboratory-related duties, operatives shall be capable of assisting laboratory staff in routine tasks.

4 Operatives provided under sub-Clauses 2 and 3 above shall have valid driving licences and driving experience suitable for the vehicles supplied in accordance with Appendix 1/2.

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, L_{Aeq} (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, L_{Aeq} (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 Period	Hours	Total Noise Levels at Occupied Building		
		Ambient Noise Level. L_{Aeq} measured 1 m from the façade of any occupied building dB(A)	Period of Hours over which L_{Aeq} 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:

- 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).
- The ambient noise level, L_{Aeq}, is the total L_{Aeq} from all the noise sources in the vicinity over the specified period (sampling time to be minimum 5 minutes duration).
- The existing ambient noise level, L_{Aeq}, is the total L_{Aeq} 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).
- 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 in particular with the following requirements:

- 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.

- All vehicles and mechanical plant shall be fitted with effective exhaust silencers maintained in good working order.

- 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.

- Machines in intermittent use shall be stopped in the periods intervening between work.

- The sound levels shall be monitored by methods set out in Annex G of BS 5228-1.

- The Contractor shall adhere to the codes of practice for construction and piling given in BS 5228-1.

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 reasonable 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 Scope.

Vibration

8 The Contractor shall comply with BS 6472 parts 1 and 2. Any vibration monitoring carried out shall also be in compliance with BS 6472 parts 1 and 2.

9 In general, construction works should avoid producing vibration levels above 1mm/s peak particle velocity (PPV) measured at foundation level of a property. No proposed works shall result in peak particle velocities (PPV) greater than 7.5mm/s beyond 20m of the works or 15 mm/s measured at foundation level at any location closer than 20m where damage or disturbance to private properties may occur. The Contractor and the local authority may agree lower limits.

APPENDIX 1/12: SETTING OUT AND EXISTING GROUND LEVELS

Any Ground Levels or Setting Out details will be included in the Scope.

APPENDIX 1/13: PROGRAMME OF WORKS

1 The Contractor shall provide the Programme of Works, in accordance with Clause 31.2 of 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.

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

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

4 The schedule of constraints will be provided within the Scope.

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.

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 any 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 approved 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

2.1 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.

2.2 The works shall be carried out in accordance with the traffic management proposals submitted by the Contractor to the Overseeing Organisation for approval.

2.3 Any reference to the “Police” shall be read as “Police/Highways England Traffic Officer” as applicable.

2.4 The Contractor shall comply with the requirements and recommendations of the following publications:

- Highways England Managing Network Occupancy Performance Requirement;
- Chapter 8 of the Traffic Signs Manual;
- Highways England, ‘Speed Limit Enforcement at Road works: Guidance and Best Practice’ which offers advice on procedures to follow when carrying out this activity. The Service Provider is strongly advised to take this guidance into account when planning major schemes where the speed limit is to be enforced;

- DfT Circular 01/2007 'Use of Speed and Red-Light Cameras for Traffic Enforcement' provides guidance and best practice on deployment. Visibility and signing;
- Highways England, GG 115 Requirements for works on the hard shoulder and road side verges on high speed dual carriageways.

2.5 The alignment of the traffic lanes and the crossovers must comply with the requirements of CD 109 Highway Link Design.

2.6 Restrictions on the phasing and timing of works shall be stated in the Scope, including embargo periods and details of events resulting in additional restrictions.

2.7 Traffic data to be used for the design of traffic management shall be stated in the Scope.

2.8 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 Scope.

2.9 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 his proposed sign to the Overseeing Organisation for approval. The contractor must comply with the requirements of Appendix 1/9 regarding the control of noise.

2.10 Where the circumstances of any particular case 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 of his other obligations and liabilities under the Contract and under the relevant provisions of the Highways Acts.

2.11 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 *Client*'s Maintenance Manager and with the Police, all of whom shall be kept informed of the programming of the Works in advance.

2.12 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.

2.13 The Contractor should 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 him or his employees or sub-contractors or his suppliers or his haulers or their employees are executed in such a manner as to constitute hazards or safety risks to traffic or themselves.

2.14 The Contractor shall sluice (including the provision of clean water) any working areas affected by grit and salt, so as to avoid de-bonding between layers of flexible construction. Another Contractor will be responsible for gritting and snow ploughing of the lanes open to traffic, but the Contractor shall reset all disturbed cones, cylinders, lamps and signs and clear all snow and ice moved onto the working areas by the other Contractor's operations.

2.15 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%.

2.16 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).

2.17 Vehicular and Pedestrian access to side roads, accesses and to all properties shall be maintained unless otherwise directed in the Scope.

2.18 Pedestrian walkways shall be provided where required by the Scope. The contractor shall maintain pedestrian crossing points or provide and sign in accordance with 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.

2.19 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 Scope 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.

2.20 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 Scope when the signals are not in use.

2.21 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.

2.22 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 *Client* 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 must 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 must be submitted to the Overseeing Organisation for approval seven days prior to the proposed date of installation. Convoy working arrangements must comply with Chapter 8 Traffic Signs Manual: 2006
- `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 small hatchback type cars 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.

2.23 Where 'lane closure' traffic management arrangements are required, these shall be provided in accordance with Chapter 8 of the Traffic Signs Manual Part 1

2.24 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

2.25 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

2.26 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

2.27 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

2.28 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

2.29 Workforce crossing carriageway and live lane working

- The Contractor is to eliminate carriageway crossing and live lane working in accordance with Highways England 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 Project Managerand to NDD Performance@highwaysengland.co.uk.

2.30 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, his representative and 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.

2.31 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 must 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

2.32 Recovery Vehicles are required whenever specified in Appendix 1/20.

2.33 Temporary lighting is required whenever specified in Appendix 14/3.

3 Traffic Safety and Control Officer (TSCO)

3.1 In order that all matters of traffic safety and control in relation to the control of traffic and the works comply with the necessary requirements, the Contractor shall appoint a Traffic Safety and Control Officer and a deputy,

- One of either shall be available at all times in case of emergency.
- Their names and telephone numbers shall be supplied to the Overseeing Organisation and to the Police.
- They shall be direct employees (and not a Sub-Contractor) who shall be entirely responsible for arranging and agreeing lane closures, liaison with the Overseeing Organisation and the Police in all matters relating to traffic control, controlling traffic during periods of time when traffic restrictions are necessary. and ensuring that all traffic requirements are met.

3.2 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 men 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.

3.3 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.

4 Temporary Traffic Regulation Orders and other Statutory Orders

4.1 Details of Temporary Traffic Regulation Orders previously applied for are specified in the Scope.

4.2 Notice required by the Overseeing Organisation for him to arrange for:

- Amending or making temporary traffic orders .....12 weeks
- Authorising of non-prescribed signs…… .....8 weeks
- Authorising temporary traffic signals .....2 week

5 Crossovers

5.1 The alignment of crossovers must 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 Scope.

5.3 Requirements for the removal of crossovers is detailed in the Scope.

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 Scope.
- 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, Part 1, Table A for the sizes of these signs.

7 Temporary Speed Limit Cameras

7.1 Refer to Appendix 1/27 for temporary speed limit cameras.

APPENDIX 1/18: TEMPORARY HIGHWAYS FOR TRAFFIC

1 Temporary highways

Any temporary highways for traffic is to be agreed with the Overseeing Organisation and any other affected organisations.

2 Schedule of prescribed and non prescribed signs to be supplied by the contractor

The contractor shall supply, install and maintain the temporary highways and information signs in accordance with the Traffic Signs Manual Chapter 8 and the Traffic Signs Regulations and General Directions 2016.

APPENDIX 1/19: ROUTEING OF VEHICLES

1 Permitted Access Routes to and from the Site

1.1 The Contractor, his 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 should avoid residential areas if 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 All areas of the permanent Works used as haulage roads must be reinstated upon completion of the Works by the Contractor. Any reinstatement costs shall be borne by the Contractor.

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.

3 Movement of Machinery and Plant Across Public Road

3.1 Traffic control at crossings of Public Roads shall be in accordance with Chapter 8 of the Traffic Signs Manual (2006).

APPENDIX 1/20: RECOVERY VEHICLES FOR BREAKDOWNS

1 SHEET 1: Requirements for Recovery Vehicle Operation

1.1 Recovery vehicles are required whenever specified in the Scope.

1.2 The Contractor shall comply with guidance within Chapter 8 Traffic Signs Manual Parts 1 and 2 when planning recovery operations.

1.3 Before the installation of any traffic management the Contractor shall inform the Overseeing Organisation of the name, address and telephone number of the recovery firm and supply details of the arrangements that have been made to ensure that vehicles are recovered within the stipulated time period. The names and permanent address of recovery operatives are to be submitted to the Overseeing Organisation at the same time.

1.4 In the event that the recovery firm proposed by the Contractor cannot fulfil the requirements of this Appendix by virtue of inadequate insurance or delays in response times, the Overseeing Organisation may require the Contractor to terminate the arrangement and make a new arrangement with another recovery supplier at no additional cost to the Overseeing Organisation.

1.5 Signs shall be erected through the traffic management advertising the free recovery service as sign diagram 7291.

1.6 The Recovery Controller shall be stationed at the recovery base station which shall be in direct contact with the CCTV control room.

2 SHEET 1: Recovery Vehicles to be Provided

2.1 The Contractor shall provide dedicated recovery vehicles to recover broken down, accident damaged or abandoned vehicles (heavy, light and motorcycle) from within the traffic management for the works. The vehicles shall be provided 24hrs per day 7 days per week whenever the Contractor has any form of traffic management in place on the site.

2.2 The response time, from issuing of the order to recover, to the recovery vehicle arriving on site to commence the recovery, shall not exceed 20 minutes. The Contractor shall determine the numbers of types of recovery vehicles needed depending upon the location of the vehicles, the areas of traffic management and normal levels of motorway congestion during road works.

3 SHEET 1: Locations for Recovery Vehicles

3.1 The Contractor shall determine and provide the locations for recovery vehicles to suit the location of traffic management in order to meet the required response time described in this Appendix.

3.2 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.

3.3 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.

3.4 Use of caravans will not be permitted at the recovery stations.

3.5 The Contractor shall also be responsible for the erection, maintenance and removal of all necessary traffic management at these locations.

4 SHEET 1: Limit of Service

4.1 The vehicle recovery service is to be limited to those vehicles requiring assistance within the traffic management system. In most cases that is between the "500m prior to the initial taper and the "end of works" sign on each carriageway, unless instructed otherwise by the Overseeing Organisation. 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.

4.2 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.

4.3 Drivers should 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.

4.4 If for any reason, the recovery of a vehicle is likely to take an excessive amount of time the recovery operative must inform the Traffic Safety Officer.

4.5 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.

5 SHEET 1: Locations for Vehicle Removal

5.1 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.

5.2 Vulnerable motorists and their vehicle are to be dropped off at a suitable safe location where they will not be alone or exposed to the risk of crime, and where they can get any support necessary including welfare facilities and access to a telephone. Such locations are to be agreed with the Overseeing Organisation prior to Commencement of Works. Vulnerable motorists include, but are not limited to:

- Lone or obviously pregnant females;
- Lone parents with young children;
- Mobility impaired;
- Elderly; and

- Distressed drivers.

5.3 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.

6 SHEET 1: Communication System

6.1 The communication system shall be operational at all times that recovery vehicles are required.

6.2 A secondary 'back up' system shall also be provided for communications with the Police/Regional Control Centre. Provision shall also be made for communication between the recovery vehicles and the recovery base station.

7 SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET **Week Commencing: .....**							
Driver's Name:		Vehicle Type/Registration No:			Mileage:		
Driver to initial against check list below:							
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems): Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

8 SHEET 3: Information to be provided by the Contractor

LEAFLET FOR ISSUE BY RECOVERY VEHICLE OPERATIVES TO DRIVERS OF ALL BROKEN-DOWN OR ACCIDENT-DAMAGED MOTOR VEHICLES

Name of Scheme:

[compiler: Insert accurate name of the scheme before the issue of tender documents]

.....

Vehicle Recovery Service - Explanatory Leaflet authorised by the …….. *[compiler insert name of the Overseeing Organisation or Highway Authority as appropriate]* **for issue to drivers of broken-down and accident-damaged motor vehicles within the above works.**

1. The roadworks operations commence at the "Roadworks Ahead - 2 miles" sign and end at the "Roadwork End" sign. *[compiler: See Note 1 below]*
2. The recovery service provided along the extent of the roadworks operations is free.
3. Vehicles will be recovered clear of the roadworks operations to ……unless otherwise directed by the police. *[compiler: See Note 2 below]*
4. It will then be at the discretion of individual drivers of broken-down or accident-damaged vehicles requiring assistance to arrange for assistance or the removal of their vehicle to a garage of their choice. The operators of the free recovery service do not make such arrangements.

……

……...

(11/05) Useful contact numbers are given below:

Directory Enquiries ……

AA ……...

RAC ……

Greenflag ……

Local Garage ……

Assistance will also be given by telephoning …….. *[compiler: See Note 3 below]*

If a motorway emergency telephone is used, the police will assist.

[Notes to compiler:

(1) If different, replace with the appropriate limits of service for the works.

(2) The chosen location should take into account safety, security and the availability of a telephone, see Chapter 8 of the Traffic Signs Manual.

(3) The telephone number should be agreed with the police prior to the commencement of the works.]

9 SHEET 4: Information to be provided by the Contractor

LAYOUT FOR 'VEHICLE RECOVERY LOGSHEET'

VEHICLE RECOVERY LOGSHEET (1 of 2) **[Scheme name]**						**Recovery Vehicle: …….**								**Week Ending: ……**			**Sheet No: ……..**			
Date	Time			Where?	Dir.	Lanes Closed					Police etc Present*	Incident		Recovery	Vehicle Type #	Q'ing	Weather	Road Surface		Remarks
	Call Out	Arrival at Scene	Road Clear	Marker Post No.		HS	1	2	3	4		Acc	B/d	Tow? ** Y/N		Y/N		Dry	Wet	

*P - Police
F - Fire Service
A - Ambulance

**T - Tow
L - Lift
R - Restart

F - False Call
#C - Car
M/C - Motorcycle

V - Van
HGV - Heavy Goods Vehicle

VEHICLE RECOVERY LOGSHEET (2 of 2) **[Scheme name]**	**Recovery Vehicle: …….**	**Week Ending: ...../...../.....**	**Sheet No: ……**

Date & Time	Type of Vehicle	Registration No.	Name and Address of Driver or Firm	Location of Breakdown	Nature of Breakdown	Recovery Operator's Name

APPENDIX 1/21: INFORMATION BOARDS

The Contractor shall provide the information boards in accordance with Traffic Signs Manual Chapter 8 part 1, D4.15.

APPENDIX 1/22: PROGRESS PHOTOGRAPHS

The Contractor shall provide Progress Photographs as detailed within the Scope.

APPENDIX 1/23: RISKS TO HEALTH AND SAFETY

1 General

1.1 This Appendix is directed at measures to protect the workforce, members of public and persons visiting the site from exposure to substances hazardous to health.

1.2 The Contractor's attention is drawn to the fact that many common building materials that would not usually be considered hazardous to health, might in certain circumstances become so, e.g. cement dust raised by grinding or cutting of concrete components.

1.3 No uncommon substances are used in the works beyond those stated in Highways England Advice Note SA8/94 "Use of Substances Hazardous to Health and Highway Construction" incorporating Amendment No 1 dated October 1994, (MCHW 6.2.1).

1.4 Under the COSHH Regulations, it is the responsibility of the Contractor to ensure that working practices, protective measures, monitoring and control measures are in place to minimise risks to the workforce and the general public.

1.5 The following materials have been identified as potentially hazardous to the health of the public:

(i) Sprayed curing membranes;
(ii) Substances that cure by releasing compounds into the air;
(iii) Paint systems;
(iv) Dust caused by cutting of concrete, removing the existing join sealant, and sweeping of pavements;
(v) The Contractor's attention is drawn to the presence of oil and diesel residue in drainage runs. 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;
(vi) The Contractor's attention is drawn to the potential presence of contaminates in site won materials in locations identified in Appendix 6/2;
(vii) The Contractor's attention is brought to the fact that it is assumed that Asbestos-Containing Material (ACM)'s are located in the works, in cabinets, drainage pipework and beneath parapets and drawn to the Scheme Asbestos Management Plan (SAMP) and the possible presence of Asbestos in some of the existing materials used in the construction of the motorway and supporting systems. To discharge responsibilities under the control of Asbestos Regulations 2006 the contractor is required to include for and follow the Asbestos Action Plans referred to in the SAMP and to carry out such surveys identified as required in the SAMP before undergoing any works, to prepare and submit a report identifying any asbestos found, arrange for the information identified to be accurately reported in an electronic format to the Highways England or their agents. ACM's are not to be removed or disturbed without detailed consultation with the Overseeing Organisation.

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

1.7 Plant should be sited and screened where necessary to minimise dust emission to adjoining areas. All stockpiles should be covered to prevent the generation of dust.

1.8 Signs to warn the public shall be positioned at suitable locations. Signs are to comprise black lettering, 75mm high, on a yellow background and are to bear the legend 'WARNING - MATERIALS HAZARDOUS TO HEALTH BEING USED IN

CONSTRUCTION WORKS'.

1.9 Temporary fencing shall be used to prevent unauthorised access into areas where hazardous substances are being used, or (in the case of asbestos formwork) removed.

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

1.11 Other measures shall be detailed in the Scope.

2 Assessment of Risk Measures to Prevent or Control Exposure

2.1 The Contractor shall provide the Overseeing Organisation with details of the measures to be taken to prevent or control the exposure of the public with the substance to acceptable levels.

2.2 Each specialist contractor shall provide the Overseeing Organisation with details of potentially hazardous substances, their associated risks, and the mitigating measures to be taken to prevent or control the exposure of the public to hazardous substances, to acceptable levels.

2.3 Details provided are to include:
(i) Restrictions in relation to traffic management measures
(ii) Restrictions in relation to working practices
(iii) Measures taken to protect members of the public
(iv) Monitoring is to be undertaken

3 Measures to be taken to protect members of the public.

3.1 Measures to be taken to protect members of the public are 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

Substance	Hazard	Operation	Special Measures
			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

3.2 Additional measures to be taken to protect members of the public are scheduled in the Scope.

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.

2 The Quality Plan shall cover the following items:
- (i) Contractor's organisation and management
- (ii) Contractor's method statements and construction procedures
- (iii) Contractor's construction quality control
- (iv) Supplier's Quality Plans
  (for each of the quality management schemes listed at Appendix A of MCHW Volume 1)

3 Quality Plans shall conform with the requirements tabulated in this Appendix.

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

CONTRACTOR'S ORGANISATION AND MANAGEMENT

5 This section of the Quality Plan shall include:
- (i) Definition of the Contract and its documentation;
- (ii) The organisation of the Contract, including the line of command and communication between parties involved in the Contract;
- (iii) Names, roles, responsibilities and authority of principals and key personnel;
- (iv) Control of liaison and meetings with third parties;
- (v) Identification of the Contractor's own staff responsible for overseeing each major activity;
- (vi) The main Contractor's control of sub-contracts;
- (vii) Document control;
- (viii) Programme for submission of method statements and Suppliers' Quality Plans;
- (ix) 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;
- (x) The quality of plans for sub-contractors and suppliers of work, goods and materials which are the subject of quality management schemes;
- (xi) Procedure for the preparation, review and adjustment of programmes for the effective progression of the Works and the recording of this;
- (xii) Control and approval of purchases of materials;
- (xiii) Control of off-site activities (where appropriate);
- (xiv) Procedures for the regular review and recording by the Contractor of the quality of the Works;
- (xv) Control of personnel selection, based on their care, skill and experience;
- (xvi) Management review/audits to monitor and exercise adequate control over the implementation of the quality plan;
- (xvii) Any other relevant item.

CONTRACTOR'S METHOD STATEMENTS AND CONSTRUCTION PROCEDURES

6 This section of the Quality Plan shall include:
- (i) 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.

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

CONTRACTOR'S CONSTRUCTION QUALITY CONTROL

7 This section of the Quality Plan shall include:

(i) 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.

(ii) Arrangements for "receiving" and "in-process" testing.

(iii) Control of test laboratories.

(iv) Control of test, measuring and inspection equipment.

(v) Document control.

(vi) Procedure for monitoring and recording the inspection, test and approval status of the constructed/installed work.

(vii) 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.

(viii) Procedure for the review of work submitted for review but not accepted as conforming to the Contract.

(ix) 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

8 The Quality Plan shall include:

(i) Definition of the product or service to be provided.

(ii) 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.

(iii)* 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.)

(iv) 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:

(v)* Receipt and examination of certificates of conformity and test results for purchased products.

(vi)* Product identification and traceability.

(vii)* Handling, storage, packaging and delivery to Site and storage and handling on Site.

(viii) Quality records.

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

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 During daylight hours it shall be possible to read the number plate of a stationary vehicle on a monitor within the CCTV Control Room, under normal daylight conditions for the time of year. Daylight hours are the hours between official lighting up times as specified by the local Meteorological Office for the area of the works in question. The contractor will need to ensure that the design of temporary CCTV cameras is sufficient to take account of any dark areas as a result of existing lit areas not being maintained in accordance with TS 501 Road lighting inspection.

5 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.

6 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.

APPENDIX 1/26: TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROAD WORKS (TASCAR)

General

1 The Contractor shall supply, install, maintain in conjunction with the Chief Officer of Police and remove on completion the Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Road works (TASCAR) as described in this Appendix and in Appendix 1/27. Wherever the 'Chief Officer of Police' occurs in this Appendix it shall be construed to refer to the Chief Officer of Police named in Appendix 1/27. The Contractor shall ensure that the system is completely installed and fully operational from the time defined in Appendix 1/27 and that it remains in operation for the duration of the Contract unless otherwise specified in Appendix 1/27.
For reference use Highways England publication "Speed Limit Enforcement at Road works: Guidance and Best Practice".

2 As a prescribed device under the provisions of the Road Traffic Act 1991, all equipment shall conform as a minimum to the requirements of the Home Office "The Speed meter Handbook" (fourth Edition) issued by the Police Scientific Development Branch (PSDB), Publication No 15/05, and have received 'type approval' from the Secretary of State at the Home Office. Should there be any inconsistency between the requirements of the contract and HOTA the latter should take precedence. All equipment shall be so maintained by the Contractor throughout the period that the TASCAR is required to be provided, as specified in Appendix 1/27.

3 The number of monitoring sites required for this Contract is as specified in Appendix 1/27 or the Scope. All equipment necessary to bring the sites into operation shall be provided by the Contractor.

4 The Contractor shall be responsible for the design of the System which shall be approved by the Overseeing Organisation and the Chief Officer of Police before installation commences. The Contractor shall contact the Chief Officer of Police to determine operating requirements.

Average Speed Measuring System

5 The system shall include one or more linked pairs of camera outstations located at entry and exit points of a defined zone or zones as specified in Appendix 1/27 or the Scope. Each pair of camera outstations shall include one entry outstation and one exit outstation unless otherwise specified. The camera outstations shall be connected to one or more roadside cabinets as referred to below.

6 There shall be an adequate electrical supply to all components of the system.

Camera and Control Unit

7 The equipment shall be capable of calculating the average speed of vehicles over a defined zone and generating a record of those violating a pre-set threshold.

8 The violation record shall include an image of the target vehicle in the context of its surroundings and the registration number of the target vehicle will be legible in all but adverse lighting and poor weather conditions.

9 A record of detected violations shall be written onto Write Once Read Many (WORM) disks in accordance with the requirements of the Home Office Type Approval (HOTA). WORM disks

shall be capable of storing at least 8000 speed violation records. WORM disks shall be supplied as specified below (Para 22). WORM disks shall be housed within an enforcement cabinet, the location of which shall be as agreed with the Overseeing Organisation. The equipment shall be stored such that only authorised personnel may gain access to it.

10 Each speed violation record shall have the following information as a minimum:
a) Data of violation displayed in Day, Month, Year;
b) Time of violation displayed in Hours, Minutes, Seconds;
c) Average Speed of offending vehicle;
d) Site Identification Code;
e) Offence number;
f) WORM disk reference number;
g) Distance and time taken to travel between the entry and exit cameras

11 The system shall have an inbuilt self-test mechanism and shall not be capable of operation while any fault in the system exists.

12 The control unit shall be capable of recording the total number of vehicles monitored and the total number of offences above an operator-specified threshold.

Dummy Equipment

13 The dummy equipment shall be designed to be portable and easily transferable between housings and of external appearance indistinguishable from that of a live one.

Street Furniture

14 Camera outstations shall be installed such that there is a minimum height clearance of 5.41m over any part of the pavement or verge capable of being trafficked. There shall be an unrestricted view from the camera of the section of carriageway to be monitored. Camera outstations are to be mounted on purpose- designed columns. Where this is impracticable, suitable existing structures may be used.

15 When the camera outstation is column mounted, the column and foundation design shall comply with CD 354, ‘Design of minor structures’. The Contractor shall provide the Overseeing Organisation with 2 copies of certified drawings of the cameras columns and foundation for approval.

Installation

16 The Contractor shall install the equipment required under this Appendix and Appendix 1/27 and in accordance with any particular installation requirements in Appendix 1/27.

17 The distance between linked outstations shall be measured in accordance with the requirements of the HOTA.

18 The video cable connecting each camera outstation to the roadside cabinet shall be surface laid or tied to barriers as directed. Where the cable is to cross any carriageway this shall be by means of bridges, gantries or ducts as defined in Appendix 1/27 or as specified in the Scope. Where ducts are used, these are to be rodded and roped prior to cable installation by the main contractor

19 The Contractor shall carry out any necessary reinstatement on removal.

Commissioning and Acceptance

20 The Contractor shall be responsible for the commissioning of the TASCAR as a whole, including secondary checks and the calibration of each piece of equipment, including ensuring its correct operation.

21 The commissioning of the TASCAR shall be carried out by the supplier of the system in the presence of and for acceptance of the Chief Officer of the Police. The Contractor shall give at least 4 days notice of his intention to carry out this work to allow for a designated representative of the Chief Officer of Police to attend. Commissioning certificates shall be provided to the Overseeing Organisation.

Operation and Maintenance

22 The TASCAR operator will be the Chief Officer of Police and his delegated officers. Once the TASCAR has been commissioned any redirecting of the camera outstations or the switching of detection equipment between zones will be the responsibility of the Chief Officer of Police as operator. He will also be responsible for the loading and unloading of WORM disks Each enforcement cabinet shall be provided with 1 WORM disk per week and replacement disks shall be provided by the supplier to the Contractor The Contractor shall furnish whatever assistance is requested by the Chief Officer of Police through the Overseeing Organisation to carry out these tasks.

22 The Contractor shall provide all temporary speed limit signs, repeater signs and other associated signing, and provide the Overseeing Organisation with a log showing the locations of all such signs relative to existing marker posts.

23 The Contractor and his supplier shall maintain the System as specified in paragraphs 1 to 4 above and in Appendix 1/27.

APPENDIX 1/27: TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROAD WORKS (TASCAR) – PARTICULAR REQUIREMENTS

Scope – Location and Quantities

Instantaneous Speed Measuring System

1 The number of speed monitoring sites required for the TASCAR is to be defined on a scheme by scheme basis. The following ancillary equipment is therefore required:

Number of fixed housings	to be defined on a scheme by scheme basis.
Number of live camera units	to be defined on a scheme by scheme basis.
Number of monitoring only units	to be defined on a scheme by scheme basis.
Number of trailer-mounted housings	to be defined on a scheme by scheme basis.

2 For the purpose of this Appendix live camera units are HOTA devices at which enforcement is taking place. Monitoring only units are for speed measurement only and not for enforcement but still activate with a flash. These units should only activate for receding traffic i.e. not flash at oncoming traffic.

3 The Contractor, in conjunction with the CPO, shall supply, install, maintain and remove on completion, the TASCAR specified in Appendix 1/26 and in this Appendix at the following locations within the works as defined in the Scope:

Northbound verge	Chainages to be defined on a scheme by scheme basis.
Southbound verge	Chainages to be defined on a scheme by scheme basis.
Central Reserve (CR)	Chainages to be defined on a scheme by scheme basis.

4 Parts of the TASCAR which are located within the central reserve may be rotated through 180 degrees at some point during the works and will require appropriate site commissioning.

Average Speed Systems

5 A camera outstation consists of a camera system and its lighting source. A pair of linked camera outstations is required for each monitored lane within a speed-controlled zone. The number of lanes to be monitored within the speed-controlled zone is to be defined on a scheme by scheme basis. The lane(s) to be monitored is/are to be defined on a scheme by scheme basis. The lane(s) to be monitored only is/are to be defined on a scheme by scheme basis. The following equipment is therefore required and to be completed on a scheme by scheme basis.

