



PERSIMMON HOMES THAMES VALLEY
NORTH LITTLEHAMPTON SITE
LYMINSTER SOUTHERN BYPASS
LITTLEHAMPTON, WEST SUSSEX

S38/278 AGREEMENT HIGHWAY WORKS
SPECIFICATION

SEPTEMBER 2019

REVISION P7

Ref: PHLY-MB-S278-GF-SP-D-301

the journey is the reward

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Project Code:	A/PHLYM2
Prepared by:	JS/AB
Checked by:	AB
Issue Date:	September 2019
Status:	FOR APPROVAL

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Summary of Revisions

P1 - First Issue (PBA input in purple)

P2 - (30/7/18) – Amended to accommodate PBA input and to accommodate WSCC comments dated 22/6/18

- * Preamble - Note 12 added.
- * Appendix 0/1 – Clauses 20AR, 14AR, 15AR and 16AR added.
- * Appendix 0/3 – Updated.
- * Appendix 0/4 – PBA drawing list updated.
- * Appendix 1/4 – Section 1.4.1 added.
- * Appendix 1/5 – Minor amendments to Table in Series 600.
- * Appendix 1/7 – Note 2 (h) added.
- * Appendix 1/10 – Added.
- * Appendix 1/11 – Added.
- * Appendix 1/21 – Note 2(a) amended
- * Appendix 3/1 – Notes 5 to 8 added.
- * Appendix 4/1 – Added.
- * Appendix 4/2 – Added.
- * Appendix 6/1 – Note 11 added. Minor amendments to Table including additional notes 7 and 8.
- * Appendix 6/3 – Notes 9 to 16 added.
- * Appendix 6/5 – Note 1 deleted, appendix not required.
- * Appendix 6/6 – Notes 4 to 7 added.
- * Appendix 6/7 – Notes 6 and 8 amended, References to Geotextile material deleted. Notes 9 and 10 added.
- * Appendix 6/9 – Formatting corrected. New Note 2 added
- * Appendix 7/1 – References to Geotextile material deleted. Fitzalan Link Spec amended to WSCC standard.
- * Appendix 11/1 – Note 2.6 added.
- * Appendix 12/1 – Note 10 amended.
- * Appendix 12/3 – Notes 4 and 5 amended.
- * Appendix 12/5 – Note 3 added.
- * Appendix 13/1 – Note 3 amended to include 'and factory applied'.
- * Appendix 13/1 – Note 4 amended to read 'Numbers shall be as indicated on the SSE drawings'.
- * Appendix 14/1 – Note 4 amended from 'our' to 'the WSCC'.
- * Appendix 14/4 – 6(a) and 6(b) amended to refer to SSE drawings for numbering.
- * Appendix 17/1 – Added.
- * Appendix 17/3 – Added.
- * Appendix 17/4 – Added.
- * Appendix 17/5 – Added.
- * Appendix 20/1 – Added.
- * Appendix 21/1 – Added.
- * Appendix 26/1 – Reference to Type Z deleted.
- * Appendix 90/1 – Added.
- * Schedule B - Sign Faces - Updated

P3 - (13/08/18) – Amended to include PBA Input received 6/8/18 and other minor revisions.

- Appendix 0/4 Fo3 removed, WYG drawings added., PBA drawing list updated, WSCC detail 011/1 added, MB drawing list updated.
- Appendix 1/1 Increased to space for two engineers.
- Appendix 1/4 Requirements added
- Appendix 1/5 Note 2 added, requested by PBA
- Appendix 1/10 Table item 5 amended 11 added
- Appendix 3/1 Note 8 amended
- Appendix 5/1 Petrol interceptor renames Bypass separator. Vortex separator added. Attenuation crates spec amended. Alternatives products require WSCC approval.
- Appendix 6/1 Table 6/1 amended to better match PBA GDR rev3
- Appendix 7/1 SC1 spec amended to require PSV68+ on high speed/volume approaches
- Schedule A Additional manufacturers information added.
- Schedule B Signs updated.

P4 - (16/11/18) – Amended to include PBA Input received 6/8/18 and other minor revisions.

- Preamble Table 0/1 updated.
- Appendix 0/4 Detail S278/38/06, F/05, F/06 and F/07 added. PBA dwg 35944/2001/012 added. TK2 title amended.
- Appendix 5/1 Filter drain and subsoil drains removed.
- Appendix 5/5 Notes 2 and 3 amended.
- Appendix 6/1 Tale updated
- Appendix 6/5 Note 1 reinstated.
- Appendix 6/7 Notes 4 and 8 amended.
- Appendix 6/14 Table added.
- Appendix 7/1 Geotextile added
- Appendix 11/1 KT6 amended, KT7 and R added. Footway sub-base increased. Grasscrete spec included.
- Schedule A Enviro kerb + Bedding Mortar Data sheets added.
- Schedule B Signs updated.
- Schedule C Updated to include design standards.

P5 - (17/04/19) – Amended following WSCC comments # 3 received dated 14/01/19

- Appendix 0/4 NR Front End pack removed, PBA advised not required.
- Appendix 1/1 'and Network Rail' added, as requested by F+G.
- Appendix 1/5 Notes 1 and 5 amended to include Project Manager, as requested by F+G. Testing tables updated.
- Appendix 1/6 Note 1 amended to include Project Manager and Network Rail, as requested by F+G.
- Appendix 1/7 Note 2(h) amended to include and other unauthorised persons, as requested by F+G.
- Appendix 1/17 Note 3(ii) amended to include 'a minimum of' as requested F+G.
- Appendix 1/18 Note 1 amended to include Project Manager and Highway Authority.
Note 2 amended to include 'a minimum of' as requested F+G.
- Appendix 1/19 Note 1(a) and 2(d) amended to include Network Rail, as requested by F+G.

- Appendix 2/2 Note 5 amended.
- Appendix 3/1 Note 3 amended to include 'a minimum of', as requested by F+G.
- Appendix 5/1 Notes 3, 14, 15, 16 and 17 amended to include ref to Project Manager.
 Note 16 amended to include or similar approved, as requested by F+G.
- Appendix 5/2 Note 4 amended to refer to Project Manager, as requested by F+G.
- Appendix 6/3 Notes 5 and 8 amended as requested F+G.
- Appendix 6/5 Note 1 amended as requested by F+G.
- Appendix 6/11 Note 2(f) added, as requested by F+G.
- Appendix 6/12 Note 4 amended, as requested by WSCC and F+G.
- Appendix 7/6 Notes 1.2, 2.2 and 2.3 amended to refer to Project Manager and/or highway Authority, as requested by F+G.
- Appendix 11/1 Note 2.2 amended to include 'approved'. Note 3.1 amended to include 'or similar approved'.
- Schedule B Sign face TS307 and 308 mounting height increased.

P6 - (23/07/19) – Amended following WSCC Meeting 3/6/19

- Appendix 1/5 Note 10 amended to omit Clegg Hammer
- Appendix 5/1 Note 14 amended to refer to details F04 and F05.
- Schedule B Sign faces TS403 and TS403F amended mounting height. TMP01 mounting height amended. Signs TS444 to 455 added.
- Schedule D Updated to latest WSCC version.

P7 - (05/09/19) – Amended following comments from WSCC

- Appendix 0/4 Drawing lists updated
- Appendix 3/1 Note 4 amended
- Appendix 5/1 Vortex Separator removed
- Schedule A Amended to remove Vortex Separator / Downstream Defender
- Schedule B Sign face 305 to 312 and 407 to 414

Preamble to the Specification (Rev P4, 18/11/18)

- 1 The Specification referred to in the Tender shall be the 'Specification for Highway Works', published by the Stationery Office (formerly HMSO) as Volume 1 of the Manual of Contract Documents for Highway Works, as modified and extended by the following:
 - (i) Appendix 0/1: Contract-specific Additional, Substitute and Cancelled Clauses, Tables and Figures;
 - (ii) Appendix 0/2: Contract-specific minor alterations to existing Clauses, Tables and Figures;
 - (iii) The Numbered Appendices listed in Appendix 0/3;
 - (iv) Appendix 0/5: Special national alterations of the Overseeing Organisation of Scotland, Wales or Northern Ireland. 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.
- 3 An Additional Clause as indicated by a suffix 'A' in Appendix 0/5 is an alteration originating from the Overseeing Organisation of Scotland, Wales or Northern Ireland. 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 'S' in Appendix 0/5 is an alteration originating from the Overseeing Organisation of Scotland, Wales or Northern Ireland. A Substitute Clause as indicated by a suffix 'SR' in Appendix 0/1 is a Contract-specific alteration.
- 5 A Cancelled Clause as indicated by a suffix 'C' in Appendix 0/5 is an alteration originating from the Overseeing Organisation of Scotland, Wales or Northern Ireland. A Cancelled Clause indicated by a suffix 'CR' in Appendix 0/1 is a Contract-specific alteration.
- 6 Insofar as any of the Numbered Appendices may conflict or be inconsistent with any provision of the Specification for Highway Works the Numbered Appendices shall always prevail. Additionally, Numbered Appendices 0/1 and 0/2 shall take precedence over Numbered Appendix 0/5.
- 7 Any reference in the Contract to a Clause number or Appendix shall be deemed to refer to the corresponding Substitute Clause number or Appendix listed in Appendix 0/1, 0/2 or 0/5.
- 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 Where a Clause in the Specification is prefixed by an # this indicates that this particular Clause has a substitute National Alteration for one or more of the Overseeing Organisations of Scotland, Wales or Northern Ireland. Substitute or additional National Clauses shall be used within countries to which they specifically apply and they are deemed to replace corresponding Clauses in the main text of the Specification as appropriate. The substitute National Clauses are located at the end of the relevant Series together with the additional National Clauses of the Overseeing Organisations.
- 12 The Works shall be carried out in accordance with the requirements of the Highways Agency Manual of Contract Documents for Highway Works Volume 1: Specification for Highway Works dated March 1998 with all current amendments (May 2018), hereinafter referred to as the SHW, together with the Appendices to the Specification included in this document.

(05/18) **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	May 2018
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 to 24F	May 2017
500	23 to 24, 26	November 2004
500	28F	May 2005
500	3, 22, N1F	May 2006
500	2, 5, 27	November 2006
500	6, 25	November 2007
500	1, 4, 7 to 21	November 2009
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 to 31F	February 2016
900	1 to 77F	May 2018
1000	1 to 45F	February 2016
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

(65/18) **TABLE 0/1 SCHEDULE OF PAGES AND RELEVANT PUBLICATION DATES (Cond.)**

Series/Appendix	Page Number	Publication Date
1700	1 to 27F	December 2014
1800	1 to 35F	August 2014
1900	1 to 35F, S1 to S2F	August 2014
2000	1, 3 to 4F	May 2001
2000	2	November 2004
2100	1 to 2F	February 2016
2300	1	March 1998
2300	2 to 3F	May 2001
2400	1, 4, 7F	May 2005
2400	2	May 2006
2400	3, 5 to 6	May 2008
2500	1	May 2001
2500	2, 8, 11F	November 2003
2500	10	November 2004
2500	6 to 7, 9	May 2005
2500	5	May 2006
2500	3 to 4	November 2006
2600	1	March 1998
2600	2 to 4	November 2003
2600	5	November 2004
2600	6	May 2005
2600	7F	November 2006
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
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 54F	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 (Rev P2, 30/07/18)

List of Additional Clauses, Tables and Figures

Clause No (etc.)	Title	Written on following Page No.
NONE		

List of Substitute Clauses, Tables and Figures

Clause No (etc.)	Title	Written on following Page No.
NONE		

List of Cancelled Clauses, Tables and Figures

Clause No (etc.)	Title	Written on following Page No.
NONE		

AS PROVIDED BY PPA

- (1) The following Scheme Specific Substitute, Additional and Cancelled Clauses are included in the Specification

602 General Requirements

20AR¹ The Contractor shall prepare a detailed method statement, risk assessment and plans, in advance of the commencement of the earthworks operations, demonstrating the process by which he will achieve the requirements of all sub-Clauses. These shall include details of all testing to be undertaken, details of method of the tests and the soils laboratory to be utilized for such.

608 Construction of Fills

14AR In addition to any grading requirements the maximum particle size of any fill material placed by method compaction shall be no more than two-thirds of the compacted layer thickness.

¹ A suffix 'AR' indicates a Contract-specific Additional Clause to the Specification.

15AR The Contractor shall ensure that fill comprises material from a single source only. Cohesive and granular materials shall be excavated, placed and compacted separately without intermixing; use of interbedded cohesive and granular fill is not acceptable.

16AR Where a sheep's foot or similar compaction plant is adopted the testing shall be undertaken on the layer below the layer being compacted. Where the tested layer fails to meet the required specification both layers and any further overlying layers shall be removed and reworked at the Contractor's expense.

Appendix 0/2 - Contract Specific Minor Alterations to Existing Clauses, Tables and Figures Included in the Contract (Rev P2, 30/07/18)

PART A: VOLUME 1 SPECIFICATION

Clause No (etc.)	Alterations to be made
903.21SR	For new pavement construction, all longitudinal joints in all layers shall be situated outside wheel-track zones. Where an existing road pavement is resurfaced, joints in the surface course shall coincide with either the lane edge, the lane marking, or the middle of a traffic lane, whichever is appropriate. Joints shall not coincide with the wheel path. For the purposes of this Clause, the wheel-track zones shall be taken to be between 0.5 m and 1.1 m and between 2.55 m and 3.15 m from the centre of the nearside lane markings for each traffic lane (or, in the absence of lane markings, lane edges). All joints shall be offset at least 300 mm from parallel joints in the layer beneath.

PART B: VOLUME 2 NOTES FOR GUIDANCE ON THE SPECIFICATION FOR HIGHWAY WORKS

Clause No (etc.)	Alterations to be made
NG 903.12SR	Joints should always be located in low stress areas of the pavement wherever practicable, as indicated in sub-Clause 903.21. However, where an existing road surface is being replaced, it is permitted to locate the longitudinal joints within the surfacing material in the middle of a traffic lane. This position should only be selected if positioning the joint under the lane edge or lane marking would result in significant areas of sound surface course material being unnecessarily replaced. Joints should never be placed in the wheel-track zones.'

Appendix 0/3 - List of Contract Specific Numbered Appendices Referred to in the Specification and included in the Contract (Rev P2, 30/07/18)

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'. Those identified by the letters T or C shall be completed by the Tenderer or Contractor respectively.

List 'A'

(05/14) List of Numbered Appendices Referred to in the Specification for Highway works

Page No.	Completed By	Appx. No.	Title
			<u>INTRODUCTION</u>
		0/1	Contract specific, Additional, Substitute and Cancelled Clauses, Tables and Figures Included in the Contract
		0/2	Contract specific Minor Alterations to Existing Clauses, Tables and Figures Included in the Contract
		0/3	List of contract specific Numbered Appendices Referred to in the Specification and included in the Contract
	Not used	0/4	List of drawings Included in the Contract
		0/5	Special National Alterations of the Overseeing Organisations of Scotland/Wales/Northern Ireland
			<u>PRELIMINARIES</u>
		1/1	Temporary Accommodation and Equipment for the Overseeing Organisation
	Not used	1/2	Vehicles for the Overseeing Organisation
	Not used	1/3	Radio Communication System for the Overseeing Organisation
		1/4	Working and Fabrication Drawings
		1/5	Working and Fabrication Drawings
		1/6	Supply and Delivery of Samples to the Overseeing Organisation
		1/7	Site Extent and Limitations on Use
		1/8	Operatives for the Overseeing Organisation
		1/9	Control of Noise and Vibration
		1/10	Permanent Works to be Designed by the Contractor
		1/11	Temporary Works Design
		1/12	Setting Out and Existing Ground Levels
		1/13	Programme of Works
	Not used	1/14	Payment Applications
		1/15	Accommodation Works
		1/16	Private and Publicly Owned Services and Supplies
		1/17	Traffic Safety and Management
		1/18	Temporary Highways for Traffic
		1/19	Routeing of Vehicles
	Not used	1/20#	Recovery Vehicles and Operation for Breakdowns
		1/21	Information Boards
		1/22	Progress Photographs
		1/23	Risks to Health and Safety
	Not used	1/24	Quality Management System

Page No.	Completed By	Appx. No.	Title
	Not used	1/25	Temporary Closed Circuit Television (CCTV) System for the Monitoring of Traffic
	Not used	1/27	Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Road Works (TASCAR)
			<u>SITE CLEARANCE</u>
	Not used	2/1	List of buildings, etc. to be Demolished or Partially Demolished
		2/2	Filling of Trenches and Pipes
		2/3	Retention of Material Arising from Site Clearance
		2/4	Explosives and Blasting
	Not used	2/5	Hazardous Materials
			<u>FENCING</u>
		3/1	Fencing, Gates and Stiles
			<u>ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)</u>
		4/1	Road Restraint Systems (Vehicle and Pedestrian)
		4/2	Information Required to demonstrate Compliance of Road Restraint Systems to BS EN 1317-1, BS EN 1317-2, BS EN 1317-3 and DD ENV 1317-4: 2002
			<u>DRAINAGE AND SERVICE DUCTS</u>
		5/1	Drainage Requirements
		5/2	Service Duct Requirements
	Not used	5/3	Surface Water Channels and Drainage Channel Blocks
	Not used	5/4	Fin drains and Narrow Filter Drains
		5/5	Combined Drainage and Kerb System
	Not used	5/6	Linear Drainage Channel Systems
	Not used	5/7	Thermoplastics Structural Wall Pipes and Fittings
			<u>EARTHWORKS</u>
		6/1	Requirements for Acceptability and Testing etc. of Earthworks Materials
		6/2	Requirements for Dealing with Class U1B and Class U2 Unacceptable Materials
		6/3	Requirements for Excavation, Deposition, Compaction (Other than Dynamic Compaction)
	Not used	6/4	Requirements for Class 3 Material
		6/5	Geotextiles Used to Separate Earthworks Materials
		6/6	Fill to Structures and Fill Above Structural Foundations
		6/7	Sub-Formation and Capping and Preparation and Surface Treatment of Formation
		6/8	Topsoiling
		6/9	Earthwork Environmental Bunds, Landscape Areas, Strengthened Embankments
	Not used	6/10	Ground Anchorages, Crib Walling and Gabions
		6/11	Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings
		6/12	Instrumentation and Monitoring
	Not used	6/13	Ground Improvement

Page No.	Completed By	Appx. No.	Title
		6/14 6/15	Limiting Values for Pollution of Controlled Waters Limiting Values for Harm to Human Health and the Environment (11/04)
			<u>ROAD PAVEMENTS – GENERAL</u>
		7/1	Permitted Pavement Options (Schedules 1, 2, 3, 4 and 5)
		7/2	Excavation, Trimming and Reinstatement of Existing Surfaces
	Not used	7/3	Surface Dressing – Performance Specification (Sheets 1, 2 and 3)
		7/4	Bond Coats, Tack Coats and Other Bituminous Sprays (Sheets 1, 2 and Binder Data Sheet)
	Not used	7/5	In Situ Recycling – The Remix and Repave Processes
		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
		7/9	Cold-Milling (Planning) 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
	Not used	7/13	Saw-Cut Crack and Seal Bituminous Overlays on Existing Jointed Concrete Pavements
	Not used	7/14	Preparation of Jointed Concrete Pavements Prior to Overlaying and Saw-Cut and Seal of the Bituminous Overlay
	Not used	7/15	Saw-Cut, Crack and Seal Existing Jointed Reinforced Concrete Pavements
	Not used	7/16	Cracking and Sealing of Existing Jointed Unreinforced Concrete Pavements and CBM Bases
	Not used	7/17	Cracking Plant and Equipment Progress Record
	Not used	7/18	Site Specific Details and Requirements for Cold Recycled Bitumen Bound Material
	Not used	7/19	Site Specific Details and Requirements for Recycled Cement Bound Material
	Not used	7/20	Not used
	Not used	7/21	Surface Dressing – Recipe Specification (Sheets 1, 2 and Binder Data Sheet)
	Not used	7/22	Repairs to Potholes
			<u>ROAD PAVEMENTS – CONCRETE AND CEMENT BOUND MATERIALS</u>
	Not used	10/1	Plant and Equipment for the Construction of Exposed Aggregate Concrete Surface
			<u>KERBS, FOOTWAYS AND PAVED AREAS</u>
		11/1	Kerbs, Footways and Paved Areas
	Not used	11/2#	Access Steps
			<u>TRAFFIC SIGNS</u>
		12/1#	Traffic Signs: General
	Not used	12/2	Traffic Signs: Marker Posts

Page No.	Completed By	Appx. No.	Title
			<u>TRAFFIC SIGNS (Continued)</u>
	Not used	12/3 12/4	Traffic Signs: Road Markings and Studs Traffic Signs: Cones, Cylinders, FTD's and Other Traffic Delineators
	Not used	12/5 12/6	Traffic Signs: Traffic Signals Traffic Signs: Special Sign Requirements on Gantries
			<u>ROAD LIGHTING COLUMNS AND BRACKETS, CCTV MASTS AND CANTILEVER MASTS</u>
		13/1#	Information to be Provided When Specifying Lighting Columns and Brackets
		13/2	(Specification for Highway Works) Typical Lighting Column and Bracket Data Sheets 1 and 2
		13/3	Instructions for Completion of Lighting Column and Bracket Data Sheets
	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
			<u>ELECTRICAL WORK FOR ROAD LIGHTING AND TRAFFIC SIGNS</u>
		14/1	Site records
		14/2	Location of Lighting Units and Feeder Pillars
		14/3	Temporary Lighting
	Not Used	14/4	Electrical Equipment for Road Lighting
		14/5	Electrical Equipment for Traffic Signs
			<u>MOTORWAY COMMUNICATIONS</u>
	Not used	15/1	Motorway Communications
	Not used	15/2	Cable Duct Requirements
			<u>PILING AND EMBEDDED RETAINING WALLS</u>
	Not used	16/1	General Requirements for Piling and Embedded Retaining Walls
	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

Page No.	Completed By	Appx. No.	Title
	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
			<u>STRUCTURAL CONCRETE</u>
		17/1	Schedule for the Specification of Designed Concrete
	Not used	17/2	Note used
		17/3	Concrete – Surface Finishes
		17/4	Concrete – General
		17/5	Buried Concrete
	Not used	17/6	Grouting and Duct Systems for Post-tensioned Tendons
	Not used	17/7	Precast Concrete Products
			<u>STRUCTURAL STEELWORK</u>
	Not used	18/1	Requirements for Structural Steelwork
			<u>PROTECTION OF STEELWORK AGAINST CORROSION</u>
	Not used	19/1	(Specification for Highway Works) Form HA/P1 (New Works) Paint System Sheet Requirements for Other Work
	Not used	19/2	Requirements for Other Work
	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
			<u>WATERPROOFING FOR CONCRETE STRUCTURES</u>
		20/1	Waterproofing for Concrete Structures
			<u>BRIDGE BEARINGS</u>
		21/1	Bridge Bearing Schedule
	Not used	22/1	Not Used
			<u>BRIDGE EXPANSION JOINTS AND SEALING OF GAPS</u>
	Not used	23/1	Bridge Deck Expansion Joints Schedule
	Not used	23/2	Sealing of Gaps Schedule (Other than in Bridge Deck Expansion Joints)
			<u>BRICKWORK, BLOCKWORK AND STONework</u>
	Not used	24/1	Brickwork, Blockwork and Stonework
			<u>SPECIAL STRUCTURES</u>
	Not used	25/1	Requirements for Corrugated Steel Buried Structures
	Not used	25/2	Requirements for Reinforced Soil and Anchored Earth Structures
	Not used	25/3	Requirements for Pocket – Type and Grouted – Cavity Reinforced Brickwork Retaining Wall Structures

Page No.	Completed By	Appx. No.	Title
	Not used	25/4	Environmental Barriers
	Not used	25/5	Requirements of Buried Rigid Pipes for Drainage Structures
			<u>MISCELLANEOUS</u>
		26/1	Ancillary Concrete
	Not used	26/2	Bedding Mortar
	Not used	26/3	Cored Thermoplastic Node Markers
			<u>LANDSCAPE AND ECOLOGY</u>
	Not used	30/1	General, sheets 1, 2 and 3
	Not used	30/2	Weed Control
	Not used	30/3	Control of Rabbits and Deer
	Not used	30/4	Ground Preparation
		30/5	Grass Seeding, Wildflower Seeding and Turfing
	Not used	30/6	Planting, sheets 1 and 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 Waterbodies
	Not used	30/12	Special Ecological Measures
			<u>MAINTENANCE PAINTING OF STEELWORK</u>
	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 Sample Despatch List: Sheets 1 and 2
	Not used	50/5	General Requirements
			<u>INFORMATION FOR SPECIFICATION OF LIGHTING UNITS</u>
		90/1	Information for specification of lighting units