Number of functional linked camera outstation pairs;
Number of monitoring only camera outstations;
Number of column-mounted outstations;
Number of structure-mounted outstation;
Number of control cabinets.

6 The Contractor, in conjunction with the CPO, shall supply, install, maintain and remove on completion, the TASCAR specified in Appendix 1/26 and this Appendix, at the locations as defined in the Scope.

Chief Officer of Police

7 The Chief Officer of Police in Appendix 1/26 is the CPO for affected police district(s).

Provision of Speed Monitoring Site Media

8 Where digital HOTA equipment is used, the Contractor will provide appropriate media such as WORM (Write Once Read Many) drives, CDs, memory sticks as appropriate, and in quantities required by the CPO for the use of the equipment for the duration of the works. If HOTA 35mm wet film systems are used, the film will be supplied to the CPO by the Contractor, typically at the rate of one film per day per live camera in operation, plus ten which shall be supplied at the commencement of the works

Installation, Commissioning and Period of Operation

9 Cameras sited on the nearside of the carriageway shall be installed and commissioned prior to 24 hour lane closures being put into operation. Cameras sited in the central reserve shall be installed and commissioned not later than 12 hours after installation of the contraflow. Both sets of cameras shall then remain in continuous operation until a Certificate of Completion has been issued for the whole of the works. At the end of the period of operation required under the Contract, the equipment shall remain the property of the Contractor.

Reinstatement of Surfaces

6 Reinstatement of verge areas shall consist of backfilling any hole(s) with acceptable material to Clause 601 up to a level 100 mm below specified finished levels. The remaining 100mm thickness shall be filled with topsoil Class 5B to Clause 601.

7 Reinstatement of paved footway areas shall consist of backfilling any holes with sub-base Type 1 to Clause 803 and compacting adequately such that this terminates 65 mm below specified finish levels. The remaining 65 mm thickness shall be backfilled with a 50 mm thick layer of dense macadam (20 mm aggregate) to Clause 906 covered by 15 mm thickness of dense macadam wearing course (6mm aggregate) to Clause 909. The wearing course shall extend not less than 150 mm beyond the hole which has been backfilled and shall be keyed into existing surfacing by its prior excavation to a depth not greater than 15 mm.

8 Reinstatement of carriageway surfaces shall include, but not be limited to, removal from the pavement surface of the secondary speed check markings specified in this Appendix and Appendix 1/26. This shall be done either on removal of the TASCAR or on completion of the works.

Temporary Traffic Signs

9 Additional temporary traffic signs may be needed to operate with TASCAR. Refer to IAN 113/08 – Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadwork's (TASCAR).

APPENDIX 1/71: SECURITY OF THE SITE

General Information

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 OR PARTIALLY DEMOLISHED

1 General

1.1 This specification document contains the numbered appendices required by the Specification for Highways Works and is to be read in conjunction with the Scope and Site Clearance drawings listed in Appendix 0/4 and Specification Schedules Series 200.

1.2 All works in relation to site clearance shall be carried out in accordance with series 200 of the Specification for Highway Works (SHW).

1.3 The Contractor shall demolish, break up and remove buildings and structures, as described in the Scope, and superficial obstructions within the Site in the way of or otherwise affected by the permanent works. The Contractor shall clear each part of the Site at times and to the extent indicated in the Scope. The extent of any partial demolition of structures is described in the Scope.

1.4 The Contractor shall ensure that individual trees, shrubs or other environmental features and areas indicated in the Scope to be preserved, are identified and protected in accordance with Appendix 2/6.

1.5 The Contractor shall note that tree removal by blasting is not permitted.

1.6 Modifications required on existing fencing, hedges or walls are described in the Scope.

1.7 Disused surface water drains, sewers, cables and ducts together with any bed or haunch or surround shall be dealt with in accordance with SHW Clause 201.

1.8 The Contractor shall take all measures required by any Statutory Undertakers, the management of other publicly owned services, or owners of privately owned services or supplies, for disconnection and proper sealing off of all redundant drains, services and supplies. Refer to Appendix 1/16. If the relevant Statutory Undertaker does not want to retain the apparatus it shall be removed to an appropriate tip off site.

1.9 The treatment of hazardous material encountered in site clearance shall comply with any specific requirements stated in Appendix 2/5.

1.10 Where the Scope states ‘To be removed’ or ‘Remove to store off site’ this shall mean remove to tip unless a location to store that item is stated in Appendix 2/3.

1.11 The actions outlined in the Scope, shall be carried out on the structures listed in the schedule during the appropriate works phase taking due cognisance of hazards identified. (i.e. central reserve phase or verge phase). The contractor shall ensure that safety critical elements such as safety barriers are not removed before the implementation of temporary VRS for the relevant works phase. Gantry technology should be safely decommissioned prior to any works to the gantry structures

1.12 Foundations of superficial structures (such as marker posts, safety fences, lighting columns, sign posts etc.) that are subject to general site clearance shall be removed down to formation level.

2 Site Specific Requirements

2.1 The Contractor shall allow for areas of general verge site clearance in existing verges and earthworks as described in the Scope. This shall also include for the footprint of, and working space for all EA's, buildouts and for all proposed infrastructure. The Contractor shall refer to the Scope if the following items are to be included within his price.

a) Demolition, breaking up and removal;
b) Tree felling uprooting of brambles/bushes, small trees and hedges;
c) Tree pruning;
d) Grubbing up stumps and roots including backfilling and compaction;
e) Credit value of materials;
f) Disposal of material;
g) Making good severed ends of existing fences, hedges and walls;
h) Cutting back trees, bushes and hedges;
i) Disconnecting, removing and sealing services and supplies;
j) Reinstatement and making good;
k) Preservation and protection of individual or groups of trees, shrubs and the like; and
l) Treatment of hazardous materials.

2.2 The Contractor shall allow for areas of general carriageway site clearance. The Contractor shall refer to the Scope if the following items are to be included within his price.

m) Removal of white lines inclusive of Node markers;
n) Removal of road studs, and filling of voids;
o) Removal if manhole covers and frames in the hardshoulder
p) Disposal of material;
q) Reinstatement and making good;
r) Treatment of hazardous materials;
s) Removal of kerbs and backings.

Material Arising Requirements

2.3 Unless stated otherwise in the Scope, all materials arising from the site clearance which are not required, or unacceptable for use in the Permanent Works and not included in Appendix 2/3, shall become the property of the Contractor and shall be disposed of by him. Reference shall be made to Appendices 1/23 and 2/5 when considering disposal methods and potential waste disposal sites.

2.4 Materials included in Appendix 2/3 shall be carefully dismantled, taken up or taken down, cleaned and retained for re-use, stacked, labelled and protected or loaded, and transported to store as described in Appendix 2/3 and items damaged in this operation shall be replaced. All replacements shall be of equivalent quality to the original materials and approved by the Overseeing Organisation.

2.5 The treatment of hazardous material encountered in site clearance shall comply with any specific requirements stated in Appendix 2/5.

2.6 The Contractor shall confirm how any resulting waste materials are to be dealt with.

Road Restraint System Requirements

2.7 Refer to the Scope for any existing safety barriers to be removed.

2.8 The removal of safety fence anchor blocks shall be carried out as an earthworks operation. The resulting hole shall be filled with acceptable material which shall be compacted to the satisfaction of the Overseeing Organisation

2.9 The extent of safety fence removal at each site shall include the removal of foundations. The resulting holes shall be filled with acceptable material which shall be compacted to the satisfaction of the Overseeing Organisation.

Highway and Site Boundary Requirements

2.10 Where the line of an existing fence, hedge or wall is severed by the highway or site boundary, the severance shall be made good; either by

- Reinstatement
- Continuation of the fence, hedge or wall in a different direction.

2.11 In the case of a strained wire or chain link fence, a straining post shall be installed at the point direction change and the fence re-strained.

Drainage and Service Duct Requirements

2.12 Existing drainage assets shall be abandoned or grouted as detailed in Appendix 5/1 and as described in the Scope.

2.13 The removal of any other pipes and/or service, unless described in detail elsewhere within the Specification, shall only be undertaken with the agreement of the Overseeing Organisation.

Traffic Sign and Road Marking Requirements

2.14 Refer to the Scope for details of traffic signs, road markings and marker posts that are to be removed. Only signs described in the Scope are to be removed.

2.15 Existing signs at junctions shall not be removed unless otherwise stated in the Scope. Where existing signs are not shown to be cleared, they are assumed to remain in situ and included within the finished scheme.

2.16 Where existing traffic signs are described in the Scope for removal, their foundations shall also be removed and backfilled with suitable material, this is to remove the risk of conflict with new apparatus. For pricing, assume concrete foundation at an average $3m^3$ per post.

2.17 All sign illumination shall be disconnected and removed in accordance with series 1400 specification and street lighting section within this series.

2.18 Where all road markings and road studs are described in the Scope to be removed, they should match the extent of pavement to be removed as described in the Scope. Any exception to this will be described in the Scope. Markings should be removed in accordance with SHW Clause 1212.

2.19 Where existing white lines are to be removed as part of the permanent works:

- The existing white lines will be permanently removed by planing in locations where the road surface is to be replaced, or where rib lines are required to be removed.
- In locations where the existing road surface is to remain, the white lines will be permanently removed by hydroblasting.

2.20 The Contractor shall record the locations of all Node markers prior to removal of the existing carriageway as described in the Scope within the 700 series – Pavement treatment. The locations shall be recorded and replacement node markers reinstated within the recorded positions as per the 1200 series and 2600 series specification.

2.21 Road studs should be removed prior to any planing of the pavement. Unless stated otherwise in the Scope, existing studs should be assumed to be “Halifax”, BS EN 1463-1:2009 class P1B. Road studs to be removed are detailed in within Appendix 2/1.

2.22 Where the marker posts on the mainline are described in the Scope to be removed to facilitate the works. Removal should be wherever possible phased and aligned with works to ensure as many are retained in the verge as possible at any one time. Any removal is mitigated by retention of existing driver location signs (DLS) which are provided at 500m intervals. Where necessary additional DLS shall be provided on A frames in the verge to assist traffic officers”. Prior to their removal their location shall be surveyed for x, y co-ordinates, marker post reference and scheme chainage so that their replacements can be reinstalled at the same location.

2.23 Where necessary marker posts are also to be removed from slip roads. These shall also be surveyed prior to removal. All other marker posts on slip roads are to be retained. Marker posts to be removed are described in the Scope.

2.24 For the schedule of traffic signs, road markings and marker posts to be removed refer to the Scope.

Street Lighting Requirements

2.25 For existing lighting and associated cabling and feeder pillars including any photo electric control units (PECUs) mounted posts to be decommissioned in central reserve and in the verges refer to the Scope.

Technology and Motorway Communications Requirements

2.26 The Contractor shall remove all existing cabling forming part of the existing communications network as described in the Scope, with the agreement of the Overseeing Organisation in order to facilitate the installation of new cables and items of equipment in the final locations conveyed on the detailed communications design for the scheme. This process shall only be undertaken once the bypass cable installed by the scheme has been installed, tested and fully commissioned. The disposal process for the cabling assets deemed as redundant shall be agreed with the Overseeing Organisation prior to commencing their removal. The contractor shall include within their pricing for the temporary storage of the removed cables until any environmental disposal has been agreed and arranged.

2.27 The disconnection of existing circuits on the longitudinal communications cable network will be undertaken by National Roads Telecommunications Service (NRTS) Contractor with the approval of the Overseeing Organisation. The Contractor shall give the NRTS Contractor written notice copied to the Overseeing Organisation of any works requiring disconnections and isolation of equipment.

2.28 The Contractor shall ensure all cables removed forming part of the existing communications network are disconnected and proved ‘non-live’ prior to their removal by positively identifying both ends of each cable before cutting or disconnecting. Care shall be undertaken during this process to avoid any damage to the existing ducted infrastructure.

2.29 The Contractor shall retain all existing Electricity Interface (EI) cabinets, along with their respective access arrangements, even if the cabinets have not previously been identified in the Scope.

2.30 For the schedule of technology to be removed refer to the Scope.

2.31 Details of existing motorway communications equipment and infrastructure is provided within the Scope.

2.32 Unless stated otherwise in the Scope, where the existing technology infrastructure is not being replaced, then provided the site is not in the way of the new works the site should be treated as follows:

- Ducts to be cut off minimum 50mm below ground level and voids filled with pea gravel;
- Redundant chamber covers to be removed and chamber backfilled with pea gravel;
- Verge to be reinstated with minimum 150mm of topsoil (if available) or suitable excavated material;
- Following removal of steps and retaining walls, slopes are to be reinstated to match existing to the satisfaction of the Overseeing Organisation.

The Contractor is to agree with the Overseeing Organisation prior to undertaking the work.

2.33 Following the completion of the NRTS longitudinal commissioning, the NRTS Contractor will decommission and remove the interrupter cable. The Contractor shall then carry out the following:

- Recover all temporary power cables and associated ducting and fixings from the verge and ensure that all cabinets adopted for the temporary power supplies are returned to a condition that is acceptable to the Maintenance Service Provider and Distributor Network Operator (DNO) at handover (i.e. all temporary switchgear is removed and all temporary cabinet doors with slotted cable access are replaced with permanent doors).

Structural Requirements

2.34 Unless stated otherwise in the Scope, all existing bridges shall be retained.

2.35 For the bridge parapets to be removed at widening works, refer to the Scope.

2.36 For the treatment of existing gantry mounted signs and equipment refer to the requirements detailed within the Scope.

2.37 Demolition works shall be carried out in accordance with BS 6187 (Code of Practice for full and partial demolition).

2.38 Auxiliary fittings such as VRS brackets on piers that are exposed due to the removal of existing structures shall be removed and any resulting voids reinstated during the appropriate works phase.

2.39 Existing lighting and technology chambers and foundations, underground structures etc. within both the existing and proposed carriageway areas that are not to be retained shall be removed to a minimum depth of 1m below formation level. Any resulting voids shall be filled in accordance with Appendix 2/2.

2.40 For further details relating to Structures Site Clearance, refer to the Scope.

APPENDIX 2/2: FILLING OF TRENCHES AND PIPES

General

1 Where noted in the Scope all disused and abandoned soil and surface water drains, sewers, cables and ducts shall be grouted throughout the full length of their run with a cement and Pulverised Fuel Ash (PFA) mixture in accordance with the Environment Agency guidance and SHW Clause 506.3.

2 Unless otherwise agreed with the Project Manager, all redundant surface water drains below areas of proposed carriageway and hard shoulder are to be treated as shown in Appendix 5/1.

3 Unless otherwise agreed with the Project Manager, all redundant surface water cross carriageway drains shall be grouted throughout the full length of their run with a cement and Pulverised Fuel Ash (PFA) mixture in accordance with the Environment Agency guidance and SHW Clause 506.3.

4 All abandoned gullies and chambers shall be treated in accordance with Appendix 5/1.

5 The Contractor shall take all measures required by any Statutory Undertaker, the Management of other publicly owned services, or owners of privately owned services or suppliers for the support, protection, backfilling and compaction of materials below, adjacent to and above Statutory Undertakers apparatus whether exposed or buried.

6 All voids resultant on removal of drains or services within areas accessible to the public shall be backfilled immediately.

7 All redundant street lighting cable shall be removed as required by SHW Clause 1421.17 to the Contractors tip off site.

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

General

1 The intent is to reuse or recycle materials from site clearance with the preference being on the scheme, in the concrete roads programme, in part of the wider portfolio of the Client schemes and then used elsewhere. Where the material cannot be reused, then all materials from site clearance to be disposed to an appropriate and licenced tip off site.

2 Statutory Undertakers apparatus which is made redundant by the Works and requires removal for the construction of the works shall be dealt with in a manner which the Contractor shall agree with the relevant Statutory Undertaker.

3 Electrical supplies to redundant signs, gantries and lighting columns shall be disconnected and made safe to the approval of the electricity supplier and the Highway Authority. The Contractor shall liaise with the Police, Highway Authority and Statutory Undertakers regarding removal.

4 Voids left by the removal of equipment otherwise unaffected by the permanent works shall be backfilled immediately in accordance with the appropriate Clauses of the 600 Series. Where appropriate the upper reinstatement shall match the existing or proposed construction.

5 Unless otherwise indicated in Appendix 2/1, and SHW Series 400 Appendices and drawing series HW04, all existing safety fencing within the Limit of Works shall be retained in place.

6 Unless otherwise indicated in Series 500 Appendices, all other existing drainage features shall be retained in place.

7 Crushed concrete materials arising from the existing pavement being removed shall be taken away and recycled for re-use within this scheme extents where possible. Recycled concrete aggregate (RCA) shall be tested in accordance with SHW Clause 710. Use of RCA in unbound mixtures shall also be assessed in accordance with SHW Clause 802 to 807 as appropriate. Use of RCA in HBM shall be in accordance with SHW Clause 820 and Appendix 7/23.

8 Unless otherwise indicated in SHW Series 1300 Appendices all existing lighting equipment within the Limit of Works shall be retained in place.

9 CCTV cameras marked as ‘Existing to be Retained’ on the 1500 Series drawings shall be powered down (if required because of wider works) and removed from site and stored prior to being reinstated at the same location on the same mast. The Contractor shall inform the RCC prior to removing power from these cameras to ensure they do impact on monitoring of the wider Highways England network.

10 Unless otherwise indicated in Appendix 2/1, and SHW Series 1500 Appendices all existing motorway communications equipment within the Limit of Works shall be retained in place.

11 Unless otherwise indicated in the Works Information all other existing environmental barriers shall be retained in place.

APPENDIX 2/4: EXPLOSIVES AND BLASTING

Explosives shall not be used.

APPENDIX 2/5: HAZARDOUS MATERIALS

General

1 The Contractor shall liaise with the relevant Authorities to agree acceptable measures for the handling and disposal of hazardous material found in the course of site clearance.

2 The Contractor shall make use of available factual site investigation data to assist in the identification and classification of materials which may require offsite disposal at an appropriately licensed tip capable of accepting such materials. In addition, the Contractor shall be responsible for carrying out any supplementary chemical testing which may be necessary to aid the classification of any materials encountered during site clearance operations.

3 Any hazardous materials which requires offsite disposal shall be transported from site by a waste carrier registered under the Controlled Waste (Registration of Carriers Seizure of Vehicles) (Amendment) Regulation 1998. The Contractor and his carrier will be subject to Section 34 (duty of care) of the Environmental Prosecution Act 1990 and Special Waste (Amendment) Regulations 2001 and shall complete descriptions of the waste removed using a Transfer Note or Special Waste Consignment Note as appropriate.

4 The Contractor shall comply with the requirements given in the Health and Safety Plan and Appendix 1/23 for a specific procedure to ensure that if asbestos is encountered or suspected the ‘Control of Asbestos at Work Regulation’ and all other Mandatory Regulations are complied with.

5 All concrete materials excavated within the works and not categorized as hazardous are recognised as a saleable commodity and the SHW now identifies a range of acceptable uses including as recycled concrete aggregate (RCA) for inclusion in either sub-base or Hydraulically Bound Mixture (HBM).

6 Treatment of any other hazardous material, if encountered in the Works, shall be agreed with the Department’s Nominee, and shall comply with the current regulations.

7 Invasive species are to be dealt with in accordance with the CEMP and as directed by the Environmental Clerk of Works.

APPENDIX 2/6: SITE CLEARANCE ENVIRONMENTAL REQUIREMENTS

General

1 The Contractor shall ensure that individual trees, shrubs or other environmental features and areas stated in the Scope to be preserved, are suitably identified and protected.

2 Should any trees, shrubs or other planting features and planting areas which were intended to be preserved are killed, removed or damaged by the Contractor during the Works, they shall be replaced by the Contractor during the course of the Works. Should this occur they shall be replaced by the Contractor with plants of the same species killed, removed or damaged, all in accordance with Series 3000; or made good by arboriculture work in accordance with Clause 3010, or as directed by the Overseeing Organisation. The size of replacement plants will be determined by the Landscape Architect and Overseeing Organisation. Such work shall be carried out at the Contractor's own expense.

Environmental, Landscape and Ecology

3 Site clearance should be undertaken outside the breeding season for birds such that no nest in use or being built will be disturbed, and in accordance with the interests of other habitats, flora and fauna. For the purposes of this specification, the bird nesting season shall be from the beginning of March until the end of August. Where site clearance needs to take place within the bird nesting season it shall be undertaken under Ecological Clerk of Works (ECoW) supervision. Extended ECoW outside of the bird nesting season is at the direction of the lead ecologist, depending on the weather and other ecological constraints.

4 The Contractor's attention is drawn to additional environmental site clearance constraints that relate to European Protected Species that must be adhered to, included within the Scope and the project Construction Environmental Management Plan and shown on the environmental constraints plans.

5 The Contractor shall take account of the guidance given in the Pollution Prevention Guidelines issued by the Environment Agency and SEPA, where these relate to construction works, and in particular PPG06 Working at Demolition & Construction Sites.

6 Care shall be taken during the clearance works not to damage adjacent onsite and offsite vegetation. All retained onsite vegetation and vulnerable offsite vegetation overhanging the site boundary or with root zones within the site shall be protected from damage to root, stem and crown as detailed in this specification.

7 Clearance, or any other works, closer than 10m from the top of the bank to existing waterways shall be agreed with the Environment Agency by the Environmental Clerk of Works.

8 Clearance works within areas defined as ecological constraints within the Construction Environmental Management Plan (CEMP) shall not commence until an ecological inspection has been undertaken and the Environmental Clerk of Works is satisfied mitigation outlined within the CEMP has been satisfactorily undertaken or is not required. Clearance works that are in areas subject to European Protected Species licences shall not commence until the scheme ecologists confirms the licence is in place and specifies the mitigation measures required.

9 Setting out of the limits of site clearance, shall be as directed by the Environmental Clerk of Works and agreed by the Project Manager. This will be agreed on site following directions from the Environmental Clerk of Works.

10 The Contractor's attention is drawn to the measures for the control of noise and vibration which are included in Appendix 1/9.

Protection of Onsite Vegetation

11 All onsite retained existing vegetation and areas of ecological importance shall be delineated on the ground in such a manner as to be clearly visible to any persons carrying out the works as described in the Scope and shall be appropriate to the proximity and extent of the works. Where doubt exists, referral shall be made to the Environmental Clerk of Works.

12 The method of delineation shall be agreed with the Environmental Clerk of Works, and shall refer to the guidelines detailed below:

a) Exact setting out of the vegetative protective line shall be agreed on site, and where possible the setting out shall comply with the requirements of BS5837:2012 Trees in relation to design, demolition and construction - recommendations. Where this is not feasible and the line of the fence (clearance) is closer than recommended to existing trees, these shall be inspected by the Environmental Clerk of Works. If it is considered that the long-term health and stability of the trees may be at risk due to the works, they shall be inspected by an Arboricultural Consultant who shall recommend any tree surgery and/or methods of working to mitigate the effects of the works.

b) Mitigation works may include:
   (i) Surgery to the crowns of trees.
   (ii) Remedial works to severed roots.
   (iii) Temporary ground protection to prevent compaction over exposed root zone areas by construction traffic. Depending on the weight and frequency of the traffic this may consist of interlocking geogrid laid on geotextile and filled with Type 1 aggregate or substantial heavy duty boarding laid on geotextile and levelled with sand as appropriate.

c) Where areas of ecological importance exist, they shall be protected with fencing as described in the Scope, and work shall be undertaken under the advice of the Ecological Clerk of Works.

d) Where Environmental Barriers are to be replaced adjacent to existing retained vegetation the works shall be carried out from the road and clearance of the adjacent vegetation shall not be necessary. The adjacent vegetation shall be delineated with coloured tape set on sturdy supports such that it is clearly visible at all times.

e) Where works are being undertaken under a Natural England 'Disturbance Licence' then the licenced clearance area shall be fully marked by physical means. Clearance of such areas shall be in accordance with the conditions of the licence.
   If the condition of the licence is breached then works shall cease; the action is to be reported in the Incident Log and the HE Project Manager advised so that the need for amended operations or a renewed licence can be agreed.

13 All protected areas shall have notices erected identifying the areas, where appropriate detailing reasons for the protection, and forbidding access without approval from the Environmental Clerk of Works. In addition, the following precautions shall be taken to avoid damage to onsite trees and offsite trees with overhanging branches and root zones within the site:
   a) No materials likely to damage vegetation shall be stored or deposited or concrete mixed within 10m of the trunks of trees to be retained.

b) Trees to be retained shall not be used as anchorage for equipment.
c) Notice boards, cables or other services shall not be attached to trees to be retained.
d) Care shall be taken when operating equipment, which may damage overhead branches of trees to be retained.
e) If works are required within the root zone of retained vegetation these shall be carried out by hand or to an agreed method to ensure minimal damage to the vegetation.

14 All protective fencing and coloured tape shall be maintained in place and in effective condition at all times during the duration of the works, it shall not be removed or altered without prior approval from the Environmental Clerk of Works.

15 All protective fencing and coloured tape shall be removed and disposed of offsite at the completion of the works.

Protection to offsite vegetation

16 The offsite vegetation shall be inspected by the Environmental Clerk of Works, and if areas are considered to be at risk from the works due to potential damage to branches overhanging the site or root zones within the site, they shall be inspected by an Arboricultural Consultant and actioned as necessary as detailed in Clause 2 above.

Damage to vegetation

17 Where any damage is caused to retained vegetation onsite and offsite vegetation the Environmental Clerk of Works shall be notified, and remedial work carried out as appropriate.

Tree works

18 Where tree surgery works are required, either because of damage to vegetation or in the course of mitigation works, these shall be carried out by a contractor and approved by the Overseeing Organisation.

19 For any tree species type and recommended protection or tree surgery works, refer to the Scope.

Briefings

20 All operatives shall be briefed prior to the works commencing on the locations, status and protection requirements for all retained existing vegetation onsite, vulnerable offsite existing vegetation and areas of ecological importance.

21 No clearance of vegetation is to be carried out until the areas have been marked out by the contractor and agreed by the Environmental Clerk of Works.

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), setback, Working Width Class (W), Vehicle Intrusion (VI), maximum height that allows the required visibility, and the Length of Need requirements for safety barriers, RBS and transitions are shown in the Scope.

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

(iii) The location, Containment Level, Impact Severity Level (ISL), setback, Working Width Class (W) and Vehicle Intrusion (VI) requirements for vehicle/pedestrian parapets are shown in the Scope.

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

(v) The location, Performance Level, redirective (R) or non-redirective (NR) type of crash cushion, directional or bi-directional type of crash cushion, Impact Severity Level (ISL), setback, Vehicle Redirection Zone Class (Z), Permanent Lateral Displacement Zone Class (D), and maximum height that allows the required visibility requirements for crash cushions are shown in the Scope.

1.2 Pedestrian Restraint Systems

(i) The location for pedestrian parapets and pedestrian guardrails is shown in the Scope. Refer to Table C.1 of BS 7818 for the information to be supplied by the purchaser. Where purchasers indicate alternatives or do not specify a particular requirement, suppliers should state what they intend to provide.

1.3 Anti-glare Screens

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

2 Testing

2.1 The Contractor shall supply details of proposed Vehicle Restraint Systems in accordance with SHW Clauses 401, 402, and 403.

2.2 The Contractor is to provide testing equipment and carry out testing in accordance with SHW Clauses 404, 406, 407, 409, and 410 and Appendix 1/5 as appropriate.

3 Temporary Safety Barriers

3.1 Temporary Safety Barriers are to be provided in accordance with SHW Clauses 401 and 405 at locations as defined in the Scope.

APPENDIX 4/2: INFORMATION REQUIRED TO DEMONSTRATE COMPLIANCE OF TRANSITIONS AND TERMINALS TO CLAUSE 401

The Contractor shall complete and submit the following supporting information for each type of transition or terminal as required by SHW Clause 401 demonstrating compliance with BS EN 1317-1:2010, BS EN 1317-2:2010 and DD ENV 1317-4:2002 to the Overseeing Organisation for acceptance.

			Sheet 1 of 3	
SUBMISSION FOR COMPLIANCE WITH CLAUSE 401 **TYPE OF TRANSITION:** **Ref(s) used in contract specific Appendix 4/1 Schedule of RRS:** **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	In accordance with either BS EN 1317-2:2010, Annex A or DD ENV 1317-4:2002, clause 7.8.		
2	Video/high speed film	Of test coverage as specified in relevant part of DD ENV 1317-4:2002. Annotated showing date, test number and performance class		
3	Still photographs	Of complete installation.		
4	Still photographs	Of vehicle before and after impact.		
5	Drawings	Fully detailed drawings of tested item.		
6	Certification from the manufacturer	Confirming that the item tested complies with drawings supplied.		
7	Confirmation from test house	That the test conforms to the relevant requirements of BS EN 1317-1:2010 and BS EN 1317-2:2010 and DD ENV 1317-4:2002 for transitions.		
Additional information, which will be required on acceptance of initial type test prior to installation.				
8	System specification	Manufacturer's specification.		
9	Installation details	Manufacturer's drawings.		
10	Installation procedures	Manufacturer's installation instructions or installation manual.		
11	Maintenance Manual	Manufacturer's inspection, repair and maintenance instructions.		
12	Certificate of registration	National Highways Sector Scheme 2B for the Supply and Installation of Vehicle Restraint Systems for each organisation installing the transition.		
13	Additional information	Any additional information required in contract specific Appendix 4/1.		
Notes:				
1. All documents are to be in English.				
Signature:		Name:		
Date:				

				Sheet 2 of 3		
SUBMISSION FOR COMPLIANCE WITH CLAUSE 401 (cond.) **TYPE OF TRANSITION:** **Ref(s) used in contract specific Appendix 4/1 Schedule of RRS:** **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: 2010, Table 1	Vehicle Details	**Impact Conditions** Total vehicle mass (kg) Speed (km/h) Angle (degrees) Combination of tolerances meets Figure 6 of ENV1317-4:2002		..... (± ...) ..... (0, +7%) ..... (-1, + 1.5) Refer to Figure 6 of ENV1317-4:2002			
		Centre of Gravity Vertical height (m) Longitudinal (m) Lateral (m)		..... (± 10%) ..... (± 10%) ±			
		Model					N/A
BS EN 1317-2: 2010, clause 4.2	Vehicle Restraint System (VRS) transition Behaviour	1) The transition shall contain the vehicle without breakage of any of the principal longitudinal elements of the system. 2) All totally detached parts of the transition with a mass greater than 2,0 kg shall be identified, located and recorded in the test report with their size. 3) Elements of the transition shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into the passenger compartment that can cause serious injuries shall not be permitted. 4) Foundations, ground anchorages and fixings shall perform according to the design of the VRS transition.					
BS EN 1317-2: 2010, clause 4.3	Vehicle Behaviour	1) During and after the impact, no more than one of the wheels of the vehicle shall completely pass over or under the transition. 2) The vehicle shall not roll over (including rollover of the vehicle onto its side), during or after impact. 3) For tests with Heavy Goods Vehicles and buses, not more than 5 % of the mass of the ballast shall become detached or be spilt during the test up to the time when the wheel tracks of the vehicle leaves the exit box. 4) The vehicle shall leave the transition after impact so that the wheel track does not cross a line parallel to the initial traffic face of the system, at a distance A (2.2m for cars, 4.4m for other vehicles) plus the width of the vehicle plus 16 % of the length of the vehicle within a distance B (10m for cars, 20m for other vehicles) from the last (namely closest to the downstream end of the barrier) point P, where the last of the vehicle wheel tracks re-crosses the original line of the traffic face of the barrier after initial impact.					
BS EN 1317-2: 2010, clause 5.3.2	Installation	1) The length of the transition shall be sufficient to demonstrate the full performance characteristics of the system. 2) Post foundation shall meet the design specification. 3) Description of impact point location (with explanation of the choice of impact point if not at 3/4L for the light vehicle test and L/2 for the heavy vehicle test)					
BS EN 1317-2: 2010, clause 4.4	Impact Severity Level	**SPECIFIED** THIV Limit 33 km/h ASI Limit 1.4	**ACTUAL** THIV ..... km/h ASI				
BS EN 1317-2: 2010, clause 4.4	Transition Deformation	**DEFORMATION CHARACTERISTIC** Dynamic Deflection Working Width Vehicle Intrusion	**MEASURED (m) [Class]**	**NORMALISED (m) [Class]**			
BS EN 1317-2: 2010, clause 5.6, Figure 4	Photographic 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 5.6 and Figure 4. 4) Still Photography shall also be provided.					
	Drawings	Drawings included					
						N/A = Not Applicable	
FULLY COMPLIES WITH STANDARD: BS EN 1317-1:2010 , BS EN 1317-2:2010 , DD ENV 1317-4:2002							
Signature:			Name:				
Date:							

					Sheet 3 of 3	
SUBMISSION FOR COMPLIANCE WITH CLAUSE 401 **TYPE OF TERMINAL:** **Ref(s) used in contract specific Appendix 4/1 Schedule of RRS:** **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: 2010, Table 1 and DD ENV 1317-4: 2002, clauses 7.4 and 7.5	Vehicle Details	**Impact Conditions** Total vehicle mass (kg) Speed (km/h) Angle (degrees) Combination of tolerances meets Figure 6 of ENV1317-4:2002	..... (± ...) ..... (0, +7%) ..... (-1, + 1.5) Refer to Figure 6 of ENV1317-4:2002			
		Centre of Gravity Vertical height (m) Longitudinal (m) Lateral (m)	..... (± 10%) ..... (± 10%) ±			
		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 of DD ENV 1317-4:2002. 3) Anchorages and fixings shall perform to the terminal design specifications and other specified requirements as listed in the test report. 4) The permanent lateral displacement zone for the terminal shall be reported after the test.				
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 terminal Performance Class P1 rolling onto a side may be accepted. 2) The exit box values for the specified test are as defined in Figures 5 and Tables 7 and 8. (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 Level	**SPECIFIED** Level A: THIV ≤ 44km/h (Tests 1-and 2) THIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.0 Level B: THIV ≤ 44km/h (Tests 1 and 2) THIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.4	**ACTUAL**			
DD ENV 1317-4:2002, clause 7.7, Figure 7	Photographic 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 frames per second. 3) Still photography shall also be provided.				
	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

Existing drainage system

1 For the locations of the existing pipes to be removed and replaced refer to the Scope.

2 Where the existing drainage system is to be removed and replaced with a new drainage system, the design and selection of type of pipe and bedding for pipes up to 900 mm internal diameter shall be in accordance with CD 533 (DMRB 4.2.5). Details of drainage construction shall be in accordance with SHW Clause 503 and are shown on HCD F Series. For drains, box culverts, piped culverts (and other drains) of clear span or internal diameter exceeding 900 mm are subject to Overseeing Organisation's technical approval and should comply with Series 2500. Only one type of pipe shall be used within any individual drain between consecutive chambers.

3 The Contractor shall ensure that all drainage materials are not subjected to any form of deterioration before installation into the works.

4 The Contractor shall also demonstrate the pipes selected satisfy the hydraulic design of the system. On completion of the whole of the drainage works, the Contractor shall provide the Overseeing Organisation with a schedule showing details of all pipe types used, including quality, joints and name of manufacturer. This will form the basis of a declaration of performance for the drainage.

5 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.

6 Joints in surface water drains shall be watertight.

7 Existing land drains severed by the works are to be connected into the drainage system in accordance with SHW Clause 511.

8 Connecting to existing drains chambers and channels shall be in accordance with SHW Clause 506. Before entering or breaking into an existing drain, the Contractor shall give notice of his intention to do so to the authority responsible for the drainage system to which the connection is to be made.

9 Existing drains no longer required shall be sealed with ST2 concrete, in compliance with Clause 2602, or removed and replaced with general fill material complying with Clause 601 and Table 6/1 and compacted in compliance with Clause 612, or grouted with a 1:10, cement: pfa mix. The grout shall use the minimum quantity of water to ensure the fluidity necessary to render it capable of being pumped to the ends of the pipe and be in accordance with the manufacturer's instructions. It shall be used within one hour of mixing but when the mix contains a retarding admixture this time may be extended in accordance with the manufacturer's instructions. The cement shall comply with BS EN 197-1 and the pulverised fuel ash (pfa) with BS 3892-2, fineness to Zone B and sulfate content not exceeding 1.5%.

Existing frames, covers or gratings

10 For the locations of the existing frames and/or covers or gratings to be adjusted or replaced or existing refer to the Scope.

11 Where the adjustment or replacement of existing frames and covers or gratings is required, the units shall be taken up and re-fixed or removed and replaced with new units complying with SHW Clauses 507.9 to 507.15. On taking up or removal of the unit, any concrete or mortar bedding shall be broken out and the surface prepared.

12 Where existing frames and covers or gratings are to be adjusted, the Contractor shall take up the unit and clean it so it is free from existing mortar, any debris, rust and is dry before re-use. The adjusted or replaced units shall be laid on a mortar bed complying with SHW Clause 507.16. The finished thickness of the mortar bed shall be between 10mm and 25mm. Covers and gratings shall be bedded using a quick setting high strength mortar with a declaration of performance for its intended use. The declaration of performance shall be provided to the Overseeing Organisation before use. Adjusted or replaced frames and covers or gratings shall be set flush with the new or reinstated surface. Any additional adjustments shall be by modifying the brickwork, or adjusting units in accordance with BS EN 1917 and BS 5911- 3, in compliance with sub-Clause 507.3 or by using a frame of a suitable depth. On completion of the works, each cover shall be lifted and the frame and seating cleaned.

13 Surround materials shall only be placed in contact with the frame once the bedding material has set.

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

Chambers

(i) 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.

(ii) 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 must comply with CS 228.

(iii) 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

(i) 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.

Repair the concrete surround chambers and/or gullies

15 For the locations of the concrete surround chambers and/or gullies to be repaired refer to the Scope. For the repair method, refer to Appendix 7/14.

Cleaning of Existing Drainage System

16 Existing drainage systems to be cleared are shown in the Scope.

17 All new 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.

18 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 chambers, gullies and drains including verge/surface water drains and filter drains excluding all fin and narrow filet 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.

19 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.

20 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 Contract*or* shall supply certification of compliance to the Overseeing Organisation.

21 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.

22 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.

23 A functioning drainage system (permanent or temporary) shall be in place before any operational drainage features are removed or modified.

24 Headwall construction details as provided in the Figures 5-1 to 5-3 below. Location details to be provided as part of the Scope. 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.

25 The detail for the concrete protection to existing drains, service ducts or service mains is given in Figure 5-4 below.

Pipe schedule

26 Refer to Appendix B of CD533 revision1 for allowable pipe/bed combinations. Trench and bedding details are shown on drawing HCD F1 and F2. Pipe schedule information is to be provided as part of the Scope.

Chamber Schedule

27 Information to be provided as part of the Scope.

Gullies

28 Gullies are shown on HCD F13.

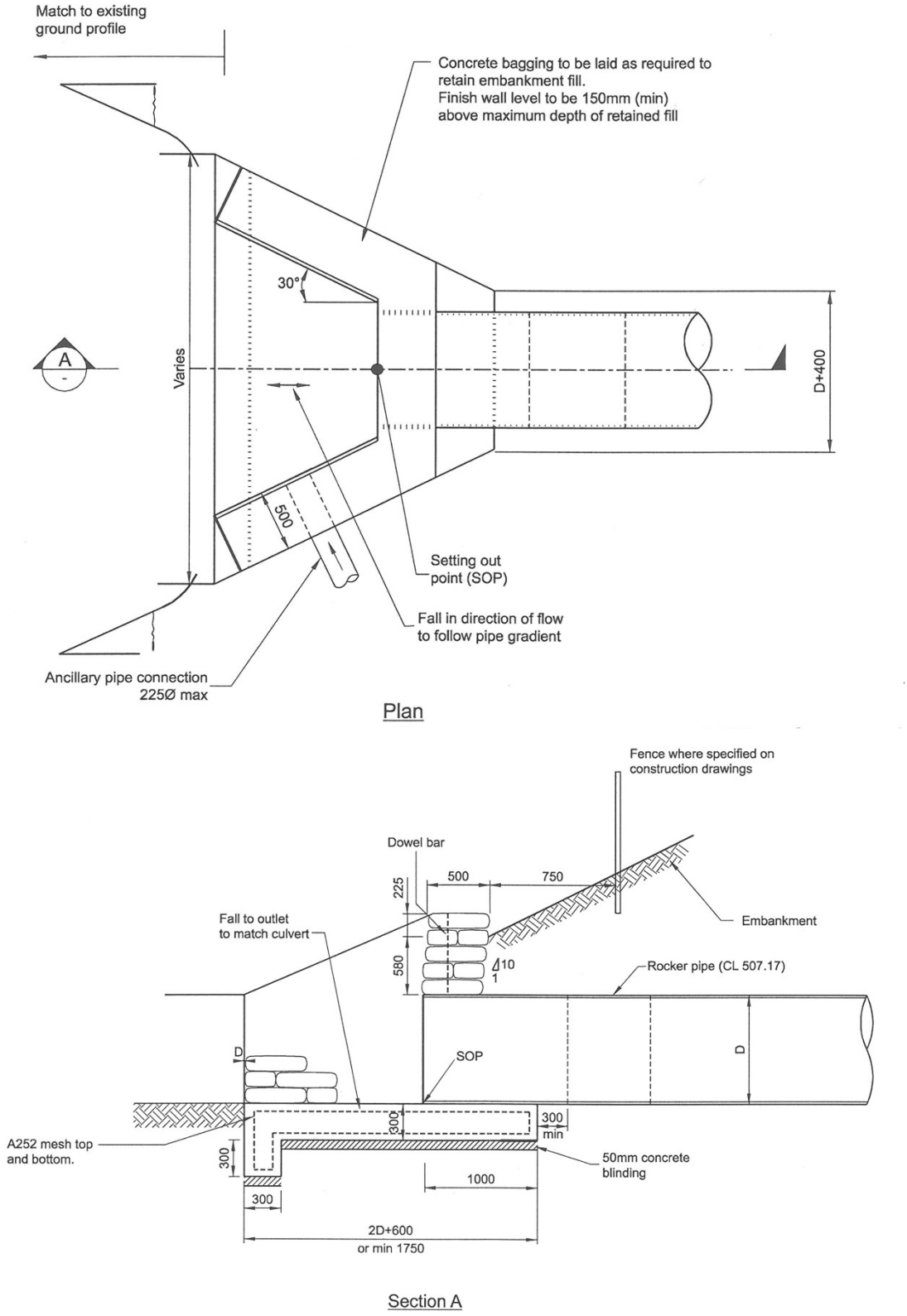
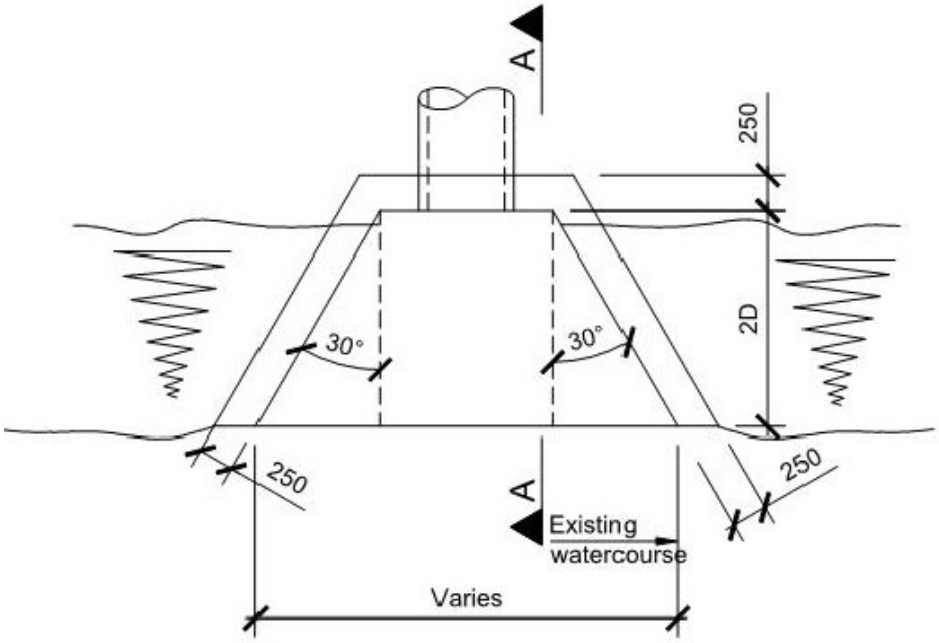
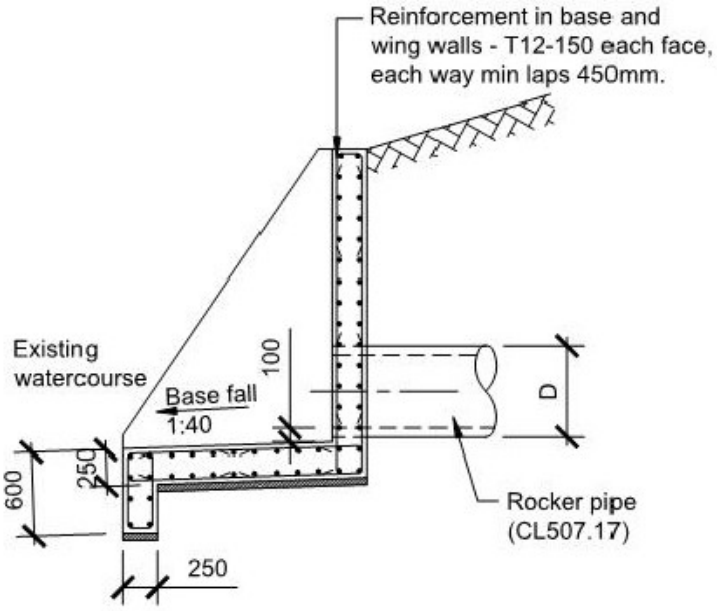


Figure 5-1 Headwall – Concrete Bagging



Plan

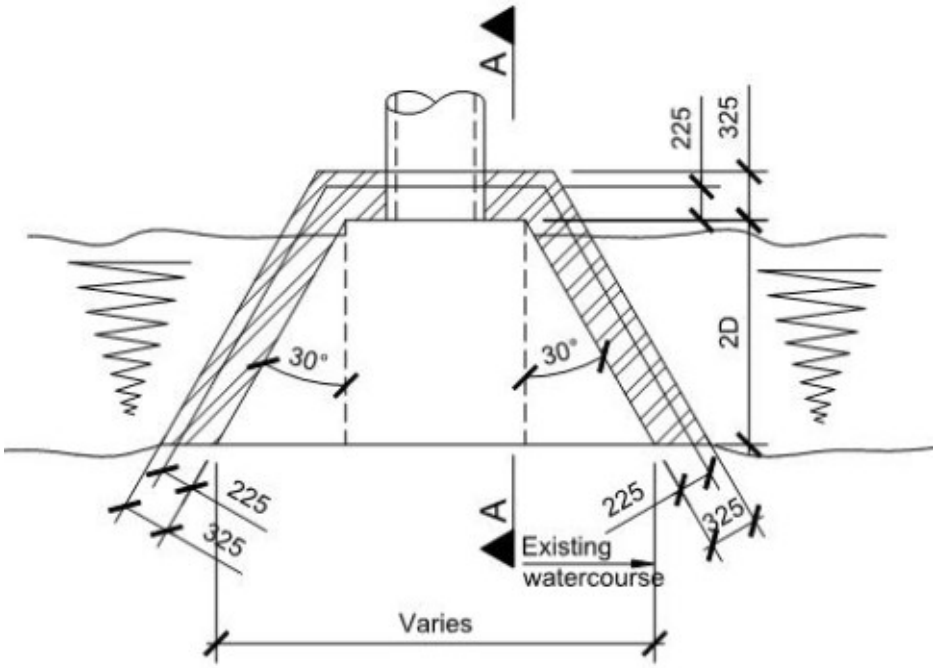


Section A-A

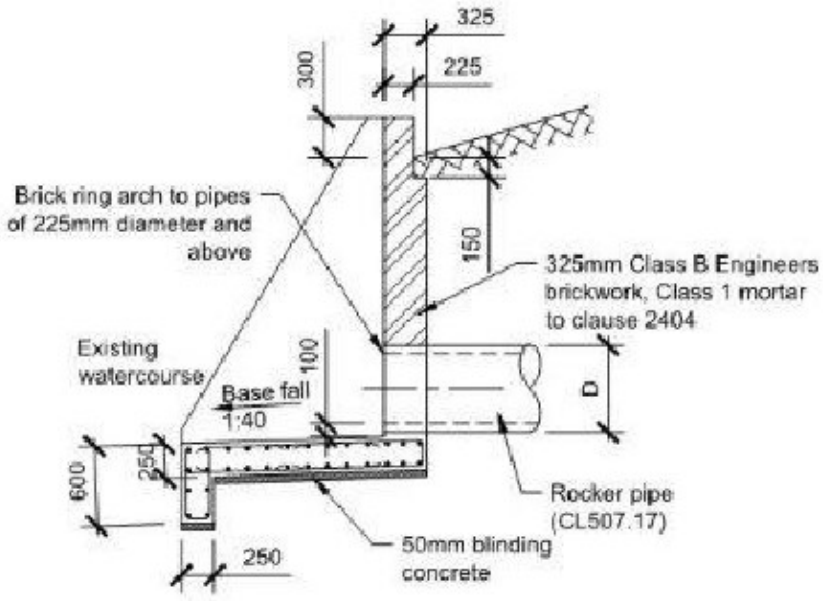
Notes:

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

Figure 5-2 Headwall - Concrete



Plan



Section A-A

Figure 5-3 Brick Headwall

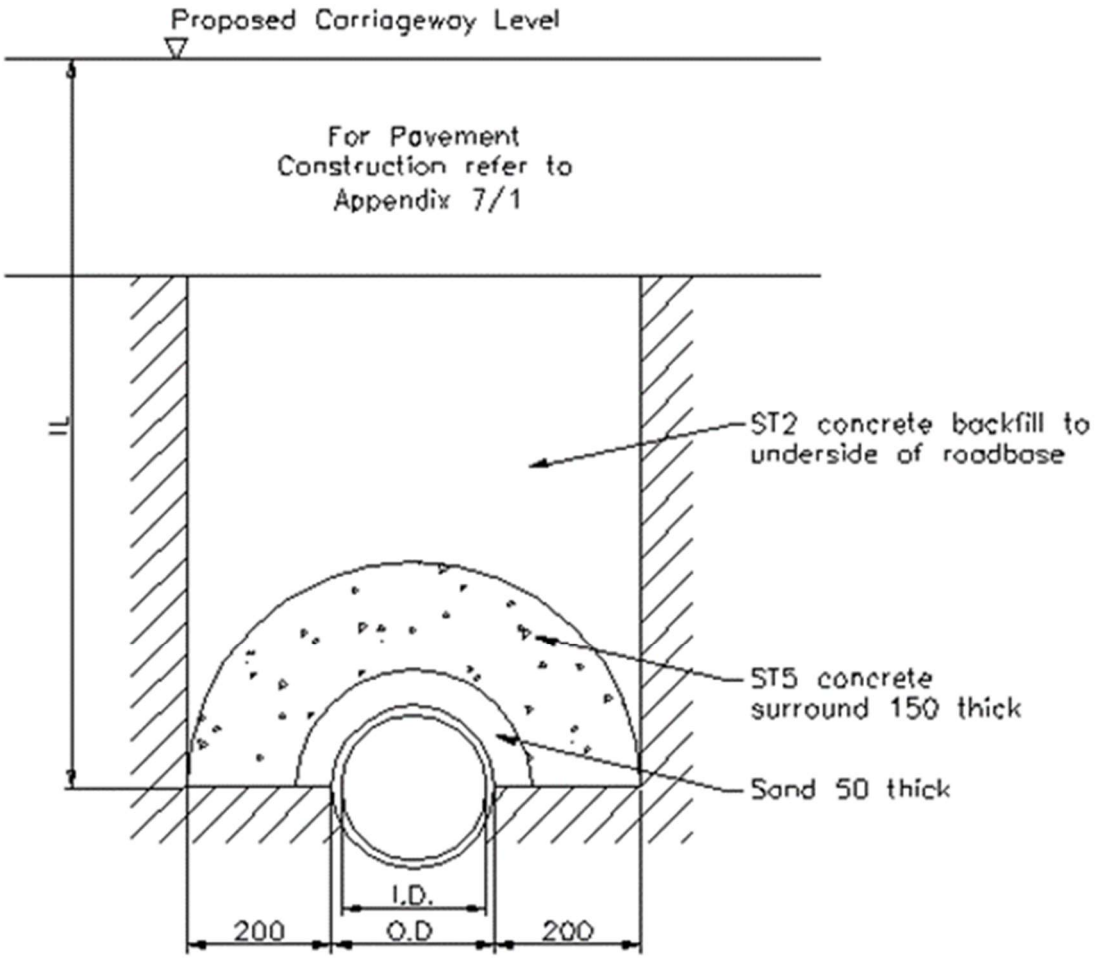


Figure 5-4 Concrete protection to existing drains, service ducts or service mains

APPENDIX 5/2: SERVICE DUCT REQUIREMENTS

1 Details of duct construction are shown on drawing number HCD I1 and I2For the locations of the existing pipes to be removed and replaced refer to the Scope.

2 Cross carriageway ducts shall be provided in the locations shown in the Scope.

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 Scope.

APPENDIX 5/4: FIN DRAINS AND NARROW FILTER DRAINS

1 For the locations of fin drains or narrow filter drains to be repaired or replaced or installed refer to the Scope.

2 Unless stated otherwise, the Contractor shall liaise with the Overseeing Organisation to agree the type of fin drain to be used. Fin drains or narrow filter drains shall be installed in accordance with the relevant HCD. They will be either Type 5, 6 or 7 as detailed on HCD F18. Narrow filter drains shall be Type 8.

3 The maximum permissible O_{90} of the geotextile is 0.15mm.

4 The permeability of the geotextile shall be 100 $lm^{-2}s^{-1}$.

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 $ls^{-1}m^{-1}$.

7 The maximum pipe diameter shall be 100 mm.

8 The permeability of granular material in narrow filter drains shall be greater than $1x10^{-4}$ ms^{-1}.

APPENDIX 5/5: 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 Scope

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 must be in accordance with BS EN 1433 Class D, unless specifically identified otherwise in the Scope. 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 Scope.

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. All components will be compliant with BS EN 124: Load Class D400. Access fittings are to be installed at minimum 50 m spacings, and at all terminals, sumps and outlets. The minimum 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 Scope.

2 Units must be in accordance with BS EN 1433 Class D, unless specifically identified otherwise in the Scope. 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.

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-Clauses 518.3 and 518.5.

2 Material specification, as required in sub-Clause 518.2:

Table 5/7-1: 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 ISO 2505	
K-value	BS EN IO 13229	
PVC content	BS EN 1905	
Density	BS EN ISO 1183-3	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN ISO 580	

Table 5/7-2: Polyethylene (PE)

Property	Test method reference	Specification
Tensile Properties	BS EN ISO 6529 BS EN ISO 527-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133-1, BS EN ISO 1133-2	
Density	BS EN ISO 1183-3	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN ISO 580	

Table 5/7-3: Polypropylene (PP)

Property	Test method reference	Specification
Tensile Properties	BS EN ISO 6529 BS EN ISO 527-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133-1, BS EN ISO 1133-2	
Density	BS EN ISO 1183-3	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN ISO 580	

APPENDIX 6/1: REQUIREMENTS FOR ACCEPTABILITY AND TESTING ETC. FOR 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 Pavement Quality Concrete and lean concrete
- 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 CLASS U2 UNACCEPTABLE MATERIALS

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 Supervisor 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 Supervisor 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 Supervisor.

(iii) Where the Contractor sub-contracts the disposal of material the above conditions shall apply to the Sub-contractor. The Main Contractor shall be responsible for checking Waste Transfer Notes/Waste Management Licences and making copies available to the Supervisor.

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

General Information

1 Refer to the Scope for excavation, deposition and compaction details.

Excavation

2 The adequacy of the extent of excavation on site will be checked and confirmed by the Supervisor.

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 5930:2015+A1:2020). 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 Supervisor. 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 Supervisor, 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	kN/m	8.0	Pore Size Mean AOS	BS EN ISO 12956	μm	75 (±20)
CBR Puncture Resistance	BS EN ISO 12236	N	1500	Permeability (H_{50})	BS EN ISO 11058	$l/m^2/s$	90
Cone Drop	BS EN ISO 13433	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.

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 Project Manager 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 Project Manager and 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 or surface modulus and other methods of testing, as detailed in the Appendix 1/5, are found on site to be lower than expected then the Contractor will provide to the Project Manager and 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.

4 If the subgrade surface modulus is lower than 30MPa or CBR value less than 2.5%, improvement of the subgrade shall be undertaken. Unless otherwise stated in the Scope, options for improvement of the subgrade are:

(i) excavation and replacing between 500 to 1000 mm of the soft subgrade with granular fill;
(ii) mechanical stabilisation (geogrids and/or geotextiles) and
(iii) soil stabilisation.

The Contractor shall agree with the Project Manager and Overseeing Organisation on improvement of the subgrade. The upper limit on design surface modulus for areas of improvement of the subgrade shall be 50 MPa.