List 'B'

List of Contract Specific Numbered Appendices Devised for the Contract

Page No	Appendix No.	Appendix Title
	Schedule A	Drainage System Manufacturer's Details
	Schedule B	Traffic Sign Face Details
	Schedule C	WSCC Traffic Signal Design and Installation Standards
	Schedule D	WSCC document Lighting of Developer Promoted Highway Schemes in West Sussex

Appendix 0/4 - List of Drawings Included in the Contract

FF 00000000

Contract Specific – Mayer Brown Limited

Northern Roundabout (Northern Bypass / Southern Bypass)

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
PHLY-MB-S278-GF-DR-D-308	Topographical Survey Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-310	General Arrangement Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-311	Construction Treatments Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-312	Drainage and Ducting Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-312-2	Drainage and Ducting Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-313	Visibility Drawing	Varies	A0
PHLY-MB-S278-GF-DR-D-320	String Labels and Setting Out Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-321	Stockdale	Varies	A0
PHLY-MB-S278-GF-DR-D-322	Longitudinal Sections Along MC6N, MC7N, MC8N, MC9N, MCL0, M001, MCL8, MCLW, MCLX & MCLY	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-323	Northern Roundabout Cross Sections Along MCR5, MCR6 & MCR7	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-324	Northern Roundabout Cross Sections Along MCR8, MCR9 & M001	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-325	Northern Roundabout Cross Sections Along MCL8 & MCL0	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-326	Southern Bypass Roundabout Forward Visibility Splay Long Sections	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-327	Southern Bypass Roundabout Vegetation Height Plan	1:500	A3
PHLY-MB-S278-GF-DR-D-399	Section 38/278 Agreement Drawing	1:250	A0

Southern Roundabout (A259 / Fitzalan Link Road)

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
PHLY-MB-S278-GF-DR-D-408	Topographical Survey Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-409	Site Clearance Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-410	General Arrangement Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-411	Construction Treatments Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-412	Drainage and Ducting Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-412-2	Drainage and Ducting Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-413	Visibility Drawing	Varies	A0
PHLY-MB-S278-GF-DR-D-414	Traffic Signals Drawing	Varies	A0
PHLY-MB-S278-GF-DR-D-415	Tree/Vegetation Removal Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-420	String Labels and Setting Out Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-421	Stockdale	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-422	Southern Roundabout Cross Sections Along MCR0 & MCR1	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-423	Southern Roundabout Cross Sections Along MCR2 & MCR3	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-424	Southern Roundabout Cross Sections Along MCR4 & MCL4	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-425	Longitudinal Sections Along MR01, MR02 MR03, MR04, MCL4 & MFTZ	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-426	A259 Worthing Road Roundabout Forward Visibility Long Sections	H = 1:250 V = 1:100	A0
PHLY-MB-S278-GF-DR-D-427	A259 Worthing Road Roundabout Vegetation Height Plan	1:500	A3

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
PHLY-MB-S278-GF-DR-D-498	Section 278 Agreement Drawing	1:500	A0
PHLY-MB-S278-GF-DR-D-499	Section 38/278 Agreement Drawing	1:250	A0
PHLY-MB-S278-GF-DR-D-TK1	Anticipated Vehicle Swept Paths	1:500	A0
PHLY-MB-S278-GF-DR-D-TK2	Anticipated Vehicle Swept Path of 12m Rigid Truck Utilising the Maintenance Access on the A259 Worthing Road Roundabout	1:500	A3

Contract Specific – SSE Enterprise Street Lighting Drawings and Documents

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
SSE203224-LD-001	Southern Bypass Roundabout Street Lighting Layout Drawing 1 of 2	1:500	A1
SSE203224-LD-002	Southern Bypass Roundabout Street Lighting Layout Drawing 2 of 2	1:500	A1
FO-CG-LS-048	Lighting Design Hazard Elimination and Management List	-	A4

Contract Specific – MK Surveys (Existing Statutory Undertakers Drawings)

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
19945 – Sheet 9	Utility Survey – Sheet 9	1:200	A0
19945 – Sheet 10	Utility Survey – Sheet 10	1:200	A0

Standard Details (Supplied) – West Sussex County Council

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
S278/38/01	Alternative Methods of Laying Kerbs	As shown	A3
S278/38/02	Approved Kerb Type Selection Sheet 1	As shown	A3
S278/38/03	Approved Kerb Type Selection Sheet 2	As shown	A3
S278/38/04	Footway / Cycleway Type 1 and 2	As shown	A3
S278/38/05	Footway / Cycleway Type 3 and 4	As shown	A3
S278/38/06	Footway/Footpath (Rural) Type 5	As shown	A3
S278/38/09	Service Margins	As shown	A3
S278/38/10	Preferred Arrangement of Services within Public Highway	As shown	A3
S278/38/11	Drainage – Gully A – Pre-Cast Concrete	As shown	A3
S278/38/13	Drainage – Type B Catchpit	As shown	A3
S278/38/14	Vortex Flow Control – Type B Manhole	As shown	A3
S278/38/17	Street Furniture - Bollards	As shown	A3
S278/38/18	Street Furniture – Tactile Crossings	As shown	A3
S278/38/19	Street Furniture Refuge Islands	As shown	A3
S278/38/20	Carriageway – Tie-in Options	As shown	A3
S278/38/21	Carriageway – Flexible Specification	As shown	A3
	WSCC Traffic Signal Installation Standards - Annex D		
	- Typical Section Through Traffic Signals Access Chamber and Kerb Loop Connection	As shown	A4
	- Traffic Signal Access Chamber Details		
	- Traffic Signal Duct Bedding Details		
	Lighting of Developer Promoted Highway Schemes in West Sussex		
	- Road Lighting Column Erection Details	As shown	A4
WSCC-SD1-1400-011/1	Illuminated Road Traffic Signs – Sheet 1 of 3	NTS	A3

Standard Details (Supplied) – Mayer Brown Limited

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
PHLY-MB-S278-GF-DR-D-C/01	Proposed Island Over Existing Carriageway	1:10	A3
PHLY-MB-S278-GF-DR-D-F/01	Drainage Trench Details	1:20	A1
PHLY-MB-S278-GF-DR-D-F/02	Beany Kerbs Standard Details Drawing	1:10	A1
PHLY-MB-S278-GF-DR-D-F/04	Beany Block Dropped Crossing Detail - Elevation	1:20	A3
PHLY-MB-S278-GF-DR-D-F/05	Proposed Attenuation Tank 01 – Details	Varies	A1
PHLY-MB-S278-GF-DR-D-F/06	Proposed Attenuation Tank 02 – Details	Varies	A1
PHLY-MB-S278-GF-DR-D-F/07	Intersection Between PDS Envirokerb Bridge Drainage Unit System And Marshalls Beany Block Linear Kerb Drainage System	1:20	A3

Standard Details (Not Supplied) – Manual of Contract Documents for Highway Works HCD's

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
F1	Surface Water Drains – Trench and Bedding Details	NTS	A4
I2	Duct Trench Cross Sections and Details of Mandrell	NTS	A4

Contract Specific - PBA Lyminster Bypass Southern Section Drawings and Documents

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
35944/2001/000	Lyminster Bypass – South North Littlehampton General Arrangement	1:1000	A1
35944/2001/001	Lyminster Bypass – South North Littlehampton Proposed Road Alignment and Contours	1:1000	A1
35944/2001/002	Lyminster Bypass – South North Littlehampton Proposed Finishes and Kerbing	1:500	A1
35944/2001/003	Lyminster Bypass – South North Littlehampton Highway Construction Details	AS SHOWN	A1
35944/2001/005	Lyminster Bypass – South North Littlehampton Proposed Cross Sections	1:250H, 1:250V	A1
35944/2001/010	Lyminster Bypass – South North Littlehampton Proposed Vehicle Restraint Systems	1:500	A1
35944/2001/011	Lyminster Bypass – South North Littlehampton Proposed Traffic Sign Layout	1:500	A1
35944/2001/012	Lyminster Bypass – South North Littlehampton Proposed Traffic Sign Face Details and Mounting Arrangements	NOT TO SCALE	A1

Drawing No.	Title	Scale	Size
35944/1501/001	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) General Arrangement	AS SHOWN	A1
35944/1501/003	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) North Abutment, Concrete Outlines Sheet 1 of 2	AS SHOWN	A1
35944/1501/004	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) North Abutment, Concrete Outlines Sheet 2 of 2	AS SHOWN	A1
35944/1501/005	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) South Abutment, Concrete Outlines Sheet 1 of 2	AS SHOWN	A1
35944/1501/006	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) South Abutment, Concrete Outlines Sheet 2 of 2	AS SHOWN	A1
35944/1501/007	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck, Concrete Outlines	AS SHOWN	A1
35944/1501/008	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck, Precast Concrete Beam Details 1 of 2	AS SHOWN	A1
35944/1501/009	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck, Precast Concrete Beam Details 2 of 2	AS SHOWN	A1
35944/1501/010	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck, Precast Concrete Edge Unit Details	AS SHOWN	A1
35944/1501/011	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Temporary Fixing Support Details	AS SHOWN	A1
35944/1501/013	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) North Abutment, R.C Details Sheet 1 of 2	AS SHOWN	A1
35944/1501/014	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) North Abutment, R.C Details Sheet 2 of 2	AS SHOWN	A1

Drawing No.	Title	Scale	Size
35944/1501/015	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) South Abutment, R.C Details Sheet 1 of 2	AS SHOWN	A1
35944/1501/016	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) South Abutment, R.C Details Sheet 2 of 2	AS SHOWN	A1
35944/1501/017	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck R.C Details Sheet 1	AS SHOWN	A1
35944/1501/018	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck R.C Details Sheet 2	AS SHOWN	A1
35944/1501/019	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck R.C Details Sheet 3	AS SHOWN	A1
35944/1501/020	Lyminster Bypass – South North Littlehampton Railway bridge (WSCC Ref: 1741) Deck R C Details Sheet 4	AS SHOWN	A1
35944/1501/030	Lyminster Bypass – South North Littlehampton H4a Parapet Foundation, Concrete Outlines	AS SHOWN	A1
35944/1501/031	Lyminster Bypass – South North Littlehampton H4a Parapet Foundation, R.C. Details	AS SHOWN	A1
35944/1502/001	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) General Arrangement	AS SHOWN	A1
35944/1502/003	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) North Abutment, Concrete Outlines Sheet 1 of 2	AS SHOWN	A1
35944/1502/004	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) North Abutment, Concrete Outlines Sheet 2 of 2	AS SHOWN	A1
35944/1502/005	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) South Abutment, Concrete Outlines Sheet 1 of 2	AS SHOWN	A1

Drawing No.	Title	Scale	Size
35944/1502/006	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) South Abutment, Concrete Outlines Sheet 2 of 2	AS SHOWN	A1
35944/1502/007	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Deck, Concrete Outlines	AS SHOWN	A1
35944/1502/008	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Deck, Precast Concrete Beam Details	AS SHOWN	A1
35944/1502/010	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Deck, Precast Concrete Edge Unit Details	AS SHOWN	A1
35944/1502/011	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Temporary Fixing Support Details	AS SHOWN	A1
35944/1502/013	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) North Abutment, R.C Details Sheet 1 of 2	AS SHOWN	A1
35944/1502/014	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) North Abutment, R.C Details Sheet 2 of 2	AS SHOWN	A1
35944/1502/015	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) South Abutment, R.C Details Sheet 1 of 2	AS SHOWN	A1
35944/1502/016	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) South Abutment, R.C Details Sheet 2 of 2	AS SHOWN	A1
35944/1502/017	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Deck R.C Details Sheet 1 of 3	AS SHOWN	A1
35944/1502/018	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Deck R.C Details Sheet 2 of 3	AS SHOWN	A1
35944/1502/019	Lyminster Bypass – South North Littlehampton Toddington Lane Overbridge (WSCC Ref: 1740) Deck R.C Details Sheet 3 of 3	AS SHOWN	A1

Drawing No.	Title	Scale	Size
35944/1503/001	Lyminster Bypass – South North Littlehampton Allotment Underpass (WSCC Ref: 1753)	AS SHOWN	A1
35944/1509/001	Lyminster Bypass - South, North Littlehampton, General Arrangement	AS SHOWN	A1
35944/1513/001	Lyminster Bypass Acoustic Barrier GA Sheet 1 of 4	AS SHOWN	A1
35944/1513/002	Lyminster Bypass Acoustic Barrier GA Sheet 2 of 4	AS SHOWN	A1
35944/1513/004	Lyminster Bypass and Fitzalan Link Road Acoustic Barrier 4 of 4	AS SHOWN	A1
35944/3501/004	Lyminster Bypass – South North Littlehampton Reinforced Earth Panel Walls (WSCC Ref: 6078, 6079 & 6092) General Arrangement Sheet 1 of 2	AS SHOWN	A1
35944/3501/005	Lyminster Bypass – South North Littlehampton Reinforced Earth Panel Walls (WSCC Ref: 6078, 6079 & 6092) General Arrangement Sheet 2 of 2	AS SHOWN	A1
35944/3500/R01	Ground Investigation Report (GIR) – PBA Dec 2016		
35944/3500/R02	Geotechnical Design Report (GDR) – PBA Aug 2016		
35944/3501/C6300	Final Factual Report		
35944/3501/C6306	Final Factual Report Combined		

Contract Specific WYG Drawings

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
A088461 SLB1	Landscape Proposals 1 of 2	1:1000	A1
A088461 SLB2	Landscape Proposals 2 of 2	1:1000	A1

Appendix 1/1 - Temporary Accommodation and Equipment for the Overseeing Organisation (Rev P5, 17/04/19)

Accommodation Required

An adequate desk, chair and filing cabinet(s) and associated space within a secure section of the Contractor's Site offices will be required for two Engineers throughout the course of the works. Suitable power supply for a computer etc will be required. Adequate parking and welfare facilities etc shall be made available on site for use by the Resident and Visiting Engineers (including the Highway Authority and Network Rail) as may be required during the course of the works.

Appendix 1/4 - Working and Fabrication Drawings

1.4.1 The working and fabrication drawings listed in this appendix are to be submitted to the Designer for review.

Series	Description of Work	Minimum period for submission of drawings
100	Traffic Management	8 weeks
300	Temporary fencing	6 weeks
300	Permanent fencing - Double leaf palisade security gates shall be provided at both ends of the Allotment Underpass (WSCC Ref. 1753) as indicated on drawing 35944/1503/001.	6 weeks
300	Permanent fencing - Acoustic Fencing exact specification to suit WYG specification.	6 weeks
400	Vehicle/pedestrian bridge parapet in accordance with PBA drawing 35944/2001/010 and 35944/3501/004.	4 weeks
1200	Traffic Signs	6 weeks
1200	Traffic Signals	6 weeks
1300/1400	Road Lighting and Cabling	6 weeks
1700	Precast prestressed concrete deck beams and precast reinforced concrete edge parapet units in accordance with drawings 35944/1501/008 to 011, for the Railway bridge (WSCC Ref. 1741), and drawings 35944/1502/008, 010 and 011, for the Toddington Lane bridge (WSCC Ref. 1740).	4 weeks
2100	Bridge bearings in accordance with Appendix 21/1	4 weeks

Appendix 1/5 - Testing to be carried out by the Contractor

Notes:

- 1 **The Contractor is advised to agree the exact testing regime with the Project Manager, Engineer/Highway Authority in writing prior to commencement of the works.**
- 2 The contractor is required to carry out ground investigation. See Appendix 1/10 for details.
- 3 For all tests a UKAS test report or certificate is required. For all geoenvironmental/chemical tests a MCERTS test report or certificate is required.
- 4 Unless otherwise stated above, all sampling and testing in this Appendix shall be by the Contractor.
- 5 Tests comparable to those specified in this Appendix will be necessary for any equivalent work, goods or materials proposed by the Contractor (See sub-Clause 105.4).
- 6 Unless otherwise shown in this Appendix test certificates for work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.
- 7 The Contractor should note that surface course surface regularity testing (Clause 702) is included in this Appendix / Schedule.
- 8 All samples/tests shall be given a site reference number (not the laboratory reference number) that enables ease of reference and location. Such reference should include location and depth/elevation as a minimum. Colour photographs shall be taken of each sample/test location showing all necessary details of the location and material being sampled/tested. Artificial (flash) lighting shall be used for each photograph. Each photograph shall contain a graduated scale together with a reference board identifying the project and the sample/test number, a standard colour chart and a monochrome step wedge.
- 9 Preliminary records of all test results shall be provided to the Project Manager within 48 hours of completion of the test. On completion of the works, an Earthworks Validation Report shall be prepared by the Contractor presenting a record of the works carried out, full records of all loads delivered to and removed from site, and full records of all acceptability and compliance testing. The Earthworks Validation Report shall be presented in a single document together with a copy of the report in pdf format and digital data in AGS4 format.
- 10 In areas of new full depth carriageway construction, the CBR value of the placed Capping and Type 1 subbase material shall be tested by a method approved by the Project Manager and Highway Authority".

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 300					
306	Permanent Fencing				Quality management scheme applies
	Concrete components	Cover to reinforcement	1 per consignment (maximum 1 per 100 components) (BS 1722)		[Tests/samples should not normally be required]
308	Gates and stiles				Quality management scheme applies
	Reinforced concrete posts	Cover to reinforcement	1 per consignment (maximum 1 per 100 components) (BS 3470)		[Tests/Samples should not normally be required]
308 & 311	Preservation of Timber	Full sapwood penetration	As required in sub-Clause 311.2(v)	Required for each batch	Quality management scheme applied [Test/samples should not normally be required]
Series 400					
402	Welding	Welding procedures (manufacturers tests)	(Every seven years)	Required	Quality management scheme applies
		Welder qualification (manufacturers tests)	As required in sub clause 402.7 (iii)		
		Production testing (Manufacturers tests)	As required in sub clause 402.7 (iv)		
	Welded joints	Destructive testing	[See sub clauses 402.7 (v) and 402.7 (vi)]		
403	Anchorage and attachment systems for use in drilled holes	Ultimate tensile load (Manufacturers test)		Required	To provide well attested and documented evidence
404	Anchorage in drilled holes	Loading test on site	As required in Appendix 4/1	Required	
	Post foundations				

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 400 (continued)					
406	Vehicle parapets			Required	Quality management scheme applies – applicable only to legacy systems not falling under the CPR.
407	Anchorage and attachment systems for use in drilled holes	Ultimate Tensile load (Manufacturer's test)		Required	To provide well attested and documented evidence for legacy systems not falling under the CPR.
409	Vehicle parapet posts			Required	
	General				In accordance with manufacturer's installation manual
	Legacy Systems	Static destructive testing:			Acceptance criteria in BS 6779-1 clause 9.4.3.2.6.3
410	Anchorage in drilled holes	On-site tensile load test	As required in contract specific appendix 4/1	required	†
411	Pedestrians Parapets and Guardrails		Manufacturer's tests: yield/proof strength of material, ultimate strength and the extension at break		(N) [see 411.8]
Series 500					
501	Pipes for Drainage and Service ducts				Product certification scheme or equivalent applies for product not falling under the Construction Products Regulations (CPR).
	Vitrified clay				
	Concrete PC/SRC	Not exceeding 900mm dia			
	Concrete Prestressed				
	Iron-cast				
	Iron Ductile				
	PVC-U				

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)						
	GRP		(Manufacturers tests)			
	Plastics. See Table 5/1					
	Corrugated steel				Required (AASHTO)	
	Corrugated steel bitumen protection	Not exceeding 900mm dia				
	Other materials				Required	
503	Pipe bedding		Grading and fines content			<i>Exact testing requirements to be agreed with the Adopting Authority and Project Manager</i>
			Water-soluble sulphate (WS) content (N)			<i>Minimum to allow for natural variability of sulphur compounds</i>
			Oxidisable sulfides (OS) content and total potential sulphate (TPS) content (N)			
			Resistance to fragmentation (N)			
505	Filter medium backfill		Plastic index (N)	1 per source *	Required	<i>Exact testing requirements to be agreed with the Adopting Authority and Project Manager</i>
			Resistance to Fragmentation (N)	1 per source *	Required	
			Water-soluble sulphate (WS) content (N)	5 per source		
			Oxidisable sulfides (OS) content and total potential sulphate (TPS) content (N)	5 per source		
			Grading	1 per 500 tonnes*		<i>[for bedding types not falling under the (CPR), Results of routine control tests from the factory production control system operated by the producer to be provided – see BS EN 13285]</i>
			Permeability (N)	1 per source *		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
506	Sealing existing drains				<i>[Appropriate tests/samples should be scheduled where not included under other Clauses]</i>
	Concrete				
	Grout				
507	Chambers				
	Precast concrete				Product certification scheme applies
	Corrugated galvanised steel	(Manufacturers tests)		Required	Product certification scheme applies
	Manhole steps				
	Steel fitments				
	Covers, grates and frames				Product certification scheme applies
	Cover bolts				Quality management scheme applies
508	Gullies and pipe junction				For products not falling under the (CPR) product certification scheme or equivalent applies
	Precast concrete				
	Clay				
	Cast iron and steel				
509	Watertightness of joints	Air test	All pipelines with watertight joints	Required	
512	Backfill to pipe bays	Grading	1 per 50 tonnes (min of 3)	Required	<i>[Acceptance testing can be scheduled for bedding types not falling under the Construction Products Regulation (CPR)]</i> <i>Exact testing requirements to be agreed with the Adopting Authority and Project Manager</i>
		Water-soluble sulfate (WS) content (N)	5 per source*		
		Oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	5 per source*		
Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
513		Plastic Index (N)	1 per source*	Required	

	Permeable backing to earth retaining structures		Water-soluble sulfate (WS) content (N)	5 per source		<i>[Acceptance testing can be scheduled for bedding falling under the CPR]</i> <i>Exact testing requirements to be agreed with the Adopting Authority and Project Manager</i>	
			Oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	5 per source			
		Precast hollow concrete blocks	Resistance to fragmentation (N)	1 per source*			
			Grading	1 per 200 tonnes (min of 3)*			
			Permeability (N)	1 per source*			
		(Manufacturers tests)		Required			
514	Fin Drains	(Manufacturers tests)		Required	BBA certification (or equivalent) applies		
515	Narrow filter drains						
		Geotextile, pipes and fittings	(Manufacturers tests)		Required	Product Acceptance Scheme or equivalent) applies	
		Granular fill	Plastic Index (N)	1 per source*		<i>[Acceptance testing can be scheduled for bedding falling under the CPR]</i> <i>Exact testing requirements to be agreed with the Adopting Authority and Project Manager</i>	
			Resistance to fragmentation (N)				
			Water-soluble sulfate (WS) content (N)	5 per source			
			Oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	5 per source			
			Grading	1 per 200 tonnes (min of 3)*			
			Permeability (N)	1 per source*			

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)						
516	Combined drainage and kerb system		Load test			
517	Linear drainage systems		Load test			
518	Thermoplastics structured wall pipes and fittings		(Manufacturers tests)		Required	<i>Product Acceptance Scheme or equivalent applies</i>
Series 600						
601, 631 to 637, 640	Acceptable material				Required	<i>[Acceptance testing can be scheduled for bedding falling under the CPR]</i> <i>[For recycled aggregate see Sub-Clause 601.12 and 601.18]</i> <i>[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]</i>
	Class	General Description				
	1	General granular fill				
			Grading/uniformity coefficient	Twice a week*		
			Mc/MCV (N)	2 per 1000m3 up to max of 5 per day*		
		SMC of chalk (N)	Twice a week*			
		1C only	Resistance to fragmentation (N)	Weekly*		

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)						
	Class	General Description				
	2	General cohesive fill	Grading	Twice a week*	Required	
			Mc/MCV/PL Undrained shear strength (N)	2 per 1000m3 up to max of 5 per day*		Cross-reference should be made to any requirements in Appendix 6/1
			SMC of chalk (N)	Twice a week*		
			Bulk density (pfa) (N)	2 per 1000m3 up to max of 5 per day		
	3	General chalk fill	mc (N)	2 per 1000m3 up to max of 5 per day*	Required	
			SMC (N)	Daily*		
	4	Fill to Landscaped Areas	Contamination Suite - Note 1	Note 2		
	5	Topsoil	Grading	Daily*		
	6	Selected granular fill	Grading	Source approval (3 tests) and then every 200 m3		
			Dry density / moisture content relationship	Source approval (3 tests) and then every 800 m3		
			Moisture Content	Source approval (3 tests) and then every 200 m3		
			Los Angeles coefficient	Source approval (3 tests) and then every 800 m3		
			Effective angle of internal friction and effective cohesion	Source approval (3 tests) and then every 800 m3		
			Contamination Suite – Note 1	Note 2		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)					
	6F4 and 6F5	Size designation and overall grading category	1 per week*		<i>Exact testing requirements to be agreed with the Adopting Authority and Project Manager</i>
	6F4 and 6F5	Maximum fines and oversize categories	1 per week*	Required	
		Volume stability of blast furnace slag	6 monthly		
		Volume stability of steel (BOF and EAF) slag	6 monthly		
		Other aggregate requirements	Annex C of BS EN 13242		
		Laboratory dry density and optimum water content			
		Water content			
	7	Selected cohesive fill	Grading /mc/MCV/bulk density (N)		[BS EN 1744-1, clause 10, clause 11, clause 13]
			SMC of chalk (N)		
			PI/LL (N)		
			Organic matter/water soluble sulfate (WS) (N)		
			Oxidisable sulfides (OS) and total potential sulfate (TPS) content (N)		
			pH/chloride ion content (N)		
			Resistivity (N)		
			Undrained and drained shear parameters (N)		
			Permeability (N)		
	8	Miscellaneous fill	Mc/MCV (N)		[Cross-reference should be made to any requirements in Appendix 6/1]
	9	Stabilised materials	Pulverisation		
			1 per lane width per 200m length*		
			mc/MCV (N)		

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)						
	Class	General Description	Bearing Ratio (N)		Required	
	Pulverised fuel ash		Chemical analysis	1 per consignment*		[As appropriate to properties stated in Table 6/1 or Appendix 6/1]
	Furnace bottom ash		Grading	1 per 300 tonnes*		
	Fill adjacent to cementitious material or metallic items		Water-soluble sulfate (WS) content, oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	1 per 400 tonnes or per location if less than 400 tonnes*	At least 5 tests per source for sulfur compounds over the course of the contract in accordance with TRL Report 447, tests 1-5	
602	Earthworks material beneath surface of a road or paved central reserve		Frost heave (N)		Required	[Acceptance testing can be scheduled for materials not falling under the Construction Products Regulation (CPR)] [Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]
	(i) Off site source			1 every four months*		
	(ii) On site source			As required		
609 621	Geotextiles		Tensile Strength	1 per 400 square metres*	Required	Exact product and testing requirements to be agreed with the Project Manager and Highway Authority.
			Elongation			
			Tensile Strength of seams and joints			
			Static puncture			
			Characteristic opening size			
			Water Permeability			
			Durability			
612	Compaction of fills				Required	
		Method compaction	Field dry density (N)	[As required]		††
		End product compaction	Optimum mc (2.5kg rammer/vibrating hammer method) (N)	Each class or sub-class of material*		†
			Field dry density and Moisture Content (N)	Every 500 m³ or 1 per day		†

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)					
614	Cement stabilisation to form capping	Rate of spread of cement	1 per 500 square metres of lime spread*	Required	
615 641 643	Lime stabilisation to form capping	Rate of spread of lime	1 per 500 square metres of lime spread*	Required	
		Available lime content	Each source of lime weekly during stabilisation operation*		†
622 638 639	Earthworks for reinforced soil and anchored earth structures	Redox potential	5 locations within the affected area*	Required	<i>[Acceptance testing can be scheduled for materials not falling under the Construction Products Regulation (CPR)]</i> <i>[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]</i> †
	Drainage layers	Grading	1 per 400 tonnes*		
	Reinforcing elements	Chemical analysis Coeff. Of friction	Each type of element with each type of fill*		
	Anchor elements	Adhesion			
624	Ground anchorages	Proof loading	As required in Appendix 6/10	Required	†
626	Gabions			Required	
	Fill	Grading Los Angeles coefficient (N)	1 per 400 tonnes*		
	Wire and wire mesh	<i>[As appropriate to properties stated in Appendix 6/10]</i>	1 per 400 squaremetres *		
642	Earthworks materials for corrugated steel buried structures	Constrained soil modulus (M*)	3 on each side of each structure*	Required	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 700					
710	Constituent materials in recycled aggregate	Quality control	As required by the 'Quality Protocol for the production of aggregates from inert water'	Required	[See NG 710.1 and NG 710.2]
711	Overbanding and inlaid crack sealing systems			Required	Product Acceptance Scheme or equivalent applies

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 800					
801 803 804 805 806	General requirements for unbound mixtures for adjacent to cement bound materials, concrete pavements, structures or products	Water-soluble sulfate (WS) content (N)	1 per 400 tonnes or per location if less than 400 tonnes*	Required	<i>Acceptance testing can be scheduled for materials not falling under the Construction Products Regulation (CPR)]</i>
		Oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	1 per 400 tonnes or per location if less than 400 tonnes*		
	Unbound mixtures beneath surface of a road or paved central reserve	Frost heave (N)	1 per source*		<i>[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]</i>
		Grading and fines content	1 per week*		
		Plastic Index (N)			
		Resistance to fragmentation (N)	6 monthly*		
		Resistance to wear-micro-Deval test			
		Resistance to freezing and thawing (magnesium sulfate soundness) (N)	1 per source*		J
		Water absorption (N)	<i>[As required]</i>		
		Volume stability of blast furnace slag	6 monthly		
		Volume stability of steel (BOF and EAF) slags	6 monthly		
		CBR (N)	1 per source and then monthly*		
		OMC/mc (N)	<i>[As required]</i>		
		Density (N)	<i>[As required]</i>		
		Water absorption (N)	<i>[as required]</i>		

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900					
821 822 823 830 831 832 834 835 840	Cement and other Hydraulically Bound Mixtures (HBM)	Tests for control and checking of HBM	Tests specified in Table 8/14 and table 8/15	Required	
		Coefficient of linear expansion			
		Tests for laboratory mixture design			
901, 925, 937, 938 943	Aggregates for bituminous materials			Required	
	Resistance to fragmentation (hardness)	Resistance to fragmentation (N)	Monthly*		
	Resistance to freezing and thawing (durability)	Soundness (N)	1 per source*		
		Water absorption (N)	<i>[as required]</i>		
	Cleanness	Sieve test (mass passing 0.063mm sieve) (N)	Monthly*		
	Shape	Flakiness index (N)			
	Blastfurnace slag	Bulk density (N)			
		Soundness (N)			
		Dicalcium silicate disintegration (N)			
		Iron disintegration (N)			
	Steel slag	Bulk density			
		Volume stability (N)			
	Coarse aggregate for surface course	Resistance to polishing (PSV) (N)			
		Resistance to surface abrasion (AAV) (N)			
	Binders for bituminous materials	Penetration (N)			
		Softening point (N)			
		<i>[Other BS EN tests]</i>			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
903 to 907, 909 to 912, 914, 916, 925, 926, 929, 937, 938, 942, 943, 946 to 948	Bituminous mixtures	Grading (N)	For Audit Test purpose only		
		Binder Content (N)			
929	Base and Binder Course Asphalt Concrete (Design Mixtures)	Permanent Works – In situ air void content (N)	[As required]		
		Permanent Works – Refusal air void content (N)			
		Permanent Works – Deformation resistance			
		Deformation resistance (design)			
		Stiffness (design)			
930	EME 2	Permanent Works – In situ air void content (N)	[As required]		
		Richness Modulus (design)			
		Duriez (design)			
		Deformation Resistance (design)			
		Stiffness			
911	Rolled asphalt surface course (design mix)	Stability value (N)			
		Flow value (N)			
		Density (N)			
915	Coated chippings	Grading (N)			
		Binder content (N)			
		Flakiness index (N)			
		Resistance to polishing (PSV) (N)			
		Resistance to surface abrasion (AAV) (N)			
		Hot sand test (N)			
		Rate of spread (N)			
921	Surface macrotexture	Volumetric Patch (N)	[As required]	Required	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments	
Series 900 (continued)						
924	High Friction surfaces	Quality control checks	As required in sub-clause 924.5	Required	Product Acceptance Scheme or equivalent applies	
		System coverage	As required in Clause 924.6			
		Aggregate	Resistance to polishing (PSV) (N)			
937	Stone mastic asphalt (SMA) binder course and regulating course	Permanent Works – In situ air void content (N)	[As required]			
		Permanent Works – Deformation resistance				
		Binder drainage test (design)	[As required]			
		Deformation Resistance (design)				
942	Thin surface course systems	General Properties		Required	Product Acceptance Scheme or equivalent applies	
943	Rolled asphalt surface course (performance-related design mix)					
		Permanent Works – In situ air void content (N)	[As required]			
		Permanent Works – Deformation resistance				
		Binder drainage test (design)	[As required]			
918	Slurry surfacing incorporating microsurfacing					
		Binder				
			Product Identification			
			Vialit cohesion			
			Rate of spread			
			Penetration at 25 deg and 5 deg. Celcius (N)			
		Aggregates	Flakiness index (N)			
			Resistance to polishing (AAV) (N)			
			Resistance to surface abrasion (AAV) (N)			
			Grading (N)			
System						

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
920	Bond coats, tack coats and other bituminous sprays				
		Binder	Product identification		
			Vialit cohesion		
			Accuracy of spread		
			Rate of spread		
			Penetration at 25 deg and 5 deg. celcius		
919 922	Surface Dressing				
		Binder			
			Product Identification		
			Vialit cohesion (N)		
			Accuracy of spread		
			Rate of spread		
			Penetration at 25 deg and 5 deg celcius		
	Chippings		Resistance to (PSV) polishing (N)		
			Resistance to abrasion (AAV) (N)		
			Grading (N)		
			Binder content (N)		
			Flakiness index (N)		
			Accuracy of spread (N)		
			Rate of spread		Frequency to be reduced to daily after 3 satisfactory results, but not less than 1 test per lane per site
	Rollers	Spray bars working	Before works starts and daily during works		
950	Depressions				Product Acceptance Scheme or equivalent applies

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000					
1001 1030 1044	Cement				
	Portland cement CEM I				
	Portland blastfurnace cement				
	Blastfurnace cement CEM III/A				
	Portland pfa cement CEM II/B-V				
	Pozzolan cement CEM IV/A				
	Portland cement with microsilica				Product Acceptance Scheme applies for microsilica
	Pulverised-fuel ash				
	Ground granulated blast furnace slag				
	Admixtures				
	Mixing water	Sulfate content (N)			
	Aggregates	Resistance to freezing and thawing – magnesium sulfate soundness (N)			
		Water absorption (N)			
		Flakiness index (N)			
		Shell content (N)			
		Resistance to fragmentation (N)			
		Resistance to polishing (PSV) (N)			
		Resistance to abrasion (N)			
		Grading and fines content (N)			
		Chloride content (N)			
		Total sulfur (TS) and acid-soluble sulfate (AS) content (N)			
	Flint course aggregate containing white flints	Water absorption (N)		Required	
		Acid-soluble material (N)			
		Bulk Density (N)			
		Dicalcium silicate disintegration (N)			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)					
		Iron disintegration (N) Total sulfur (TS) and acid-soluble sulfate (AS) content (N)			
	Pulverised-fuel ash				
1002 1003 1004 1044	Pavement concrete	Air content test (N)	As required in Table 10/10	Required	Product certification scheme applies
		Density (N)	As required in Table 10/10		
		Strength (N)	As required in Table 10/10		
1005	Consistence (workability)	Degree of Compactability (Compaction Index) (N)	As required in Table 10/10	required	
		Vebe (N)			
		Slump (N)			
1011 1012	Dowel bars Tie bars			Required (BS 4449)	Product certification scheme applies
	Dowel bars and supporting cradles	Load test	1 per arrangement*		[See also sub-clauses 1011.5-7].
	Sheathed dowel bars	Bond stress	4 bars		
	Cranked tie bars (coated)	Bend test	4 bars*		
		Salt fog cabinet	4 bars*		
1015	Joint filler board	Weathering test	3 per source	Required	Normally undertaken by manufacturer
		Compression and recovery	4 per source		
		Extrusion	1 per source		
	Cork filler board	Immersion in water	2 per source		
		Immersion in acid	2 per source		
1016 1017	Applied sealants		1 per 1000m or 1 per day		
		Resilience	1 per 1000m or 1 per day		

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)						
	Compression seals				Required (ASTM D2628) (BS 2752) (BS 4443: Part 4, Method 10 and BS EN ISO 2440) (BS EN ISO 1856) (BS 903: Part A16 or BS ISO 1817)	
			Compression set	1 per type of seal*		
			Immersion in oil	1 per type of seal*		
	Self expanding cork seal		Tests specific in Clause 1017	1 per type of seal*		
1026 1044	Surface macrotexture		BS EN 13036-1 Volumetric patch Technique (N)	1 per day (set of 10)*	Required	
1027	Aluminised curing compound		Efficiency Index	1 per source*	Required	
1030	Wet lean concrete		Density	As required in Table 10/10	Required	
			Cube strength (N)			
1043	Foamed Concrete		Cube strength (N)	2 cubers per 12m3	Required	
Series 1100						
#1101	Precast concrete kerbs, channels, edgings and quadrants		Bending strength			
1102	In situ asphalt kerbs		Grading	1 test per 500 metres laid*	Required	[See BS 5931 for materials for in situ asphalt kerbs]
			Binder content			
1104	Precast concrete flags		Bending strength			
	Bedding	Granular material				
		Mortar				

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)					
1107	Concrete block paving	Compressive strength			
1108	Clay pavers	Bending strength			
		Skid resistance			
Series 1200					
1202	Permanent traffic signs				
1207	Anchorage in drilled holes to supports of traffic signs	Loading test on site	[As required]		
1210	Holding down bolts and anchorages to bases of permanent bollards				
1212	Road markings				
1214	Permanent traffic cones and traffic cylinders			Required	Certification that permanent traffic cones and cylinders have been tested and comply with BS EN 13422 is required
	Flat traffic delineators			Required	
		Test specific in Appendix 12/4	[As require]		† [Where required]
	Other traffic delineators			Required	Certification that delineators have been tested and comply with Clause 1214 is required
		Test specific in Appendix 12/4	[As require]		† [Where required]
	Temporary cones, cylinders, FTD's and other delineator			Required	Certification that at least 1 in 500 of any batch of cones, cylinders, FTD's and other delineators to be used in the Temporary Works have passed the tests in Clause 1214 as appropriate is required

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200 (continued)					
1217	Traffic signals				Quality management scheme applies. Statutory type approval of equipment applies
	Cables				<i>[Special sample tests to BS 6346 should be scheduled where appropriate]</i> Product certification scheme applies
	Controllers <i>[Other equipment]</i>	Test specified in Appendix 12/5	Each controller before delivery to Site and again after installation		
	Cabling	Tests a, b, c, e, f, g, h, j as defined in sub clause 1424.2	Each traffic signal installation	Required	Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
1218	Detector loops				
	Cable			Required	Certification that completed cables comply with specification TR 2029 is required
	Epoxy resin			Required <i>[Where considered appropriate]</i>	Certification that the epoxy resin complies with specification MCH 1540 is required
	Feeder cable			Required	Certification that completed cable comply with specification TR 2031 is required
	Joints	Pull test (4 kgf)	Each crimp		
	Installation	Series resistance	Each loop	Required	Certification in accordance with specification MCH 1540 is required
		Insulation resistance			
		Inductance			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1300					
1305	Anchorage for use in drilled holes	Tensile load			
1306	Anchorage in drilled holes to columns and masts with flange plates	Loading test on site	[As required]		†
1313	GFRP laminates	Loss on ignition	1 per 50 production columns		[See sub-clauses 1313.10-17]
		Colour fastness	1 per batch		
		Electric strength			
		Water absorption			
		Impact strength			
1314	Brackets for laminated GFRP lighting columns			Required	
		Polyurethane foam	Bulk density		
	Surface hardness				
	Apparent bulk density		2 per batch		
	Impact strength				
	Flexural stress				
Series 1400					
1421	Cable				Product certification scheme or equivalent applies
1424	Lighting Units	Tests specified in Clause 1424	Each unit	Required	† Product certification scheme applies. Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
	Networks	Tests specified in Clause 1424	Each network	Required	† Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
Series 1500					
1506	Copper communications cable			Required	Certification that each completed cable complies with specification TR 2150 or TR 2158, as appropriate, is required

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1500 (continued)					
	Optical fibre communications cable			Required	Certification that each completed cable complies with specification TR 2151 or TR 2159, as appropriate, is required
	Coaxial communications				Certification that each completed cable complies with specification TR 2152 or TR 2160, as appropriate, is required
	Energy cable			Required	Certification that each completed cable complies with specification TR 2153 or TR 2161, as appropriate, is required
1513	Cable Joint Enclosures	Test specified in Clause 1513.12	Each CJE	Required	† Certification that the CJE satisfies the air pressure test is required
1518	Coaxial and copper communications and power cable	Test specified in specification MCG 1022 or MCG 1099, as appropriate	Each cable (Stage 1) As required in Appendix 15/1 (Stage 2)		† Results to be reported in accordance with MCG 1022 or MCG 1099, as appropriate
	Optical fibre communications cable	Test specified in specification MCG 1055 or MCG 1099, as appropriate	Each cable (Stage 1) As required in Appendix 15/1 (Stage 2)		† Results to be reported in accordance with MCG 1055 or MCG 1099, as appropriate
1522	Motorwarn System				
	Steel posts			Required (BS 6323)	
1526	Electrical Installations	Tests specified in BS 7671	Each Installation	Required	† Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1500 (continued)					
1530	Cable ducts				Product Acceptance Scheme or equivalent applies
1533	Cable ducts				
	Mandrel test	Test specified in Clause 1533	Each duct	Required	† Certificate that each length of duct between chambers satisfies the Mandrel test is required
	Air test	Test specified in Clause 1533	Each duct	Required	† Certificate that each length of duct between chambers satisfies the Air test is required
Series 1600					
1601	Soil samples In situ soil tests			Required	<i>[Appropriate soil tests should be scheduled where required]</i>
1602 to 1606 1610 to 1615	Concrete Grout Reinforcement Prestressing Steelwork Welding Protection against corrosion			Required	<i>[Appropriate tests/samples should be scheduled where not included under other Clauses/Series]</i>
1606	Coatings for protection against corrosion	Adhesion	As required in Appendix 16/6		
1607	Reduction of friction on piles				<i>[Particular requirements detailed in Appendix 16/7 should be scheduled]</i>
1608 1616	Integrity testing Dynamic testing				<i>[particular requirements detailed in Appendix 16/8 or 16/16 should be scheduled]</i>
1609	Static load testing of piles			Required	<i>[Testing of preliminary piles should be scheduled in Appendix 1/5 Particular requirements detailed in Appendix 16/9 should be scheduled]</i>

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1600 (continued)					
1612	Self hardening slurry mixes				<i>[Particular requirements detailed in Appendix 16/12 should be scheduled]</i>
1617	Instrumentation				<i>[Particular requirements detailed in Appendix 16/18 should be scheduled]</i>
1618	Support Fluids	To be proposed by the Contractor			<i>[Particular requirements detailed in Appendix 16/18 should be scheduled]</i>

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700					
1707	Hardened Concrete – Identity Testing	Cube strength (N) – as described in contract specific Appendix 17/4	Prestressed concrete- two cubes from 12m3 or 2 batches whichever represents the lesser volume	Required	Contractor to cast and test sufficient additional cubes to demonstrate cube strength before transfer †
			Reinforced concrete- two cubes from 24m3 or 4 batches whichever represents the lesser volume		[See also Table NG 17/1]
			Mass concrete- two cubes from 50m3 or 50 batches whichever represents the lesser volume		[See also Table NG 17/1]
			Additional cubes for special purposes		[tests/samples should be scheduled as required See NG 1707.6]

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
			2 cubes from each of two samples of each batch		<i>[Requirements should be given in Appendix 17/1 as appropriate]</i>
		Density	<i>[As required]</i>		
	Fresh concrete	Consistence (slump or compacting factor or Vebe) (N)	Each batch	Required	<i>[See sub-Clause 1707.2]</i>
		Air content	Each batch		
		Density	<i>[as required]</i>		
		Water/cement ratio			
1710	Concrete packing Mortar packing Epoxy resin bonding agent				<i>[Appropriate tests/samples should be scheduled]</i>
	Precast concrete not conforming to any product Standard or to BS EN 13369	Cube strength (Manufacturers tests)			Contractor to make available records of tests by the manufacturer
1711	Grouting and Duct Systems for Post-tensioned tendons				Product acceptance scheme or equivalent applies
		Full scale trials, where required in the Contract			See sub-Clause 1711.1 and Appendix 17/6

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
		Duct assembly verification tests			See sub-Clause 1711.3 and Appendix 17/6
		Fluidity			See sub-Clause 1711.8 and sub-Clause 1711.9 and table 17/15
		Bleeding	In accordance with BS EN 447 and BS EN 446		
		Volume change			
		Cube strength			
		Sieve			
		Sedimentation			
1712	Reinforcement				Product certification scheme applies
	Steel bars			Required (BS 4449)	
	Steel wire			Required (BS 4482)	
	Steel fabric			Required (BS 4483)	
	Stainless steel			Required (BS 6744)	
1713	Fabricated reinforcement			Required (BS 8666)	Certification that fabricated reinforcement complies with the routine inspection/testing requirements of BS 8666 is not covered by a product certification scheme listed in Appendix B

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1716	Reinforcement jointing systems	Permanent elongation Characteristic strength (Manufacturers tests)		Required for each type of connection	Product acceptance scheme or equivalent applies
1717	Reinforcement metal arc welding	Welding procedure approval (BS EN ISO 17660)	As required in BS ISO 17660		[Where tests in addition to those specified in BS 7123 (tensile test and macroetch test) are required full details should be scheduled] Tests should be carried out by an independent testing body specified in BS 8666
		Welder approval (BS EN ISO 17660)			
1718	Prestressing tendons				
	Steel wire				
	Steel bar				
	Seven-wire strand				
	Prestressing steel (all types)	Proof load Breaking load Elongation Ductility Relaxation Modulus of elasticity	[as required]		†
	Other than lowest strength wire or strand to BS 5896	0.1% proof load Breaking load	Each reel		†
1724	Post-tensioning anchorages	Tests in accordance with BS EN 13391 (Manufacturers tests)		Required (BS EN 13391)	Product acceptance scheme or equivalent applies
1726	Stainless steel bar			Required (BS 6744)	Product acceptance scheme or equivalent applies
1727	Inspection and testing of structures and components				[Tests should be scheduled as appropriate and requirements given in Appendix 17/4]