APPENDIX 6/8: TOPSOILING

1 Topsoil shall be stripped and stored in accordance with BS 4428 Section 2.5. The subsoil and topsoil should be stripped and stored separately under favourable weather conditions so that a proper soil profile can be re-established. Storage-mound depth is related to the method used to make it. Loose tipping is the ideal way to make a storage mound, when it may be up to 4 m high at the centre of the tipped heaps. Otherwise, mounds should not exceed 2 m in height. The structure of clay soil, in particular, is irreversibly damaged by stripping when it is too wet. The contract should specify that soils with a clay fraction of more than 25 per cent should not be handled when their moisture content exceeds a specified level.

2 Once completed, soil mounds must not be trafficked by any machinery and should be kept free of injurious weeds by the application of herbicide if necessary. If they are to be left for longer than nine months they should be sown with annual rye-grass or another appropriate species.

3 The formation on which soil is spread must have the surface roughened to 150 mm deep, to allow it to key in properly. The same constraints apply to spreading soil as apply to stripping it. Appropriate machinery with the lightest possible footprint must be used. Compaction must be avoided.

4 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 Supervisor. Excess material shall be removed from site.

5 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 Supervisor prior to placement.

6 The requirements of Clause 618.3 apply.

7 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.

8 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.

9 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.

10 Multiple handling of topsoil must be minimised.

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

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

2 Assessment Criteria

2.1 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.

2.2 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 phytoxicity and suitability as a growing medium.

2.3 Materials exhibiting visual or olfactory evidence of contamination can be reused within the scheme subject to meeting acceptance criteria set out in Tables 6/15A or 6/15B below.

2.4 Materials containing asbestos containing materials shall not be reused within the work.

2.5 All other site won materials do not require testing.

2.6 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.

2.7 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 6/15A 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

Determinand	Unit	Acceptance Criteria
Nickel (MS)	mg/kg	130
Zinc (MS)	mg/kg	3,750
Cyanides	mg/kg	5.5
Asbestos	[-]	no fibres present
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

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

Determinand	Unit	Acceptance Criteria
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 General

1.1 Location of existing concrete pavements to be removed and rebuilt or overlaid or saw-cut, cracked and seated and overlaid or cracked and seated and overlaid is in the Scope.

1.2 Where the work involves an increase in pavement height, the Contractor shall ensure the following consequential impacts have been assessed prior to undertaking any overlay work.
(i) headroom at structures, gantries, and overhead lines;
(ii) carriageway surface geometry;
(iii) kerb and vehicle restraint system heights;
(iv) drainage and ironwork;
(v) marker posts, telephone posts, hardstandings, communication cabinets, and other roadside furniture;
(vi) heights of copings and parapet walls adjacent to retaining walls and underbridges; and
(vii) overloading at under-bridges and adjacent to retaining walls.

1.3 Where the existing concrete pavement is to be strengthened and treated with fractured slab techniques (crack, seat and asphalt overlay for jointed unreinforced concrete or saw-cut, crack, seat and asphalt overlay for jointed reinforced concrete), the Contractor shall ensure the following.
(i) The existing concrete or rigid pavement has a bound sub-base. Fractured slab techniques shall not be used on rigid pavements with an unbound subbase.
(ii) Minimum overlaying asphalt thickness shall be 150mm;
(iii) The pavement treatment shall be designed using the analytical design approach in CD 226 with an approval from the Overseeing Organisation

1.4 If the work involves saw-cutting, cracking and seating and overlaying the existing jointed reinforced concrete (JRC) pavement, the Contractor shall ensure the following.
(i) Mill the existing asphalt surfacing if the existing JRC has asphalt running surface;
(ii) Undertake any joint or existing crack repairs to the existing jointed reinforced concrete prior to overlaying. Refer to Appendix 7/14 for concrete repairs and treatments. For construction material requirement for slab or bay replacement, refer to pavement option BR1 of Appendix 7/1;
(iii) Saw-cut, crack and seat as specified in the Appendixes 7/15, 7/17 and 7/19;
(iv) If a bituminous overlay is to be undertaken on the existing concrete running surface (not asphalt running surface), it is recommended to fine mill the top 2 to 6mm to provide a good bond between the existing and overlay treatment. The Contractor is to agree with the Project Manager the milling depth prior to overlaying;
(v) Seek an approval from the Overseeing Organisation prior to undertaking any overlay work;
(vi) Apply a bond coat in accordance with SHW Clauses 920 and 942 and Appendix 7/4;
(vii) Overlay with asphalt surfacing as specified in the Appendix 7/1 for pavement option OL1.

1.5 If the work involves cracking and seating and overlaying the existing jointed unreinforced concrete (URC) pavement and hydraulically bound mixture (HBM) bases, the Contractor shall ensure the following:
(i) Mill the existing asphalt surfacing if the existing URC has asphalt running surface;
(ii) Undertake any joint or existing crack repairs to the existing jointed unreinforced concrete and hydraulically bound mixture (HBM) bases prior to overlaying. Refer to Appendix 7/14 for concrete repairs and treatments. For construction material requirement for slab or bay replacement, refer to pavement option BR1 of Appendix 7/1;
(iii) Crack and seat as specified in the Appendixes 7/16, 7/17 and 7/19;

(iv) If the overlay is to be undertaken on the existing concrete running surface (not asphalt running surface), it is recommended to fine mill the top 2 to 6mm to provide a good bonding between the existing and overlay treatment. The Contractor is to agree with the Project Manager for milling depth prior to overlaying;
(v) Seek an approval from the Overseeing Organisation prior to undertaking any overlaying work;
(vi) Apply a bond coat in accordance with SHW Clauses 920 and 942 and Appendix 7/4;
(vii) Overlay with asphalt surfacing as specified in the Appendix 7/1 for pavement option OL1.

1.6 If the work involves overlaying the existing concrete pavement, the Contractor shall ensure the following.
(i) Mill the existing asphalt surfacing if the existing concrete pavement has an asphalt running surface;
(ii) Undertake any joint or existing crack repairs to the existing concrete pavement prior to overlaying. Refer to Appendix 7/14 for concrete repairs and treatments. For construction material requirement for slab or bay replacement, refer to pavement option BR1 of Appendix 7/1 for permitted construction materials;
(iii) Prepare the existing jointed concrete pavement prior to overlaying and saw-cut and seal of the bituminous overlay as specified in Appendix 7/14;
(iv) If the overlay is to be undertaken on the existing concrete running surface (not asphalt running surface), it is recommended to fine mill the top 2 to 6mm to provide a good bonding between the existing and overlay treatment. The Contractor is to agree with the Project Manager the milling depth prior to overlaying;
(v) Seek an approval from the Overseeing Organisation prior to undertaking any overlaying work;
(vi) Apply a bond coat in accordance with SHW Clauses 920 and 942 and Appendix 7/4;
(vii) Overlay with asphalt surfacing as specified in the Appendix 7/1 for pavement option OL1;
(viii) Saw-cut and seal bituminous overlays on existing jointed concrete pavement as specified in Appendix 7/13.

1.7 If the work involves removing and reconstructing with either a new fully flexible or flexible composite pavement, the Contractor shall ensure the following:
(i) Remove the existing concrete pavement and dispose of the materials arising in accordance with Appendix 2/3 unless stated otherwise in the Scope.

Existing pavement foundation

(ii) Referring to the Scope, if the existing sub-base is to be removed and reconstructed to allow for new pavement construction.
(iii) If the existing pavement foundation is to be removed and reconstructed, the Contractor shall dispose of the materials arising in accordance with Appendix 2/3 unless stated otherwise in the Scope. The exposed subgrade shall be recompacted in accordance with SHW Series 600 and assessed in accordance with SHW Clause 882.
Unless stated otherwise in the Scope, the new pavement foundation shall be designed in accordance with CD 225.
Where the subgrade surface modulus is lower than 30MPa, improvement of the subgrade shall be undertaken. Refer to Appendix 6/7 for subgrade improvement. The upper limit on design surface modulus for areas of improvement of the subgrade shall be 50 MPa.
Where the construction subgrade surface modulus is found to be lower than the design subgrade surface modulus, then action shall be taken by either effecting improvement of the subgrade or by reviewing the design subgrade surface modulus with a view to redesign using the lower value.
(iv) If the existing pavement foundation comprises of unbound sub-base and is to be retained, the Contractor shall recompact and assess the existing unbound foundation in accordance with SHW Clauses 884 and 885. The mean and minimum foundation surface modulus values for Class 2 Foundation shall be as specified in Table 8/16 of

SHW Series 800.

(v) If the existing pavement foundation comprises of bound sub-base and is to be retained, the Contractor shall inspect and assess the existing bound foundation in accordance with SHW Clauses 884 and 885. The mean and minimum foundation surface modulus values for Class 3 Foundation shall be as specified in Table 8/16 of SHW Series 800. The Contractor shall remove and replace any shattered bound sub-base with new bound sub-base material if required as directed by the Overseeing Organisation;

New pavement construction

(vi) Referring to the Scope for new pavement construction built-up.

(vii) Unless stated otherwise in the Scope, pavement option FF1 is for fully flexible and FC1 for flexible composite pavement construction.

(viii) For flexible composite, pavement option FC1, for HBM layers that reach a compressive strength of 10MPa at 7 days, shall have cracks at a maximum spacing of 5m induced and sealed in accordance with SHW Clause 818.

(ix) Referring to Appendix 7/1 for permitted construction materials for fully flexible, FF1, and flexible composite, FC1.

2 Permitted Pavement Options – Schedule 1

Schedule 1: Permitted Pavement Options				
Drawing Ref:	**Area**	**General Requirements**	**Permitted Pavement Option**	
Refer to the Scope for locations of slab or bay replacement		Schedule 2	BR1	
Refer to the Scope for location(s) of existing concrete pavements to be overlaid		Schedule 2	OL1	
Refer to the Scope for location(s) of existing jointed reinforced concrete pavements to be saw-cut, cracked and seated and overlaid		Schedule 2	OL1	
Refer to the Scope for location(s) of existing jointed unreinforced concrete pavements to be cracked and seated and overlaid		Schedule 2	OL1	
Refer to the Scope for location(s) of existing concrete pavements to be removed and rebuilt		Schedule 2	FF1	FC1

3 General Requirements – Schedule 2

Schedule 2: General Requirements		
Grid for checking surface levels of pavement courses [702.4]	Longitudinal Dimension	10.0m
	Transverse Dimension	2.0m
Surface Regularity [702.5, Table 7/2]	Category of Road:	A for high speed road ≥50km/h) B for low speed road (<50km/h)
Interval for measurement of longitudinal regularity [702.7]		As Table 7/2 of SHW Series 700
Interval for measurement of transverse regularity [702.8]		Each wheel track
Surface texture is required. Measurement of surface texture shall be in accordance with clause 921 for bituminous surface courses. For concrete surface, the measurement shall be in accordance with SHW Clause 1026.		

4 Permitted Construction Materials – Schedule 3

Schedule 3: Permitted Construction Materials				
	Pavement Option BR1		Pavement Option OL1	
Pavement Layer	Material Ref.	Thickness (mm)	Material Ref.	Thickness (mm)
Surface Treatment	-	-	HFS1	Refer to Table 3.3b of CD236
Surface Course	URC1/JRC1	To match the existing slab	SC1	See Note 1
Binder Couse			BC1/BC2	See Note 1
Base Course			RB1/RB2	See Note 1
Sub-base	SB1 or SB2 or SB3 or SB4 (see Note 2)	To match the existing slab foundation	-	-
	Pavement Option FF1		Pavement Option FC1	
Pavement Layer	Material Ref.	Thickness (mm)	Material Ref.	Thickness (mm)
Surface Treatment	HFS1	Refer to Table 3.3b of CD236	HFS1	Refer to Table 3.3b of CD236
Surface Course	SC1	See Note 1	SC1	See Note 1
Binder Couse	BC1/BC2	See Note 1	BC1/BC2	See Note 1
Base Course	RB1/RB2	See Note 1	RB1/RB2	See Note 1
Lower Base	-	-	LB1	See Note 1
Sub-base	SB1 or SB2 or SB3 or SB4 (see Note 2)	See Note 1	SB1 or SB2 or SB3 or SB4 (see Note 2)	See Note 1
Note 1: Thickness of each layer is to be defined on a scheme by scheme basis. Note 2: Type of the sub-base either unbound (option SB1 or SB2) or bound (SB3 or SB4) is to be defined on a scheme by scheme basis.				

5 General Requirements for Construction Materials – Schedule 4

Schedule 4: General Requirements for Construction Materials	
Clause	Requirement
	To be defined on a scheme by scheme basis.

6 Requirements for Construction Materials – Schedule 5

Schedule 5: Requirements for Construction Materials			
Material Ref.	Clause	Description	Requirement
HFS1	924	High Friction Surfacing	Type Classification: Type 1 Minimum declared PSV category in accordance with BS EN 13043, clause 4.2.3 = PSV70 Maximum AAV in accordance with BS EN 13043, clause 4.2.4.= AAV10 Colour: to match the existing HFS. If TSSC is opened to traffic before High Friction Surfacing is laid, the Contractor shall erect temporary road signs as approved by the Overseeing Organisation.
SC1	942	Thin Surface Course Systems	Overall performance guarantee period [942.3]: 5 years. Required declared PSV value [942.6 and NG 942.20]: refer to Table 3.3b of CD236. Required maximum AAV value [942.6 and NG 942.20]: refer to Table 3.13 of CD236. Aggregate resistance to fragmentation [942.6(i)]: LA_{30}. Aggregate Flakiness Index [942.6(ii)]: FI_{20}. Maximum aggregate size [Table 9/9]: 10mm or 14mm (preferable 10mm) Whether PMB or SMA paving grade bitumen is required [Table 9/10]: PMB. Mixture Type Classification and Minimum target design binder content [942.7 and Table 9/10]: EN13108, Parts 1 and 2 (AC & BBTM with PMB to BS EN 14023) and $B_{min}5.2$ for 10mm aggregate and $B_{min}5.0$ for 14mm aggregate Resistance to permanent deformation [942.8 and NG 942.39]: Site classification 2 to Table D2 of PD6691. Water Sensitivity Category [942.9]: ITSRmin70. Traffic flow in cv/l/d [NG 942.11]: to be confirmed. Minimum design thickness [942.13, Table 9/11 and NG 942.14]: 25mm for 10mm aggregate (or 35mm for 14mm aggregate). Maximum design thickness [942.13, Table 9/11 and NG 942.14]: 40mm for 10mm aggregate (or 50mm for 14mm aggregate). Whether the existing substrate surface shall be strengthened or regulated [942.14 and 942.15]: Yes. Whether bond coat or tack coat shall be applied in accordance with Clause 920 or the Installation Method Statement [942.17]: bond coat to Clause 920. Whether surface macrotexture measurement is required [942.19]: yes. Initial Surface Macrotexture requirements: refer to Tables 9/12 and

Schedule 5: Requirements for Construction Materials			
Material Ref.	Clause	Description	Requirement
			9/13 of SHW Clause 942. Retained Surface Macrotexture Requirements in accordance with Clause 942.20 and Table 9/14. Road/Tyre noise level [942.34, Table 9/17, NG 942.36 and NG 942.37]: Level 2 for noise-sensitive areas and Level 3 for very noise sensitive areas.
URC1	1001 to 1034	Unreinforced Concrete Slabs	Pairs of cubes shall be tested at intervals of [1004.9]: for main work, 3 cubes per 400m2 not less than 6 sets per day. 1 to be tested at 7 days and 2 at 28 days. For trial, at least 9 cubes, 3 to be tested at 7 days and 6 at 28 days. For spacing (m) of Transverse joints [1009.1]: refer to Clause 2.4.10 of Appendix 7/14. Refer to material ref. SC3 for finished surface requirement. Hot-applied sealant Type N1 or Type F1 or Type F2 [1017.1]: Type N1 for concrete joints and Type F1 or F2 for lay-bys or hardstandings. Prior to reopening of the carriageway, the high-early strength concrete should have attained a compressive strength of at least 25N/mm^2 for PQC surface slabs and 20 N/mm^2 for PQC surface road base within 4 to 5 hours.
JRC1	1001 to 1034	Jointed Reinforced Concrete Slabs (JRC)	Pairs of cubes shall be tested at intervals of [1004.9]: for main work, 3 cubes per 400m2 not less than 6 sets per day. 1 to be tested at 7 days and 2 at 28 days. For trial, at least 9 cubes, 3 to be tested at 7 days and 6 at 28 days. Maximum spacing (m) of Transverse joints [1009.1]: refer to Clause 2.4.10 of Appendix 7/14. Refer to material ref. SC3 for finished surface requirement. Longitudinal steel reinforcement [1008.9 and CD226]: refer to Clause 2.4.10 of Appendix 7/14. Transverse reinforcement [1008.8 and CD226]: refer to Clause 2.4.10 of Appendix 7/14. Hot-applied sealant Type N1 or Type F1 or Type F2 [1017.1]: Type N1 for concrete joints and Type F1 or F2 for lay-bys or hardstandings. Prior to reopening of the carriageway, the high-early strength concrete should have attained a compressive strength of at least 25N/mm^2 for PQC surface slabs and 20 N/mm^2 for PQC surface road base within 4 to 5 hours.
BC1	929	Binder Course Asphalt Concrete AC 20 dense bin 40/60 des	Mixture designation [929.1]: AC 20 dense bin 40/60 des. Whether void content at refusal is to be monitored in the permanent works [929.3]: Yes. Resistance to permanent deformation classification [929.4, Table NG 9/24 and PD 6691 Table D2]: Site classification 2 to Table D2 of PD6691. Whether resistance to permanent deformation is to be monitored

Schedule 5: Requirements for Construction Materials			
Material Ref.	Clause	Description	Requirement
			in the permanent works [929.5]: Yes. Nominal target layer thickness is 50-100mm. If the binder course is greater than 100mm thick, it should be laid in two layers. Bond coat shall be applied in accordance with SHW Clause 920. Hot bituminous mixtures shall be laid in accordance with the requirements of BS 594987.
BC2	929	Binder Course Asphalt Concrete AC 20 HDM bin 40/60 des	Mixture designation [929.1]: AC 20 HDM bin 40/60 des. Whether void content at refusal is to be monitored in the permanent works [929.3]: Yes. Resistance to permanent deformation classification [929.4, Table NG 9/24 and PD 6691 Table D2]: Site classification 2 to Table D2 of PD6691. Whether resistance to permanent deformation is to be monitored in the permanent works [929.5]: Yes. Nominal target layer thickness is 50-100mm. If the binder course is greater than 100mm thick, it should be laid in two layers. Bond coat shall be applied in accordance with SHW Clause 920. Hot bituminous mixtures shall be laid in accordance with the requirements of BS 594987.
RB1	929	Base Course Asphalt Concrete AC 32 dense base 40/60 des	Mixture designation [929.1]: AC 32 dense base 40/60 des. Whether void content at refusal is to be monitored in the permanent works [929.3]: Yes. Resistance to permanent deformation classification [929.4, Table NG 9/24 and PD 6691 Table D2]: Site classification 2 to Table D2 of PD6691. Whether resistance to permanent deformation is to be monitored in the permanent works [929.5]: Yes. Nominal target layer thickness is 70-150mm. If the base course is greater than 150mm thick, it should be laid in two layers. Bond coat shall be applied in accordance with SHW Clause 920. Hot bituminous mixtures shall be laid in accordance with the requirements of BS 594987.
RB2	929	Base Course Asphalt Concrete AC 32 HDM base 40/60 des	Mixture designation [929.1]: AC 32 HDM base 40/60 des. Whether void content at refusal is to be monitored in the permanent works [929.3]: Yes. Resistance to permanent deformation classification [929.4, Table NG 9/24 and PD 6691 Table D2]: Site classification 2 to Table D2 of PD6691. Whether resistance to permanent deformation is to be monitored in the permanent works [929.5]: Yes. Nominal target layer thickness is 70-150mm. If the base course is greater than 150mm thick, it should be laid in two layers. Bond coat shall be applied in accordance with SHW Clause 920. Hot bituminous mixtures shall be laid in accordance with the requirements of BS 594987.

Schedule 5: Requirements for Construction Materials			
Material Ref.	Clause	Description	Requirement
LB1	822 or	HBM Category is to be confirmed Cement bound granular mixtures B (CBGM B) – strength to be confirmed	Aggregate requirements LA_{50}, or LA_{60} [822.2, Table 8/12] : refer to the Scope. Laboratory mechanical performance category: C8/10, C12/15, C16/20, C20/25; T3, T4, T5 [822.5 and Table NG 8/2] : refer to the Scope. Cement bound granular mixtures B (CBGM B) shall comply with BS EN 14227-1.
	830 or	HBM Category is to be confirmed Fly ash bound mixture 1 (FABM 1) and Hydraulic road binder bound mixture 1 (HRBBM 1) – strength to be confirmed	Aggregate requirements: $C_{90/3}$, or $C_{50/30}$, LA_{50}, or LA_{60} [830.2, Table 8/12] : refer to the Scope. Laboratory mechanical performance category: C6/8, C9/12, C12/16, C15/20, C18/24; T2, T3, T4 [830.5 and Table NG 8/2]: refer to the Scope.
	835	HBM Category is to be confirmed Slag Bound Mixtures B1-1, B1-2, B1-3 & B1-4 (SBM B1) – strength to be confirmed	Aggregate requirements: $C_{90/3}$, or $C_{50/30}$, [835.2, Table 8/12] : refer to the Scope. Laboratory mechanical performance category: C6/8, C9/12, C12/16, C15/20, C18/24; T2, T3, T4 [835.5 and Table NG 8/2] : refer to the Scope.
SB1	803	Type 1 unbound mixture	Mixtures containing crushed gravel coarse aggregate: – permitted [803.1]: crushed rock, crushed slag, crushed concrete, recycled aggregates or well burnt non-plastic shale and may contain up to 10% by mass of natural sand that passes the 4 mm test sieve. – minimum CBR [803.8] : 30% – trafficking trial [803.8]: mixtures containing crushed gravel coarse aggregate shall be assessed using a trafficking trial complying with sub-Clause 802.12. Mean and minimum foundation surface modulus shall be in accordance with SHW Clause 884 and 885. The sub-base at the slab or bay replacement must be fully compacted, especially at corners; a heavy plate vibrator is required to compact granular sub-base material.
SB2	807	Type 4 (asphalt arisings) unbound mixture	Trafficking trial [807.9]: unless stated otherwise in the Scope, it shall be assessed using a trafficking trial complying with sub-Clause 802.12. Mean and minimum foundation surface modulus shall be in accordance with SHW Clause 884 and 885.
SB3	821	Cement bound granular mixtures A (CBGM A)	Laboratory mechanical performance category: C 3/4, C 5/6, C 8/10; T1, T2, T3 [821.5 and Table NG 8/2] : refer to the Scope. Mean and minimum foundation surface modulus shall be in accordance with SHW Clause 884 and 885.

Schedule 5: Requirements for Construction Materials			
Material Ref.	Clause	Description	Requirement
			The bound sub-base at the slab or bay replacement must be fully compacted, especially at corners; a heavy plate vibrator is required to compact cement-bound sub-base material.
SB4	822	Cement bound granular mixtures B (CBGM B)	Aggregate requirements [822.2, Table 8/12] : LA50 or LA60 Laboratory mechanical performance category: C 8/10, C 12/15, C 16/20, C 20/25; T3, T4, T5 [822.5 and Table NG 8/2] : refer to the Scope. Mean and minimum foundation surface modulus shall be in accordance with SHW Clause 884 and 885. The bound sub-base at the slab or bay replacement must be fully compacted, especially at corners; a heavy plate vibrator is required to compact cement-bound sub-base material.

7 Thin Surface Course Systems: Information to be provided by the Contractor – Schedule 6

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

8 Modified Binder and Mixture Data Requirements – Schedule 7

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 Highways England, a copy of the results should be handed to the Overseeing Organisation, to be forwarded to: Pavement Engineering Team at Highways England, 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), 100g 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			
Batch ref:			
Binder type:			
Binder source:			
Softening point difference in storage stability test			
Test	Supplied binder	After RTFOT	After RTFOT and PAV85
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 maximum peak value J/cm2	#	#	#
Product identification test	#	#	#
Complex shear (stiffness) modulus (G*) and phase angle (δ) data			
Fraass brittle point			
Other properties the Contractor considers useful			

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

9 Mixture Data Requirements – Schedule 8

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

APPENDIX 7/4: BOND COATS, TACK COATS AND OTHER BITUMINOUS SPRAYS

1 SHEET 1: Information to be provided by the compiler

1.1 Prior to placing bituminous material on any new or existing bound substrate, a bond coat or tack coat shall be applied in accordance with SHW Clauses 920 and 942.

1.2 All surfaces shall be kept clean and uncontaminated in accordance with SHW sub-clause 903.3.

1.3 All surfaces (except new pavement layers) should be mechanically suction swept before application of tack and bond coats.

1.4 Bond or tack coat shall be supplied and laid in accordance with BS594987.

1.5 Existing ironwork, kerbs and street furniture shall be masked using self adhesive masking material before application starts and removed on completion of works.

1.6 Before spraying is commenced, the surface shall be free of all loose material and standing water. Surface preparation shall be carried out in accordance with BS594987.

1.7 Rate of spread should comply with SHW sub-clause 920.8.

1.8 Accuracy of application should comply with SHW sub-clause 920.9.

1.9 Site specification limitations should comply with Appendix 1/7.

2 SHEET 2: Information to be provided by the Contractor

2.1 The Contractor shall provide the following information with his tender, or prior to the commencement of the work:

(i) The product or products he proposes to use together with their declaration(s) of performance, as specified. The declaration of performance shall demonstrate that the product or products meet the requirements of the specification.

(ii) For each product, a copy of the BS EN ISO 9001 certificate showing the name of the manufacturer, the name of the certification body and the reference number and date of the certificate.

(iii) Evidence of the suitability of the bond or tack coats he intends to use when overlaying concrete surfaces;

(iv) The spraying equipment proposed, and a test certificate in accordance with SHW Clauses 920.7 and 920.9.

(v) The source or sources of blinding material proposed in accordance with SHW Clause 920.12.

(vi) Contingency plans in the event of any breakdown.

APPENDIX 7/5: IN SITU RECYCLING – THE REMIX AND REPAVE PROCESSES

1 Refer to the Scope for location of existing pavement to be treated with the remix and repave processes.

2 Requirements for milling shall in accordance with SHW Clause 709 and Appendix 7/9.

3 Requirements for surface course material:

(i) Thickness: refer to the Scope.
The depth of scarification shall be such that the bottom of the scarified layer is parallel to and below the finished road surface level by the thickness of surface course material specified in the Scope. A tolerance of ± 6 mm is permissible.

(ii) Material: refer to the Scope.
New surface course material shall conform to SHW Clauses 923 or 942. The new surfacing material shall be laid on, and compacted with the re-profiled surfacing, which shall be at a temperature within the range of 70°C to 150°C.

APPENDIX 7/6: BREAKING UP OR PEFORATION OF EXISTING PAVEMENT

Refer to the Scope for location(s) of existing pavement to be broken up or perforated including the treatment(s).

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

1 Refer to the Scope for location of concrete pavement to be treated, repaired or overlaid with bituminous or concrete material including the type of treatment.

2 Where the existing concrete comprises of asphalt running surface, the existing asphalt surfacing shall be milled prior to undertaking any saw-cutting, cracking and seating and overlaying the existing jointed reinforced concrete (JRC) pavement or cracking and seating and overlaying the existing jointed unreinforced concrete (URC) pavement or overlaying the existing concrete. The Contractor shall refer to the Scope for the milling depth.

3 Where the existing concrete comprises of concrete running surface, the top of the existing concrete surface shall be fine milled by 2 to 6mm prior to undertaking any saw-cutting, cracking and seating and overlaying the existing jointed reinforced concrete (JRC) pavement or cracking and seating and overlaying the existing jointed unreinforced concrete (URC) pavement. The Contractor is to agree with the Project Manager for milling depth prior to overlaying.

4 Where cold-milling of bituminous bound flexible pavement is required, the area of carriageway to be milled shall be removed by a suitable milling machine to the requirements specified in the drawings above. The process shall be carried out so as not to produce excessive quantities of dust, which shall be minimised by damping with water sprays.

5 48 hours prior to cold-milling the Contractor shall carry out a sweep of the area(s) to locate any buried metalwork within the layer to be cold-milled. The sweep shall be carried out with electronic detection equipment suitable for the purpose. The surface shall be clearly marked above all objects to show their detected extent. The objects shall be referenced and their location and depth reported to the Overseeing Organisation within 6 hours of discovery. Surfacing in the vicinity of such objects shall be excavated using pneumatic tools or other suitable methods.

6 The Contractor shall allow for working around drainage channels, chamber covers, gully gratings, expansion joints and the like by cutting out and removal of material by pneumatic tools or other suitable methods

7 The edge of area requiring cutting out by other suitable methods shall be saw cut back and edges left neat, vertical and in straight lines.