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1800 (continued)					
1805	1805.2 Metallic products			Required according to BS EN 1090-2:2008+A1:2011 Table 1	<i>[Give type of metallic product and document required, noting specific requirement for steel grade S355 JR and JO described in 1805.2]</i>
	1805.3.4 Special Properties of constituent products	Testing to identify internal discontinuities or cracks in zones to be welded as specified in Appendix 18/1	As required in Appendix 18/1		<i>[Give specific testing requirements and frequency of testing in Appendix 18/1 with cross reference in Appendix 1/5]</i>
1806	1806.4.4 Check of the capability of cutting processes that are likely to produce local hardness	Testing in accordance with BS EN ISO 6507	As required		
	1806.5.4 d) Check of the hardness and geometry of hollow section components subject to bending by cold forming	Check of the hardness, testing in accordance with BS EN ISO 6507	As required		
1807	1807.4.1.2 Qualification of welding procedures (Process 111, 114, 12, 13 and 14)	Tests specified in BS EN ISO 15614-1 or BS EN ISO 15613	As required in BS EN ISO 15614-1 or BS EN ISO 15613		Results to be reported in accordance with BS EN ISO 15614-1 or BS EN ISO 15613
	1807.4.1.2 (3 Qualification of welding procedures for joints with restricted access	Tests specified in BS EN ISO 15613	As required in BS EN ISO 15613		Results to be reported in accordance with BS EN ISO 15613
	1807.4.1.2 (3 Qualification of welding procedures for other welding processes	Tests specified in the standards listed in BS EN 1090-2:2008+A1:2011 Table 13	As required in the standards listed in BS EN 1090-2:2008+A1:2011 Table 13		Results to be reported in accordance with the standards listed in BS EN 1090-2:2008+A1:2011, 7.5.12 relating to stud weld procedure testing
	1807.4.1.4 Validity of welding procedure qualification	Additional tests specified in BS EN 1090-2:2008+A1:2011, 7.4.1.4 for a welding procedure qualified in accordance with BS EN ISO 15614-1, which is undertaken	As required in BS EN 1090-2:2008-2008+A1:2011, 7.4.1.4		<i>Results to be reported in accordance with BS EN ISO 15614-1</i>

		by a welding process that has not been used			
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Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1800 (continued)					
Series 1900					
1903	Abrasives	Grading	[As required]		†† [See NG 1903]
	Abrasives	Hardness	[As required]		†† [See NG 1903]
1909	Galvanised Coatings	Test specified in BS EN ISO 1416	As required		
	Thermally sprayed aluminium metal coatings	Test specified in BS EN ISO 1416	As required		
	Aluminium Coating material			Required in accordance with BS EN ISO 14919	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1900 (continued)					
1910	Thermally sprayed to aluminium metal coating	Pull of adhesion test in accordance with ASTM D4541-Type 3	<i>At the start of the works and [specific subsequent intervals]</i>		†
	Thermally sprayed to aluminium metal coating (expected areas)	Grid test specified in BS EN 22063	<i>[As required]</i>		<i>[Any additional tests should be scheduled in Appendix 19/5]</i>
1911, Table 19/2B	Hot dip galvanised coating to fasteners	Tests specified in BS EN ISO 10684	<i>As required</i>		<i>[Any additional tests should be scheduled in Appendix 19/5]</i>
1912 1912S E	Paints – ‘A’ and ‘B’ samples	Provision of samples for ‘A’ and ‘B’ samples tests	<i>As required</i>		Samples selected in accordance with clauses 1912 and 1912SE
	Paints – ‘A’ and ‘B’ samples	Specify gravity	<i>As required by rate of ‘A’ and ‘B’ sampling</i>		See NG 1912,3’ Appendix 19/4, Note 4; Appendix 19/4SE, Note 4; NG 1912.3NI, 3 and Appendix 19/4NI
	Paints – ‘A’ and ‘B’ samples	Colour Match	<i>As required by rate of ‘A’ and ‘B’ sampling</i>		See NG 1912, 3 and NG 1912NI, 3
1914	Coating system minimum film thicknesses	Minimum dry film thickness measurement. In accordance with BS EN ISO 2808, BS3900-C5	<i>Required – representat ive testing</i>		
	Coating system adhesion	Pull of adhesion test in accordance with ASTM D4541 – Type 3	<i>Required – representat ive testing</i>		
	Coating system defects	Visual assessment supplemented by appropriate testing	<i>Required</i>		<i>[Any additional tests should be scheduled in Appendix 1/5]</i>
	Coating system defects – pin – holding or porosity	Low or high voltage detectors in accordance with ASTM G62-07	<i>Required – representat ive testing excluding corners, bolted joints or welds</i>		
Series 2000					
2003	Permitted waterproofing systems	<i>[As required-See NG 2003]</i>			Product acceptance

					scheme or equivalent applies	
	Additional bituminous protection			1 per 15 tonnes*		
		Stability value		1 per 15 tonnes*		
2004	Tar		Tests specified in BS 76	1 per source*	Sampling to comply with BS 76	
	Cut back bitumen				Sampling to comply with BS 3690:Part 1 <i>[The viscosity test is normally sufficient]</i>	
Series 2100						
2101	Bridge bearings					
		Bearings (other than Elastomeric)	Load testing – serviceability limit state	As required in contract specific Appendix 21/1		
			Load testing – ultimate limit state			
			Other tests specified in contract specific Appendix 21/1			
		Elastomeric bearings	Compressive test	As required in contact specific Appendix 21/1	[Use test methods given in BS EN 1337-3 section 4.3.3 and annex H, or state in contract specific Appendix 21/1]	
			Stiffness test			
			Shear stiffness test			
			Other tests specified in contract specific Appendix 21/1			
	Series 2400					
	2401	Masonry cement				
2402	Sand					
2403	Water		Test Specified in BS EN 1008	<i>[As required]</i>		
2404	Mortar admixtures					
2405	Lime					
2406/2417	Bricks					
		Clay				
		Calcium silicate				
		Concrete				
2407	Blocks					
		Clay				
		Concrete				

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2400 (continued)					
2408	Reconstituted stone				
2410	Stainless steel				
2411	Wire/fabric				
	Bars				
	Ready mixed mortars				
	Mortars		1 set of tests per mix*		
Series 2500					
2501	Materials for corrugated steel buried structures exceeding 900mm clear span or internal diameter				Type approval applies
	Steel components			Required as appropriate to the standard or specification listed in the type approval Certificate	
	Zinc coating				
	Protective coating				
	Paved invert system				Product acceptance scheme or equivalent applies
2502	Materials for reinforcing elements, prefabricated facing and capping units, and washers				Product acceptance scheme or equivalent applies
	Carbon steel strip			Required (BS 1449: Part 1.1 or BS EN 10025-1 and BS EN 10025-2)	Silicon content and mechanical properties to be stated on the certificate
	Stainless steel strip			Required (BS EN 10029, 10048, 10051, 10258 and 10259)	Mechanical properties to be stated on the certificate

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2400 (continued)					
	Reinforcing bar for anchor elements			Required (BS 4449)	Tests scheduled under Clauses 1717 and 1909 are required for welding and galvanising of anchor elements
	Materials for fasteners				
	Stainless steel				
	Bolts, screws and nuts				
2503	Materials for pocket type reinforced brickwork retaining wall structures				
	Clay bricks	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) BS 3921/TRL Report 447) (N)	1 set of tests per type of brick*		<i>[Soluble salt content – sulfate shall be determined in accordance with test No 2 in TRL report 447]</i> <i>[random sampling to BS 3921 to be employed]</i>
2504	Environmental barriers				Quality management scheme applies <i>[Appropriate tests/samples should be scheduled under other Clauses]</i>
	Timber				
	Concrete				
	Steel				
	Brickwork				
	Other materials				
	Barriers	Sound absorption Sound Insulation	As required in Appendix 25/4		<i>[See NG 2504 14-17]</i>
	Post foundations	Loading test on site	As required in Appendix 25/4		<i>[See NG 2504.12]</i>

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2400 (continued)					
2505, 2506	Drainage structures/buried rigid pipes for drainage structures Pipes for drains and culverts having diameters or clear span exceeding 900mm				
	Vitrified clay				
	Concrete PC/SRC	(Manufactures test)			See sub-Clause 2506.28
	Iron	[see Note 2]			[Note 2. Certificates are provided for in the relevant BS but should not normally be required except for pipes which are not quality marked by a UKAS or equivalent accredited body listed in Appendix B of SHW.]
	Corrugated steel	(Manufacturers test)			Type Approval Certificate and BBA Roads and Bridge Certificate apply
Series 2600					
2601	Bedding mortar materials			Required for each batch	Certification in accordance with Clause 2601 is required
	Bedding mortar	Flow cone test	Each batch		† laboratory tests
		Flow between glass plates			
		Compressive strength			
		Expansion test			
		Water absorption			
		Elastic stability	1 per source		
		Flow cone test Compressive strength	Each load		Site control tests
2604	Plastic coating to fencing post, gates and ancillaries			Required (BS 1722: Part 16) applicator is required	Certification by powder manufacturer and coating
2607	Granolithic concrete				Testing to be in accordance with Clauses 1702, 1703, 1707 and 1710

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 3000					
3001	General				Inspection Report as Required in Appendix 30/1
3005	Grass seeding, Wildflower seeding and turfing	Rate of spread of fertilizer	1 per 1000 square metres*		
		Rate of spread of seeding	1 per 1000 square metres*		††
		Chemical analysis of fertilizer	1 per source*		
		Grass seed germination and purity (Official Seed Testing Station tests)	1 per source and mix variety*	Required prior to sowing	†
Series 5000					
5003	Abrasives	Grading	[As required]		†† [see # NG 5003]
		Hardness			
5005	Aluminium and zinc spray coatings	Tests specified in BS EN 22063	[As required]		Areas to be tested in accordance with Clause 5006
	Aluminium coating material			Required (BS EN 1301-1)	
	Zinc coating material			Required (BS EN 1179)	
	Sherardized coatings	Tests specific in BS 4921	[As required]		[Sampling procedure and any special adhesion requirements including test method should be scheduled]
	Zinc electroplated coatings	Tests specified in BS 3382: Part 2	[As required]		
	Planting to high strength grip and tension control bolts				[Special tests to detect hydrogen embrittlement should be scheduled where required]
5006	Metal spray coatings	Tensile test specified in BS EN 22063	[As required]		†
		Grid test specified in BS EN 22063	[As required]		†

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 5000 (continued)					
# 5007 5007SE	Paints				
	'A' and 'B' Samples	Specific Gravity	[see Clauses #5007 and 5007SE]		†† [see NG #5007] Samples will be selected in accordance with Clauses #5007 and 5007SE
		Colour match			
		Composition			[see Clauses #5009 and 5009SE]
		Application characteristics			

Note for Table 1/5

- Contamination testing in accordance with Appendices 6/14 and 6/15.
- Frequency of contamination testing to be:
 - For natural materials excavated from the site minimum 3 or 1 suite every 2000 m³ (whichever is greater).
 - For natural materials imported onto the site, source approval 3 suites, then every 2000 m³ from any one source.
 - For recycled aggregates; source approval 3 suites, then every 1000 m³ from any one source.

Key

- † Indicates a requirement in SHW for the test to be carried out by the Contractor; such tests should therefore be scheduled in Appendix 1/5.
- †† Indicates a statement in SHW that the test may/will be carried out under the direction of the Overseeing Organisation; samples for such tests should therefore be required in Appendix 1/6.
- * Indicates that the frequency of testing is given for general guidance and is only indicative of the frequency that may be appropriate (i.e. no frequency is given in the SHW or reference documents). Where materials are known to be marginal or if initial test results show them to be such, the frequency of testing should be increased. Conversely where material properties are consistently in excess of specified minimum requirements or well below specified maximum limits, then the frequency of testing should be reduced.
- (N) Indicates that a UKAS or equivalent accredited laboratory sampling and test report or certificate is required.

Appendix 1/6 - Supply and Delivery of Samples to the Engineer (Rev P5, 17/04/19)

1. All testing required is to be carried out by the Contractor to the satisfaction of the Project Manager, Highway Authority and where applicable, Network Rail.

Appendix 1/7 - Site Extent and Limitations on Use (Rev P5,17/04/19)

1. Extent of the Site

- a) The extent of the site is indicated on the drawings.
- b) The site includes the following areas:

Part of the carriageway, footway and verges of A259 Worthing Road, Highdown Drive and part of the development site.

2. Limitations on Use

- a) The Contractor shall note that any works on the public highway requires agreement from the Highway Authority.
- b) Work on the existing carriageways is likely to be restricted (where possible) to ensure that free flowing traffic conditions are maintained at all times.
- c) The use of temporary traffic signals will only be permitted with the advance written permission of the Highway Authority.
- d) For the purposes of work on the existing carriageways, permitted hours of working are provided in Appendix 1/17.
- e) Access is to be maintained at all times to properties adjacent to the works, unless otherwise agreed with the owner and occupier of those properties.
- f) The Contractor shall obtain the written approval of the Highway Authority to the siting of all huts, equipment, stacks or heaps within the highway boundary. On completion of the works, the huts, equipment etc. shall be removed and the sites made good to the satisfaction of the Highway Authority.
- g) The Contractor shall at all times keep all roads, street, private entrances, verges, cycle tracks, paths, footways, drains and sewers in the area of the works in a safe, and passable state. All waste or superfluous material on the site shall be cleared away by the developer as the works progress.
- h) Contractor to be responsible for preventing access to the land by travellers and other unauthorised persons etc.

Appendix 1/8 - Operatives for the Overseeing Organisation

1. During periodic inspections of the works by the Overseeing Organisation, the Contractor shall make available on request the services of a site engineer and/or a survey operative for the purpose of assisting in checking measurements and levels.

Appendix 1/9 - Control of Noise and Vibration

1. The Contractor shall obtain the noise control requirements from the Local Planning Authority.
2. The Contractor shall comply with the general recommendations set out in BS5228 Noise Control on Construction and Open sites.
3. All compressors shall be 'sound reduced' models fitted with properly lined and sealed acoustic covers which shall be kept closed when the machines are in use, and all ancillary pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturer.
4. All vehicles and mechanical plant used for the purpose of the works shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order so that extraneous noise from mechanical vibrations, squeaking, hissing, etc. shall be reduced to a minimum.
5. The Contractor shall take all steps necessary to limit vibration caused by plant and machinery used on site. In particular, no machine which uses a system of dropping a heavy weight, whether power assisted or by gravity, on the surface of paving or foundation will be permitted for the purpose of breaking up.
6. Machines in intermittent use shall be shut down in the intervening periods between work or throttled down to a minimum.
7. Compliance with this Appendix shall not relieve the Contractor of any of his other obligations and liabilities under the Contract or requirements of the Planning Consent for the development.
8. Any works requiring the breaking out of any carriageway or other hard material using any form of percussion tool, pneumatic and/or hydraulic, (excluding cold milling and saw cutting) will not be permitted between 18:00 and 08:00 hours, on any day (after 13:30 on Saturday) or at any time on a Sunday. Working hours as described in Appendix 1/17 will also apply.

Appendix 1/10 - Permanent Works to be Designed by the Contractor

1.10.1 The Contractor shall undertake the design of and production of Works Information for the elements and aspects of the permanent works listed in the following table.

ELEMENT	LOCATION	DESIGN SPECIFICATION
1. Lifting points for precast prestressed concrete deck beams and precast reinforced concrete edge beams	Railway bridge (WSCC Ref. 1741) and Toddington Lane bridge (WSCC Ref. 1740)	Appendix 17/4
2. Cast in threaded bars, clamping plates and temporary fixing support of precast reinforced concrete edge parapet units to outer prestressed concrete deck beams	Railway bridge (WSCC Ref. 1741) and Toddington Lane bridge (WSCC Ref. 1740)	Appendix 17/4 Drawings 35944/1501/011 and 35944/1502/011
3. GRP permanent bridge deck formwork	Railway bridge (WSCC Ref. 1741) and Toddington Lane bridge (WSCC Ref. 1740)	Drawings 35944/1501/001 and 007 and 35944/1502/001 and 007
4. Bearings to prestressed concrete deck beams	Railway bridge (WSCC Ref. 1741) and Toddington Lane bridge (WSCC Ref. 1740)	Appendix 21/1 Contractor to provide Mageba (or alternative equivalent supplier) proposed bearing design for engineer review
5. Allotment Underpass (WSCC Ref. 1753), including precast reinforced concrete box units, headwalls, wing walls and VRS post support above box unit	Between chainages 420 and 440.	Appendix 17/1 and 17/4 Drawing 35944/1503/001 Contractor should allow for designing a solution to accommodate the VRS post above box unit in conjunction with their preferred VRS supplier. See 1.10.2 for technical approval/design process
6. Allotment Underpass - Light fittings	Allotment Underpass between chainages 420 and 440.	Appendix 90/1 Drawing 35944/1502/001
7. Allotment Underpass - Double leaf palisade security gate	Both ends of Allotment Underpass (WSCC Ref. 1753) between chainages 420 and 440.	Appendix 3/1 Drawing 35944/1503/001
8. Reinforced earth walls with concrete facing panels (WSCC Ref. 6078, 6079 and 6092)	WSCC Ref. 6078 between chainages 55 to 230	Drawing 35944/3501/004 See 1.10.2 for technical approval/design process.

	WSCC Ref. 6079 between chainages 275 to 315 WSCC Ref. 6092 between chainages 375 to 475	
9. Base foundations to directional signs S07 and S18	Directional signs S07 and S18	Drawings 35944/2001/011. Contractor is responsible for obtaining technical approval for the base foundation designs with the adopting authority as necessary.
10. Acoustic fence	Between chainages 530 and 790	Drawings: A083461 SLB2 Contractor is responsible for obtaining technical approval for the base foundation designs with the adopting authority as necessary.
11. Ground investigation	Various	There may be natural solution features and mining cavities underneath the proposed footprint of the bridge foundations. It was not possible to complete ground investigation at the proposed location of the Rail Bridge north foundation and Toddington Lane Bridge south foundation due to land ownership issues at the design stage. The contractor is required to carry out ground investigation as specified in appendix 1/5 and in document SP01/Rev1 -- tender document for ground investigation, and the associated addendum 01/Rev1.

1.10.2 The Allotment Underpass (WSCC Ref. 1753) shall be detail designed by the Contractor's selected sub-contracted precast supplier/designer in accordance with the WSCC agreed Approval in Principle (AIP) 35944/1503/AIP/001 dated July 2017. Upon completion of the design, the design and check certificate shall be signed by the Designer and Checker and submitted to the TAA for acceptance in accordance with the requirements of BD 2/12.

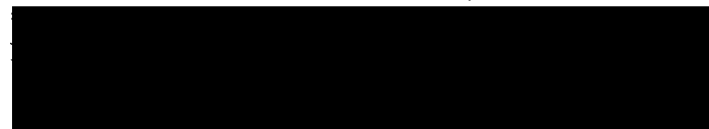
1.10.3 The reinforced earth walls with concrete facing panels (WSCC Ref. 6078 between chainages 55 to 230; WSCC Ref. 6079 between chainages 275 to 315 and WSCC Ref. 6092 between chainages 375 to 475) shall be designed by the Contractor's selected sub-contracted reinforced earth panel wall supplier/designer in accordance with the Strengthened Earthwork Appraisal Forms (SEAF/01, 02 and 03). The Designer shall review each Strengthened Earthwork Appraisal Form (SEAF) and determine whether any updating or amendment is required. In such circumstances the outcome shall be recorded in an updated SEAF, in accordance with the requirements of HD 22/08, and issued to the Overseeing Organisation's Geotechnical Advisor for acceptance before the design. Upon completion of the design, the Designer shall revise the current Geotechnical Design Report (GDR) R002/r02 and provide an accompanying Geotechnical Certificate, in accordance with the requirements of HD 22/08, to the Overseeing Organisation's Geotechnical Advisor for acceptance.

Appendix 1/11 - Temporary Works Design (Rev P2, 30/07/18)

- 1.11.1 The Contractor shall undertake all Temporary Works designs required during construction, including, but not limited to, the design of crane platforms, the formwork to all in-situ reinforced concrete elements, the temporary stability of the precast prestressed concrete deck beams and the precast reinforced concrete edge beams and the temporary support to existing services.
- 1.11.2 Where the failure of Temporary Works would be likely to affect the safety of the railway, Network Rail staff, other contractors, or the public, the temporary works elements shall be designed and checked in accordance with NR/SP/CIV/003 with F002/F003 submissions to Network Rail South East Asset Protection Team for approval. It is suggested that Network Rail approval is obtained a minimum of 8 weeks prior to the commencement of works.

Contact:

Trevor Iddenden
Asset Protection Engineer
Network Rail South East - Asset Management / Asset Protection

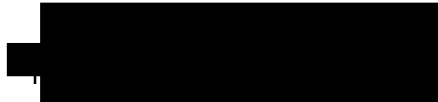


A Front End Pack has been produced to provide supplementary information to Network Rail. This can be found in the Site Information volume.

Appendix 1/12 - Setting Out and Existing Ground Levels

1. The information given below will be available for inspection during the Tender Period at:

Mayer Brown Limited
Lion House
Oriental Road
Woking
Surrey GU22 8AR



and will be supplied to the Contractor at the commencement of the Works.

2. The method of setting-out shall be related to a system of co-ordinated survey markers. Existing survey stations are as indicated on the setting out drawings.
3. Details of existing levels are indicated on the existing survey drawing.
4. All setting-out is to be verified with the Engineer prior to the commencement of any kerb or edging works.
5. Vertical profile of finished roads will be achieved by extension of existing long and crossfalls and additional level information provided in the form of MX Printouts and information on the setting out drawings.
6. Specific requirements for setting out Survey and Geometrical Information:
 - a) As soon as practicable after taking possession of the Site, the Contractor shall check the accuracy of the Bench Marks and immediately notify the Engineer of any discrepancies.
 - b) The Contractor shall not disturb or remove any Bench Mark except with the prior approval of the Engineer, and shall take all necessary precautions to maintain the stability of Bench Marks until such time as they are no longer required.
 - c) The Contractor shall carefully establish additional setting-out stations and Works Bench Marks, at locations approved by the Engineer, as may be necessary from time to time for the proper setting out of the Works.
 - d) The Contractor shall set out parts of the Works at such times as he may be directed by the Engineer to enable Public Utilities Undertakers, Local Authorities or other Statutory Bodies to carry out temporary or permanent alterations to their mains, services or other apparatus.
 - e) Should any setting out mark, station, peg or other apparatus however established be disturbed during the course of the works the Contractor shall suspend the activity, operatives or machinery responsible until such time as it has been replaced to the satisfaction of the Engineer.

Appendix 1/13 - Programme of Works

1. The Contractor shall provide the programme in the form of a Network Diagram/Bar Chart produced as a result of a 'critical path analysis' and must abide by the constraints below. 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 with earliest and latest event dates.

At the time of presentation of the Programme the Contractor shall also provide a general description of the arrangements and methods of construction.

2. Schedule of Constraints

- a) Work to Privately and Publicly owned services and supplies - see Appendix 1/16.
- b) Traffic safety and management including notice requirements and restricted working hours - with reference to Appendix 1/7 and 1/17.
- c) Restrictions arising from the use of substances hazardous to health - refer to Appendix 1/23.
- d) Restrictions arising from the control of noise or vibration - refer to Appendix 1/9.
- e) Trials and demonstrations in advance of main construction.
- f) Timeframes for acceptance, approval or authorisation requirements.
- g) Permanent lane markings and edge of carriageway markings shall be constructed prior to re-opening of carriageways unless otherwise agreed by the Engineer. If the Engineer agrees that carriageway markings should not be relaid by the end of a particular day/night's work the Contractor shall prior to opening of traffic either
 - i) erect and maintain appropriate Chapter 8 signing to the Engineer's approval and maintain such signs until permanent road markings are constructed;
 - or
 - ii) construct temporary road markings to the Engineer's approval. Such markings shall be completely removed prior to construction of permanent road markings (all as per Traffic Signs Manual Chapter 8, Clause 3.3)

3. The level of detail should be set not less than the following:

Level 1

Within 21 days after the acceptance of Tender and any subsequent revision, or as may be requested by the Engineer

- (i) Earthworks-each cutting and embankment.
- (ii) Roadworks
 - (a) Fencing
 - (b) Site clearance
 - (c) Topsoil strip
 - (d) Drainage, foul and surface water (pre-earthworks and second stage)
 - (e) Subbase
 - (f) Base
 - (g) Binder course
 - (h) Surface course
 - (i) Street lighting
 - (j) Traffic signing
 - (k) Traffic Signals
 - (l) Retaining structures

- (j) Landscaping
- (iii) Major privately and publicly owned services and supplies.
- (iv) Traffic management measures including operation of site accesses, plant crossings and temporary diversions for traffic.

Level 2

Further breakdown of items and other details as may be required.

The Contractor shall allow in his programme for the following (subject to Highway Authority requirements):

- (i) 3 months advance notice
- (ii) 1 month advance notice
- (iii) 7 day notice
- (iv) Start on site notice
- (v) Preparation and approval of Programme, Traffic Management proposals, Method Statements etc by the Highway Authority pre-start
- (vi) Contractor to obtain permit to work from the Highway Authority
- (vii) Pre-start meeting with the Engineer and the Highway Authority at least 4 weeks prior to commencement
- (viii) Erection of advance notices signs at least 2 weeks prior to commencement, or as otherwise agreed
- (ix) Works Finish notice (exact timing to be agreed with highway authority)
- (x) 6 weeks for the Stage 3 RSA and Designer's Response following a practical completion inspection
- (xi) 6 weeks for RSA remedial and snagging works
- (xii) A final practical completion inspection, post snagging and RSA remedial works.

Appendix 1/15 - Accommodation Works

1. No specific accommodation works outside the highway boundaries are identified. However, the Contractor is required to make good any access or footway serving an adjacent property due to the alteration of kerblines, carriageway or footway.
2. Similarly, any damage caused by the actions of the Contractor to boundary fences/walls/hedges of properties adjacent to the works is to be made good.

Appendix 1/16 - Privately and Publicly Owned Services and Supplies

1. The Contractor shall make arrangements with the Statutory Undertakers and others concerned, for the co-ordination of his work with any work which needs to be done by them or their contractors concurrently with the Works. Compliance with the periods of notice given in this Appendix does not relieve the Contractor of his obligations.
2. Private services to individual properties have not generally been listed or shown on the Drawings. The Contractor shall make arrangements with the Statutory Undertakers and others concerned for the phasing of all necessary disconnections and diversion of private services affected by the Works.
3. Disconnected apparatus shall be removed by the Contractor only with the prior consent of the Authority concerned.
4. The names, addresses and telephone numbers of the affected authorities serving in the locality are listed below.

<u>Name</u>	<u>Address</u>	<u>Contact/Tel No.</u>
SGN - Gas		
UKPN - Electric		
Virgin Media - Cable		
Instalcom (Level3) - Cable		
SSE - Cable		
BT - Telecommunications		
Southern Water – Water		
Vodafone		
Transco (ducts for Vodafone)		

5. Services and Supplies Affected by the Works are as indicated on Service Consultant's drawings and documents. A summary of the protection / diversion works are as follows:

<u>Authority/Description of Works</u>	<u>Group</u>	<u>Notice required to commence</u>	<u>Time for completion</u>
SGN – Gas	TBC	TBC	TBC
UK Power Networks – Cable lowering & diversions associated with proposed road improvement scheme.	TBC	TBC	TBC
UK Power Networks – Disconnection / connections associated with the electrical supply for street lighting columns and illuminated signs			
Virgin Media – Cable	TBC	TBC	TBC
Instalcom (Level3) – Cable	TBC	TBC	TBC
SSE – Cable	TBC	TBC	TBC
BT – Telecommunications	TBC	TBC	TBC
Southern Water – Water	TBC	TBC	TBC
Vodafone	TBC	TBC	TBC
Transco (ducts for Vodafone)	TBC	TBC	TBC
GTC HV Network	TBC	TBC	TBC

New HV electricity route along the western side of the new bypass. Currently Planned route indicated on ENC Drawing numbered EN0015711-1_220517_1 of 8

The above information is given as a guide only. Discussions with the statutory undertakers is ongoing and further liaison will be required throughout the construction process to establish the actual effect on the existing apparatus.

- A - Work expected to be completed before the commencement of the Works.
- B - Work required in the Contract which does not require prior work by the Contractor.
- C - Work required in the Contract which does require prior work by the Contractor.
- D - Work expected to be under construction at the commencement of the Works.
- E - Work to be wholly undertaken by the Contractor.

6. Services and Supplies Affected by the Works are being dealt with by the Service Consultants. Please refer to their drawings and documents for full details of existing and proposed Statutory Undertakers' apparatus.

Appendix 1/17 - Traffic Safety and Management (Rev P5, 17/04/19)

1. Definitions

- a) **Traffic Management Operation:** A Traffic Management Operation consists of those activities necessary to assemble, alter and remove a traffic management system.
- b) **Traffic Management System:** A Traffic Management System is the method chosen to direct the traffic around the Works area and shall be lane closure as stated in the Contract.
- c) **Traffic Management Equipment:** Traffic Management Equipment consists of all signs and their covers, cones, cylinders, studs, barriers, road markings and lights including their supports and fixings and any cabling, piping joint connectors, gas/electricity supply or weighting down required for a Traffic Management System.

2. Responsibility for Traffic Management etc.

The Contractor is responsible for the Traffic Safety and Management and associated work as described in this Appendix.

3. Traffic Management Requirements

- i) The Contractor shall phase the Works so as to cause the minimum disruption to traffic and shall agree the phasing with the Highway Authority and the Police.
- ii) The Contractor shall produce drawings showing traffic management layouts including as appropriate:-
 - (a) Working area(s)
 - (b) Safety zone(s)
 - (c) Width of lanes
 - (d) Entrance and exit positions to works for site vehicles
 - (e) Start of taper positions

The Contractor should allow a minimum of 10 working days for the checking of his submissions by the Highway Authority.

- iii) Subject to approval by the Highway Authority, permitted hours of working on the public highway and within the site boundary are as follow:-

*08:00 to 18:00 Monday to Friday inclusive
08:00 to 13:30 Saturdays
No works on Sundays / Public Holidays*

Working on live carriageways will not be permitted during the following times (unless agreed in advance with the Highway Authority):

*08:00 to 09:30 Monday to Friday inclusive
16:00 to 18:00 Monday to Friday inclusive*

Continued.....

iv) Implementation

- (a) The works will necessitate the setting up, alteration, and removal of Traffic Management Systems. Systems shall be based on the recommendations of Chapter 8 of the Traffic Signs Manual published by Her Majesty's Stationery Office and any setting up, alteration or removal of such a system shall be in accordance with the recommendations of the same document and any amendments thereof.
- (b) The Contractor shall supply, erect and remove all Traffic Management Equipment required for any Traffic Management System. All signs shall be covered when not in use.
- (c) The Contractor shall not commence any permanent works that will affect the public highway until the Traffic Management System is approved by the Police and Highway Authority and is fully operational.
- (d) The Contractor shall regularly inspect the Traffic Management System in operation at the time. Each part of the Traffic Management System shall be inspected at least once in every four hours. Any damaged or displaced Traffic Management Equipment shall be immediately reinstated. A written defects sheet together with details of remedial measures taken shall be compiled daily and submitted to the Highway Authority at weekly intervals. When major damage to the Traffic Management System occurs, e.g. in the event of a traffic accident, the Contractor shall make provision for any manpower necessary to reinstate the Traffic Management System.
- (e) Site vehicles are to be equipped with an amber flashing lamp. Hazard warning lights are not an acceptable alternative to a roof-mounted amber flashing lamp.
- (f) In addition to Clause 117.14 the roof-mounted amber flashing lamp shall be switched on when the vehicle is in the following situations:
 - a] during short term, low speed, mobile operations (e.g. vehicles engaged in surveillance of traffic management systems during maintenance operations);
 - b] whilst stationary adjacent to a trafficked lane;
 - c] whilst manoeuvring within a coned off area;
 - d] at any other time as instructed by the Highway Authority or the Police.

v) Traffic Safety and Control Officer

- (a) 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. The Traffic Safety and Control Officer shall be a direct employee (and not a sub-contractor) who shall be entirely responsible for arranging and agreeing lane closures, liaison with the Highway Authority and the Police in all matters relating to traffic management, the management of traffic during periods of time when traffic restrictions are necessary and ensuring that all traffic management requirements are met, inspection and maintenance of all equipment as described and dealing with traffic in emergencies as specified, including notifying the police immediately of any accidents, emergencies, etc. The Contractor shall supply to the Highway Authority and Police the name and telephone number of the Traffic Safety and Control Officer.

- (b) The responsibilities of the Traffic Safety and Control Officer shall include liaison with the Highway Authority and Police concerning the following matters:-

1. Control of entry and exit to a temporary site
2. The safe working of plant, machinery and men within a temporary site.
3. Notifying the Contractor's Agent and the Highway Authority of any deterioration of safety precautions, including all traffic management and trafficked road surfaces.
4. Ensuring all personnel engaged on the Works are aware of the Contract requirements in respect of site safety.

vi) Traffic Management Operations

- (a) Each Traffic Management Operation shall be agreed with the Highway Authority as detailed on the drawings and shall include all equipment and activities necessary to set up, alter and maintain, remove the type(s) of Traffic Management System(s) employed in that operation, including all temporary signing and transportation of equipment to and from store (Employers or Contractors) to the temporary site.
- (b) The Highway Authority shall have the unqualified right to instruct workmen and /or sub-contractors on matters relating to traffic safety and control.
- (c) In the event of an accident or emergency occurring in the vicinity of the works, the Contractor shall, upon receipt of a written order by the Highway Authority, temporarily suspend his works and aid the Police as may be directed.
- (d) In the event of poor visibility due to fog or spray from vehicles the Highway Authority may, after consultation with the Police, withhold approval for the Contractor to set up, alter or remove a Traffic Management System until visibility is deemed, by the Police, to be suitable for the operations being carried out.
- (e) No vehicles are to utilise their white lights against the flow of traffic
- (f) The Contractor shall ensure that all his staff and those of his sub-contractors and any other personnel; who from time to time may visit the site, are aware of the requirements of Clause 117 and this Appendix. Particular attention is drawn to the requirements of Clause 117, sub-clause 18 with regard to high visibility clothing.
- (g) Non-essential vehicles, particularly private cars, shall not enter a coned off area.
- (h) During the hours of darkness the Contractor shall provide lighting which, to the satisfaction of the Highway Authority, is adequate for the work being carried out.

4. Ways affected by the Works

The Contractor must make due provision for the safety of pedestrians and cyclists crossing through or passing around the Works. All proposals to divert the route of a footway or bridleway during the course of the works must be agreed in advance with the Engineer and the Highway Authority.

It is the responsibility of the Contractor to make all necessary arrangements with the Highway Authority for Temporary Traffic Regulation Orders for the closure, partial closure or restriction of highways. The Contractor should expect an advertisement/notice period of 3 months to apply before a road closure can be effected.

Appendix 1/18 - Temporary Highways for Traffic (Rev P5, 17/04/19)

1. The Contractor shall submit all proposals for the temporary diversion of vehicular traffic, cyclists and pedestrians to the Project Manager and Highway Authority for approval. The proposals shall be in the form of drawings to indicate the proposed diversion routes and shall include all traffic management measures required by Appendix 1/17 and Chapter 8 of the Traffic Signs Manual, as appropriate.
2. The Contractor should allow a minimum of 20 working days for the checking of their submissions.
3. The Contractor must pay due regard to the times and constraints for carriageway restrictions and closures as detailed in Appendix 1/17, and the limitations on the use of the site as detailed in Appendix 1/7.
4. Access and egress from all properties adjacent to the works shall be maintained at all times unless otherwise agreed with the property occupiers and/or owners and approved by the Engineer.

Appendix 1/19 - Routeing of Vehicles (Rev P5, 17/04/19)

1. Permitted Access Routes to and from the Site

- a) The Contractor shall agree access routes to the site with the Engineer, Highway Authority, Network Rail and Police at the commencement of the Contract.

2. Movement of Machinery and Plant across Public Roads

- a) The Contractor shall be restricted from moving excavated material across public roads unless written authorisation has been obtained from the Highway Authority.
- b) Any plant crossing shall be set up to meet the requirements of Paragraph 2.3.8 of Chapter 8 of the Traffic Signs Manual, as a minimum, and to meet the requirements of the Police and the Highway Authority.
- c) The Contractor shall keep the crossing area in a safe condition at all times compatible with the status and use of the road/footway being crossed. Repairs and reinstatement shall be carried out promptly and be subject at all times to the satisfaction of the Highway Authority.
- d) The movement of machinery and plant of an isolated nature will be subject to any restriction which the Police, Network Rail or Highway Authority may impose. The Contractor shall take such action as is necessary to protect and maintain the surface of the highway crossed by plant.

Appendix 1/21 - Information Boards (Rev P2, 30/07/18)

1. Driver Information Signs

- a) The Contractor shall supply, erect, maintain and remove driver information signs as part of his traffic Safety and Management works in accordance with Appendix 1/17 and this Appendix.
- b) The Contractor shall ensure that all driver information signs are erected and positioned so as to expose the said sign's face to the approaching traffic at all times during the Works.

- c) Signs on Approach to Roadworks

Advance signs shall be provided as required by Chapter 8 of the Traffic Signs Manual and as directed by the Highway Authority. The Contractor shall liaise with the Highway Authority to agree the exact form and wording of the proposed signs to be erected.

- d) Commencement Signs

The Contractor shall erect commencement signs adjacent to the highway at locations to be agreed with the Highway Authority. The sign shall be erected 4 weeks prior to the Date for Commencement of the Works, or such other reduced period as agreed by the Engineer.

2. Advertisements

- a) The content and positioning of all of the Contractor's name boards and similar advertisements by the Contractor or by any sub-contractor shall require the prior written approval of the Highway Authority. Adverts shall not be placed on the Public Highway. Adverts placed on WSCC land shall only be placed with the consent of the landowner.
- b) Advertisement signs shall comply with the Town and Country Planning (Control of Advertisements) Regulations 1992.
- c) Advertisement signs shall be removed no later than 7 days after the date of completion of the Works.

Appendix 1/22 - Progress Photographs

1. ***The contractor shall arrange for a photographic record of the site to be made at the commencement of the works and fortnightly thereafter.***
2. The photographs shall be taken with a digital camera by a competent photographer, who may be a member of the Contractor's staff. The photos shall be presented to the Engineer on a compact disk.
3. Photograph locations are to be agreed with the Engineer.
4. No aerial photographs are required.

Appendix 1/23 - Risks to Health and Safety

The Contractor is required to comply with all relevant Health and Safety legislation.

1 Details of known specific or extraordinary hazards or risks that would require particular or unusual precautions and would place limitations on the methods of working.

- a. The Designer is unaware of any specific or extraordinary hazards or risks that would require unusual precautions. However, the Contractor's attention is drawn to the Hazard and Risk Assessment and in particular the requirement to undertake excavations within the vicinity of live services.

2 Details of known required actions or precautions.

- a. Observe the requirements of HSG47 Avoiding danger from underground services.
- b. The Contractor shall contact the statutory undertakers as necessary to allow their apparatus to be located on site using suitable detection tools.
- c. Carefully hand dig trial holes to locate services as necessary.

3 Details of notifications required to and from the Overseeing Organisation or other parties.

The exact process and requirements relating to notifications varies from authority to authority. However, the following should be considered the minimum relevant to this project:

4 Details of any specific monitoring requirements and submission of records to the Overseeing Organisation.

- a. No specific monitoring has been identified at this stage.
- b. The Contractor shall be required to provide any information relating to the works required by the Principal Designer and/or Contractor for inclusion within the Health and Safety File. This may include the following:
 - » 'As Built' Drawings
 - Drawings
 - Details
 - Signing schedules
 - Specification Summary
 - Schedule of materials used (Materials, source and/or supplier)
 - Subcontractors used within The Works
 - Technical Information
 - Test Results
 - Post Construction Surveys
 - Schedule of operating and maintenance manuals
 - Schedule of equipment with health and safety implications
 - » Operational Hazards and Method Statements

Appendix 2/2 - Filling of Trenches and Pipes (Rev P5, 17/04/19)

1. Existing gully pots to be abandoned where they are to be located within areas of new soft verge. Cover, frame and one course of brick shall be removed, connection sealed and gully pot filled with suitable granular material sufficient to enable topsoil and seeding to be placed.
2. Existing gully pots to be removed where they shall be located within areas of new carriageway. Redundant gully pot shall be broken out to at least formation level and the connection sealed as close to their discharge points as is practically possible, all to the satisfaction of the Highways Inspector.
3. Any abandoned/redundant pipes and chambers less than 1.0m deep that fall within the proposed adoptable highway shall be grubbed up and the void backfilled in layers up to formation level to the carriageway with selected granular material.
4. Any abandoned/redundant pipes and chambers more than 1.0m deep and greater than 375mm diameter that fall within the proposed adoptable highway shall be permanently filled with a grout of cement and pfa (or similar filler to the approval of the Engineer).
5. All redundant connections in existing manholes/chambers shall be sealed and the benching made good, all to the satisfaction of the Highway Inspector and utility company/owner.
6. Redundant open drainage channels are to be cleared of debris and vegetation and then filled in accordance with Series 600 of SHW and Appendix 6/3.

Appendix 2/3 - Retention of Materials arising from Site Clearance

The Contractor shall provide new materials for the construction of the Permanent Works, except as detailed below:

1. Existing gully gratings and frames and manhole covers and frames to be raised/lowered/adjusted or replaced if deemed necessary by Highways Inspector, to suit new road, footway or verge levels as required.
2. Existing traffic signs to be taken down and set aside for re-use are as indicated within the Traffic Signing Schedules at the rear of this document.
3. Existing street lighting columns to be removed / relocated as shown on SSE street lighting drawings.

Appendix 2/4 - Explosives and Blasting

1. Explosives shall **not** be used at any location on the site.
2. No burning of refuse, waste materials or vegetation shall be undertaken on the site in connection with the site clearance or construction of the development.

Appendix 3/1 - Fencing, Gates and Stiles (Rev 07-05/09/15)

Temporary fencing

1. The Contractor is to agree with the owners/occupiers and the highway authority the extent of any temporary fencing to be provided at the boundary of the Works with adjacent properties.
2. The Contractor is to provide hoarding and security fencing as necessary to protect the permanent works, temporary works, accommodation works, third party properties abutting the site, site offices and compounds.
3. The Contractor shall submit to the Project Manager and highway authority details of the standard and location of temporary fencing to be provided during the course of the works. The Contractor should allow a minimum of 4 weeks for the checking of his submissions by the highway authority.

Permanent Fencing: Wooden Fencing, Gates and Stiles including Planting Works Fencing

4. Acoustic Fencing shall be provided at the locations indicated on the PBA Acoustic Barrier drawing.
5. Double leaf palisade security gates shall be provided at both ends of the Allotment Underpass (WSCC Ref. 1753) as indicated on drawing 35944/1503/001.
6. The security gates shall be galvanised to BS EN ISO 1461:2009.
7. The gate posts shall be fixed to the reinforced concrete slab using steel bolts.
8. Heavy Duty Padlocks shall be provided for each security gate. Access/keys shall be kept by Littlehampton Town Council and West Sussex County Council.

Appendix 4/1 - Road Restraint Systems (Vehicle and Pedestrian) (Rev P2, 30/07/18)

General

The locations of the new vehicle restraint system (VRS) are shown on drawing 35944/2001/010.

Only those firms registered with an approved certification body in accordance with Appendix A of the Specification for Highway Works will be permitted to erect the VRS.

Prior to excavation for foundations, the Contractor shall locate all existing and proposed services including highway drainage within 1 metre of the proposed longitudinal alignment of a VRS.

1 Safety Barriers, Terminals, Transitions and Crash Cushions

- 1.1 The Contractor shall undertake a survey of existing retained barrier containment class and confirm to the Project Manager and approving authority, the proposed transition connections between existing and proposed VRS.
- 1.2 The Contractor shall install transitions between different working width barriers as required by the specific system installed.

2 Testing

- 2.1 The Contractor shall provide drawings, specifications and testing requirements for the proposed safety barriers, terminals and transitions to the Overseeing Organisation for acceptance. The drawings shall show the type of post foundation selected on the basis of the tested ground conditions.

Destructive Testing

- 2.2 The Contractor shall supply copies of certified reports on destructive tests of components to be incorporated in the Works. These shall be provided to the Overseeing Organisation within 14 days of the commencement of the contract.
- 2.3 Provision of certified reports of destructive tests on test components shall be provided in accordance with Clauses 402.6(v) and 408.

Site Testing on Post Foundations

- 2.4 The Contractor shall carry out tests on post foundations in accordance with Clause 404.
- 2.5 Testing shall be carried out at the locations where the posts are to be installed in the direction of the anticipated deflection and at a time when the ground is likely to have least resistance. Testing locations and frequencies to be agreed with the Overseeing Organisation.
- 2.6 The Contractor shall submit for approval a test schedule to check compliance with the safety barrier, terminal and transition system to the manufacturer's specification. As a minimum testing shall be carried out as follows:
 - (i) Each safety barrier, terminal and transition system;
 - (ii) At intervals not greater than 100m on sections of safety barrier exceeding 200m in length. However in all instances a min of two tests shall be conducted on each section of the barrier and parapet.
- 2.7 The Contractor shall install test posts and foundations after the completion of finished ground.
- 2.8 The Contractor shall arrange to undertake tests and make results available for inspection prior to the installation of the relevant safety barrier, terminal and transition system.

Site Testing on Anchorages in Drilled Holes

- 2.9 The Contractor shall carry out tests in accordance with Clauses 404 and 410.

Temporary Safety Barriers

The Contractor shall refer to Clause 405 for Temporary Safety Barrier and submit specification and plans as part of the Traffic management approval process.

Appendix 4/2 - Information Required to demonstrate Compliance of Road Restraint Systems to BS EN 1317-1, BS EN 1317-2, BS EN 1317-3 and DD ENV 1317-4: 2002 (Rev P2, 30/07/18)

The Contractor shall submit the following supporting information demonstrating compliance with BS EN 1317-1, BS EN 1317-2, BS EN 1317-3 and DD ENV 1317-4:2002 to the Overseeing Organisation for acceptance:

EUROPEAN COMMITTEE FOR STANDARDIZATION (CEN) COMPLIANCE ¹

Initial submission documents to be supplied for consideration of initial type test are as follows:

1. Test report in accordance with BS EN1317-1, clause 9 (and including any additional test data required under BS EN 1317-3, clauses 7.3 and 7.4 and DD ENV 1317-4:2002, clauses 7.3 and 7.4).
2. Video / high speed film of test annotated showing date, test number and performance class.
3. Still photographs of complete installation including anchorage points.
4. Still photographs of vehicle before and after impact.
5. Full drawings of tested items.
6. Certification from the manufacturer that the item tested complies with drawings supplied.
7. Certificate from test house accredited in accordance with the requirements of Series 400 (MCHW/1.400).

Additional information, which will be required on acceptance of initial type test prior to installation.

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

Notes:

1. All documents, which are not in English, will have to be translated. If they are in a language other than French or German the promoter will be required to supply a full translation.
2. Items 12 and 13 are required for safety barrier systems and transitions
3. Items 14 and 15 are required for vehicle parapets. See also Note 1 under Sector Scheme B in Appendix A of the Specification for Highway Works. (11/06)

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 Highway 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:

SUBMISSION FOR COMPLIANCE WITH CLAUSE 401 (cont.)

TYPE OF TRANSITION:

Ref(s) used in contract specific Appendix 4/1 Schedule of NRS:

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 meet Figures 6 of ENV 1317-4:2002		(+/- 5%) (0, +7%) (-1, +1.5) Refer to Figure 6 of ENV 1317-4:2002			
		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 flanges 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 split 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, 4.0m for other vehicles) plus the width of the vehicle plus 10 % of the length of the vehicle within a distance B (10m for cars, 20m for other vehicles) from the test (namely closest to the downstream end of the barrier) point P, when 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 1/2 for the heavy vehicle test)					
BS EN 1317-2: 2010, clause 4.4	Impact Severity Level	SPECIFIED TSN Limit 35 km/h ASH Limit 1.4	ACTUAL				
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, BS EN 1317-4:2002							
Signature: Name,							
Date,							

SUBMISSION FOR COMPLIANCE WITH CLAUSE 401

TYPE OF TERMINAL:

Ref(s) used in contract specific Appendix 4/1 Schedule of RBS:

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 BS ENV 1317-4: 2002, clauses 7.4 and 7.5	Vehicle Details	Impact Conditions Test vehicle mass (kg) Speed (km/h) Angle (degrees) Combination of tolerances meets Figure 6 of ENV 1317-4:2002		(± 0.5) (0, $\pm 7\%$) (-1, ± 1.5) Refer to Figure 6 of ENV 1317-4:2002			
		Centre of Gravity Vertical height (m) Longitudinal (m) Lateral (m)		($\pm 10\%$) ($\pm 10\%$) N/A			
		Model					N/A
BS 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 intrusion into, the passenger compartment that could cause serious injuries are not permitted. 2) If a 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 BS 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.					
BS 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).					
BS 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.					
BS 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				
BS 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 BS ENV 1317-4:2002							
Signature: Name.							
Date.							

Appendix 5/1 - Drainage Requirements

- For locations and details of highway drainage refer to drawings numbered PHLY-MB-S278-GF-DR-D-312 and 412, Surface Water Manhole Schedule and associated standard details.

Surface Water Pipes

- All pipes and fittings are to carry the relevant BS number and be kitemarked. Pipes shall be Clay, UPVC or Concrete in accordance with WSCC detail numbered S278/38/11.
- The Contractor shall submit pipe strength calculations if so requested by the *Project Manager and/or Highway Authority*.

Bedding and Jointing

- Pipe bedding to highway drainage to be Type Z when located under carriageway and Type T at all other times as indicated on WSCC detail numbered S278/38/11.
- Pipework for road gully connections shall be 150mm diameter minimum. The minimum diameter for a highway surface water carrier sewers shall be 225mm diameter.

Gullies and Connections

- Gullies and connections shall be installed at the locations shown on the drawings unless otherwise agreed.
- Gullies shall be constructed in accordance with WSCC detail numbered S278/38/11 and must be precast concrete unless agreed in writing with WSCC.
- The internal diameter of gully pots shall be 450mm on all carriageways. Pots shall be 900mm deep with a 150mm diameter outlet and trapped.
- Gully grating and frame shall be to BS EN124 Class D400 and hinged and have a minimum frame depth 100mm for 'B' Road and 150mm for 'A' Roads.