8 Where the new construction or widening ties into existing pavement (excluding the new binder or surface course layers), a minimum 150mm wide of the existing pavement surface will need to be milled off to allow for the transition joint.

APPENDIX 7/13: SAW-CUT AND SEAL BITUMINOUS OVERLAYS ON EXISTING JOINTED CONCRETE PAVEMENTS

1 Where concrete pavements are to be overlaid with 40mm to 180mm thick bituminous surfacing, the overlay shall be saw-cut and sealed at the concrete pavement joint in accordance with SHW Clause 713. When the total thickness of bituminous overlay to the existing concrete pavement is designed to be 40 mm or less, saw-cut and seal techniques to Clause 713 should not be used. In such cases, reflection cracks should be routed out and sealed with hot-applied sealant to comply with BS EN 14188-1.

2 Refer to the Scope for location of existing concrete pavement to be overlaid, resurfaced or inlaid. The existing concrete pavement shall be treated and prepared as specified in SHW Clause 714. The overlay or inlay shall then be saw-cut and sealed above existing transverse joints.

3 The Contractor is to ensure that the area shall be cleared of all debris and detritus and then be thoroughly brushed clean prior to bond coating in preparation for overlaying with the specified bituminous material.

4 Before any bond coating commences, the Contractor shall ensure that there are adequate stable accurate reference marks delineating all existing transverse pavement joints or saw-cuts and that they have been clearly marked and agreed with the Overseeing Organisation for purposes of accurately locating the positions of saw-cuts after overlaying. The marking procedure and the nature and location of offsets and the means of their establishment shall be agreed in advance with the Overseeing Organisation in a method statement. The accuracy of such markings shall be compatible with the specified accuracy of subsequent saw-cutting operations to Clause 713.

5 Bituminous overlay shall comply with contract specific Appendix 7/1 and the relevant Clauses of Series 900. For the purposes of this Clause, bituminous overlay shall include all specified regulating course, base, binder course and surfacing. Bond coating shall be as specified in contract specific Appendix 7/4.

6 Saw-cutting of grooves, cleaning, application of bond-breaker tape and sealing of grooves shall be carried out in one continuous operation and shall be completed in its entirety before the surface is opened to site traffic. This trafficking restriction shall not apply to Contractor's vehicles and plant necessary to complete the bituminous overlay.

7 As soon as practicable following the completion of the bituminous overlay in a given area, transverse saw-cutting of grooves shall be carried out at each of the pre-marked locations defined in Clause 3 of this Appendix. The tolerance on co-linearity of the crack-initiation slot with the underlying joint or saw-cut should be based on the following guidelines.

- ± 5 mm for target overlay thickness less than 100 mm,
- ± 10 mm for target overlay thickness 100 mm and greater.

8 The saw-cut groove shall comprise both the sealant slot and the crack-initiation slot. The cross-section of saw-cut grooves including width of sealant and width of crack initiation slot shall comply with Figure 7/13-1 below. The centre line of the crack-initiation slot in the overlay shall be aligned with each existing joint in the underlying concrete pavement to within the tolerance specified in Clause 6 of this Appendix.

9 The Overseeing Organisation should monitor sealant temperatures to ensure compliance with the manufacturer's recommendations.

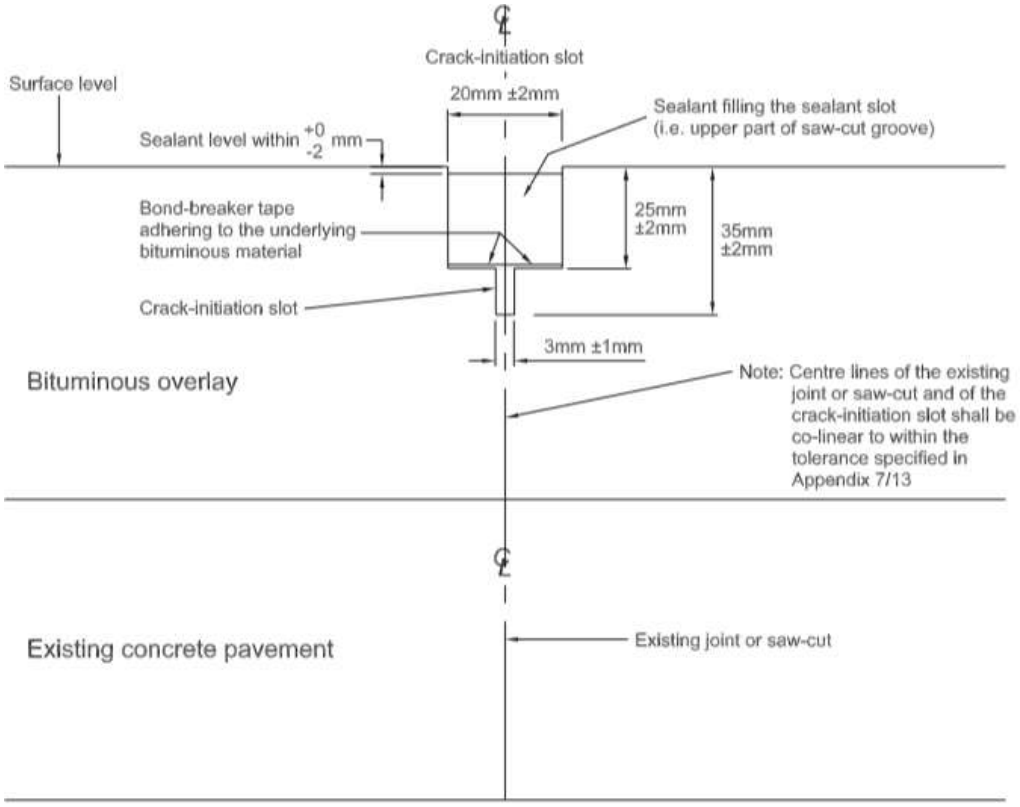


Figure 7/13-1 Detail of saw-cut and seal groove with sealant in bituminous overlay (taken from Figure 7/1 of SHW Series 700)

APPENDIX 7/14: PREPARATION OF JOINTED CONCRETE PAVEMENTS PRIOR TO OVERLAYING AND SAW-CUT AND SEAL OF THE BITUMINOUS OVERLAY

1 Refer to the Scope for location of existing concrete pavement to be prepared before receiving a bituminous overlay which will then be saw-cut and sealed in accordance with SHW Clause 713.

2 Contractor shall ensure that all joints, arrises and temporary repairs shall be checked and repaired prior to overlaying. Any cracks shall be assessed in accordance with CD227 and Concrete Pavement Maintenance Manual (2001). The concrete repair might involve the following works.

(i) Re-sealing joint grooves (refer to Clause 2.1 of this Appendix);
(ii) Part-bay repairs (refer to Clause 2.4 of this Appendix);
(iii) Thin bonded joint arris repair (refer to Clause 2.2 of this Appendix);
(iv) Full depth repair procedure for jointed slabs (refer to Clause 2.4 of this Appendix);
(v) Full depth repair procedure for continuously reinforced slabs and bases (at ends of proposed bituminous overlay) (refer to Clause 2.4 of this Appendix);
(vi) Full depth repair to longitudinal cracks (refer to Clause 2.4 of this Appendix);
(vii) Stitched crack repair procedure (refer to Clause 2.3 of this Appendix);
(viii) Slab lifting (refer to Clause 2.5 of this Appendix);
(ix) Pressure grouting (refer to Clause 2.5 of this Appendix);
(x) Bay replacement repair procedure (refer to Clause 2.4 of this Appendix);
(xi) Joint connectors (to transfer load across joints);
(xii) Sealing cracks (refer to Clause 2.6 of this Appendix);
(xiii) Checks on load transfer between slabs may be required in order to determine what repair technique(s) is/are necessary.

2.1 Resealing joint grooves

Materials

2.1.1 Type of joint sealants for joint repairs shall be in accordance with SHW Clause 1017 and one of the following:

(i) For hot applications between concrete joints, an approved Type N1 to BS EN 14188: Part 1. Within lay-bys and hardstandings, the joint sealants shall be fuel resistant sealant, either an approved Type F1 or F2 to BS EN 14188: Part1;

(ii) For cold application between concrete joints, the Contractor is to agree with Overseeing Organisation the permitted joint sealant. The cold applied sealant shall comply with BS EN 14188-2;

(iii) For joints between concrete slabs and bituminous surfacing, the sealing options are either an approved hot applied Type N1 sealant to BS EN 14188: Part 1 or polymer modified bitumen sealing strips. The latter option shall be applied in accordance with the manufacturer's instructions;

(iv) For joints in asphalt kerbs laid on concrete pavements, an approved hot applied Type N1 sealant to BS EN 14188: Part 1 shall be used.

2.1.2 For hot-applied and cold applied sealants the Contractor shall submit the declaration of performance for each sealant to the Overseeing Organisation prior to the incorporation of the sealant into the works. The declaration of performance shall demonstrate that the sealant meets the specification requirements and be pitch free.

2.1.3 Overbanding materials should not be used to seal joints or cracks in concrete pavements.

Preparation and sealing of joint grooves with applied sealant

2.1.4 The failed sealants shall be removed cleanly without damaging the joints to such depth as will provide an applied seal to the dimensions shown in Table 7/14-1, after allowing for any necessary caulking material described in SHW Clause 1016.6.

2.1.5 Any spalling adjacent to the joints shall be sawn wider and perpendicular to the surface to encompass the defects up to a maximum width of 40 mm for transverse joints and 25 mm for longitudinal joints. If the spalling cannot be corrected within these limits, then the arris shall be repaired by suitable thin bonded arris repair using cementitious materials as specified in SHW Clause 1032 and Clause 2.2 of this Appendix.

Table 7/14- 1 Dimensions of applied joint seals

Type and Spacing of Joints (m)	Minimum Width	Minimum Depth of Seal (Note 1)		Impregnated Foam Compression Strips	Depth of Seal Below the Concrete Surface
		Cold Applied	Hot Applied		
	mm	mm	mm	mm	mm
Contraction					
15 and under	13 (Note 2)	13	15	30	5 ± 2
Over 15 to 20	20	15	30	30	5 ± 2
Over 20 to 25	30	20	25	40	5 ± 2
Expansion	30	20	25	40	7 ± 2
Transverse Warping	10	10	13	30	5 ± 2
Longitudinal Joints (if sealed)	10	10	13	30	0 to 5
Gully and Manhole Slabs	20	15	20	30	0 to 3

NOTE (1): The depth of seal is that part in contact with the vertical face of the joint groove. The depth of seal below the surface shall be taken at the centre of an applied seal relative to a short straight edge, 150 mm long, placed centrally across the joint within 7 days of sealing.

NOTE (2): For cork seals other than in construction joints, grooves shall be 20 mm width, 50 mm depth.

2.1.6 The joints including the joint sides shall be cleaned of any dirt or loose material by air blasting with filtered, oil-free compressed air. The joint shall be clean and dry at the time of priming and sealing.

2.1.7 The joint grooves shall be primed with the relevant primer for the hot or cold applied sealant in accordance with the manufacturer's recommendations, as soon as the grooves have been grit-blasted and cleaned.

2.1.8 Sealing shall be carried out continuously along the full length of joint. When hot or cold applied sealants are used the sealant shall be applied within the minimum and maximum drying times of the primer recommended by the manufacturer. Priming and sealing with applied sealants shall not be carried out when the naturally occurring temperature in the joint groove to be sealed is below 10°C except between 8°C and 10°C it may be carried out when the temperature is rising. Local heating is not recommended because the effect will be temporary and the concrete will quickly cool, causing moisture to condense on surface.

2.1.9 Hot-applied sealants shall be prepared and applied in accordance with the manufacturer's instructions.

2.1.10 The components of cold-applied sealants shall be thoroughly mixed in the correct proportions in accordance with the manufacturer's instructions. As soon as possible

after mixing and within the worklife of the sealant, the material shall be dispensed into the joint, or applied using a caulking gun, to the correct level below the concrete surface. The tack-free time shall be achieved within 3 hours for machine dispensed material, or within 12 hours for hand applied material.

2.1.11 There are two grades of two part cold-applied sealing compounds to BS EN ISO 11600, used in structures and kerbs, etc; one for horizontal joints and the other for vertical joints. The grade offered by the Contractor should be suitable for the particular joint.

2.1.12 Although the British Standards refer to two part sealants some types have three parts. These sealants may also be permitted as it could be advantageous to vary the quantity of retarder (within limits set by the manufacturer) according to the temperature conditions at the time of sealing, rather than include it in the hardener. In cooler weather cold applied sealants take longer to cure.

2.1.13 With all sealants it is important to keep the top of the sealant below the surface at transverse joints to prevent damage by traffic when the joints are compressed in summer. When sealing in colder periods the level of the seal should be lower than in summer to allow for the compression of the seal upwards in warm periods. When longitudinal joints are sealed, the seal should be just below the surface.

2.1.14 In circumstances where longitudinal joints may not be on line with road markings, consideration should be given to the avoidance of contrasting colours between joint sealant and pavement.

2.1.15 Any failed expansion isolation joints should be investigated if joint filler board needs to be replaced. Any new joint filler board for expansion joints and isolation joints (access chamber and gully slab joints) shall be in accordance with SHW Clause 1015.

Testing of applied sealants

2.1.16 No additional testing of sealants is required provided a declaration of performance for cold-applied sealants in accordance with BS EN 14188-2 or BS EN 14188-1 for hot-applied sealants has been provided to the Overseeing Organisation.

2.2 Thin bonded repair

2.2.1 Thin bonded repair is normally used to repair shallow joint spall with no more than one-third of the slab depth and no more than 50mm from joint, surface scaling up to 1m^2, cobweb crazing, aggregate pop-out, surface irregularity due to punchouts and stepping, transverse and longitudinal cracks with shallow spall.

2.2.2 Refer to SHW Clause 1032 for thin bonded repair material. Cement mortar shall be used for depths less than 20 mm and fine concrete for greater depths. Resin mortar may be used for patch repairs where insufficient time for adequate curing of a cementitious cement mortar exists. Thin bonded repairs at joints must not be used for depths greater than the joint groove.

2.2.3 Using epoxy concrete, or other 'concretes' with thermal properties and strengths different from the existing concrete, is not recommended, since further debonding or cracking of the existing concrete often follows.

2.2.4 The cements, aggregates, admixtures and water shall comply with Clause 1001. The sand (ie fine aggregate) for mortars or fine concrete shall be within the limits of 0/4 (CP), 0/4 (MP), 0/2 (MP) or 0/2 (F/P) of BS EN 12620. Coarse aggregate for fine concrete shall be (4/10) single sized aggregate complying with BS EN 12620. All aggregates shall have the same thermal properties as the aggregate in the original

concrete, and match other properties as closely as possible. Filler and aggregate for resin mortars shall be prepacked in the correct proportions and mixed with the resin all in accordance with the manufacturer's instructions.

2.2.5 Thin-bonded repairs must not bridge the joint or crack. Refer to the Figure 7/14-1 for the procedure for thin bonded arris repairs to shallow spalling at joints. For thin bonded arris repair refer to Figure 7/14-2 below. Thorough preparation, attention to detail and good workmanship are essential. As sawing produces a polished surface that inhibits good bond, a groove should be chased out to provide a roughened vertical edge around the repair, against which the repair. The success of thin-bonded arris repairs depends entirely upon a good bond. This is best achieved by compacting the repair material against a freshly scabbled, clean surface and finishing it flush with the existing slab surface.

2.2.6 For single particle pop-outs, Contractor to consider the use of resin mortar plugs.

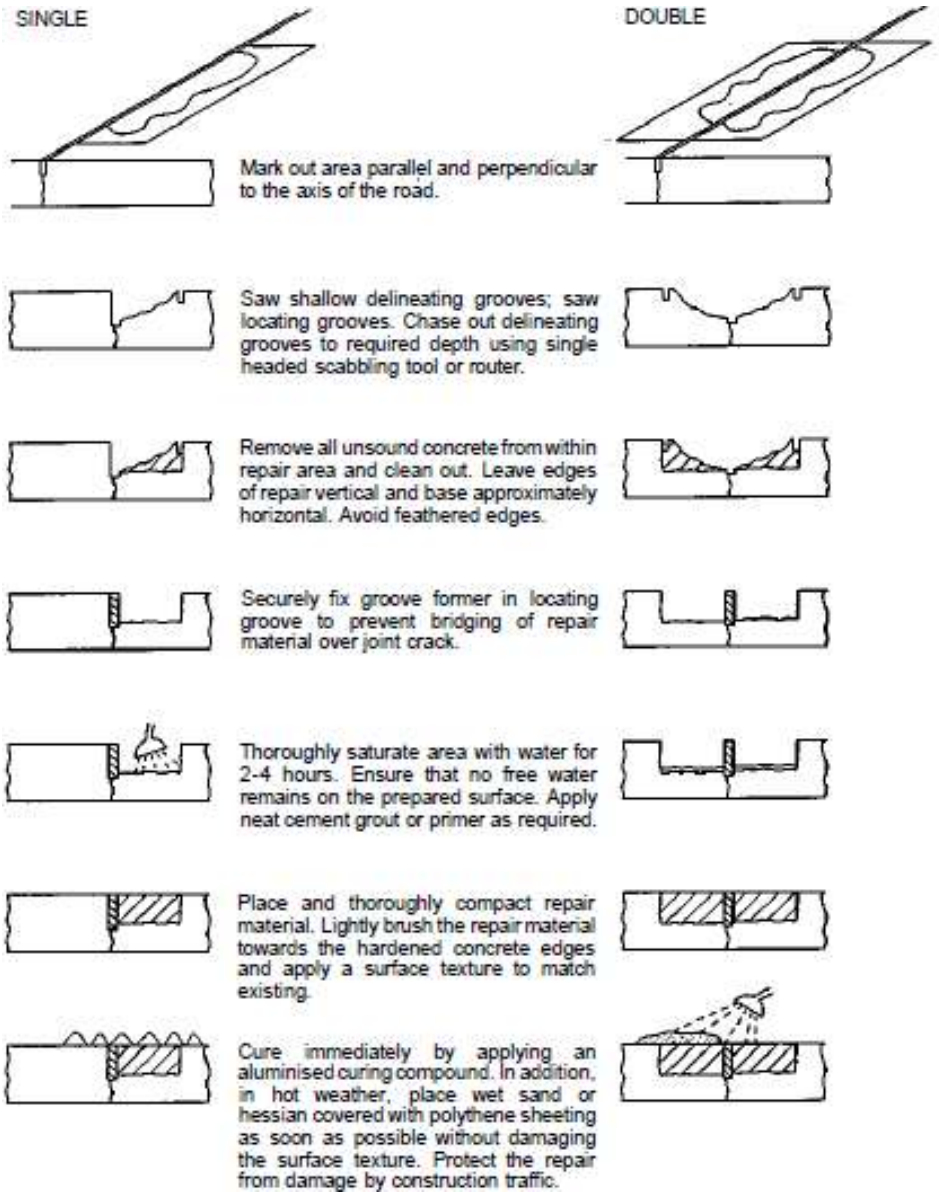


Figure 7/14- 1 Procedure for thin bonded arris repairs to shallow spalling at joints (taken from Figure 8.2 of Concrete Pavement Maintenance Manual, 2001)

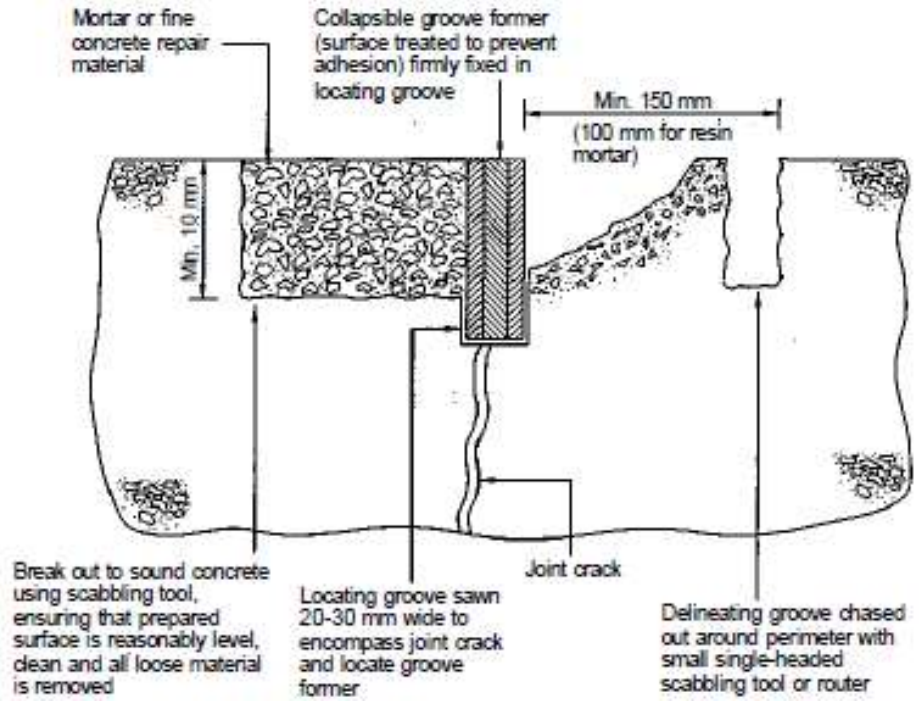


Figure 7/14- 2 A thin bonded arris repair (taken from Figure 8.3 of Concrete Pavement Maintenance Manual, 2001)

2.3 Stitched crack repairs

2.3.1 Stitched crack repairs are normally undertaken to convert narrow longitudinal cracks in unreinforced slabs or medium longitudinal cracks in reinforced slabs into a tied warping joint that will allow the slab to 'hinge' at that point, maintaining aggregate interlock and preventing it from widening. The two types of stitched crack repairs are:

(i) Type 1 – Staple Tie Bar Repair, slots 25 – 30 mm wide by 470 mm long at 600 mm centres and at right angles to the line of the crack shall be chased out to a depth such that, when bedded, the tie bars lie between 1/3 and 1/2 of the depth of the slab below the surface. Holes of 25-30 mm diameter and 50 mm deep are drilled at each end of the slot and the slots then cleaned with oil-free compressed air. Once dry, the slots are primed and the staple tie bars placed onto beds of epoxy resin mortar and covered with the same material to a minimum depth of 30 mm. The sides of the slots are then cleaned of loose material and filled with thoroughly compacted resin or cementitious mortar. After the repair material has cured, a groove is sawn or routed along the line of the crack and sealed in the same manner as a transverse joint.

(ii) For Type 2 – Diagonal Tie Bar Repair, holes at least 16 mm in diameter are drilled across the crack at right-angles to it and about 26° to the slab surface. These holes are spaced every 600 mm along the crack with alternate entry points on opposite sides. The entry points should be at a distance from the crack equal to the slab depth.

Refer to Figure 7/14-3 for Types 1 and 2 repairs. The Contractor shall ensure the repaired joints are outside of the wheeltrack zone, the transverse width of the repair shall not exceed 45% of the width of the slab under repair, and the minimum transverse width of the repair shall not be less than 1.0 m. Otherwise, a full-width repair in accordance with SHW Clause 1033 shall be made.

2.3.2 The length of bar depends on the slab depth and should be enough to allow 50 mm

cover at the bottom of the slab. Deformed 12 mm grade 460 steel tie bars are used and notched at a point that will be 50 mm below the slab surface when the bars are fully inserted.

2.3.3 Each hole is filled with epoxy resin mortar so that, with the tie bar inserted, the mortar level reaches to 25 mm below the notch. Once the mortar has set, the length of tie bar above the notch is broken off by twisting. Any bars that rotate after the mortar should have hardened must be withdrawn and the hole redrilled.

2.3.4 Epoxy resin mortar is recommended for stitch repairs because the material must harden before crack movement can disrupt the repair. As stitching will not allow transverse movement at the crack, care must be taken to ensure that the crack to be stitched has not taken on the role of an adjacent transverse joint. If it has, new cracks or spalling of the concrete above the tie bars could develop. If the crack is within the middle third of the tie bars at a longitudinal joint, stitched crack repairs will not normally be necessary; sawing and sealing of a groove along the crack will usually suffice.

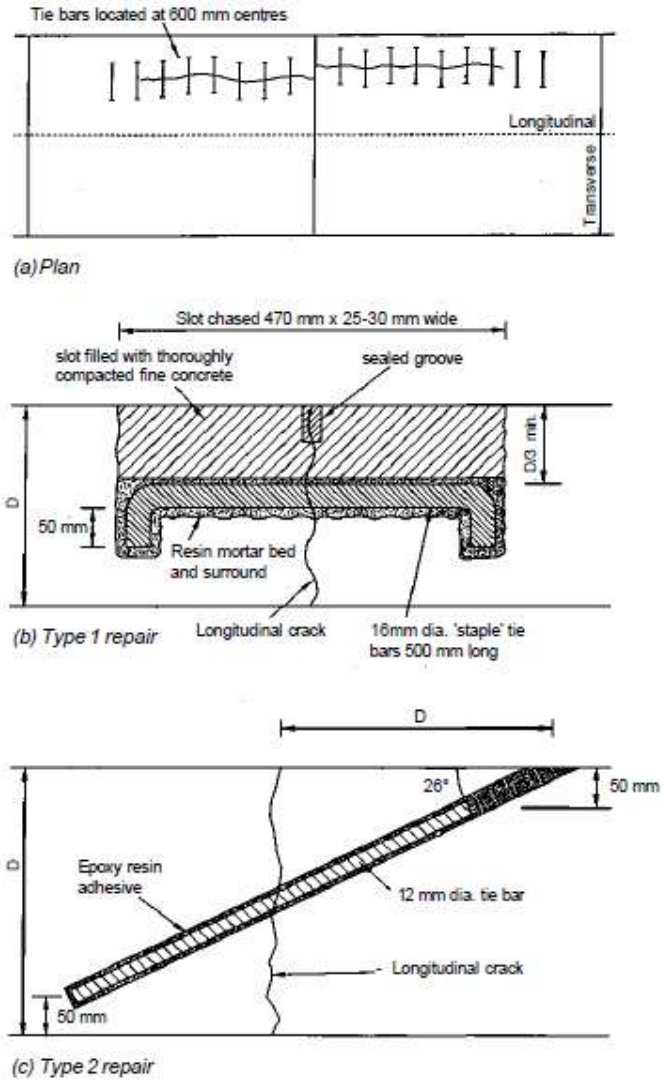


Figure 7/14- 3 Stitched crack repairs (taken from Figure 8.4 of Concrete Pavement Maintenance Manual, 2001)

2.4 Slab or bay replacement

2.4.1 Any bay or slab replacement shall be in accordance with SHW Clause 1034. Where individual bays are to be replaced they shall match the design thickness of the original

concrete including reinforcement if originally included.

2.4.2 The replacement bay shall be connected to the surrounding concrete with new dowel and tie bars at transverse and longitudinal joints in accordance with SHW Clauses 1011 and 1012. Grooves shall be formed in accordance with SHW Clause 1013. Joints surrounding the new bay shall be sealed specified in Clause 1016. A surface texture as specified in SHW Clause 1026 shall be applied and a sprayed resin based, aluminised curing compound in accordance with SHW Clause 1027.

2.4.3 For bay replacement with high-early-strength concrete, compression seals can be installed as soon as the groove is sawn. Hot- or cold-applied sealants can be applied as soon as the concrete has reached sufficient strength for grit-blasting without damaging joint grooves. Use of compression seals shall be in accordance with SHW Clauses 1016 and 1017.

2.4.4 For use of high-early strength concrete for bay replacement theContractor shall submit a quality plan (QP) and agree with Project Manager prior to the commencement of works. The QP shall contain the following elements:

- Constituent materials;
- Mix design;
- Site trials;
- Site production;
- Control testing;
- Laying process including forming of joints (transverse and longitudinal) and compaction process;
- Finishing and
- Curing.

2.4.5 Prior to the reopening of the carriageway, the high-early strength concrete should have attained a compressive strength of at least 25N/mm^2 for PQC surface slabs and 20 N/mm^2 for PQC surface road base within 4 to 5 hours.

2.4.6 Full depth repairs shall be repairs which will require full depth reinstatement of the concrete slab in accordance with this Clause to the extent instructed by the Overseeing Organisation, which repairs may also require reinstatement of sub-base. Full width repairs shall be repairs over the full width of a bay or bays. Part width repairs shall be repairs over part of the width of a bay or bays. A bay shall be that portion of the concrete pavement bounded by adjacent longitudinal and transverse joints.

2.4.7 The area of concrete to be removed shall be marked out perpendicular to and parallel to the axis of the road. For continuously reinforced concrete slabs (CRCP or CRCB) the edge of the repair shall be not less than 0.5 m from the nearest crack and not less than 3 m from any transverse construction joint. The minimum repair length should be 1 m. Where this and the provisions of Clause 2.4.6 of this Appendix would otherwise require a longitudinal repair joint within 1 m of the existing longitudinal joint or edge, the repair shall be extended to align with that longitudinal joint or edge.