Catchpits

- Catchpits shall be constructed in the locations and to the levels shown on the drawings and shall be precast concrete Catchpits for highway drainage in accordance with WSCC detail numbered S278/38/13.
- Chamber covers and frames shall be ductile iron in accordance with BS EN 124 Class D400.

Testing / CCTV

- If requested, it is the Contractor's responsibility to undertake pressure tests on completion of every drainage run between manholes/catchpits on pipes up to 750mm diameter and witnessed by the Highway Authority inspector.
- If requested, the Contractor shall undertake a CCTV survey prior to completion certificate being signed off and issued. The sewerage shall be mechanically cleansed as directed by the Engineer.

Attenuation Crates

- The scheme includes the provision of two attenuation crate systems manufactured by Aquacell (*or similar approved by the Project Manager and WSCC*). The location of the crate features are indicated on drawing PHLY-MB-S278-GF-DR-D-412. For details refer to details PHLY-MB-S278-GF-DR-D-F/05 and F/06. For details refer to the data sheet at Schedule A at the end of this document.

Bypass Separator

- The scheme includes the provision of a Bypass Separator manufactured by SPEL (*or similar approved by Project Manager and WSCC*). Model ref 345 C1/SC. The location of the crate features are indicated

on drawing PHLY-MB-S278-GF-DR-D-412. For details refer to the data sheet at Schedule A at the end of this document.

Hydrobrake Flow Control

16. The scheme includes the provision of a flow control chamber limited to 10 l/s with 2.0m of design head. The location of the chamber is indicated on drawing PHLYM-MB-S278-GF-DR-D-412. For design criteria refer to Micro Drainage extract at Schedule A at the end of the document and WSCC detail numbered S278/38/14. The contractor shall confirm details with the manufacturer, Hydro-International (or similar approved by the Project Manager and WSCC), prior to supply and installation.'

Appendix 5/2 - Service Duct Requirements (Rev P5, 17/04/19)

1. The locations of electrical ducts and drawpits are as indicated on the drawings.
2. Unless specified otherwise, drawpits shall be in accordance with WSCC requirements and/or statutory authority requirements.
3. Ducts for Statutory Undertakers and Service Companies shall be as indicated on the **Service Consultants drawings**. Ducts where necessary shall be supplied in the following colours, unless otherwise indicated :-

Water Company	blue
British Telecom	grey
Gas Company	yellow
Communication Company	White
Electricity	black
	Street Lighting Orange (Embossed with text 'STREET LIGHTING')
Road Signs	Orange (Embossed with text 'STREET LIGHTING' stamped at 1m intervals)
Traffic Signals	Orange (Embossed with text 'TRAFFIC SIGNALS' stamped at 1m intervals)
4. All ducts shall be 100mm diameter minimum (50mm for traffic signal loop under kerb ducts) and are to have a smooth internal bore; unless agreed otherwise with the ~~Project Manager~~ and appropriate SU, Service Company or Highways Authority.
5. Duct materials are to be in accordance with Series 500 of SHW and the WSCC *Traffic Signal Installation Standards*, provided at ~~Schedule C~~ at the rear of this document.

Appendix 5/5 - Combined Drainage and Kerb System (Rev P5, 17/04/19)

1. Marshalls kerb drainage system to be minimum width 430mm in accordance with WSCC detail numbered S278/38/02, except for PDS Envirokerb drainage system over and between structures which shall be minimum width of 310mm.
2. The scheme indicated the provision of Marshalls Beany Kerb units with access units spaced approximately 50m apart, located at the head of the run, near to dropped kerbs and at joints with PDS Envirokerb Bridge Drainage units. The location of these features are indicated on drawings PHLY-MB-S278-GF-DR-D-312, 312-2, 412 and 412-2. For details refer to detail PHLY-MB-S278-GF-DR-D-F/02, F/04 and F/07.
3. The scheme indicated the provision of PDS Envirokerb Bridge Drainage units with access units spaces approximately 20m apart, located at the head of the run, near to dropped kerbs and at joints with Marshalls Beany Block units. The location of these features are indicated on drawings PHLY-MB-S278-GF-DR-D-312-2 and 412-2. For details refer to manufactures details at Schedule A at the end of this document and detail PHLY-MB-S278-GF-DR-D-F/07.

Appendix 6/1 - Classification and Acceptability of Earthworks Materials Requirements for Earthworks Materials (Rev 04, 15/11/18)

1. Acceptable limits and criteria for the Permitted Classes of fills appropriate to the Contract are detailed on Table 6/1 of the SHW, the modified Table 6/1 included in this Appendix and Appendices 6/14 and 6/15 of the Specification. The Contractor is responsible for appropriate sampling and testing, including testing to determine the concentration of potential contaminants, to classify and determine the acceptability of earthworks materials based on the specified limits and criteria.
2. Samples for classification and acceptability testing shall be taken at the point of excavation for on-site materials and at the point of deposition for imported materials. If the material has altered its classification or become unacceptable for whatever reason, the Contractor shall repeat the classification and acceptability tests. The frequency and scope of acceptability testing requirements shall be according to Appendix 1/5 of the Specification.
3. The Contractor is to submit an Earthworks Quality Control Method Statement for approval by the Project Manager not less than 10 working days prior to the start of Earthworks.
4. Permitted Constituents of fill materials shall be any natural materials or combinations of natural materials other than chalk and material designated as Class 3. There are no existing on-site materials to be designated as Class 3 and no Class 3 materials are to be used in the works.
5. Where fill materials include recycled crushed concrete, the Contractor shall determine the nature of the ground and groundwater beneath and surrounding the areas of proposed fill with respect to sulphur, sulphates, and any other potentially deleterious materials, in accordance with TRL 447 and other relevant guidance, and shall assess in accordance with TRL 447 and other relevant guidance the suitability of using materials containing recycled crushed concrete in the proposed areas.
6. The fill materials shall be inert as defined in Clause 7(4) of the Landfill (England and Wales) Regulations 2002. The fill materials shall be tested to determine the concentration of potential contaminants in accordance with the methodology and limits of detection included in Appendices 6/14/and 6/15 of this Specification. The materials shall be classified as Unacceptable Material Class U2 when the concentrations of potential contaminants exceed the acceptability limits given in Appendices 6/14/and 6/15 and shall be dealt with in accordance with Appendix 6/2. The frequency and scope of acceptability testing requirements shall be to Appendix 1/5 of this Specification.
7. The Contractor is responsible for ensuring all statutory and regulatory requirements for the receipt and use of all materials either excavated from the site or imported onto the site are observed. The Contractor is responsible for ensuring a record of each load delivered and accepted is kept giving: (i) date, (ii) nature and quality, (iii) place of origin, (iv) quantity by weight/volume, (v) carrier, (vi) supplier. The Contractor is responsible for ensuring a visual and olfactory assessment is carried out on every load, on initial receipt and after deposition, to ensure compliance with the Acceptance Criteria; the findings of the assessment shall be recorded with the record sheet for the load.
8. There are no specified requirements for processing to render unacceptable material Class U1A or Class U1B acceptable. There are no specified requirements for the removal off site of excavated acceptable or unacceptable material requiring processing or retention on site of surplus material. The Contractor shall be responsible for removal and / or processing of unacceptable material or surplus acceptable material deemed not acceptable for use in the Permanent Works.
9. Acceptable or unacceptable fill, other than contaminated material may be used in landscape areas. This excludes the environmental, noise bunds, or any other earthworks of structural nature, where the fill parameters are determined through stability or bearing capacity requirements. Class 5 and Class U2 materials shall not be used as landscape fill.

10. There are no specified requirements for groundwater lowering or other treatment. The Contractor shall take all necessary measures (both temporary and permanent) to ensure that the presence or ingress of groundwater, infiltration water and the effects of weather does not compromise the integrity of earthworks. Operations shall not take place during adverse weather conditions.
11. Where material is imported onto site which is not 'as dug' it shall be natural aggregates (except shale, siltstone, or slate) or crushed concrete, bricks or masonry conforming to BS EN 12620.

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Class	General Material Description	Typical Use	Permitted Constituents (All subject to requirements of Clause 601 and Appendix 6/1) See Note 1	Material Properties Required for acceptability (in addition to requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631) See Note 2				Compaction Requirements See Note 3
				Property (see exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits Within:		
						Lower	Upper	
2A	Wet cohesive material	General fill	Any material, or combination of materials, other than chalk.	Grading	BS 1377: part 2	Table 6/2	Table 6/2	Table 6/4 Method 1
				plastic limit (PL)	BS 1377: part 2	-	-	
				Mc (see note 4)	BS 1377: part 2	PL -4%	App 6/1	
				MCU	Clause 632	App 6/1	App 6/1	
				Undrained shear strength of remoulded material	Clause 632	75	150	
4	Various	Fill to Landscaped Areas	See App 6/1 Cl (4) & (6)	Grading	BS 1377 : Part 2	-	125mm	See Clause 620
				Moisture content	BS 1377 : Part 2	-	35%	
5A	Topsoil existing on site	Topsoiling	Topsoil or turf designated as Class 5A in the Contract	Grading	Clause 618	-	Clause 618	-
5B	Imported topsoil	Topsoiling	General purpose grade complying with BS 3882	-	-	-	-	-

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Class	General Material Description	Typical Use	Permitted Constituents (All subject to requirements of Clause 601 and Appendix 6/1) (Note 1)	Material Properties Required for acceptability (In addition to requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631) (see Note 2)				Compaction Requirements (See Note 3)
				Property (see exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits Within:		
						Lower	Upper	
6F5	Selected granular material (coarse grading) - imported on to the Site	Capping	Unbound mixture complying with BS EN 13285 containing aggregate conforming to BS EN 12642 comprising natural aggregates, or crushed concrete bricks, or masonry – except chalk, shale, siltstone or slate, see Notes 7 and 8	Size designation and overall grading category	BS EN 13285 - 0/80 and GE	Tab 6/5	Tab 6/5	Table 6/4 Method 6
				Maximum fines and oversize categories	BS EN 13285 - UF12 and OC75	Tab 6/5	Tab 6/5	
				Los Angeles Coefficient	BS EN 13242 - LA50	-	50	
				Laboratory dry density and optimum water content	BS EN 13285, clause 5.3 - declared values	-	-	
				Moisture content	BS EN 1097-5	OMC -2%	OMC	

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Class	General Material Description	Typical Use	Permitted Constituents (All subject to requirements of Clause 601 and Appendix 6/1) See Note 1	Material Properties Required for acceptability (In addition to requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631) See Note 2				Compaction Requirements See Note 3
				Property (see exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits Within:		
						Lower	Upper	
6f	Selected well graded granular material	Fill to reinforced soil and anchored earth structures	See App 6/1 Cl (4) & (6) other than argillaceous rock	Grading	BS 1377 : Part 2 (On-site)	Table 6/2	Table 6/2	Table 6/4 Method 2
					BS EN 933-2 (Imported onto site)	Table 6/5	Table 6/5	
				Uniformity coefficient	See Note 5	10	-	
				Moisture content	BS 1377 : Part 2 See Note 6	OMC-2%	OMC+2%	
				Effective angle of internal friction and effective cohesion	Clause 636	tba	-	
				Coefficient of friction and adhesion (fill/elements)	Clause 639	tba	-	

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Class	General Material Description	Typical Use	Permitted Constituents (All subject to requirements of Clause 601 and Appendix 6/1) See Note 1	Material Properties Required for acceptability (In addition to requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631) See Note 2				Compaction Requirements See Note 3
				Property (see exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits Within:		
						Lower	Upper	
6J	Selected uniformly graded granular material	Fill to reinforced soil and anchored earth structures	See App 6/1 Cl (4) & (6) other than argillaceous rock	Grading	BS 1377 : Part 2 (On-site)	Table 6/2	Table 6/2	Table 6/4 Method 3
					BS EN 933-2 (Off-site)	Table 6/5	Table 6/5	
				Uniformity coefficient	See Note 5	5	10	
				Moisture content	BS 1377 : Part 2 See Note 6	OMC-2%	OMC+2%	
				Effective angle of internal friction and effective cohesion	Clause 636	tba		
				Coefficient of friction and adhesion (fill/elements)	Clause 639	tba	-	

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Class	General Material Description	Typical Use	Permitted Constituents (All subject to requirements of Clause 601 and Appendix 6/1) <i>See Note 1</i>	Material Properties Required for acceptability (In addition to requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631) <i>See Note 2</i>				Compaction Requirements <i>See Note 3</i>
				Property (see exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits Within:		
						Lower	Upper	
6N	Selected well graded granular material	Fill to structures	See App 6/1 Cl (4) & (6) other than argillaceous rock	Grading	BS 1377 : Part 2 (On-site)	Table 6/2	Table 6/2	End product 95% of maximum dry density of BS 1377 : Part 4 (vibrating hammer method)
					BS EN 933-2 (Imported onto site)	Table 6/5	Table 6/5	
				Uniformity coefficient	See Note 5	10	-	
				Los Angeles coefficient	Clause 635	-	40	
				Effective angle of internal friction and effective cohesion	Clause 636	38 degrees and 0.0 kPa		
6P	Selected well graded granular material	Fill to structures	See App 6/1 Cl (4) & (6) other than argillaceous rock	Grading	BS 1377 : Part 2 (On-site)	Table 6/2	Table 6/2	End product 95% of maximum dry density of BS 1377 : Part 4 (vibrating hammer method)
					BS EN 933-2 (Off-site)	Table 6/5	Table 6/5	
				Uniformity coefficient	See Note 5	5	-	
				Los Angeles coefficient	Clause 635	-	60	
				Effective angle of internal friction and effective cohesion	Clause 636	38 degrees and 0.0 kPa		

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Footnotes to Table 6/1

- 1 Permitted constituents shall all be subject to requirements of Clause 601 and Appendix 6/1 Clause (4) & (6).
- 2 Material properties required for acceptability shall be in addition to requirements on use of fill materials in Clause 601.
- 3 Compaction requirements shall be as defined in Clause 612.
- 4 Optimum moisture content (omc) determined in accordance with BS 1377 : Part 4, 2.5 kg rammer method.
- 5 Uniformity coefficient is defined as the ratio of the particle diameters D_{60} to D_{10} on the particle-size distribution curve, where:
 D_{60} = particle diameter at which 60% of the soil by weight is finer
 D_{10} = particle diameter at which 10% of the soil by weight is finer
- 6 Optimum moisture content (omc) determined in accordance with BS 1377 : Part 4, vibrating hammer method.
- 7 Where materials are required to be aggregates conforming to BS EN 12642 materials certified as being compliant with BS EN 12685 are acceptable for use provided that they meet all the specification requirements and the Declaration of Performance for constituent parts to BS EN 12642 are provided to the Overseeing Organisation.
- 8 Materials shall comply with the current Environmental Regulations at the time of use. Reference shall be made to Annex ZA (informative) of BS EN 12642.

Appendix 6/2 - Requirements for Dealing with Class U1B And Class U2 Unacceptable Materials

1. The Contractor shall report immediately to the Project Manager any Class U1B and U2 Unacceptable Material found within the works. Unacceptable material Class U1B and U2 shall not be permitted to remain on site. The Contractor shall agree with the Project Manager methods for the safe removal of the material.
2. The Contractor is responsible for dealing with Class U1B and Class U2 unacceptable material including where required:
 - a) Classification of Class U1B and Class U2 material by appropriate chemical testing including WAC testing.
 - b) Preparation of method statements for dealing with any Class U1B and Class U2 materials
 - c) Keeping records of the location, volumes, extent, nature and test results for all Class U1B and Class U2 materials encountered.
 - d) Agreement of special requirements for dealing with unacceptable materials with the Environmental Health Officer, Environment Agency and other statutory bodies.
 - e) Agreement of special requirements for dealing with leachate and contaminated water with the Environmental Health Officer, Environment Agency and other statutory bodies.
 - f) Dealing with unacceptable materials whether by excavation and disposal, treatment, sealing or other means.
 - g) Dealing with leachate and contaminated water whether by pumping and disposal, treatment or other means, including the provision of special drainage where required.
 - h) Compliance with all Duty of Care and waste regulation obligations.
3. Where Class U1B and Class U2 material is excavated, the material shall not be left exposed overnight and the Contractor is responsible for providing temporary cover. Cover may be provided by Class U1B materials or other material determined by the Contractor as agreed with the Project Manager. This shall be placed to give a cover of not less than 150 mm. All temporary cover shall be removed in advance of the permanent works and disposal off site accordingly.
4. The Contractor is to ensure that all Class U1B and U2 materials are disposed of at an appropriately licensed landfill or processing facility approved by the Environment Agency in a safe and competent manner and in accordance with relevant Statutory Regulations. The Contractor shall keep records/transfer notes of all waste materials removed from this site and shall include the volume of waste material, the description of the waste material, date of removal, the destination of the waste material and the carrier. The Contractor is required to submit copies of this information to the Project Manager as soon as it becomes available.

Appendix 6/3 - Requirements for Excavation, Deposition, Compaction (Other than Dynamic Compaction) (Rev P5, 17/04/19)

1. The extent of excavation, cutting or filling is to be determined by reference to longitudinal section drawings and cross-section drawings.
2. The existing topsoil, subsoil and near-surface soils shall be excavated as required within the area of the proposed works as shown on the Drawings. The topsoil/subsoil shall be handled and stored in accordance with the requirements of BS 3882 (2007). Unnecessary and premature removal of topsoil and subsoil shall be avoided.
3. The exposed natural soils shall be profiled such that there are no areas in which surface water may accumulate. The Contractor shall take all necessary measures (both temporary and permanent) to ensure that the integrity of formation is not compromised by adverse affects of construction traffic, weather et cetera as required. Operations shall not take place during adverse weather conditions.
4. Where the slope to the excavated area is greater than 1 vertical in 10 horizontal, the excavation shall be cut in horizontal benches in order to "key" the existing and the new fill materials together. The benches shall be 0.5 m high and at least 0.5 m wide.
5. The Contractor shall note and record any groundwater inflows, existing land drainage or cases of instability and provide records to the Designer's Representative and Project Manager within 24 hours.
6. The exposed formation to all works is to be inspected by a qualified geotechnical engineer prior to constructing the works to identify the presence of any natural solution features and mining cavities. Particular care is to be given to identifying any features that may be indicative of the presence of any solution features and mining cavities, such as (a) voids in the ground; (b) collapsed ground that may appear as depressions or hollows at the ground surface; (c) different ground conditions to those expected, e.g. areas of infill or disturbed ground; (d) rapid changes of soil colour or soil type over short horizontal distances; and (e) vertical interfaces between different soils types. Any potential solution features or mining cavities shall be investigated by appropriate intrusive ground investigation techniques. If the presence of solution features or mining cavities is confirmed appropriate techniques shall be adopted to infill any voids and stabilise any soft or loose infill materials. The investigation and stabilisation works shall be carried out in accordance with the requirements of Appendix 6/11 of the Specification.
7. The exposed formation shall be compacted in accordance with the requirements of Clause 612 (4) to (10) using Method 1 as defined in Table 6/4. Any material exposed in the formation having an undrained shear strength less than 50 kPa or otherwise unacceptable material shall be excavated and the resulting void backfilled with Class 6N/6P material in accordance with the requirements of the Specification.
8. The prepared formation shall be subject to approval by the Project Manager, WSCC and Network Rail, as may be applicable, prior to placing any fill material.

Watercourses

9. Redundant watercourses (including ditches) shall be treated in accordance with Clause 606.2 and 606.4. The watercourse shall be cleared of vegetation and soft material, and backfilled with acceptable fill as shown on the Drainage Design Drawings and compacted in accordance with the specification. All surfaces remaining exposed shall be topsoiled and seeded in accordance with Appendix 6/8.
10. The Contractor shall be responsible for any temporary or permanent protection of watercourses, including ditches.

Embankment Construction

11. The following requirements relate to the west side of the approach embankment to the south of the rail bridge to be constructed using conventional earth fill.
12. The fill material to be used to form the embankment will be determined in agreement with the appointed contractor for the works but given the opposite side of the embankment will be constructed using reinforced soil with a modular concrete facing system it is expected that the embankment shall be constructed in Class 6/6J acceptable material complying with the requirements of Table 6/1.
13. Method compaction of fill materials is to be carried out in accordance with the requirements of Table 6/1 of the Specification. Filling shall be in uniform layers. Compaction shall be completed as soon as possible after the material has been spread and in accordance with specific requirements for the placed material. Fill material in areas of benching shall be carefully placed and compacted to ensure that no voids occur at the upright steps of the benching.
14. The surface of any layer of material shall on completion of compaction and immediately before overlaying, be free from movement under compaction plant and be free from ridges, cracks, loose materials, pot holes, ruts and other defects. All loose segregated or otherwise defective areas shall be removed to the full thickness of the layer and new material should be laid and compacted.
15. Should at any time the material change from that identified, the Contractor shall change the method of compaction to ensure compliance with the requirements of the Specification.
16. The Contractor shall keep contemporaneous records of the method of compaction including layer thickness, type of plant, number of passes and material type.

Appendix 6/5 - Geotextiles Used to Separate Earthworks Materials (Rev P5, 17/04/19)

1. Terram 1000 or Multirack 1000 or similar approved to be used between subgrade and improvement layer. Refer to Appendix 6/7.

Appendix 6/6 - Fill to Structures and Fill above Structural Foundations (Rev P2, 30/07/18)

1. Fill to structures shall be either Class 6N or Class 6P or other acceptable material as shown on the drawings complying with the requirements of Table 6/1.
2. Fill to structures shall be deposited and compacted to Clause 610.
3. Full scale trials to determine stable slope of Class 6N or 6P are not required.

Compliance Testing

4. Compliance testing is required to confirm the degree of compaction achieved is in accordance with the requirements of Appendix 6/1. Compliance testing shall be carried out in accordance with BS 1377 : Part 9 using either the sand replacement or core cutter methods. Where a Nuclear Density Meter (NDM) is used to determine the field dry densities it shall be used in accordance with BS 1377 : Part 9. The NDM shall be subject to initial calibration and calibration checks against the results of sand replacement or core cutter tests on a daily basis or every 10 NDM tests whichever the greater.
5. Details on the frequency of the compliance testing are given in Appendix 1/5. The testing shall be carried out to ensure that an even spatial distribution across the area of the works is achieved.
6. The degree of compaction for the earthworks shall be deemed to have been achieved if at least 9 of out 10 consecutive in-situ dry density determinations of the compacted material attain 95% of the determined maximum dry density for the material being placed, provided no value falls below 90% of the determined maximum dry density.
7. The in-situ density test results will be reported as in situ dry density and moisture content and also in terms of percentage of maximum dry density achieved.

Appendix 6/7 - Sub-Formation and Capping and Preparation and Surface Treatment of Formation

(Rev B4)
 16/11/18

1. During construction the Contractor must demonstrate that the CBR value of the subgrade is equal to or greater than the Design CBR value. It should be noted that the construction thickness may need to be increased if in-situ CBR values at the time of construction are less than the Design CBR value. However, a reduction in the construction thickness will not be considered if the in-situ CBR values at the time of construction are greater than the Design CBR value.
2. In-situ CBR testing shall be carried out at not greater than 30m centres, staggered across the width of the road corridor. Acceptable in-situ CBR test methods include; TRL Dynamic Cone Penetrometer testing, California Bearing Ratio (BS1377, Part 9), or alternatively the CBR value may be derived from Plate Bearing Test data.
3. The Design CBR values of the subgrade are less than 2% in many areas (0.5% Design CBR). IAN 73/06 indicates that where a subgrade has a lower CBR than 2.5%, it is considered unsuitable support for a pavement foundation. It must therefore be permanently improved.
4. The soft subgrade material immediately below sub-formation shall be removed to allow for the provision of a suitable geotextile and a suitable depth of 6F material (min 500mm – typically 500 to 1000mm required) to achieve a sub-formation CBR value of >2.5%, when measured in accordance with (2) above.
5. Although the new material may be of better quality, the new Design CBR should be assumed to be equivalent to 2.5%, in order to allow for effects of any softer underlying material and the potential reduction in the strength of the replacement material to its long-term CBR value.
6. The remaining capping and subbase design would then be based upon a 2.5% Design CBR, which would result in either 450mm of Type 1 (Clause 803) for a Subbase only design or an additional 250mm 6F Capping with 350mm of Type 1 Subbase. Subbase only designs shall only be applied where the subbase is suitably protected from rainwater ingress and where the WSCC Proper Officer has given written consent.
7. No material within 450mm of the carriageway surface shall be frost susceptible.
8. Based on the above, the typical construction subgrade improvement and road foundation thickness shall be as follows:

Subgrade (<2.5%)

Suitable Geotextile Terram 1000 or Multitrack 1000 or similar approved.