Part width bay repairs

2.4.8 Providing all the following criteria are met, part width bay repairs may be carried out in accordance with Clause 2.4.7 of this Appendix:

(i) the transverse width of the repair shall not exceed 45% of the width of the slab under repair; and

(ii) the longitudinal joint which would be formed by the repair shall not occur within the wheeltrack zone; and

(iii) the minimum transverse width of the repair shall not be less than 1.0 m.

Full width bay repairs

2.4.9 For full width bay repairs the following criteria shall apply:

(i) Repair lengths which do not replace an existing transverse joint shall be constructed with two transverse contraction joints and the longitudinal joint shall have tie bars in repair lengths which are greater than 1 metre.

(ii) Repair lengths which replace a single existing transverse joint shall be constructed with two transverse joints: one expansion and one contraction. The new expansion joint shall be formed at the end which will have the shortest longitudinal distance between this joint and the joint in the adjacent lane(s). The longitudinal joint(s) between the existing joint(s) and the new expansion joint shall be constructed without tie bars and shall have 5 mm thick compressible foam within the joint for the full depth of the concrete slab. The longitudinal joint between the new contraction joint and the joint in the adjacent bay(s) shall be constructed with tie bars where the exposed length so permits.

(iii) Repair lengths which replace more than one existing transverse joint shall be constructed with transverse joints to match expansion and contraction joints in the adjacent bay(s). Where the repair length does not replace an existing expansion joint, one end joint shall be formed as an expansion joint. Except for the end joints all transverse joints shall be formed to coincide with the existing transverse joints. Where one end joint is an expansion joint, the longitudinal joint(s) between the existing joint(s) and the new expansion joint shall be constructed without tie bars and shall have 5 mm thick compressible foam within the joint for the full depth of the concrete slab. All other longitudinal joints shall be constructed with tie bars.

Bay repair work

2.4.10 For bay repair work, Contractor should ensure that:

(i) A groove of 40 mm nominal depth but less than the depth of any reinforcement shall be sawn around the perimeter. For jointed slabs, the saw-cut shall be full depth to provide the face for a new joint. There shall be no over-cutting into the adjacent slab. Additional cuts within the repair area may be made to ease removal of the redundant portion of the slab. At internal corners, full depth holes across the corners at the limits of the saw cuts shall be drilled prior to breaking out.
The line of cut shall not vary by more than ±25 mm throughout its length from the set out line. All sawn edges shall be perpendicular or parallel to the sides and surfaces of the slab.
When sawing operations have been completed, and before any other operations are commenced, the surface of the carriageway shall be thoroughly cleaned of the slurry produced by sawing and of any other detritus.

(ii) The concrete shall be carefully broken out without undercutting the slab or damaging adjoining slabs. If reinforcement has to be removed, sufficient reinforcement shall be left for a lap length, except where a dowelled joint is being made. Reinforcement shall not be bent and subsequently straightened. Slurry from sawing, slab breaking, repair materials and other debris shall be prevented from entering joints and grooves in adjacent areas.

(iii) If the repair work is carried out in the summer months, the following considerations are recommended to reduce the risk of longitudinal cracking or localised compression failures at joints.

a) Saw full depth cuts at cooler periods of the day (i.e. at night or early morning);
b) Saw along the joint before making cuts each side to eliminate a badly spalled joint.
c) Cool the concrete with water.
d) If a series of repairs is required make intermediate cuts to relieve stress at intervals rather than cutting sequentially along the road.

(iv) Full-depth full-width repairs constitute small bays and so should be at least equivalent to the main slab in all respects (refer to Figures 7/14-4 and 7/14-5 for details). Full-depth repairs extending over only part of a bay width are not appropriate for unreinforced jointed concrete (URC) pavements.

(v) For URC repair, where the ratio of the longest to the shortest dimension of the repair is greater than 2, the repair should be reinforced with either square or long mesh reinforcement of appropriate weight as suitable. For the latter, the main bars must be parallel to the longest dimension. For jointed reinforced concrete (JRC), if square mesh reinforcement is used, its weight/m^2 should be about double that of the long mesh reinforcement in the original slab.

(vi) For URC repair the Contractor shall introduce a movement joint in the bay to be repaired and aligned with the retained original joint as shown in Figure 7/14-4a to minimise the risk of sympathetic cracking. Movement joints will usually be contraction joints unless the retained pavement adjoining the repair has been found to have locked-up joints, in which case it may be appropriate to introduce an expansion joint. Refer to Figure 7/14-5 for tied transverse joint and expansion joint details. For tied expansion joints, the dowel bars should be of plain round mild steel 25mm in diameter for slab less than 240mm thick and 32mm for slab 240mm or more and in accordance with SHW Clause 1011.

(vii) For JRC repairs, new reinforcement shall be lapped and welded or tied. The length of tied laps shall be 35 bar diameters or 450 mm whichever is the greater for longitudinal bars and 300 mm for transverse bars. Welded laps shall be 150 mm minimum length.

(viii) For JRC repairs, where the repair is limited to one lane, the best practicable arrangement is shown in Figure 7/14-6a, where the repair concrete is free to contract towards the tied joint. For layout of part width JRC slab repair refer to Figure 7/14-6c and Figure 7/14-7 for appropriate detail. Part width JRC shall meet the requirements for part width bay repairs criteria in Clause 2.4.6 of this Appendix. Refer to Figure 7/14-6b for layout of JRC concrete repair spans all lanes.

(ix) The Contractor shall avoid surface water ponding in the repair before the concrete is placed, it should either be kept out by means of sandbags or provision made for it to drain away.

(x) Any necessary reinstatement of the sub-base and separation membrane should be done before new dowel and tie bars are fixed at the transverse and longitudinal joints. Any new sub-base material shall be in accordance with SHW Series 800 and must be fully compacted, especially at corners; a heavy plate vibrator is required to compact granular or cement-bound sub-base material. Any separation membrane shall be in accordance with SHW Clause 1007.

(xi) An existing cement-bound sub-base may be reinstated and regulated with fine concrete or fine cold asphalt. If a granular sub-base is to be replaced with cement-bound material, action should be taken to avoid any potentially deleterious effect from the creation of a discontinuity in the under-slab drainage or to the slab support.

(xii) Where the small repair of URC bays constructed over a granular sub-base are 1 m long (measured along the carriageway), the Contractor shall ensure that, with a granular sub-base, the repair length be increased to at least 2m so that sub-base re-compaction is easier and the traffic load is spread over a greater length, eliminating the punching effect on a short repair.

(xiii) The reinstated concrete shall be placed, spread, compacted and finished as specified in SHW Clause 1025. Particular care shall be taken to ensure full compaction at the edges. The concrete shall be normal or high early strength pavement concrete, complying with SHW Clauses 1001 to 1005 and shall achieve the required characteristic strength prior to opening to traffic.

(xiv) When a new joint is required, holes shall be drilled of the appropriate size and depth for dowels or tie bars according to the type of joint. These holes shall be thoroughly cleaned of debris and dust. This shall include but not be limited to the use of oil-free compressed air at a pressure of not less than 0.5 N/mm^2.
Dowels and tie bars shall comply with the requirements of SHW Clauses 1011 and 1012 respectively. Epoxy mortar shall be to the manufacturer's recommendation for this specific application.
The holes shall be filled with epoxy mortar, the mortar being injected to the rear of the hole to avoid air entrapment. The dowel bars shall be inserted into the holes before the initial set of the mortar. If cartridges of epoxy mortar are used they shall be inserted into each hole, the dowel bar inserted through the cartridges and rotated for 1 minute to ensure that the epoxy mortar is well mixed. After insertion the dowels and tie bars shall be within the specified tolerances for alignment.
Where repairs straddle a movement joint with an adjacent slab, tie bars shall be omitted and the joint between the slabs debonded to ensure that movement patterns are not restricted.

(xv) For continuously reinforced slabs with punchouts or deep spalling, full-depth repairs shall be carried out one lane width at a time and succeeding repairs should not be made until the first repair is strong enough to be trafficked. Reinforcement continuity must be maintained by lapping, welding or resin fixing; with small areas, couplers may be more economic. The work must be done carefully to avoid damaging reinforcing steel. Only hand tools or light percussion tools should be used. The faces of the original concrete must be left roughened but sound and vertical without undercutting. The concrete debris accumulated below the reinforcing bars must be reduced to a fragment size such that it may be lifted out and removed through the spaces between the bars. With all debris and dust removed, any damage to the sub-base must be made good with sand/cement mortar and trowelled flush.
If reinforcement continuity is lost through damage to any longitudinal or transverse bars, the continuity must be restored. If a longitudinal bar is severed, it must be replaced by inserting a bar of the same diameter. The replacement must be either welded to the original reinforcing steel or at least 750 mm long with half of its length resin-fixed into a hole drilled into the concrete.
Unless an adequate lap length with the original steel remains, a similar bar will be required at the other end of the repair. When bars are inserted at both ends of the repair, they must have the maximum practicable overlap, and never less than 750 mm. Therefore, bars longer than 1.5 m may be required. If the original steel becomes damaged, it is likely that the repair may have to be significantly enlarged either to provide access for drilling or to permit insertion of bars long enough to provide the necessary overlay. If a defect requires removal of a wider area, a full-width repair should be carried out.

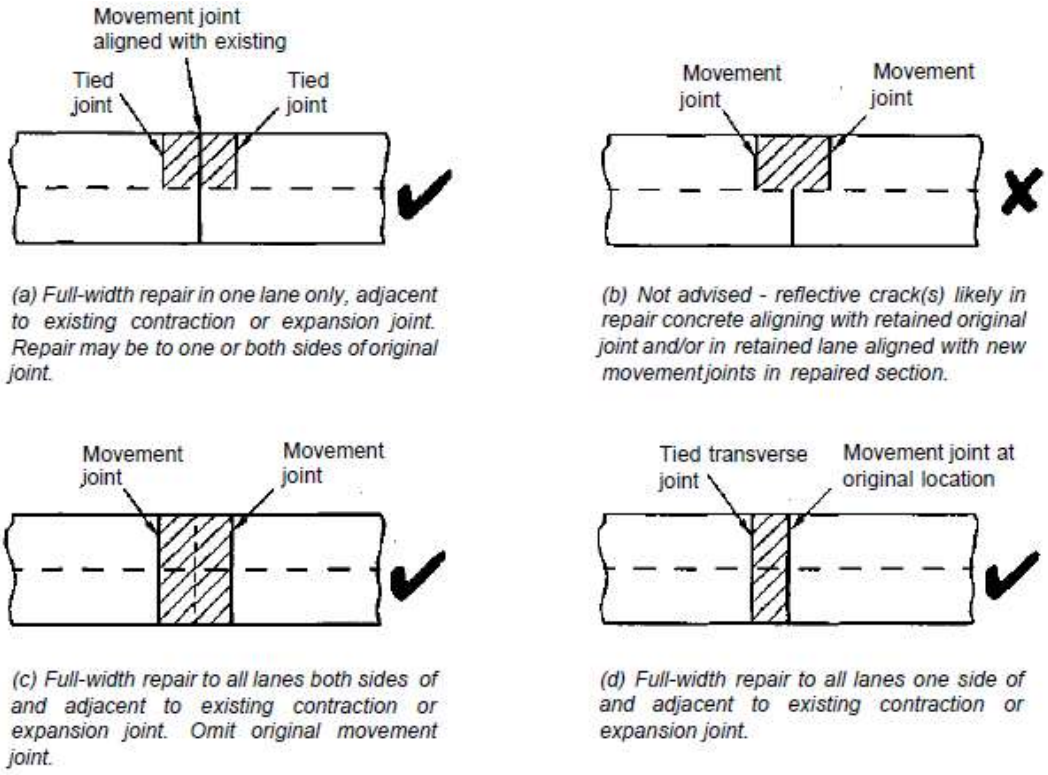


Figure 7/14- 4 Full-depth repairs to jointed unreinforced concrete (URC) pavements (taken from Figure 8.5 of Concrete Pavement Maintenance Manual, 2001)

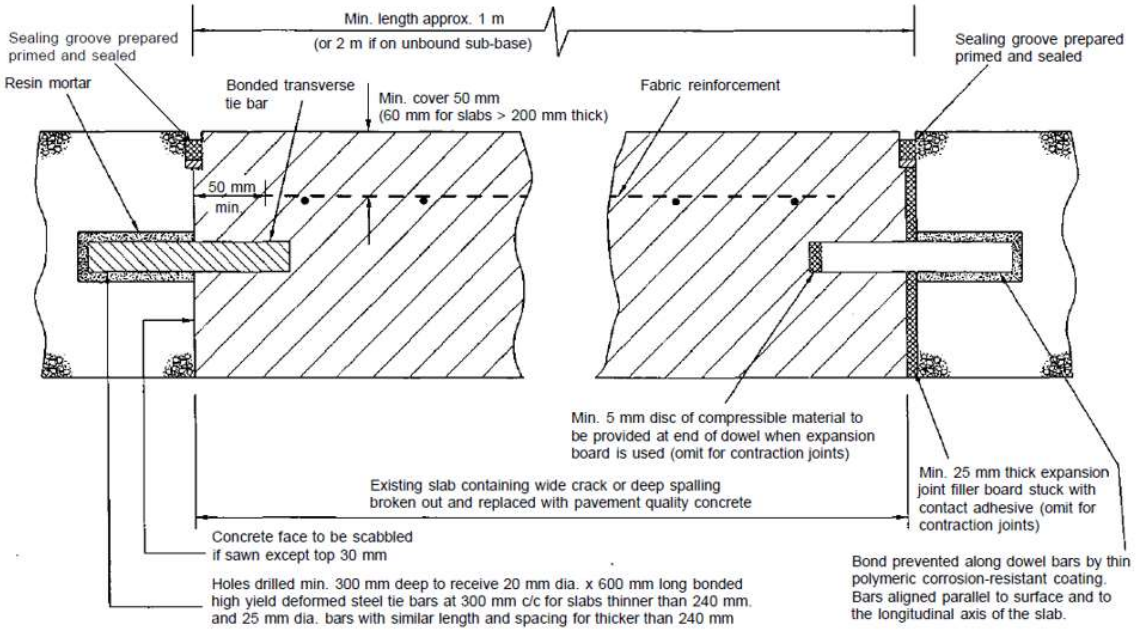
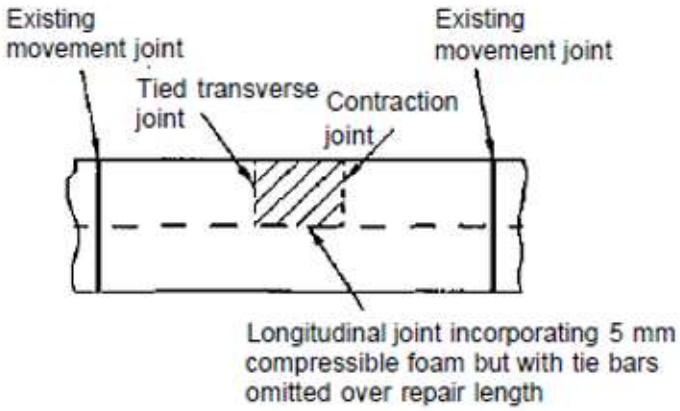
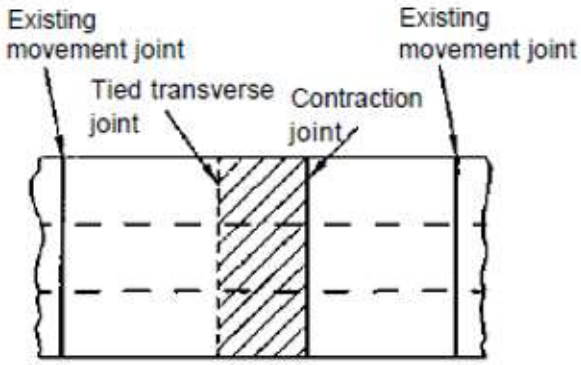


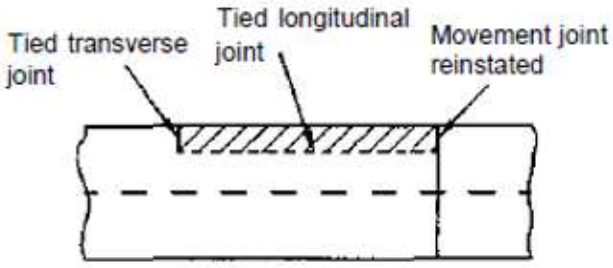
Figure 7/14- 5 Longitudinal section through transverse full-depth repair adjacent to an existing transverse movement joint in URC pavement (taken from Figure 8.6 of Concrete Pavement Maintenance Manual, 2001)



(a) Full-width repair in one lane only, remote from movement joints.



(b) Full-width repair to all lanes.



(c) Partial width repair (but note restrictions on lane width, see Clause 3.3.6 ').

Figure 7/14- 6 Full depth repairs to JRC pavements (taken from Figure 8.7 of Concrete Pavement Maintenance Manual, 2001)

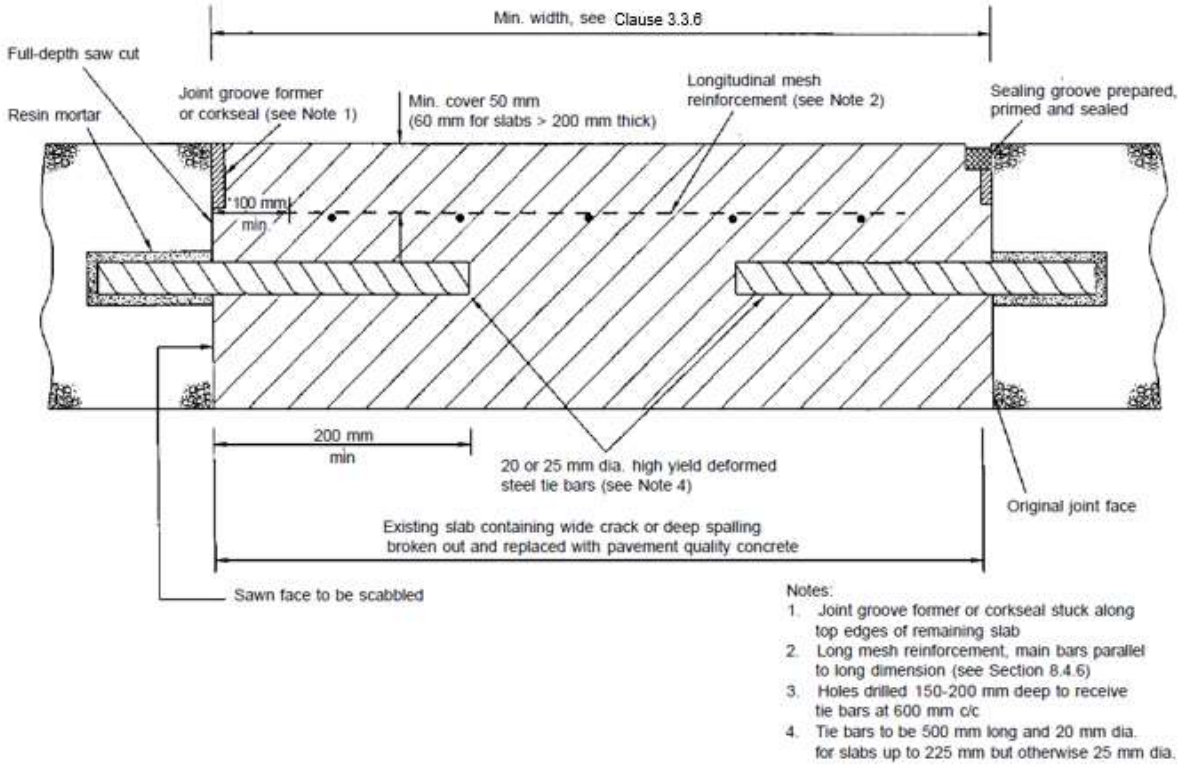


Figure 7/14- 7 Transverse section through full-depth partial-width repair for JRC slabs (taken from Figure 8.8 of Concrete Pavement Maintenance Manual, 2001)

2.5 Slab levelling with pressure-grouting or vacuum grouting

2.5.1 Contractor is to agree with Project Manager the repair method for slab settlement or rocking or joint stepping where step is greater than 3mm between adjacent slabs.
Slab lifting, pressure- and vacuum-grouting described below may not produce a durable repair if the sub-base is of unbound material. In this case, the sub-base itself and/or the underlying formation may have been weakened by persistent water penetration through a defective joint seal. The slab may then settle further despite the voids having been filled with grout.

2.5.2 Raising the level of slabs by lifting is a controllable process in which the slab is connected to a frame straddling the bay and hydraulically jacked to the required level a few millimetres at a time. While the slab is still connected to the lifting frame, the void created underneath should be filled by pressure- or vacuum-grouting. When a substantial length of slab is lifted, it may be necessary to stitch tie bars across the longitudinal joint to stop it opening subsequently.

2.5.3 Slab lifting can also be undertaken on continuously reinforced concrete pavements but requires longitudinal sawcuts between lanes to isolate each section of pavement. Unlike other types of concrete pavement, both the slab and the underlying cement-bound sub-base should be cut through if lifting is to be successful, because of the bond between the two layers.

Pressure Grouting

2.5.4 Pressure-grouting is used either to fill small voids and stabilise dynamic movement of the slab or to fill the voids created when slabs are raised to correct settlement or stepping at joints and cracks. As well as cementitious and resin grouts, a dry mix mortar may be used to fill voids, but it may be necessary to raise the slab initially to a slightly higher level than is actually required to allow for future compaction under traffic. Fluid grout is more suitable for filling smaller voids under the slab.

Vacuum Grouting

2.5.5 With vacuum-grouting, a low-viscosity resin grout is induced to flow into voids beneath the slab by applying a vacuum. Holes about 30 mm in diameter are drilled through the slab on a 1m square grid for vacuum suction and grout injection. The advantages of the process are that any water beneath the slab is drawn off before the grout is injected and the low viscosity of the grout enables small voids to be penetrated. There is also little danger of inadvertently filling service ducts.

2.5.6 As contraction and expansion joints must not be filled with grout, care is necessary during cold weather. Preventing free movement of slabs could lead to compression-type blow-up failures

2.6 Sealing cracks

2.6.1 Any medium width transverse cracks (crack width between 0.5mm and 1.5mm) shall be treated by forming a groove and seal in accordance Clause 2.2 of this Appendix. When sealing cracks, a sawn groove is preferable to one chased out by a router or single-headed scabbling tool.

3 Contractor shall also ensure that the area shall be cleared of all debris and detritus and then be thoroughly brushed clean prior to undertaking any concrete repair.

4 Once the preparation work to SHW Clause 714 has been accepted by the Overseeing Organisation for a specified portion of the total area, the bituminous overlay, including any bond coating, may proceed. Then the saw-cutting and sealing shall be carried out and accepted solely in accordance with the requirements of Clause 713.

APPENDIX 7/15: SAW-CUT, CRACK AND SEAT EXISTING JOINTED REINFORCED CONCRETE PAVEMENTS

1 Refer to the Scope for location(s) of existing jointed reinforced concrete pavement to be saw cut, crack and seat prior to overlaying with a thick asphalt surfacing including nominal thickness, position of longitudinal reinforcement, diameter of longitudinal reinforcement, strength range of existing concrete, design effective stiffness threshold.

2 For sub-base type and thickness, capping type and thickness if any, and subgrade information, refer to the Scope.

3 Before any of the main crack and seat work is commenced. The Contractor shall undertake the main trial to:
- (i) demonstrate that their proposed plant, equipment and method for the saw-cuting, cracking and seating of the existing hydraulically bound layer or layers is capable of producing the required depth of saw-cut and required type of cracks;
- (ii) allow the Overseeing Organisation to select the appropriate spacing of the saw-cutting for use in the main works and the location where FWD measurements shall be made on individual bays in the monitoring of the Main Works production cracking.

4 The main trial area should be neither less than 250m^2 nor greater than 420m^2 of existing pavement. The location of the main trial should be representative of the main body of the work and including a length of the most heavily trafficked lane, it should be neither at the thickest part of the hydraulically bound layer nor at the part which is cracked already, nor over the worst formation. If it is known that there are differing pavement constructions within the scheme, more than one trial will be required.

5 The work on the main trial length shall proceed as follows:
- (i) Saw-cutting and cracking shall proceed in stages as directed by the Overseeing Organisation. Each Stage that is cracked and seated shall be assessed in accordance with SHW Clause 715.22;
- (ii) Stage 1 of the main trial shall be on 1 no. slab. The Contractor shall set up his plant and equipment and demonstrate that he can produce the required pattern and quality of saw-cuts and transverse cracks in accordance with SHW Clause 715 and this Appendix. This shall be assessed in accordance with SHW Clause 715.22;
- (iii) In Stage 2 and any subsequent Stage of the main trial, a length encompassed by 6 no. saw-cuts shall be cracked starting from one end to produce transverse cracks at the saw-cut spacing stated in this Appendix. For each Stage, the settings of the cracking plant and equipment shall be recorded in accordance with the pro forma in contract specific Appendix 7/17. The cracked pavement shall then be seated in accordance with this Appendix;
- (iv) Seating: After cracking, the pavement shall be seated with the number of passes of the roller specified in this Appendix and as described in SHW Clause 715.18.

The Contractor shall not proceed with the main crack and seat work until the Overseeing Organisation has given its consent that the plant, equipment and methods used in the main trial length comply with the requirements in Table 7/3 of SHW Series 700. When consent by the Overseeing Organisation to the method has been given, the plant, equipment and methods shall not be changed thereafter without the prior consent of the Overseeing Organisation except for normal adjustment and maintenance of plant. Should it be necessary for the Contractor to otherwise change any plant, equipment and/or method the Contractor may be required to carry out a further main trial Stage.

6 Prior to undertaking the main production work, the Contractor shall ensure the following:

(i) adequate reference location marks based on the Overseeing Organisation's chainage have been clearly marked and agreed with the Overseeing Organisation for purposes of accurately recording progress and the locations of changes to equipment settings.
(ii) locate all bay joints, repair joints and any existing transverse cracks. Refer to Appendix 7/14 for concrete repairs and treatments.;
(iii) pre-plan and mark the positions of the intended transverse saw-cuts using the transverse saw-cut spacing determined from the main trial.
(iv) adequate side restraint in place from the adjacent verge(s) and central reserve assisted by any temporary works which may be necessary.
(v) All saw-cutting, cracking and seating operations shall be completed before the commencement of any excavation which would remove adequate side restraint in the adjacent verge(s) and/or central reserve.

7 The sequence of operations for the main production work shall be:
(i) pre-planning and marking of the positions of intended transverse saw-cuts;
(ii) saw-cutting of the concrete pavement at the spacing and depths specified in this Appendix;
(iii) verification of saw-cut depths;
(iv) inducing transverse cracks;
(v) extracting cores; and
(vi) seating;
(vii) Unless stated otherwise in the Scope, FWD measurements to SHW Clause 718.

8 The Contractor shall keep records of:
(i) the settings to his plant and equipment;
(ii) the saw-cut spacing;
(iii) the chainage; and
(iv) the time at which each and every adjustment is made to the plant and equipment.
Such records shall be in accordance with the pro forma in Appendix 7/17 for the 'Cracking Plant and Equipment Progress Record' and shall be available on demand for inspection by the Overseeing Organisation.

9 Compliance with the saw-cutting and the cracking and seating requirements shall be assessed during main work in accordance with the following criteria:
(i) The spacing and depths of transverse saw-cuts will be monitored by the Overseeing Organisation;
(ii) The surface pattern of cracking of all areas that have been cracked and seated shall be checked by the Contractor and will be monitored by the Overseeing Organisation;
(iii) The depth of saw-cut and the depth and the vertical direction of cracking shall be determined through coring full depth of the concrete pavement layer or layers symmetrically at the saw-cut position;
(iv) Recording the number of passes of the seating roller.

10 Unless stated otherwise in the Scope, the Contractor shall undertake FWD measurements in accordance with SHW Clause 718 and assessments in accordance with SHW Clause 719 both (i) before saw-cutting and (ii) after seating at the same locations. The Contractor shall make allowance in his programme for the undertaking of FWD measurements.

11 FWD Testing and Measurements:
(i) Unless stated otherwise in the Scope, FWD testing of effective stiffness and joint efficiency are required;
(ii) FWD measurements: For effective stiffness, carried out by the Contractor in accordance with SHW Clause 718;
(iii) FWD assessment: For effective stiffness, carried out by the Contractor in accordance with SHW Clause 719;

(iv) Prior to undertaking any FWD testing, the Contractor shall ensure the FWD machine has the current appropriate certification. Evidence of a satisfactory absolute calibration by the equipment manufacturer and consistency checks by the operator shall be provided as required by the Overseeing Organisation. The absolute calibration of the deflection sensors, load cell and system processor shall be carried out annually. Consistency checks of the dynamic response of the machine as a whole should take place at intervals of six weeks or less during periods of operation and after any major service involving replacement parts.