Subgrade Improvement Layer Min 500mm 6F Material (to achieve $\geq 2.5\%$ CBR)

(Subbase only design - Subbase only designs shall only be applied where the subbase is suitably protected from rainwater ingress and where the WSCC Proper Officer has given written consent.)

Subbase **450mm Type 1 Subbase (Clause 803) (to achieve $\geq 30\%$ CBR)**

Or (Capping and Subbase design)

Capping Material **250mm 6F Material (to achieve $\geq 15\%$ CBR)**

Subbase **350mm Type 1 Subbase (Clause 803) (to achieve $\geq 30\%$ CBR)**

SPECIFICATION FROM PBA

9. Preparation and surface treatment of the formation in soil shall be to levels in accordance with Clause 616.
10. On site testing of the sub-formation, in accordance with Cl 5.12 to 5.15 of IAN 73/06 (HA, 2009), shall be carried out to determine the in-situ CBR value at the time of construction. If the in-situ CBR is found to be less than the design CBR value taken to be 15 per cent for the engineered fill material, then the subgrade must either be improved to the design CBR or the foundation redesigned. If the in-situ CBR is found to be less than the design CBR value taken to be 0.5 per cent for the existing natural ground, then the Contractor shall advise the Project Manager and take all measures required to investigate for and stabilise possible infilled solution features in accordance with the requirements of Appendix 6/11.

Appendix 6/8 - Topsoiling

1. Unless otherwise agreed in the interest of encouraging species diversity, the Contractor shall use as much of the existing topsoil from the site as possible (Class 5A). The disposal and import of topsoil should be minimised.
2. All embankment slopes, cutting slopes and verges of the finished works are to have 150mm minimum of topsoil applied to them and grass seeded.
3. Imported Topsoil shall be Class 5B complying with the requirements of BS3882:2007. It shall be fertile medium loam free from any perennial weeds, weed seeds, contamination, coarse grass and stones, and levelled and raked to a fine tilth.

Appendix 6/9 - Earthwork Environmental Bunds, Landscape Areas, Strengthened Embankments

Landscaped Areas

1. Landscaped areas shall be constructed using Class 4 material compacted in accordance with Clause 620.2. Method compaction to landscaped areas is not required.

Appendix 6/11 - Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings (Rev P5, 17/04/19)

1. The Contractor shall report immediately to the Project Manager any solution features or mining cavities found within the works. The Contractor shall agree with the Project Manager methods for the investigation and stabilisation of any solution features or mining cavities.
2. The Contractor is responsible for dealing with any solution features or mining cavities including where required:
 - a) Preparation of method statements for the investigation and stabilisation of any solution features or mining cavities.
 - b) Investigation of the features using techniques such as, for example, boreholes, dynamic probing, and trial excavations.
 - c) Stabilisation of the features using techniques such as (i) excavation of all soft and loose material backfilling with a granular material; (ii) grouting to infill any voids and/or compact any soft or loose material within the feature; (iii) sealing of the feature by a layer of clay or other relatively impermeable material such as lean-mix concrete; (iv) capping of the feature with reinforced concrete; or (v) any combination of these techniques.
 - d) Keeping records of the location, volumes, extent and nature of all solution features or mining cavities encountered.
 - e) Keeping records of the location, volumes, extent and nature of the works carried out to stabilise all solution features or mining cavities encountered.
 - f) Liaising with relevant authorities in accordance with all relevant statutory requirements and/or good practice.

Appendix 6/12 - Instrumentation and Monitoring (Rev P3, 17/04/19)

1. The Contractor shall carry out precision levelling of the proposed monolithic abutments and wing walls to the road and rail bridges.
2. The Contractor shall install survey points at each end of each abutment and wing wall. The Contractor shall ensure the survey points are protected for the duration of the required monitoring.
3. The Contractor shall install datum points sufficiently remote from the proposed works such that they are not affected by any construction works or other activities. The Contractor shall ensure the datum points are protected for the duration of the required monitoring.
4. Precise levelling shall be carried out daily during infilling of the structure and twice weekly thereafter for a period of four weeks from completion of the infilling or until long-term settlements are effectively complete, whichever is the greater duration. The Contractor shall compile and submit reports to the Project Manager on the establishment of the survey and datum points and each round of levelling presenting the co-ordinate and level information of each survey and datum point with 24 hours of measurement.

Appendix 6/14 - Limiting Values for Pollution of Controlled Waters (Rev P4, 16/11/18)

- All fill materials shall be tested to ensure the concentrations of potential contaminants are below the guideline values for inert waste given by:

a) DEFRA (2005) The Landfill (England and Wales) (Amendment) Regulations 2005. Statutory Instrument 2005 No 1640. Department of the Environment, Food and Rural Affairs, London.

Table 6/14: Limiting Values for Pollution of Controlled Waters

Determinand	Units	Detection Limit	Limiting Values
Soil (Pre-Extraction) Analysis			
Total Organic Carbon ^(a)	%	0.01	3
BTEX compounds (benzene, toluene, ethyl benzene & xylenes)	mg/kg	0.01	6
Polychlorinated biphenyls (PCBs) (7 congeners)	mg/kg	0.01	1
Mineral Oil (C10 to C40)	mg/kg	20	500
Eluate Analysis			
Antimony	mg/kg	0.01	0.05
Arsenic	mg/kg	0.01	0.5
Barium	mg/kg	0.01	20
Cadmium	mg/kg	0.01	0.04
Total Chromium	mg/kg	0.05	0.5
Copper	mg/kg	0.02	2
Lead	mg/kg	0.05	0.5
Mercury	mg/kg	0.01	0.01
Molybdenum	mg/kg	0.1	0.5
Nickel	mg/kg	0.02	0.4
Selenium	mg/kg	0.05	0.1
Zinc	mg/kg	0.01	4
Chloride	mg/kg	0.1	800
Fluoride	mg/kg	0.1	10
Sulphate ^(b)	mg/kg	0.1	1000
Phenol Index	mg/kg	0.2	1
Dissolved Organic Carbon ^(c)	mg/kg	50	500
Total Dissolved Solids ^(d)	mg/kg	50	4000

Notes:

- In the case of soils, a higher limit value may be permitted by the Environment Agency, provided a Dissolved Organic Carbon value of 500 mg/kg is achieved at L/S 10 l/kg at the pH of the soil or at a pH value of between 7.5 and 8.0.
- This limit value for sulphate may be increased to 6,000 mg/kg, provided that the value of CO (the first eluate of a percolation test at L/S % 0.1 l/kg) does not exceed 1,500 mg/l. It will be necessary to use a percolation test to determine the limit value at L/S % 0.1 l/kg under initial equilibrium conditions.
- If the waste does not meet this value for Dissolved Organic Carbon (DOC) at its own pH value, it may alternatively be tested at L/S % 10 l/kg and a pH between 7.5 and 8.0. The waste may be considered as complying with the acceptance criteria for DOC, if the result of this determination does not exceed 500 mg/kg.
- The value for Total Dissolved Solids can be used alternatively to the values for Sulphate and Chloride.

- The frequency of acceptability testing shall be according to Appendix 1/5 of the Specification.
- No material exceeding these limits shall be incorporated into the works.

Appendix 6/15 - Limiting Values for Harm to Human Health and the Environment

1. All fill materials shall be tested to ensure the concentrations of potential contaminants are below the guideline values for commercial/industrial development given by:

a) CIEH (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. The Chartered Institute of Environmental Health, Nottingham.

b) CL:AIRE (2014) Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report SP1010 (Rev 2), Contaminated Land: Applications in Real Environments, London.

The guideline values shall be modified as required to restrict maximum values to below the hazardous waste criteria.

2. The required contamination testing suite and limiting values are given in Table 6/15a below.

Table 6/15a: Limiting Values of Potential Contaminants in Soil

Determinand	Units	Detection Limit	Limiting Values
Metals/Metalloids			
Arsenic	mg/kg	1.0	640 ¹
Cadmium	mg/kg	0.1	230 ¹
Chromium (total)	mg/kg	0.15	1700 ^{2,4}
Copper	mg/kg	0.2	2200 ^{2,4}
Lead	mg/kg	0.3	2300 ²
Mercury (inorganic)	mg/kg	0.05	1000 ^{2,4}
Nickel	mg/kg	1.0	1800 ¹
Selenium	mg/kg	0.5	12 000 ¹
Vanadium	mg/kg	0.8	8000 ²
Zinc	mg/kg	1.0	2000 ^{2,4}
Polycyclic Aromatic Hydrocarbons ^{Note 6}			
PAH Screen	mg/kg	0.1	1000 ^{2,7}
Aliphatic/Aromatic Hydrocarbons ^{Note 7}			
Extractable Petroleum Hydrocarbon Screen	mg/kg	10	Note 8
Other			
Asbestos	%	0.001	Note 10

Notes

- 1 EA (2009) Soil Guideline Values
- 2 CEIH (2009) Generic Assessment Criteria
- 3 Values selected to limit concentration to below the limit for classification as hazardous waste
- 4 Values derived assuming simple oxide or metal compound using HazWaste Online Engine and Database version 01 December 2014.
- 5 CL:AIRE (2013) Development of Category 4 Screening Levels
- 6 SGV/GAC for soils with Soil Organic Matter of 1% are given as detailed in the table. If required limiting values for soils with Soil Organic Matter of 2.5% or 5% to be agreed with local authority.
- 7 If PAH screen >10 mg/kg then carry out PAH EPA 16 determination with reference to the limiting values given in Table 6/15b.
- 8 If EPH result is >100 mg/kg then carry out TPH CWG with carbon banding determination with reference to the limiting values given in Table 6/15c.
- 9 Value also subject to a maximum for the sum of aliphatics to 1000 mg/kg
- 10 Should Asbestos be identified the Project Manager should be informed immediately

Table 6/15b: Limiting Values of Polynuclear Aromatic Hydrocarbons^{Note 6}

Determinand	Units	Detection Limit	Limiting Values
Acenaphthene	mg/kg	0.1	1000 ²
Acenaphthylene	mg/kg	0.1	1000 ²
Anthracene	mg/kg	0.1	1000 ²
Benzo(a)anthracene	mg/kg	0.1	170 ²
Benzo(a)pyrene	mg/kg	0.1	35 ²
Benzo(b)fluoranthene	mg/kg	0.1	44 ²
Benzo(g,h,i)perylene	mg/kg	0.1	1000 ²
Benzo(k)fluoranthene	mg/kg	0.1	1000 ²
Chrysene	mg/kg	0.1	350 ²
Dibenzo(a,h)anthracene	mg/kg	0.1	3.5 ²
Fluoranthene	mg/kg	0.1	1000 ²
Fluorene	mg/kg	0.1	1000 ²
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	500 ²
Naphthalene	mg/kg	0.1	180 ²
Phenanthrene	mg/kg	0.1	1000 ²
Pyrene	mg/kg	0.1	1000 ²

Table 6/15c: Limiting Values of Carbon Banded Hydrocarbons ^{Table 6}

Determinand	Units	Detection Limit	Limiting Values
<i>Aliphatics</i>			
>C5-6	mg/kg	0.1	1000 ^{1A}
>C6-8	mg/kg	0.1	1000 ^{2B}
>C8-10	mg/kg	0.1	1000 ^{3B}
>C10-12	mg/kg	1.5	1000 ^{2B}
>C12-16	mg/kg	1.2	1000 ^{3B}
>C16-21	mg/kg	1.5	1000 ^{1B}
>C21-35	mg/kg	3.4	1000 ^{2B}
>C35-40	mg/kg	5.0	1000 ³
<i>Aromatics</i>			
>C5-7	mg/kg	0.05	1000 ³
>C7-9	mg/kg	0.05	1000 ²
>C9-10	mg/kg	0.05	1000 ³
>C10-12	mg/kg	0.9	1000 ³
>C12-16	mg/kg	0.5	1000 ³
>C16-21	mg/kg	0.6	1000 ³
>C21-35	mg/kg	1.4	1000 ³
>C35-44	mg/kg	1.4	1000 ³

3. The frequency of acceptability testing shall be according to Appendix 1/5 of the Specification.
4. No material exceeding these limits shall be incorporated into the works.

Appendix 7/1 - Permitted Pavement Options - Flexible, Flexible Composite and Surfacing for Rigid Composite Construction (Rev P4, 16/11/18)

NOTE: Carriageway surfacing shall only be carried out by a National Highway Sector Scheme 16 Approved Surfacing Contractor

Schedule 1: Permitted Pavement Options			
Location	Area	General Requirements	Permitted Pavement Option
Lyminster Bypass	Carriageway	Schedule 2	LD1
A259	Carriageway	Schedule 2	LD2
Fitzalan Link Road	Carriageway	Schedule 2	LD3
Road 1 & Road 2 &	Carriageway	Schedule 2	LD3

Schedule 2: General Requirements		
Grid for checking surface levels of pavement courses	Longitudinal dimension:	10m max
	Transverse dimension	2m max
Surface regularity (As clause 702.5 Table 7/2)	Category of Road:	A/B
Interval for measurement of longitudinal regularity		Continuous
Interval for measurement of transverse regularity		5m

Schedule 3: Permitted Construction Materials						
	DMRB Spec Bypass Lyminster Bypass Pavement Option [LD1]		DMRB Spec Bypass A259 Pavement Option [LD2]		WSCC Local Distributor Road Specification Pavement Option [LD3]	
Pavement Layer	Material Ref.	Thickness (mm)	Material Ref.	Thickness (mm)	Material Ref.	Thickness (mm)
Surface Course	SC1	50	SC1	50	SC1	50
Binder Course	BC1	60	BC1	60	BC1	60
Base	RB1	210	RB1	240	RB1	150
Sub-Base	SB1	350*1	SB1	350*1	SB1	350*1
Capping	CP1	250*1	CP1	250*1	CP1	250*1
Subgrade improvement layer(s)	SGI	Min 500 to achieve 2.5% CBR*2		Min 500 to achieve 2.5% CBR*2		Min 500 to achieve 2.5% CBR*2
Geotextile	GG1	-	GG1	-	GG1	-
Total Thickness		1,420		1,450		1,360

Note:

*1 Subbase thickness based on subbase and capping design, refer to Appendix 6/7 for details.

*2 Subgrade improvement layer based on min possible thickness required. Refer to Appendix 6/7.

Schedule 4 - General Requirements For Construction Materials

- (i) General requirements are in accordance with the Specification for Highway Works.

903.24	Sealant shall be applied to the top surfaces of all base and binder course joints.
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Schedule 5 - Requirements For Construction Materials

Material Ref.	Clause	Description	Requirement
GG1	-	Geotextile (between subgrade and improvement layer)	Terram 1000 or Multitrack 1000 or similar approved.
SB1	803	Type 1 unbound mixture	Mixtures containing crushed coarse aggregate not permitted Minimum CBR value 30%
RB1	906	Dense Base Asphalt Concrete (Recipe Mixes)	BS EN 13108-1, PD 6691, BS 594987 AC 32 dense base 40/60 rec Binder Grade: 40/60 Aggregate Size: 32 Coarse Aggregate to be crushed rock or slag. Fine aggregate to exclude natural sand fines.
BC1	906	Dense Binder Course Asphalt Concrete (Recipe Mixes)	BS EN 13108-1, PD 6691, BS 594987 AC 20 dense binder 40/60 rec Binder Grade: 40/60 Aggregate Size: 20 Coarse Aggregate to be crushed rock or slag. Fine aggregate to exclude natural sand fines.
RC1	907	Regulating Course	As RB1 or BC1 as appropriate. Minimum thickness in accordance with BS594987 EN13108
SC1	943	Hot Rolled Asphalt Surface Course (Performance-Related Design Mix)	35/14 Hot Rolled Asphalt (Performance Related Design Mix) in accordance with BS EN 13108-4, PD 6691, BS 594987, to Cl 943 of SHW HRA 35/14F surf des Course Aggregate Percentage: 35% Coarse Aggregate to be crushed rock or slag, excluding limestone. Minimum PSV = 50 Aggregate Grading [BS EN 13108-4 Table 4] Column No.:35/14F Test temperature for wheel-tracking to BS 598-110: 45 °C Maximum Wheel-tracking rate: 2 mm Maximum Wheel-tracking rut depth: 4 mm Site classification: 1 Minimum target Binder Content Bact = 7.0% <u>Surface course to have chippings applied the following spec:</u> 14/20mm pre-coated chippings with achieving a texture depth of in accordance with series 900 table 9/3. Chippings in accordance with BS EN 13108-4, PD 6691, BS 594987 Coarse Aggregate to be crushed rock or slag, excluding limestone and gravel. Coated Chippings Nominal Size: 14/20. Aggregate Grading to PD 6691 Table C.5 Column No.: 14/20 size. Flakiness Index: F120 Minimum PSV 65 [68+ on approaches indicated on table SC1.1 below]. Maximum AAV: 12. Minimum Target Binder Content Bact = 1.5%

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Schedule 6 Thin Surface Course Systems: Information To Be Provided By The Contractor

- (i) *Not used*

Schedule 7 Binder Data Requirements [911.2, 929.4, 937.9, 938.1, 943.5 And 943.8]

The following data shall be provided to the Overseeing Organisation as required in sub-Clauses 937.9, 938.1, 943.5 and 943.8 and for materials designed in accordance with 911, 929, 944 or 952 in respect of the proposed binder [note: all these Clauses cover materials that are designed by the supplier]. The data should not be more than 6 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 Agency, a copy of all the data should be handed to the Overseeing Organisation, to be forwarded to: Pavement Engineering Team at Highways Agency, Bedford Office.

I. Binder Samples

Bituminous binders shall be sampled from the delivery 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 secs and at 5°C 200g 60 secs, before and after hardening in the Rolling Thin Film Oven Test (RTFOT) in accordance with BS EN 12607-1, or alternatively, after RTFOT and Ageing in accordance with Clause 923.

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) determined in accordance with Clause 928 for binder as supplied, after RTFOT and Ageing in accordance with Clause 923.

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 the manner described in Clause 941. 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.

VI. Cohesion

Vialit Pendulum cohesion test curve of the binder, in accordance with Clause 939 for the binder as supplied, after RTFOT and after RTFOT and Ageing in accordance with Clause 923.

VII. FRAASS Brittle Point

FRAASS brittle point measured using BS EN 12593 shall be provided on the binder as supplied, after RTFOT and Ageing in accordance with Clause 923.

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

Schedule 8 Mixture Data Requirements [919, 929, 944, 952 Or 953]

The following data should be provided to the Overseeing Organisation as required in sub-Clauses 937.9, 938.1, 943.5 and 943.8 and for materials designed in accordance with 911, 929, 944, 952 or 953 in respect of the proposed mixture as appropriate [note: all these Clauses cover materials that are designed by the supplier]. For work carried out for the Highways Agency, a copy of all the data should be handed to the Overseeing Organisation, to forwarded to: Pavement Engineering Team at Highways Agency, Bedford Office.

- I. Mixing and compaction temperatures**
Maximum and minimum mixing temperatures should be stated. Maximum and minimum compaction temperatures and any wind chill factor differing from conventional hot rolled asphalt utilizing unmodified bitumen shall be stated.
- II. Mix Sensitivity Analysis**
Wheel-tracking rate for the proposed mixture but with the binder content by mass increased above the target to the maximum binder content anticipated by the Contractor, but not more than + 0.6% above the target.
- III. Repeated Load Axial Test (RLAT)** to DD 226 : 1996 (for correlation to performance in terms of deformation).
- IV Indirect Tensile Fatigue Test (ITFT)** - after ageing, see LINK Protocol (for correlation to performance in terms of fatigue)
- V Saturation Ageing Tensile Stiffness (SATS)**

Protection of Works from Weather, including Cold Weather Working

- The Contractor shall take all necessary precautions to protect all works and materials which may be subject to damage or injury by inclement weather.
- No material in a frozen condition shall be incorporated into the works, nor shall any materials be laid on a frozen surface.

Appendix 7/2 - Excavation, Trimming and Reinstatement of Existing Surfaces

1. General

- 1.1 Areas of construction are indicated on the construction treatment drawings.
- 1.2 Trenches across existing surfacing are required at the locations of new drainage connections, electrical and service ducts as shown on the construction areas, drainage and ducting and services drawings.
- 1.3 The existing pavement to receive overlay of new Surface Course is to be trimmed to a depth sufficient to allow a full depth of Surface Course to be provided as a minimum.
- 1.4 The machinery to be used shall be fitted with equipment for smoke and dust elimination.
- 1.5 The following methods for trimming of surface areas may be used:
- 1.6 Cold planing
- 1.7 The equipment shall be of an approved type and the Contractor shall provide details of the equipment he proposes to use to the Engineer for such approval.
- 1.8 The Contractor shall reinstate, to the approval of the Engineer, road surfaces damaged by excess cold planing.
- 1.9 The Contractor shall make suitable temporary ramps to make safe the following:-
 - run-on
 - run-off
 - raised longitudinal joints
 - covers and framesAll cold vertical joints shall be treated with hot poured pitch.
- 1.10 Surplus material shall be run to spoil in tips off-site, unless it can be re-used within the works or the on-site works.
- 1.11 Trench reinstatement shall be carried out in accordance with NRSWA HAUC Document or as agreed with the Highway Authority.
- 1.12 All cold vertical joints shall be treated with hot poured pitch.
- 1.13 When requested, a layout of the proposed joint pattern should be provided.

2. Surface course joints

- 2.1 All longitudinal and transverse joints in surface courses shall be made flush.
- 2.2 The following surface course joints shall be made by cutting back the edge to a vertical face that exposes the full thickness of the layer, discarding all loosened material and painting the vertical face completely with a thin uniform coating of hot applied 40/60 or 70/100 paving grade bitumen, or, if approved by the specifier, cold applied thixotropic bitumen emulsion of similar grade or polymer modified bitumen emulsion bond coat, before the adjacent width is laid:
 - a) all transverse joints;
 - b) joints where the asphalt abuts an existing surface; and
 - c) all longitudinal joints
- 2.3 Care should be taken to avoid surplus bitumen on the surface after the joint is made. The surface of the finished joint should not be painted because of the risk of skidding and slipping.

3. Joints in other courses

- 3.1 Joints in other courses (e.g. base and binder course) shall be treated in such a way as to ensure compaction and bonding as in 2 above for transverse joints.

Appendix 7/4 - Bond Coats, Tack Coats and Other Bituminous Sprays

The Contractor shall provide the following information with his tender, and/or prior to the commencement of the work for approval by the Highway Authority:

1. The product or products he proposes to use together with their data sheets, product identification data, cohesivity data as specified.
2. 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.
3. The spraying equipment proposed, and a test certificate.
4. The source or sources of blinding material proposed.
5. Contingency plans in the event of any breakdown.
6. The results of any other tests or other data the Contractor considers would assist the Overseeing Organisation in assessing the technical merit of the treatment such as:
 - (i) Tackiness test and/or trafficability time and methods of test.
 - (ii) Breaking time test results for different weather conditions and substrates.
 - (iii) Test results for bond to newly laid concrete

Binder Data Sheet – Appendix 7/4 (03/02)			Bond Coats, Tack Coats and Other Bituminous Sprays		
Manufacturer of Binder:			Product name:		
Binder type:			Batch no:		
Binder Grade (highlight as required)					
Conventional	Intermediate	Premium	Super-premium	Non-tack	Other
Binder	Source	→	Recovered Binder	Recovered Binder after Ageing Test	
	Test		Recovered in accordance with Clause 955	Aged in accordance with Clause 955	
	↓				
Penetration at 25°C 0.1 mm (100g and 5 sec)					
Penetration at 5°C 0.1 mm (200g and 60 sec)					
Vialit pendulum cohesion see Clause 957 maximum peak value J/cm²			The Contractor shall attach a Report and graphical output to this schedule as specified in Clause 957.	The Contractor shall attach a Report and graphical output to this schedule as specified in Clause 957.	
Product identification test. The provision of data for identification and ageing is optional for unmodified bituminous emulsions to BS 434 and for bitumen to BS EN 12591 and cutback bitumen to BS 3690. Complex shear (stiffness) modulus (G*) and phase angle (δ) data. See Clause 956.			The Contractor shall attach a Report and graphical output to this schedule as specified in Clause 956.	The Contractor shall attach a Report and graphical output to this schedule as specified in Clause 956.	
Other properties the Contractor considers useful: Minimum Binder Content Binder temperature range for spray application Emulsion Properties and Viscosity Break time Breaking Agent type Weather limits – information from binder manufacturer: road or air temperatures; humidity; wind chill adjustment; tolerance of surface dampness; etc. Temperature max: Temperature min: Other:					

Appendix 7/6 - Breaking Up or Perforation of Existing Pavement (Rev P5, 17/04/19)

1. Breaking up of Existing Pavement

- 1.1 The existing pavement and hard areas shall be broken up as identified on the construction treatments drawing and disposed of off-site, unless it can be utilised within the works or in the on-site works.
- 1.2 Plant and equipment used for breaking up shall be of a type approved by the Project Manager and/or Highway Authority who may direct trials to be carried out to determine the suitability of the plant, equipment and method. The plant and equipment shall be of a type which has a crack propagation effect.
- 1.3 The full depth of all bituminous and sub-base material shall be broken up.
- 1.4 The Contractor shall take all necessary precautions to avoid damage to property, structures, drains, sewers and services.