12 Saw-cuts:
(i) Unless stated otherwise in the Scope, spacing of saw cuts will be 1 metre adjacent to each joint and equally spaced at 1m to 3m c/c (not exceeding 5-8m) to suit a bay length;
(ii) The minimum depth of saw-cuts shall be sufficiently to cut completely through the longitudinal steel reinforcement but this depth shall in no circumstances exceed 50% of the nominal depth of the concrete pavement layer. When such a saw-cut fails to fully cut through the reinforcing steel, the cracking operation shall not proceed within 5 m of the incompletely cut bar. This fact shall be recorded by the Contractor who shall report it to the Overseeing Organisation as soon as practicable. This report shall be confirmed within 18 hours. Saw-cutting shall also cease immediately and not re-commence on the same slab until so instructed by the Overseeing Organisation. If there has been any over-cutting, this shall be remedied in accordance with SHW Clause 715.31;
(iii) Width of saw cut shall be 3 mm;
(iv) Tolerance on spacing of transverse saw-cuts: ±50 mm;
(v) Tolerance on depth of transverse saw-cuts below base of reinforcement: +20mm -0mm and not greater that 50% of nominal pavement slab depth;
(vi) Not within 500mm of any existing transverse joint or crack in that lane.

13 Cracking:
(i) The induced cracks shall be single, predominantly vertical from bottom of the saw-cut to the bottom of the concrete pavement slab with no shattering or multiple cracking;
(ii) Location of the impacting head of the crack-inducing equipment shall be no closer than 0.5m from any edge of the concrete slabs.

14 Assessment of cracking:
(i) Unless stated otherwise, core diameter should be not less than 150mm diameter. Where the Overseeing Organisation is satisfied that a consistent fine cracking is being achieved it mayinstruct to reduce to 100mm diameter;
(ii) Frequency of coring for main production work is 1 core every 300m^2;
(iii) For Stage 2 of main trial and any subsequent trials, it shall be 1 core at every alternate transverse saw-cut.

15 Seating:
(i) Minimum weight of roller shall not be less than 20 tonnes.
(ii) Number of passes on main work production should not be less than 6 passes of the specified roller at every point.

16 Should the results vary from that to which consent was given in the main trial, or from any relevant subsequent Saw-cutting and Cracking Re-Assessment Trial, with the consent of the Overseeing Organisation the Contractor shall adjust the plant and equipment and/or saw-cut depth in order to produce the agreed results. The new settings of the plant and equipment shall be recorded by the Contractor, together with the location at which it was changed. These particulars shall be delivered to the Overseeing Organisation within 24 hours of the changes being completed. If the agreed surface crack pattern is not restored within 20 m production, then cracking shall cease. A Saw-cutting and Cracking Re-Assessment Trial shall then be carried out in accordance with SHW Clause 715.33 to .35 before any further production saw-

cutting and cracking and seating work is executed.

17 Cracking and seating near existing services:
(i) The Contractor shall identify the location and depth of the existing services located with the works area. The existing services location shall be marked.
(ii) No cracking and seating will be permitted at the existing services location. A minimum of 2m clearance from the surveyed existing service location shall be applied.

18 Unless stated otherwise or the recovered cores provide insufficient thickness information, data is to be supplemented by Ground Penetrating radar (GPR).

Failure to comply and remedial work

19 The results of the saw-cut and crack and seat operations of any 5 m length of jointed reinforced concrete shall be rejected if they fail to comply the saw-cutting and the cracking and seating requirements. If:
(i) shattering or multiple cracking of concrete material occurs within the extracted core; or
(ii) excessive spall damage is caused to be arrises of the saw-cuts; or
(iii) the length of any longitudinal cracks in the highway traffic wheel tracks are in excess of the spacing of the induced transverse cracks; or
(iv) the spacing of the transverse saw-cuts is outside the tolerance specified in this Appendix; or
(v) the depth of the transverse saw-cuts is greater than the depth specified in this Appendix;
or any combination of these, then the following remedial measures shall be taken. The size of the affected area shall be determined and the rejected section(s) shall be broken out, excavated to full depth and reinstated with equivalent material, unless otherwise instructed by the Overseeing Organisation. The repair joints shall be outside the highway traffic wheel tracks as defined in SHW Clause 903.21.
If the number of roller passes required for seating is less than the number of passes specified in this Appendix at each and every point on the pavement, then the Contractor shall roll the entire area again with not less than the number of passes of the roller specified in this Appendix, unless otherwise instructed by the Overseeing Organisation.

20 Unless stated otherwise or the recovered cores provide insufficient thickness information, data is to be supplemented by Ground Penetrating radar (GPR).

Use of cracked and seated pavement surface by traffic

21 In cases where the ‘saw-cut and cracked and seated’ pavement is re-opened to highway traffic and kept in use for a significant length of time (generally more than 4-5 days) before overlaying with a bituminous overlay, the saw-cuts and cracks should be sealed to prevent increased water ingress to the reinforcing steel and underlying pavement layers. Otherwise sealing of the cracked concrete is not required.
Sealing of saw-cuts: Hot-applied sealant to Clause 1017.
Sealing of cracks:
(a) Medium (0.5 < > 1.5 mm): ‘Over-banding’ with a bitumen of penetration reference 50.
(b) Wide(>1.5 mm): Chase out cracks and seal with 15D x 10W D3406 sealant.

Bond Coat

22 The saw-cut, cracked and seated surface should be bond coated in accordance with contract specific Appendix 7/4 prior to overlaying.

APPENDIX 7/16: CRACKING AND SEATING OF EXISTING JOINTED UNREINFORCED CONCRETE PAVEMENTS AND HYDRAULICALLY BOUND MIXTURE (HBM) BASES

General

1 Refer to the Scope for location(s) of existing jointed unreinforced concrete pavement or hydraulically bound mixture (HBM) bases to be cracked and seated prior to overlaying with a thick asphalt surfacing including nominal thickness, compressive strength range of existing concrete or HBM bound base, design effective stiffness threshold.

2 For sub-base type and thickness, capping type and thickness if any, and subgrade information, refer to the Scope.

3 The term “hydraulically bound layer” refers to both jointed unreinforced concrete and HBM bases.

4 Before any of the main crack and seat work is commenced The Contractor shall undertake the main trial to:
(i) demonstrate that their proposed plant, equipment and method for the cracking and seating of the existing hydraulically bound layer or layers is capable of producing the required type and pattern of cracks;
(ii) allow the Overseeing Organisation to select the appropriate spacing of the transverse cracks for use in the main works and the location where FWD measurements shall be made on individual bays in the monitoring of the Main Works production cracking.

5 The main trial area should be neither less than 250m^2 nor greater than 420m^2 of existing pavement. The location of the main trial should be representative of the main body of the work and including a length of the most heavily trafficked lane, it should be neither at the thickest part of the hydraulically bound layer nor at the part which is cracked already, nor over the worst formation. If it is known that there are differing pavement constructions within the scheme, more than one trial will be required.

6 The work on the main trial length shall proceed as follows:
(i) Cracking shall proceed in stages as directed by the Overseeing Organisation in groups of four to six bays in jointed concrete pavements, or in lengths of 20 m for HBM bases. Each group that is cracked and seated shall be assessed in accordance with SHW Clause 716.18.
(ii) In Stage 1 of the main trial the Contractor shall set up his plant and equipment and demonstrate that he can produce the required pattern and quality of transverse cracks in accordance with SHW Clause 716 and this Appendix. This shall be assessed in accordance with SHW Clause 716.18.
(iii) In Stage 2 and each subsequent Stage of the main trial, a group of four bays in jointed concrete pavements, or a length of 20 m for HBM bases, shall be cracked starting from one end to produce transverse cracks at each of the spacings stated in this Appendix. For each Stage, the settings of the cracking plant and equipment shall be recorded in accordance with the pro forma in contract specific Appendix 7/17.
(iv) Seating: After cracking in both Stage 1 and Stage 2, the pavement shall be seated with the number of roller passes specified in this Appendix and as described in SHW Clause 716.15.

The Contractor shall not proceed with the main crack and seat work until the Overseeing Organisation has given its consent that the plant, equipment and methods used in the main trial length comply with the requirements in Table 7/4 of SHW Series 700.

7 Prior to undertaking the main production work, the Contractor shall ensure the following:
(i) adequate reference location marks based on the Overseeing Organisation's chainage have been clearly marked and agreed with the Overseeing Organisation for purposes of accurately recording progress and the locations of changes to equipment settings;
(ii) locate all bay joints, repair joints and any existing transverse cracks. Refer to Appendix 7/14 for concrete repairs and treatments;
(iii) pre-plan and mark the positions of the intended induced cracks at these locations using the transverse crack spacing determined from the main trial;
(iv) adequate side restraint in place from the adjacent verge(s) and central reserve assisted by any temporary works which may be necessary;
(v) all cracking and seating operations shall be completed before the commencement of any excavation which would remove adequate side restraint in the adjacent verge(s) and/or central reserve.

8 Unless stated otherwise in the Scope, the Contractor shall undertake FWD measurements in accordance with SHW Clause 717 and assessments in accordance with SHW Clause 719 both (i) before cracking and (ii) after seating at the same locations. The Contractor shall make allowance in his programme for the undertaking of FWD measurements.

9 The sequence of operations for the main production work shall be:
(i) where necessary, pre-planning and marking of the positions of induced transverse cracks;
(ii) inducing transverse cracks;
(iii) application of clean water to assist examination of the crack pattern;
(iv) observation of the surface crack pattern in either daylight or under sufficient artificial light provided by the Contractor to the satisfaction of the Overseeing Organisation;
(v) extracting cores; and
(vi) seating;
(vii) Unless stated otherwise in the Scope, FWD measurements to SHW Clause 717.

10 The Contractor shall keep records of
(i) the settings to his plant and equipment;
(ii) the crack spacing;
(iii) the chainage; and
(iv) the time at which each and every adjustment is made to the plant and equipment.
Such records shall be in accordance with the pro forma in Appendix 7/17 for the 'Cracking Plant and Equipment Progress Record' and shall be available on demand for inspection by the Overseeing Organisation.

11 Compliance with the cracking and seating requirements shall be assessed during main work in accordance with the following criteria:
(i) The spacing of transverse cracks shall be checked by the Contractor and will be monitored by the Overseeing Organisation;
(ii) The surface pattern of cracking of all areas that have been cracked shall be checked after applying water;
(iii) The depth and the vertical direction of cracking shall be determined through coring full depth of the hydraulically bound pavement layer or layers symmetrically at the crack position.
(iv) recording the number of passes of the seating roller.

12 Cracking:
(i) Unless stated otherwise in the Scope, initial cracking spacing(s) are/is to be taken as 1m and/or1.5m for trial section. For jointed pavement quality concrete, the spacing alternatives in the main trial should be chosen such that the crack spacing divides exactly into the bay length. Spacing of transverse crack is to be confirmed after the trial section

has completed.

(ii) Spacing of transverse cracks for the production cracking re-assessment trial: as directed by the Overseeing Organisation;
(iii) Spacing of transverse cracks for the main works: determined from the main trial or from a production cracking re-assessment trial;
(iv) Tolerance on spacing of transverse cracks: ±5%;
(v) Category of transverse cracks (based on width observed at the surface): Fine ie. <0.5mm wide;
(vi) Depth of cracks: Full depth of hydraulically bound pavement layer;
(vii) Type of crack: The induced cracks shall be single, predominantly vertical through the layer with no shattering or multiple cracking;
(viii) Location of impacting head of the crack-inducing equipment: No closer than 0.5m from any edge of the concrete bays or HBM base;
(ix) Tolerance of transverse alignment: ±50mm.

13 Assessment of cracking:
(i) Core diameter: Not less than 150mm diameter;
(ii) Depth of core: Full depth of unreinforced concrete pavement or hydraulically bound pavement layer;
(iii) FWD measurements: Carried out by the Contractor in accordance with SHW Clause 717;
(iv) FWD assessment: Carried out by the Contractor in accordance with SHW Clause 719;
(v) Prior to undertaking any FWD testing, the Contractor shall ensure the FWD machine has the current appropriate certification. Evidence of a satisfactory absolute calibration by the equipment manufacturer and consistency checks by the operator shall be provided as required by the Overseeing Organisation. The absolute calibration of the deflection sensors, load cell and system processor shall be carried out annually. Consistency checks of the dynamic response of the machine as a whole should take place at intervals of six weeks or less during periods of operation and after any major service involving replacement parts.

14 Seating:
(i) Minimum weight of roller shall not be less than 20 tonnes;
(ii) Number of passes on main work should not be less than 6 passes of the specified roller at every point.

15 Should the crack pattern vary from that to which consent was given in the main trial, or from any relevant subsequent production cracking re-assessment trial, with the consent of the Overseeing Organisation the Contractor shall adjust the plant and equipment in order to produce the agreed crack pattern. The new settings of the plant and equipment shall be recorded by the Contractor, together with the chainage at which the settings were changed. These particulars shall be delivered to the Overseeing Organisation within not more than 24 hours of the changes being completed. If the agreed crack pattern is not restored within 4 bays in jointed concrete pavements or within 20 m in HBM bases production cracking shall cease. A production cracking reassessment trial shall then be carried out in accordance with SHW Clause 716.28 to .30 before any further production cracking and seating work is executed.

16 Cracking and seating near the existing services:
(i) The Contractor shall identify the location and depth of the existing services located with the works area. The existing services location shall be marked;
(ii) No cracking and seating will be permitted at the existing services location. A minimum of 2m clearance from the surveyed existing service location shall be applied.

17 Unless stated otherwise or the recovered cores provide insufficient thickness information, data is to be supplemented by Ground Penetrating radar (GPR).

Use of cracked and seated pavement surface by traffic

18 In cases where the cracked and seated pavement is to be re-opened to highway traffic and is intended to be kept in use for a significant length of time (generally more than 4-5 days, or if prolonged poor weather is anticipated) before overlaying with an asphalt overlay, the cracks should be sealed as follows. Otherwise sealing of the cracked concrete is not required.
Sealing of cracks:
(a) Medium (0.5 < > 1.5 mm): 'Over-banding' with a bitumen of penetration reference 50.
(b) Wide(>1.5 mm): Chase out cracks and seal with 15D x 10W D3406 sealant.

Bond Coat

19 The cracked and seated surface should be bond coated in accordance with contract specific Appendix 7/4 prior to overlaying.

APPENDIX 7/17: CRACKING PLANT AND EQUIPMENT PROGRESS RECORD

Information to be provided by the Contractor

Sheet no.....

Contract: (Road no. & name) .....

Site location: .....

Type of plant and Contractor's plant number.....

Blade length .....metres Blade weight.....kg

Month/year work commenced..... Carriageway .....bound
eg E/W/N/S/

Date and time	Chainage and Lane no.	Height of Drop (mm)	Crack Spacing (m)	Notes For example: Changes in crack pattern and reasons for any adjustments made to weight, drop or other settings

Name of Contractor: .....*[Block capitals]*

Signature of Contractor's representative: .....Date .....

Name and post of signatory: .....*[Block capitals]*

APPENDIX 7/19: BACK-ANALYSIS OF FALLING WEIGHT DEFLECTOMETER (FWD) MEASUREMENTS MADE ON CONCRETE PAVEMENTS TREATED BY FRACTURED SLAB TECHNIQUES

1 Unless stated otherwise in the Scope, software and documentation to be used in conjunction with this Clause:
- (i) Version of MODULUS-HA to be used in back analysis: 5.1
- (ii) Version of MODULUS-HA User's Guide (MUG) to be referred to in instructions for back analysis: 3.3.
- (iii) The electronic format of the compiled back-analysed: data to be supplied to the Overseeing Organisation for assessment: Compatible with Microsoft Excel.

Input to Modulus Back-calculation program

2 Back-analysis model to be used with MODULUS-HA: Two-layer only.

3 Drop number at each test position to be used in back-analysis: 3.

4 Geophone Weight Factors to be used in MODULUS-HA: Zero for all sensors.

5 Thickness of bound material (H1) to be used for the layers to be modelled in MODULUS-HA: Derived from cores and GPR measurements if any.

6 Stiffness ranges to be used in MODULUS-HA for the layers to be modelled:
- (i) Layer 1 (bound material): 500-50000MPa
- (ii) Most Probable Subgrade Modulus: 100MPa

7 The values of Poisson's ratio to be used for each layer to be modelled in MODULUS-HA are as follows:
- (i) Hydraulically bound (including cracked and seated) =0.2
- (ii) Combined granular foundation and subgrade =0.45

Back-analysis and Presentation of Results of FWD Monitoring of Main Trial

8 The graphical presentation(s) of the back-analysed data arising from the Main Trial shall show the:
- (i) Effective stiffness modulus of the hydraulically bound layer or layers before and after crack and seat
- (ii) Stiffness modulus of the foundation layer before and after crack and seat
- (iii) Crack spacing used at each FWD test position

The graphs showing the effective stiffness modulus of the hydraulically bound layer or layers shall also show the:
- (iv) Effective stiffness design threshold specified in contract specific Appendix 7/17 appropriate at each test point.
- (v) Location of any transverse cracks present before cracking and seating.

For jointed concrete pavements, the graphs should also give the:
- (vi) Identification of the test point with lowest effective stiffness within each bay.

Back-analysis and Presentation of Results of FWD Monitoring of Main Production Works

9 The graphical presentation(s) of the back-analysed data arising from the Production Cracking

shall show the:
(i) Effective stiffness modulus of the hydraulically bound layer or layers following crack and seat
(ii) Stiffness modulus of the foundation layer following crack and seat

The graphs showing the effective stiffness modulus of the hydraulically bound layers shall also show the:
(iii) Relevant effective threshold specified in contract specific Appendix 7/17 at each test point.
(iv) Location of any transverse cracks present before cracking and seating.

Back-analysis and Presentation of Results of FWD Monitoring of Production Cracking Reassessment Trials

10 The graphical presentation(s) of the back-analysed data arising from any Production Cracking reassessment trial shall show the:
(i) Effective stiffness modulus of the hydraulically bound layer or layers before and after crack and seat
(ii) Stiffness modulus of the foundation layer before and after crack and seat
(iii) Crack spacing used at each FWD test position

The graphs showing the effective stiffness modulus of the hydraulically bound layer or layers shall also show the:
(iv) Effective stiffness design threshold from contract specific Appendix 7/17 appropriate at each test point.
(v) Location of any transverse cracks present before cracking and seating.

For jointed concrete pavements, the graphs should give the:
(vi) Identification of the test point with lowest effective stiffness within each bay.

11 Unless stated otherwise, period of time for the Contractor to allow in his programme for 12 hours for the Overseeing Organisation to assess and interpret submitted back-analysed results and prepare instructions.

APPENDIX 7/22: REPAIRS TO POTHOLE

1 General

(i) Location of pothole or road stud holes to be repaired or filled are in the Scope.
(ii) All loose material shall be removed before filling the hole.
(iii) All standing water shall be removed before filling the hole.
(iv) The filling material shall be compacted by a suitable means.
(v) The surface of the compacted material shall be level with that of the adjacent road.

2 Road Stud Holes

(i) Fill road stud socket with 6 mm bituminous instant road repair material or for concrete pavement cement mortar or resin mortar to SHW Clause 1032.

3 Holes in Paved Areas

(i) For holes less than 0.5 m^2 - fill with 6 mm bituminous instant road repair material or for concrete pavement cement mortar or resin mortar to SHW Clause 1032.

(ii) For holes greater than 0.5 m^2 - fill with 6 mm nominal size dense bitumen macadam surface course or for concrete pavement using thin bonded repair refer to Appendix 7/14.

(iii) Holes shall be backfilled with bituminous materials compacted to refusal with a circular headed vibrating hammer in layers not exceeding 75 mm thick.

APPENDIX 7/23: SITE SPECIFIC DETAILS AND REQUIREMENTS FOR RECYCLED CEMENT BOUND MATERIAL

1 Refer to the Scope for location of existing concrete pavement to be broken up and recycled.

2 Dependent on the type of pavement and specific site conditions, the recycling process may be used to form the structural course for a reconstructed pavement or the structural course and foundation platform as a combined layer. Alternatively, it may be used to provide a foundation course for a new overlying pavement construction.

3 Pavement designs containing recycled base materials shall be designed in accordance with CD 226.

4 To achieve the economies of scale and energy savings offered by the recycling process, a minimum programme of works of the order of 3,000 m^2 is suggested as a general guide, which could be a combination of a number of smaller schemes in close proximity. However, in particular circumstances, where conventional methods of reconstruction are onerous or precluded, smaller scale recycling works may still offer a cost effective solution.

5 The Contractor shall provide a Quality Plan with his tender if the work involves the use of recycled cement bound materials. The Quality Plan must state or contain definitions as the levels of quality assurance and control to be applied throughout the Contract, which should include:

(i) Locations for stockpiles of arising materials;
(ii) Location of compound/processing plant;
(iii) Procurement, inspection and safe storage of constituent materials;
(iv) Tracebility of materials;
(v) Setting up off-site mixing plants and the mixing of recycled cement bound materials;
(vi) Storage and transportation of recycled cement bound materials prior to use/despatch;
(vii) Laying and compaction of recycled cement bound materials;
(viii) Inspection and test regimes and records at appropriate stages;
(ix) Sub-contractor/supplier assessment and control;
(x) Calibration of equipment; and
(xi) Process controls;
(xii) Statistical techniques to be used for trend analysis, statistical process control and inspection.

APPENDIX 11/1: KERBS, FOOTWAYS AND PAVED AREAS

1 Kerbs, Edgings and Channels

1.1 Location of kerbs or edgings or channels to be repaired are in the Scope.

1.2 If the existing kerbs, edgings and channels are to be replaced, they shall be pre-cast concrete in accordance with BS EN 1340. 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.

1.3 Where footways are present adjacent to the carriageway, bullnose or half battered kerbs with an upstand of at least 100mm should be provided. Where a footway is less than 1.3m from carriageway way, bullnose or half battered kerbs with an upstand of at least 75mm should be provided. For all other locations, unless otherwise specified, all non-kerb-drain unit kerbs are to be SP 255 x 125 precast concrete splay units.

1.4 When resurfacing takes place, the units and backing may require lifting and relaying. If the surface is raised by less than 40 mm, the units may be rebedded with mortar. If the surface is raised by more than 40 mm, the units should be relaid on a fresh mortar bed placed on a regulating layer of hardened modified or unmodified mortar or concrete, as appropriate for the thickness

1.5 All kerbs shall have an upstand of 75mm unless noted otherwise.

1.6 Where using straight kerbs to change direction of kerb line, the kerbs are to be cut to produce a butt joint.

1.7 The contractor must consider the use of mechanical lifting equipment for the lifting, unloading, moving and laying of kerb units.

2 Footways and Paved Areas

2.1 Unless otherwise stated, where the existing footway and/or paved areas to be removed and reconstructed, the pavement options for new footway for off network access and other paved areas (central reserve) are summarised in Tables 11/1, 11/2 and 11/3 including the construction materials and requirements.

2.2 Prepared formation shall be treated with non-toxic weedkiller and a weed control geomembrane Terram or similar approved shall be installed prior to placing of sub-base.

Table 11/1 Footway for off network access – flexible pavement option

20 mm	AC 6 dense asphalt surface course 100/150 to Clause 909
50 mm	AC 20 dense binder course 40/60 rec to Clause 906
100 mm	Sub base to Clause 803 Type 1

Table 11/2 Footway with for off network access – pavers/setts option

≥50 mm	Concrete flags/slabs to Clause 1104
25 mm	Laying course to BS 7533-4
100 mm	Sub base to Clause 803 Type 1

Table 11/3 Other paved areas with heavy vehicles overrun – flexible pavement option

25 mm	AC 6 dense asphalt surface course 100/150 to Clause 909
90 mm	AC 20 dense binder course 40/60 rec to Clause 906
210 mm	Sub base to Clause 803 Type 1
Subgrade CBR >4%	

2.3 Other forms of central reserve construction are subject to approval by the Overseeing Organisation and shall require a minimum of 70 mm thickness of bound material

APPENDIX 12/1: TRAFFIC SIGNS: GENERAL

1 The location of traffic signs and bollards are shown in the Scope. The actual location is to be agreed on site with the Overseeing Organisation.

2 Signs must have a minimum lateral clearance of 1.2m from the edge of the carriageway in accordance with paragraph 1.48 of chapter 1 of the Traffic Signs Manual. Where the existing pavement to be overlaid, Contractor shall ensure the existing signs meet the minimum lateral clearance requirement.

3 All signs should be in accordance with The Traffic Signs Regulations and General Directions 2016 and the associated working drawings for traffic signs. Sign diagram references are taken from the Traffic Signs Regulations and General Directions 2002 and NP working drawings where they have not been included in the 2016 regulations.

4 All signs shall conform to BS EN 12899-1:2007 and be CE marked as indicated in figure ZA.6 of BS EN 12899-1:2007.

5 All sign faces shall be retroreflective and shall be Class RA2 in accordance with table NA.1A in the UK National Annex of BS EN 12899-1:2007.

6 All grey backing boards shall be non-reflective.

7 The sign substrate material shall be of no scrap value to deter theft.

8 Where practicably possible, sign faces shall be formed from a single sheet, otherwise, a minimum number of horizontal or vertical joints are acceptable. Details of any vertical joints shall be submitted to the overseeing organisation for acceptance.

9 With the exception of Traffic Management Signs, all sign plates shall be manufactured in accordance with BS EN 12899-1:2007 and Clause 1205.2 to 1205.6 inclusive, of the Manual of Contract Documents for Highway Works Volume 1 (MCDHW).

10 The plates shall be sheet aluminium or aluminium composite material of not less than 3mm thickness conforming to BS EN 12899-1:2007. Preparation of the base material prior to application of sheeting and film shall be in accordance with the manufacturer's instruction and complying with Appendix 19/2. Materials and finishes shall be compatible to avoid failure or deterioration due to electrolytic action or by differential thermal expansion and be capable of passing the tests described in BS EN 12899-1:2007. All ferrous components of composite construction shall be protected against corrosion, prior to any fabrication or drilling, by hot-dip galvanising inside and out to BS EN ISO 1461:2009.

11 All signs, unless approved by the overseeing organisation, must be stiffened with an aluminium channel section, including all supplementary plates, using at least two sections of stiffening, fixed from edge to edge. The stiffening and framing shall comply with BS EN 12899-1:2007 and SHW Clause 1207. Fixing devices such as rivets, bolts, etc., shall be stainless steel or other non-corrosive materials, free of oil, and shall not bring about any reaction with the sign plate or sign surface material. They shall be of sufficient size to prevent failure due to expansion or wind pressure on either side of the sign. Fixing shall be effective, taking account of any specialist instructions given by the manufacturer of the sign surface material used. Washers in contact with a surface prone to damage by over tightening of nuts or bolts shall be of a suitable soft and weather resistant material. Clips used for fixing signs to posts shall be manufactured from stainless steel, aluminium or coated mild steel and tapped for screws to prevent the signs turning on the post. All screws used must be manufactured from stainless

steel.

12 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 must be applied to all retro-reflective text, symbols and borders.

13 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.

14 Additional Information

14.1 No verge sign under 10m^2 shall be manufactured from extruded aluminium plank.

14.2 Steel constructions and steel mounting elements shall conform to BS EN 1993-1-1.

14.3 All plate signs shall be sheet aluminium in accordance with BS EN 1999-1-1.

14.4 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.

14.5 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.

14.6 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.

14.7 The sign face material manufacturer's instructions regarding transportation; storage, erection and cleaning shall be adhered to.

14.8 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 HA's approval has been received.

14.9 The Contractor shall provide and fix the sign identification numbers to the schedule provided in the Scope.

14.10 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.

14.11 Typical post foundation details are shown below.

14.12 All traffic signs mounted on a singular tubular steel post or lighting column shall be attached using anti-rotational clips.

14.13 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.

14.14 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.

14.15 Each individual sign shall have a label in accordance with BS EN 12899-1:2007

14.16 Where signs are to be temporarily, fully or partially covered over, this shall be in accordance with SHW Clause 1209 and only upon agreement with the Overseeing Organisation.

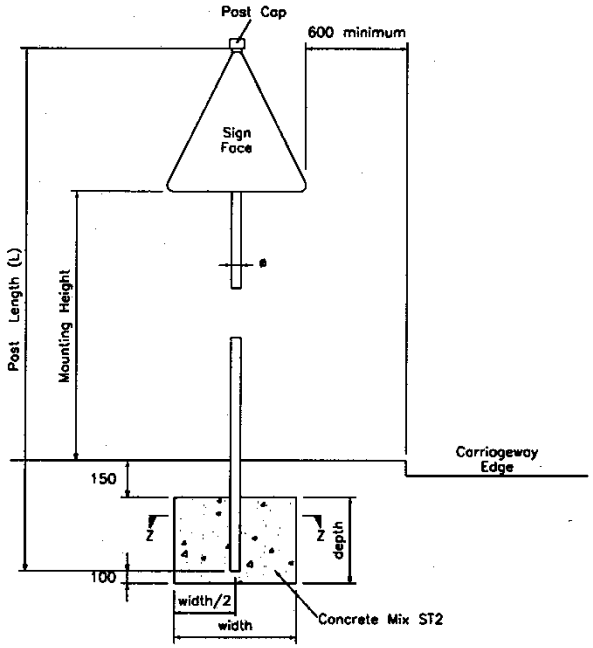
14.17 Two keys per locked traffic sign housing or feeder pillar shall be provided.

14.18 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.

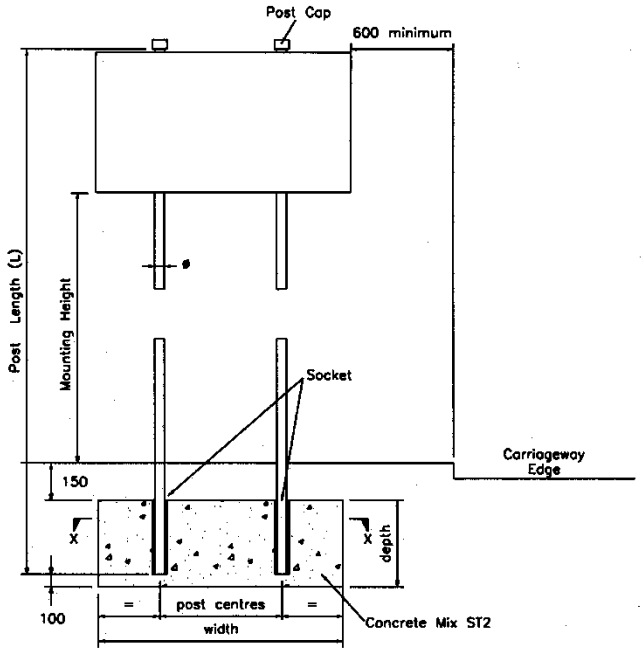
14.19 An internal baseboard of dimensions not less than 80 mm x 300 mm x 12 mm manufactured from substantially non-hygroscopic and rot-resistant material shall be fixed in the box and an earthing screw or bolt shall be provided. The distance from the face of the baseboard to the inside front of the housing shall be of sufficient size to allow installation of a suitable cut out. A suitable cable entry shall be provided below ground level.

14.20 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.

14.21 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.



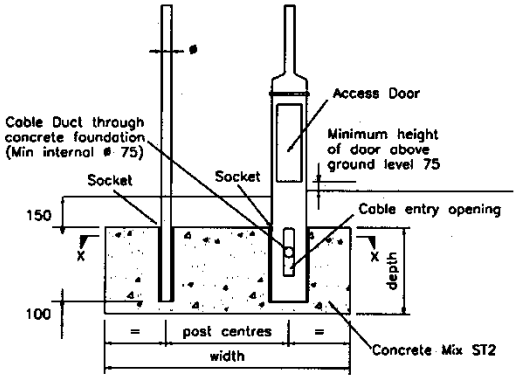
POST FOUNDATION DETAIL FOR UNLIT SIGN ON SINGLE POST



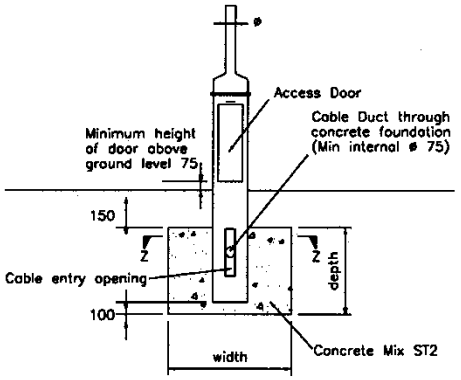
POST FOUNDATION DETAIL FOR UNLIT SIGN ON DOUBLE POSTS

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.

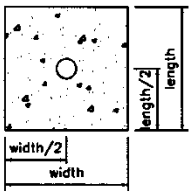


POST FOUNDATION DETAIL FOR LIT SIGN ON DOUBLE POSTS

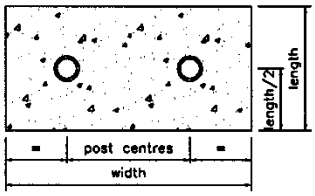


POST FOUNDATION DETAIL FOR LIT SIGN ON SINGLE POST

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 The location and type of permanent road marking to be removed shall be confirmed with the Project Manager prior to the commencement of work. The removal of road markings on surfaces that will continue to be used by traffic shall be undertaken in a manner that will avoid damage to the surface. Any residual effects shall be minimised to the satisfaction of the Overseeing Organisation.

2 All the road markings shall comply with BS EN 1436:2018, Traffic Signs Regulations and General Directions 2016 and Chapter 5 Traffic Signs Manual.

3 All permanent road markings shall be either thermoplastic material in accordance with BS EN 1871 or solvent-based Methyl Methacrylate (MMA) system. They should have been tested in road trials to the Roll-over class P5 in accordance with the procedure Stated in BS EN 1824 to demonstrate compliance with the performance requirements shown in Tables 12.3.1 – 12.3.4 below. Use of MMA system for rib line marking is not permitted.

4 The application of MMA product should follow the manufacturer's guidelines for installation (weather and temperature constraints, etc.). As the technology is undergoing active commissioning within Highways England, the use of MMA product requires a departure from standard approval by the Overseeing Organisation.

5 Unless otherwise stated, all new permanent flat line road markings shall be white, minimum skid resistance of 55, reflectorised and have the road performance properties specified in Tables 12.3.1 and 12.3.4 below and defined in BS EN 1436:2018 for the period of the functional life starting from the date of application or when the road is trafficked, whichever is later.

Property	BS EN 1436 Reference	Requirement	Value
Colour	Table 6, Corner points	White	x, y co-ordinates given
Luminance Factor	Table 2, Classes of luminance for dry markings	Class B3	0.4
Skid Resistance	Table 7, Classes of Skid resistance	Class S1	55
Retroreflectivity, Dry	Table 3, Classes for RL, dry road markings	Class R4	200
Retroreflectivity, Wet	Table 4, Classes for RL, wet road markings	Class RW3	50

Table 12.3.1 Properties of Road Markings (flat line, machine laid)

Property	BS EN 1436 Reference	Requirement	Value
Colour	Table 6, Corner points	White	x, y co-ordinates given
Luminance Factor	Table 2, Classes of luminance for dry markings	Class B3	0.4
Skid Resistance	Table 7, Classes of Skid resistance	Class S3	55
Retroreflectivity, Dry	Table 3, Classes for RL, dry road markings	Class R4	200
Retroreflectivity, Wet	Table 4, Classes for RL, wet road markings	Class RW3	50

Table 12.3.2 Properties of Road Markings (flat line, large areas, hand laid)

6 Drainage gaps shall be provided within all raised rib markings to diag.1012.2, to promote free surface water drainage. Drainage gaps of 100-150 mm shall be provided at intervals of approximately 36m where the longitudinal fall is flatter than 1 in 150. The spacing of transverse raised ribs shall be 500 mm for the mainline and 250mm for slip roads as specified in the road marking schedule and general arrangement drawings.

7 Unless otherwise stated all new permanent raised rib markings shall be white, minimum skid resistance of 55, reflectorised and have the road performance properties specified in Table 12.3.3 and defined in BS EN 1436:2018 for the period of the functional life starting from the date of application or when the road is trafficked, whichever is later.

Property	BS EN 1436 Reference	Requirement	Value
Colour	Table 6, Corner points	White	x, y co-ordinates given
Luminance Coefficient	Table 1, Classes of Qd for dry road markings	Class Q4	160
Skid Resistance	Table 7, Classes of Skid resistance	Class S1	45
Retroreflectivity, Dry	Table 3, Classes for RL, dry road markings	Class R4	200
Retroreflectivity, Wet	Table 4, Classes for RL, wet road markings	Class RW3	50

Table 12.3.3 Properties of Road Markings (Raised Rib Markings)

8 Embossed Thermoplastic road markings shall be white, minimum skid resistance of 55, reflectorised and have the road performance properties specified in Table 12.3.4 and defined in BS EN 1436:2018 for the period of the functional life starting from the date of application or

when the road is trafficked, whichever is later. The depth of embossing shall be no more than 6 mm.

Property	BS EN 1436 Reference	Requirement	Value
Colour	Table 6, Corner points	White	x, y co-ordinates given
Luminance Coefficient	Table 1, Classes of Qd for dry road markings	Class Q4	160
Skid Resistance	Table 7, Classes of Skid resistance	Class S3	55
Retroreflectivity, Dry	Table 3, Classes for RL, dry road markings	Class R4	200
Retroreflectivity, Wet	Table 4, Classes for RL, wet road markings	Class RW3	50

Table 12.3.4 Properties of Embossed Thermoplastic Road Markings

9 Permanent road marking materials shall not be used as temporary markings on surface courses that will form part of the permanent works.

Temporary road markings

10 Where temporary road markings or studs are to be used, they shall be reflectorised and meet all requirements of the specification and this appendix. Additionally, they shall be type approved by the Department for Transport for their intended use. The products will be used in accordance with the manufacturer's application instructions and shall be removed prior to the completion of works. Where temporary road markings are to be used on surfaces that will continue to be used by public traffic after their removal, any shadow trace remaining after their removal shall be permanently obliterated to the satisfaction of the Project Manager.

11 Except where otherwise permitted by the Project Manager no temporary covering of road markings or studs will be permitted. Where road markings or studs conflict with temporary road markings for traffic management, they shall be removed. When road markings or studs are removed, this shall be carried out in accordance with the SHW Series 1200 and this Appendix.

Temporary removal of road markings

12 Road markings shall only be removed by scabbling technique.

Temporary removal of road studs

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

Road Studs

14 Locations will be specified in the Scope.

15 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.

16 All road studs on a public road in the UK must fully comply with the Traffic Signs Regulations and General Directions 2016 (TSRGD) Directions 57 and 58 and the classes prescribed therein through testing and certification to BS EN 1463-1:2009 and BS EN 1463-2:2000.

17 All road studs shall be laid in accordance with manufacturer's specifications.

APPENDIX 12/4 TRAFFIC SIGNS: CONES, CYLINDERS, FLAT TRAFFIC DELINEATORS (FTDS) AND OTHER TRAFFIC DELINEATORS

1 Traffic cones, cylinders and Flat Traffic Delineators (FTDs) shall be manufactured, tested and certified in accordance with BS EN 13422.

2 The Contractor shall comply with the requirements and recommendations of the following publications:
- Regulation 56 of Traffic Signs Regulations and General Directions 2002 (TSRGD);
- Traffic Signs Regulations and General Directions 2016 (TSRGD)
- Traffic Signs Manual Chapter 8 (part 1) road works and temporary situations – design (2009);
- Traffic Signs Manual Chapter 8 (part 2) road works and temporary situations – operations (2009);
- Safety at Street Works and Road Works A Code of Practice;
- Clause 1214 of the Specification for Highway Works.

3 The requirements, sampling rate and method of testing cones, cylinders, FTDs and other delineators shall be in accordance with SHW Clause 1214.21 to 1214.56 and Appendix 1/5.

4 The Contractor shall submit to the Overseeing Organisation a copy of a test certificate confirming that samples of the identical type of cone, cylinder, FTD or delineator as those to be used in the Works and supplied as permanent cones, cylinders, FTDs or delineators under the Contract, have been tested and found to comply with SHW Clause 1214.1 to 1214.18.

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.

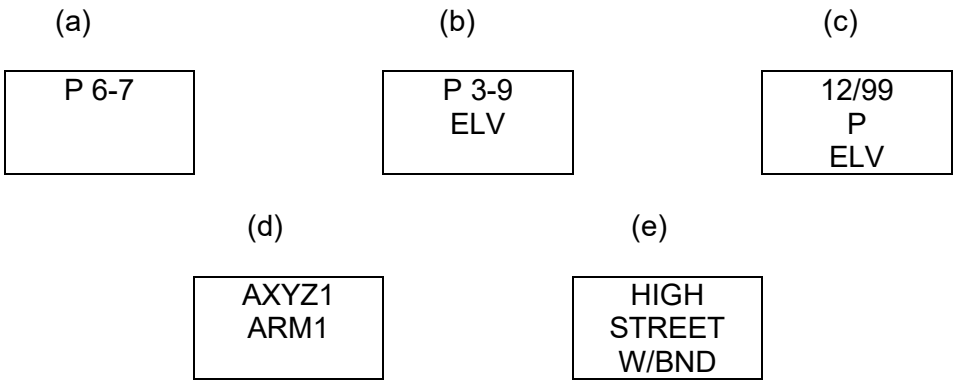
1. Traffic Signals Cable Identification

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:-

- Low Voltage Signal Cables – The tag shall be red and shall be marked with the numbers on the post, serviced by the cable.
- 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.
- 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.
- 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:-

- 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.

- 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

- 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 Scope. 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 Scope.

5 The foundation types are to be planted or flange plate. The Contractor shall design 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 in accordance with manufacturer's instructions. For planted column types the soil types in accordance with EN 40 shall be Average unless otherwise stated in the Scope.

7 Lighting columns installed within embankments shall have a bespoke retaining solution that will be identified in the Scope.

8 Protection system for steel columns shall be G2a unless otherwise stated in the Scope.

9 The root section of passive safe columns shall be protected with a black or grey anti-corrosion protective adhesive tape, Coroplast, in accordance with DIN EN 60 454-3-1, which shall be bonded to the outer surface of the column to a height of 250mm above ground level and shall be such that no ground or water course pollution is able to react with the outer surface of the aluminium tube. All materials shall be UV stabilized and resistant to chemical reaction. The base of passive safe columns shall have a Low Density Polyethylene (LDPE) protector fitted to prevent damage to the root protection during installation and provide further mechanical protection during the life of the column.

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 Scope. 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 90o 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 Scope.

15 During any inspection of the Works the Contractor shall provide adequate illumination such that there is a light intensity of 200 lux minimum over the area being inspected.

16 Lighting and all other electrical equipment within the working area shall be flameproof equipment supplied at a voltage not exceeding 110 volts.

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

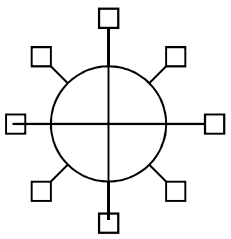
Column nominal height	(m)
Column Material	
Material Design Strength	(N/mm^2)
No. of door openings	
Door opening size – Height	(mm)
Door opening size – Width	(mm)

Cross section of base compartment

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

Acceptable positions of bracket arms relative to door position

Door Opening



Any

Manufacturer's drawing ref. no.

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 (mm^2), 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

Diameter of concrete surround (if any)

Flange plate

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

Relevant forces and moments at ground level

Line of action of max. moment relating to door opening

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

APPENDIX 13/2 – TYPICAL LIGHTING COLUMN AND BRACKET DATA - SHEET 2

(11/03) **Part C Acceptable Luminaires**

Luminaire: Maximum Characteristics

			(11/04) Terrain Categories as defined in BS EN 40-3-1				
			I	II	III	IV	
		Luminaire Max Wt (kg)	(11/04) Maximum Windage Area (m²) for Terrain Categories as defined in BS EN 40-3-1				
Post Top Column	Luminaire Connection: Diameter	Luminaire Connection: 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: Grade	Material: Design Strength (N/mm²)	Luminaire Fixing Angle	Luminaire Connection: Diameter (mm)	Luminaire Connection: Length (mm)	Luminaire Maximum Wt (kg)	(11/04) Maximum Windage Area (m²) for Terrain Categories as defined in BS EN 40-3-1

Double 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: Grade	Material: Design Strength (N/mm²)	Luminaire Fixing Angle	Luminaire Connection: Diameter (mm)	Luminaire Connection: Length (mm)	Luminaire Maximum Wt (kg)	(11/04) Maximum Windage Area (m²) for Terrain Categories as defined in BS EN 40-3-1

Part D Certification

It is certified that the information given in this Data Sheet has been obtained in accordance with Departmental Standard BD 26 (DMRB 2.2.1) and the Specifications.

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

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

General Information

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 selected from BS EN 40-2 as appropriate.

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.

17 The luminaire 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 using AutoCAD or a suitably agreed equivalent as agreed with the Overseeing Organisation for each Scope. The Contractor shall provide drawings in both DWG and PDF. The number of copies will be as stated in the Scope.

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 Scope.

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 Scope.

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 Scope.

APPENDIX 14/3: TEMPORARY LIGHTING

General

1 In an existing lit area, the level of road lighting shall be maintained during the works on any trafficked carriageways. The scheme specific Specification should detail which sections of the highway forming part of the works have road lighting.

2 Where crossovers are in use, temporary lighting shall be erected and maintained in compliance with Clause 1405.

3 Existing street lighting shall not be disconnected until either a temporary lighting system in accordance with Clause 1405 or new permanent lighting has replaced it. The temporary lighting shall remain operative until the new permanent lighting is brought into use.

4 If night time working is in progress and the working area is to be floodlit, special precautions to avoid dazzle from vehicles and plant to traffic on the adjacent lanes or carriageway shall be taken, in addition to the requirements of clause 1405.

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 Scope. General requirements are stated below.

2 BS 5489-1 lighting class requirements shall be as stated in the Scope.

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 Scope.

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 the Scope.

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 IEC, 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 IEC 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 Scope.

11 All LED life extrapolations must be based upon the Illuminating Engineering Society (IES) standard LM-80 provided by the LED source manufacturer.

12 The LED source manufacturer must 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 must 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^{o}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^{o}C with the LED chipset installed within the luminaires.

17 Any testing undertaken, or data acquired at lower temperatures, or indeed based upon LED manufacturer's lifetime projections calculated at a nominal LED junction temperature (Tj) for example must 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 + BS EN 1559-1 + BS EN 1559-4 LM6 (BS EN 1706 / 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 -5º, 0º, +5º
- Post top tilt angle 0º, +5º

26 Luminaire maximum upward light output ratio (ULOR) shall be a maximum of 0% when mounted in a horizontal position. The luminaire must 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 must be adhered to for all luminaires unless stated in the Scope.

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 Scope.

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 Scope.

46 Feeder pillars shall be suitably sized for the equipment described in the Scope 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 Scope.

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 Scope 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 CE Certificate or Declaration of performance to demonstrate compliance with EEC regulations.

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 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 Scope.

59 No underground jointing will be allowed unless specified within the Scope.

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 Scope.

Chambers

61 Chambers shall be MCX Type A, B, C or D and as outlined in the Scope.

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 Scope.

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 Highways England 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 Highways England strategic road network and the requirements for facilitating connection into either the MoRLiCS CMS systems will be identified in the Scope.

67 Notwithstanding this and as a minimum all LED lighting units to be installed on the Highways England 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 Scopes 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 Scope.

2 Requirements for wiring and installation of components within posts and Lit Sign Units shall be as described in the Scope.

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 Scope;
- 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 Scope; 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

APPENDIX 15/2: CABLE DUCT REQUIREMENTS

1 The quantity and size of ducts required are in the Scheme Information.

2 Cable ducts shall comply with SHW Series 1500. For any other requirements for cable duct refer to the Scope.

3 If existing cable ducts are proposed for reuse by the Contractor, they shall prove these ducts prior to installation to ensure they are fit for purpose, as agreed with the National Roads Telecommunications Services (NRTS) representative.

4 Where cable ducts for communication cables run close to road lighting cables or cable ducts for road lighting cables, a minimum separation of 500mm in both the horizontal and vertical planes shall be maintained. Where there are areas of restricted verge that represent 'pinch points' where the 500mm separation cannot be achieved, including any overbridges and underbridges, then the Contractor shall provide the Overseeing Organisation with a schedule of these locations such that appropriate liaison and agreement can be made with third parties prior to the works commencing

5 The longitudinal duct route shall be nominally 3m offset from the edge of carriageway. Where the offset or the depth needs to change at gantry and cabinet sites the ducts shall be swept with a minimum bend radius of 2.5m

6 Where ducts are laid across or within 500 mm of filter drains or safety fence, the ducts shall be surrounded with 150 mm of ST2 concrete in compliance with Clause 2602. Where a duct crosses a filter drain it may be necessary to provide additional drainage capacity or other measures to compensate for the volume occupied by the duct and associated concrete surround. The Contractor shall provide the Overseeing Organisation with details of the proposed arrangements for additional capacity or other measures for acceptance at least 2 weeks prior to the installation of any ducts. In the event that a duct route coincides with the line of a safety fence or filter drain an alternative duct line shall be determined. Any damage caused by the Contractor to existing drains shall be satisfactorily repaired and reinstated at no cost to the Overseeing Organisation

7 The Contractor shall install Longitudinal and Local cable ducts in accordance with the requirements of HA drawing no. MCX 0814. For locations where the 600mm minimum depth of cover for Longitudinal Ducts (as shown on drawing no. MCX 0814 sheet 1) cannot be achieved, the Contractor shall protect the ducts with ST2 concrete to Clause 2602, thickness of ST2 concrete cover being 200mm. The Contractor shall produce a schedule of locations where this is the case, for approval by the Overseeing Organisation and NRTS.

8 Ends of ducts shall be perpendicular with the inside walls of chambers. The circularity of the ducts within the chambers shall also be checked with a mandrel to ensure that the ducts can be properly sealed with duct plugs. Any ducts failing the mandrel test shall be broken out and rebuilt into the chamber wall.

9 The Contractor shall provide a schedule of all duct plugs and inserts required by reference to the Contract Cable and Duct Schematic drawings. This information shall be provided by the Contractor to the Overseeing Organisation not less than 14 days prior to the installation of ducting.

10 The Contractor shall note that carrier and other types of drains exist within the central reserve and verge. Suitable replacement materials will be held by the Contractor on Site to effect any necessary remedial action in the event that the drains are disturbed, damaged or contaminated

during the excavation works

11 The Contractor shall expect third party inspection of all longitudinal and some local duct installations. This third party (NRTS) will require access to site to witness mandrel and air testing – the frequency of these visits will be agreed with the Overseeing Organisation prior to the duct installation works commencing on site.

Installation of cable ducts beneath carriageway

12 Subject to proving each duct as per Clause 1533, existing cross carriageway ducts are to be utilised at the locations identified in the Scope.

13 New cross carriageway ducts shall be provided at the locations identified in the Scope. All locations shall be provided with a minimum of 4x100mm duct unless otherwise stated in the Scope.

14 Each new cross carriageway duct shall have four (or other quantity if stated in the Scope) 100mm diameter UPVC duct inserts (or as detailed in the Scope) to BS EN 13598-1 or BS EN1401-1 or BS 3505 (Class C) or BS 3506 (Class C). Where communications cross-carriageway ducts are 'co-located' with those required for lighting power supplies, at least a 500mm (horizontal and vertical) duct separation shall be maintained.

15 Ducts shall terminate within chambers at the locations shown in the Scope and in accordance with the MCX 0800 series drawings.

16 Transverse Cable Ducts shall be constructed or existing transverse ducts extended in accordance with the requirements of HA drawing no. MCX 0814 sheet 3. The Contractor shall note the requirements of Note 2 on MCX 0814 sheet 3 relating to ducts installed by trenchless techniques.

17 The Contractor shall excavate drive and reception pits for duct installation in accordance with Series 600 of the Specification for Highway Works and Appendix 6/3.

Testing (ducts)

18 The installation of cables shall not commence until construction has been completed and tested to the satisfaction and approval of the Overseeing Organisation of the respective ducts, chambers, cabinets or telephone posts into which cables are to be installed. Cable ducts shall be pressure tested in accordance with SHW Clause 1533.3 before cable installation commences.

APPENDIX 24/1: BRICKWORK, BLOCKWORK AND STONEWORK

Unless specified otherwise the following shall apply:

1 Mortar shall be designation (ii) comprising Portland cement complying with BS EN 197-1.

2 Bricks beneath frames for chambers and gullies and for the construction of brick chambers shall be HD type Class B clay engineering bricks conforming to BS EN 771-1 and performance characteristics given in Table 24/2 of SHW Series 2400.

3 All exposed pointing shall be bucket handle.

APPENDIX 26/1: ANCILLARY CONCRETE

1 Concrete mixes referred to in the Scope as ST followed by a number shall mean concrete for ancillary purposes which shall comply with SHW Clause 2602.

2 Concrete for ancillary purposes shall be a standardised prescribed concrete complying with BS EN 206-1 and BS 8500 and with the additional requirements of SHW Clause 2602.

3 For any special requirements for ancillary concrete eg. sulfate-resisting cement, etc., the Contractor shall refer to the Scope.

4 Unless stated otherwise in the Scope, the standardised prescribed concrete used for each purpose shall be as described in Table 26/1-1 below.

Purpose	Standardised prescribed concrete
1 Footings for fence posts and augered foundations for traffic sign posts	ST2
2 Foundations for environmental barrier posts and planted lighting columns	ST5
3 Blinding concrete, backfill for structural foundations, overdig of post holes and preparation of formation to Clause 616	ST1
4 Bedding and backing to precast concrete kerbs, channels, edgings and quadrants	ST1
5 Bed to drains Type A#. Foundations, channels and benching to chambers	ST4
6 Bed, haunch and surround to drains other than Type A#. Surround to chambers and gullies	ST2

Refer to HCD drawing number F1 and F2

Table 26/1-1 Concrete for ancillary purpose

5 Alternative designated mixes as equivalent to the standard prescribed mixes will need to be agreed with the Overseeing Organisation.

6 Concrete shall be transported and placed so that contamination, segregation and loss of materials does not occur. The maximum temperature of the concrete at any time between mixing and placing shall be no greater than 30°C. Concrete shall be placed and compacted within two hours of mixing. After compaction it shall not be disturbed within 12 hours.

7 Compacting the concrete for ancillary purpose shall be in accordance with SHW Clause 2602.

8 Unless otherwise described in the Scope, the surface finishes shall comply with SHW Clause 2602.

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/mm^2 at 24 hours at 5 °C;
b) 40 N/mm^2 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/mm^2.

(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/mm^2.

APPENDIX 26/3: CORED THERMOPLASTIC NODE MARKERS

1 Locations of node markers will be as shown in the Scope.

2 Node markers are to be installed at all CHART nodes, link and section ends. The position of the CHART nodes shall be in accordance with Trunk Road Maintenance Manual Volume 1.

3 Any changes to existing positions and provision will be agreed between Project Manager, Design Team and Contractor.

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

1 Unless otherwise agreed by the Environmental Clerk of Works, grass seed shall be sown during autumn 1st September to 31st October or spring 1st March – 31st May.

2 Immediately prior to sowing or hydraulic seeding or laying turf the upper 50 mm of soil shall be reduced to a fine tilth by use of a chain harrow or other suitable plant. Refer to the Scope for the locations.

3 If required, fertiliser or other soil ameliorants shall be evenly incorporated into the upper 50 mm of soil during final cultivations. Unless stated otherwise in the Scope, the rate of application of fertiliser is 75g/m^2.

4 For grass mixture(s) to be sown is(are), refer to the Scope. Grass seed shall comply with BS 4428. The Contractor shall also provide written evidence that seeds are to be native to the UK and of local provenance.

5 Grass seed shall be a tested mixture and certificates of germination and purity obtained from an Official Seed Testing Station not more than six months prior to sowing shall be provided to the Overseeing Organisation before sowing, together with the names of the varieties used in the mixture. The information on seed certificates and seed bag labels shall correspond.

6 Sowing shall be carried out by evenly distributing the seed at a rate of not less than 20 g/m^2 for side slopes of embankments and cuttings and not less than 15 g/m^2 elsewhere.

7 Sowing shall be immediately followed by lightly raking the surface of the soil to cover the seeds, by use of a chain harrow or other suitable plan

8 The seeding shall be repeated as necessary until an evenly distributed dense sward is established over the seeded area. The Contractor shall allow for maintenance of all grass areas in accordance with Clause 3007 until this has been achieved. Establishment shall be regarded as achieved when at least 80% of quadrant sub-divisions are recorded as ‘filled’ when tested in accordance with Annex A3 of BS 3969.

9 For newly established grass, it shall be two cuts during the first growing season or as advised by the Environmental Clerk of Works at times and using machinery to the approval of the Environmental Clerk of Works. The first mowing shall be carried out once the grass has reached a height of 100 mm, the second and any subsequent establishment cuts when it has re-grown to 100 mm. Where wheeled vehicles are used they must be fitted with low pressure tyres. All arisings from grass cutting to be removed from site.

APPENDIX 30/12: SPECIAL ECOLOGICAL MEASURES

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