2. Perforation of Existing Pavement

- 2.1 The existing pavement and hard areas shall be perforated in the areas identified on the construction areas drawing.
- 2.2 Plant and equipment used for perforating pavement shall be of a type approved by the Project Manager and/or Highway Authority who may direct trials to be carried out to determine the suitability of the plant, equipment and method. The plant and equipment shall be of a type which has a crack propagation effect.
- 2.3 The full depth of all bituminous and sub-base material shall be perforated, and the Project Manager and/or Highway Authority may direct any necessary trial holes be made to determine the depth.
- 2.4 Impervious structures, slabs, hardstanding areas etc, which are permitted to remain shall have holes to full depth made at uniform spacings to allow free drainage such that the total area of perforation shall not be less than 10% of the impervious area to be drained.
- 2.5 The Contractor shall take all necessary precautions to avoid damage to property, structures, drains, sewers and services.

Appendix 7/9 - Cold Milling (Planing) of Bituminous Bound Flexible Pavement

1. Information with regard to excavation and reinstatement of bituminous pavements is also in Appendix 7/2.
2. Areas of carriageway to have existing surfaces removed and replaced by new bituminous materials are indicated on the Construction Treatment drawings.
3. The existing pavement to receive overlay of new Surface Course is to be planed to a depth sufficient to allow the full depth of Surface Course to be provided as a minimum.
4. The machinery to be used shall be fitted with equipment for smoke and dust elimination.
5. The equipment shall be of an approved type and the Contractor shall provide details of the equipment he proposes to use to the Highway Authority for such approval.
6. The Contractor shall reinstate, to the approval of the Highway Authority, road surfaces damaged by excess cold planing.
7. The Contractor shall make suitable temporary ramps to make safe the following:-
 - run-on
 - run-off
 - raised longitudinal joints
 - covers and frames

Appendix 11/1 - Kerbs, Footways and Paved Areas (Rev P5, 17/04/19)

1 Kerbs

- 1.1 Proposed kerblines are indicated on the construction treatments drawing.
- 1.2 Location of kerb types are indicated on the construction treatment drawings and details of kerb types are indicated on WSCC details numbered S278/38/01, 02 and 03. The kerb types are as follows:

Kerb Type 1	125x255mm type HB2 precast concrete kerb to BS EN 1340:2003 Figure NA.1(d) laid with 125mm upstand with ST1 concrete bed and backing.
Kerb Type 2	125x150mm type BN precast concrete kerb laid flush (0 to 6mm) to Figure NA.1(a) of BS EN 1340:2003 with mix ST1 concrete bed and backing.
Kerb Type 3	50x150mm type EF precast concrete flat top edging to Figure NA.3(b) of BS EN 1340:2003 with mix ST1 concrete bed and backing.
Kerb Type 4	Double row of 100x200x100mm granite setts (Demarcation of limit of adoption / highway) laid flush (0-6mm) with mix ST4 concrete bed and backing.
Kerb Type 5	125x255mm Type SP precast concrete kerb to BS EN 1340:2003 Figure NA.1(b) laid with 100mm upstand with ST1 concrete bed and backing.
Kerb Type 6	Linear Kerb Drainage System, in accordance with drawing numbered A/PHLY-MB-S278-GF-DR-DR-D-412.
Kerb Type 7	Wooden edging refer to WSCC detail S278/38/06.
Kerb Type R	Proposed raker kerbs.

- 1.3 Kerb bed shall extend down to top of sub-base. Where top of sub-base is less than 150 from finished road surface the kerb shall extend into the sub-base and shall be a minimum thickness of 150 mm.

2 Paved Areas

- 2.1 Prior to commencement of laying, the formation shall be treated with an approved residual weedkiller. The Highway Inspector may request inclusion of a non-woven separation membrane to mitigate weed/root intrusion.
- 2.2 Flexible surfacing for footways and shared footway/cycleways shall be in general accordance with WSCC detail numbered S278/38/04 and material construction layers shall be as follows:

Surface Course	20mm thick, Asphalt Concrete (AC6 Dense Surf 100/150) to Clause 909 Aggregate type:-crushed rock or blast-furnace slag Nominal size:- 0/6 mm
Binder Course	50mm thick, Asphalt Concrete (AC20 Dense Bin 40/60 Rec) to Clause 906 Aggregate type:-crushed rock or blast-furnace slag Nominal size:- 0/20 mm
Sub-base	225mm thick, Type 1 sub-base material to Clause 803
Geotextile	Terram 1000, Multitrack 1000 or similar approved to be used between subgrade and subbase.

2.3 All cycleway surface courses are to be machine laid.

3 Tactile Paving

2.4 Tactile blister footway paving is to be provided at new pedestrian crossing points as indicated on the general arrangement drawings. All tactile paving layouts are to be in accordance with the Department of the Environment, Transport and the Regions 'Guidance on the use of Tactile Paving Surfaces', November 1998. Refer to WSCC detail numbered S278/38/04 and S278/38/18 for bedding details.

2.5 Tactile blister paving buff coloured at uncontrolled crossings and red at controlled crossings shall be 400x400x65mm thick laid in accordance with WSCC detail S278/38/18.

2.6 In areas vulnerable to vehicle overrun, small element tactile pavements may be installed.

2.7 Corduroy hazard warning paving is to be provided at the interface of a footway and shared cycleway as indicated on the general arrangement drawings. All tactile paving layouts are to be in accordance with the Department of the Environment, Transport and the Regions 'Guidance on the use of Tactile Paving Surfaces', November 1998. Refer to WSCC detail numbered S278/38/04 and S278/38/18 for bedding details.

2.8 Tactile Corduroy Warning paving shall be grey coloured flags, size 400x400x50mm thick laid in accordance with WSCC detail S278/38/18.

3 Grasscrete Maintenance Bay

3.1 Grasscrete, or similar approved, maintenance bay to be installed in strict accordance with manufacturer's recommendations.

Appendix 12/1 - Traffic Signs: General (Rev P2, 30/07/18)

1. New permanent traffic signs are indicated on the general arrangement drawings.
2. Steel posts, with a minimum 76mm outside diameter, shall comply, where applicable, with the requirements of BS4 and BS4848 and shall be manufactured from steel complying with the requirements of BS EN 10025 – 1:2004 as detailed in BS 8442:2006 and galvanised in accordance with the requirements of BS EN ISO 1461 “Hot Dip Galvanised Coatings on fabricated Iron and Steel Articles”, unless specifically requested otherwise by the Highway Authority.
3. Each post shall have a base plate (min 0.05 sq.m) and cap to prevent the ingress of water in accordance with the requirements of BS 8442:2006. All clips, screws, bolts, nuts and washers that come into contact with the sign shall be stainless steel.
4. Sign posts dimensions are to be sufficient to allow signs to be mounted with lateral clearances and mounting heights in accordance with the traffic signing schedule.
5. All clips used to fix sign faces to posts and lamp columns shall be of an anti-rotational type.
6. Temporary traffic signs to diagram 7014 shall be erected on a new traffic sign post, for the duration of three months, on approaches to the new works, as indicated on the traffic signing schedule. The temporary sign locations are to be agreed on site with the Engineer prior to erection. After 3 months the signs and posts shall be removed and the footway reinstated/made good.
7. All traffic signs to be mounted on street lighting columns to be installed with neoprene banding placed between the sign mounting clips and the column to protect the columns from damage.
8. Illuminated signs and bollards shall be numbered consecutively per road starting with 1 through to the conclusion of the road as per WSCC Gazetteer. In addition to this the sign or bollard shall bear the first letter of the road as a suffix. For new roads where the road name is not determined please use the letter X as a temporary placeholder for design purposes and substitute the correct suffix on installation. For signs positioned facing the carriageway, numbers and letters shall be placed at 45 degrees to oncoming traffic. For bollards, letters and numbers shall be positioned on the rear of the bollard.
9. The Contractor is to agree the exact sign and bollard numbering system with the Highway Authority.
10. Traffic Sign Face details are provided at Schedule B at the rear of this document.

Appendix 12/3 - Traffic Signs: Road Markings and Studs (Rev P2, 30/07/18)

1. Materials for road markings shall be selected from the following:
 - Screed thermoplastic
2. The above shall comply with the requirements of BS 3262 for “Superimposed Road Markings”.
3. The locations for permanent road markings are shown on the general arrangement drawing.
4. All road markings to be in accordance with The Traffic Signs Regulations and General Directions and Clause 1212.
5. Where existing road markings do not conform to new layout, they shall be removed by a method approved by the Engineer. Where reflecting road studs are also removed the hole remaining shall be reinstated with appropriate surfacing material to be approved by the WSCC Proper Officer.
6. Exact location of road markings and tie-ins to be agreed on site with the Engineer.
7. Road studs shall be ‘Halifax’ type and provided as indicated on the general arrangement drawing. All reflecting road studs shall comply with BS EN 1463 – 1 and Clause 1213.

Appendix 12/5 - Traffic Signs: Traffic Signals (Rev P2, 30/07/18)

1. Traffic signals loops, ducting and chambers shall be constructed in accordance with Traffic Signal drawing.
2. Traffic signal installations shall be in accordance with the WSCC *Traffic Signal Installation Standards*, provided at Schedule C at the rear of this document.
3. As-built drawings shall be provided in accordance with WSCC requirements including A cable drawing showing clear distinction between LV and ELV.

Appendix 13/1 - Road Lighting Columns and Brackets (Rev P2, 30/07/18)

1. Street lighting columns shall be provided as indicated on SSE drawings SSE203224-LD-001 and 002 and shall be compatible with the lanterns specified in Appendix 14/4.
2. Erection of the steel column and the concrete surround diameter shall be in accordance with WSCC detail 4 'Road Lighting Column Erection Details' included within the WSCC document Lighting of Developer Promoted Highway Schemes in West Sussex.
3. Columns to be painted BS12C39 (Sherwood green) and be factory applied.

Unit Numbering

4. All adoptable columns, illuminated signs, illuminated bollards and feeder pillars require to be numbered. Numbers shall be as indicated on the SSE drawings. Water/weatherproof stick on numbers are permissible. Numbers to be fixed 2m above ground facing the carriageway. Numbering standard detail to be provided with approval.

Appendix 13/2 - (Specification for Highway Works) Typical Column and Bracket Data - Sheet 1

Name of Manufacture:

Column Reference No

Revision No

Date

NAME OF CONTRACT:

PART A General

Column nominal height (m)

Column material

Material design strength (N/mm²)

No. of door openings

Door opening size - Height (mm)

- 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

Manufacturers drawing ref. No.

Corrosion protection (steel columns only) - basic system type (NG 1901)

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

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

(mm)

PART B Foundation Data

Planted base

Planting depth (m)

Diameter of concrete surround (if any)

Standard Soil Type Factor G		
630	390	230

Flange base

Bolt hole centres	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 - (Specification for Highway Works) Typical Column and Bracket Data - Sheet 2

PART C Acceptable Luminaires

Luminaire: Maximum Characteristics

		Standard K Factor (see BS 5649)				
		1.50	1.80	2.20	2.50	3.00
Luminaire Connection		Maximum windage area m ² for standard K factors				
Diameter	Length					

Post Top
Column

Luminaire lever arm (mm)	
Due to wt. of luminaire	Due to Windage of luminaire

Single Arm
Bracket
Column:

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

Luminaire lever arm (mm)	
Due to wt. of luminaire	Due to Windage of luminaire

Double Arm
Bracket
Column:

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

PART D Certification

It is certified that the information given in the Data Sheet has been obtained in accordance with the requirements of BS EN 40: Part1 and BS 5649 as implemented by Departmental Standard BD 26 and the Specifications.

Signed on Behalf of the Contractor.....

Date

Appendix 13/3 - Instructions for Completion of Lighting Column and Bracket Data Sheets

Data sheets shall be provided not later than 14 days after acceptance of tender.

General

1. When information is not required a dash shall be inserted in the appropriate boxes.
2. Where a Data Sheet is amended it shall be given a new revision number with a date.
3. The revision numbers shall be consecutive letters of the alphabet, commencing with "A".
4. The date of the revision shall agree with the date of the Contractor's signature.
5. The column, or bracket material shall be steel, aluminium, reinforced or pre-stressed concrete, glass fibre reinforced plastic or any other suitable material.
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 clause 2 or 3 of BS 5649: Part 2: 1978 as appropriate.
9. The number of door openings shall agree with the manufacturer's drawings.
10. The cross-section of the base compartment shall be indicated by a dimensioned diagram/sketch.
11. The acceptable positions of bracket arms relative to the door position shall be indicated on the diagram. Where all positions are acceptable the box noted "ANY" shall be ticked.
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 systems 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 column sections.

(Note: 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 (Rev P2, 30/07/18)

- 1 The Contractor is responsible for preparing electrical record drawings for the Highway Authority.
Process for Adoption of Street Lighting Equipment
- 2 All street lighting and illuminated equipment in West Sussex is adopted and maintained under a PFI contract with Tay Valley Lighting (TVL).
- 3 The County Council does not offer free installation checks. All installations shall be approved and the County Council will ask TVL inspect your installation and recover their costs prior to certifying works for the release of bonds or deposits.
- 4 Following construction the street lighting accrual package must be completed and provided as a standalone set of documents that can be issued to the WSCC PFI contractor. It shall include:
 - (i) A written notice including:
 - (A) Details of the proposed agreement. –Whether S278/38, Location, description of highway works, PSI reference number
 - (B) the identity of the parties involved;
 - (C) written confirmation by the developer that the apparatus complies with the 'Accrual Required Standards'.
 - (ii) Details of all equipment to be adopted:
 - (A) As built drawings showing the road layout the development and works and details of the types of apparatus including all adoptable lighting equipment, illuminated signs and distribution networks. - normally 1:500 scale paper copies and pdfs. Drawings must show the new unit numbers and the existing equipment numbers.
 - (B) Full details of any cable distribution networks.
 - (C) Electrical test certificates for all adoptable equipment. – Certificates shall reference the new numbering system.
 - (D) A copy of the 'Development Standard for Highway Lighting' current at the time the design was approved.
 - (iii) A copy of the IDNO (Independent Distribution Network Operator) Service Level Agreement, if applicable.
 - (iv) Any other documentation required to satisfy legislation at the time of the accrual.

Appendix 14/2 - Location of Lighting Units and Feeder Pillars

1. The position of new lighting units are as indicated on SSE drawings SSE203224-LD-001 and 002

Appendix 14/3 - Temporary Lighting

1. Temporary lighting for traffic management during carriageway diversions will be provided by the Contractor wherever there is no existing lighting of an adequate standard. Temporary lighting will also be required where new sections of highway are opened to traffic before their permanent lighting systems are in operation.
2. The Contractor shall ensure that any temporary lighting provided does not cause glare to traffic users on highway nor annoyance to occupants of surrounding property.
3. Existing illuminated regulatory signs, where not part of a traffic signal installation, must be maintained either in their existing location or temporary locations and the same standard of illumination maintained by either existing or temporary lighting. This lighting is to be maintained until the relevant regulation ceases to be appropriate and may not be removed without the prior approval of the Engineer in writing.
4. The Contractor shall ensure that all existing road lighting remains in operation for as long as that road is open to traffic. Where electrical supplies to existing units are disconnected during the execution of the Works the Contractor shall provide and install temporary supply cables as directed by the Engineer.
5. The level of illumination of the existing trafficked carriageways shall be maintained at a level not lower than that existing until the date of the completion certificate for the whole of the works. New and temporary carriageway used for traffic during the course of the Contract shall be illuminated by temporary or permanent lighting to the standards detailed in paragraph 2 below.
6. If for any reason the Contractor supplies temporary lighting the standard of lighting shall not be lower than the standard provided by the permanent road lighting system, or BS 5489 parts 2 and 4 as appropriate, whichever is the greater.
7. The use of generators for temporary lighting will need to be agreed in advance with the highway authority. However, where generators are used to provide a temporary power supply to road lighting the Contractor shall appoint a member of his staff, who shall be identified and made known to the Engineer, to be responsible for the maintenance of the generators.
8. Where necessary the contractor shall provide protection to existing cables or install new diversion cables to maintain electrical supplies to luminaires. The Contractor shall give to the Engineer 2 weeks notice of the proposed date of any changes to the cable network and shall not proceed until arrangements for the switch over from existing to temporary cables has been agreed.
9. All generators shall be fitted with a fuel tank which has sufficient capacity to allow the generator to run continuously throughout the hours of darkness without requiring filling / topping up.
10. Where a temporary supply to lighting columns is achieved by means of catenary cable between the columns then the conducting cable shall be suspended from a steel support cable. The conductor cable shall be attached to the support cable at intervals of no greater than 1.0m. Columns that are to be retained shall not be drilled.
11. Where a temporary supply to lighting columns is achieved by means of surface run cables, the cables shall be steel wire armoured with additional mechanical protection, marked by street lighting marker tape and cones attached to the cable. Under no circumstances shall traffic drive over such cables without suitable mechanical protection. Lengths of damaged cable are to be replaced immediately.
12. Temporary cable networks shall be designed, installed and tested in compliance with BS 7671 and with the 1400 Series Clauses and Appendices of the Specification.
13. If the Contractor proposes to use either temporary lighting or temporary supplies then he must submit his proposals to the Engineer in writing not less than 5 days prior to the installation of the temporary lighting.

Appendix 14/4 - Electrical Equipment for Road Lighting (Rev P2, 30/07/18)

Street lighting shall be as indicated on SSE drawings SSE203224-LD-001 and 002 and be in accordance with the 'Lighting of Developer Promoted Highway Schemes in West Sussex' included at **Schedule D**.

1. Lantern and Lamps (Clause 1407 and 1408)

Lanterns shall be as indicated on SSE drawings SSE203224-LD-001 and 002

2. Ancillary Equipment

Control Gear

- Shall accord with WSCC specification.

Lantern Photocell

- All proposed units are to be fitted with electronic photo-electric control unit (PECU) configured to accord with WSCC specification.

3. Equipment Position

- The layout of equipment within lighting column bases shall be in accordance with the overseeing authorities' requirements and in accordance with the manufacture's recommendations.

4. Proposed Equipment – Electrical supply, Isolation and Wiring

Electrical Supply

- All Electrical supply to equipment should be undertaken in accordance with WSCC requirements.

Isolator

- All isolators to accord with WSCC requirements.

Internal Wiring

- All internal wiring to accord with WSCC requirements.

5. Private Underground Service Cabling

All private cabling Low Voltage and Extra Low Voltage will be laid in orange duct marked "Street Lighting". SWA cable will be terminated into the base of the column Toeco cut-out via B21 Extension box fitted with IP7 Plate and 5 x Encapsulated Terminals. Glands used will be CW and be covered by shroud.

6. Numbering of electrical equipment

Letters and numerals shall be 50mm high black on white on adhesive labels suitable for exterior use.

Generally, the numbering of the road will follow the same direction as the house numbering although this may not be practical in the instances of one-way streets and this would be an exception.

If an additional piece of equipment is erected into an existing numbering system, then the preference is to renumber the whole road again incorporating the new equipment.

a) Columns

The Columns shall be numbered as indicated on the SSE drawings.

Numbers shall be positioned at 90 degrees to the carriageway, 2.5m above ground level (no suffix is required).

b) Signs and Bollards

Signs and bollards shall be numbered as indicated on the SSE drawings.

For signs positioned facing the carriageway, numbers and letters shall be placed at 45 degrees to oncoming traffic.

For bollards, letters and numbers shall be positioned on the rear of the bollard.

Appendix 17/1 - Schedule for the Specification of Designed Concrete (Rev P2, 30/07/18)

Toddington Lane bridge (WSCC Ref. 1740)

Requirement	Schedule			
Element	Deck and end diaphragm	Abutment / Wing walls	Precast prestressed concrete deck beams	Precast reinforced concrete edge parapet units to bridge and reinforced earth panel walls
Intended Working Life of Structure	120 Yrs	120 Yrs	120 Yrs	120 Yrs
Nominal Cover to Reinforcement	45	60	40	55
Applicable Exposure Classes (Excluding DC-class)	XC3/4, XF1, XS1	XS1, XD2, XF2	XC3/4, XD1, XS1, XF1	XD3, XS1, XF4
DC-class (where appropriate)	-	DC-1	-	-
Compressive Strength Class of Concrete	C40/50	C40/50	C50/60	C40/50
Minimum Cement Content (kg/m ³)	380kg/m ³	380kg/m ³	380kg/m ³	380kg/m ³
Maximum Free Water/Cement Ratio	0.35	0.35	0.35	0.35
Required Group or Type and Class of Cement or Combination (where a DC-class has not been specified)	IIB-V, IIIA	IIB-V, IIIA	IIB-V, IIIA	IIB-V, IIIA
Maximum Aggregate Size (mm)	10	20	20	10
Chloride Content Class	CL 0.30	CL 0.30	CL 0.10	CL 0.30
Consistence Class	To be confirmed by the Contractor			
Required Source / Special Type of Aggregate	-	-	-	Frost resistant
Minimum or Maximum Temperature of Fresh Concrete (°C)	In accordance with BS EN 206:2013 Clause 5.2.9			
Sampling and Testing	See appendix 1/5			
Other Requirements	-			

Railway Bridge (WSCC Ref. 1741)

Requirement	Schedule			
Element	Deck and end diaphragm	Abutment / Wing walls	Precast prestressed concrete deck beams	Precast reinforced concrete edge parapet units to bridge and reinforced earth panel walls
Intended Working Life of Structure	120 Yrs	120 Yrs	120 Yrs	120 Yrs
Nominal Cover to Reinforcement	45	60	40	55
Applicable Exposure Classes (Excluding DC-class)	XC3/4, XF1, XS1	XS1, XD2, XF2	XC3/4, XD1, XS1, XF1	XD3, XS1, XF4
DC-class (where appropriate)	-	DC-1	-	-
Compressive Strength Class of Concrete	C40/50	C40/50	C50/60	C40/50
Minimum Cement Content (kg/m ³)	380kg/m ³	380kg/m ³	380kg/m ³	380kg/m ³
Maximum Free Water/Cement Ratio	0.35	0.35	0.35	0.35
Required Group or Type and Class of Cement or Combination (where a DC-class has not been specified)	IIB-V, IIIA	IIB-V, IIIA	IIB-V, IIIA	IIB-V, IIIA
Maximum Aggregate Size (mm)	10	20	10	10
Chloride Content Class	CL 0.30	CL 0.30	CL 0.10	CL 0.30
Consistence Class	To be confirmed by the Contractor			
Required Source / Special Type of Aggregate	-	-	-	Frost resistant
Minimum or Maximum Temperature of Fresh Concrete (°C)	In accordance with BS EN 206:2013 Clause 5.2.9			
Sampling and Testing	See appendix 1/5			
Other Requirements	-			

Allotment Underpass (WSCC Ref. 1753)

Requirement	Schedule			
Element	Precast box units	Precast headwall and wing walls		
Intended Working Life of Structure	120 Yrs	120 Yrs		
Nominal Cover to Reinforcement	55mm	55mm		
Applicable Exposure Classes (Excluding DC-class)	XC3/4, XF1	XD3, XF4		
DC-class (where appropriate)	DC-1	DC-1		
Compressive Strength Class of Concrete	C40/50	C40/50		
Minimum Cement Content (kg/m ³)	280kg/m ³	380kg/m ³		
Maximum Free Water/Cement Ratio	0.6	0.35		
Required Group or Type and Class of Cement or Combination (where a DC-class has not been specified)	All in table A.6 except IVE-V	IIIB-V, IIIA		
Maximum Aggregate Size (mm)	20	20		
Chloride Content Class	CL 0.30	CL 0.30		
Consistence Class	To be confirmed by the Contractor			
Required Source / Special Type of Aggregate	-	Frost resistant		
Minimum or Maximum Temperature of Fresh Concrete (°C)	In accordance with BS EN 206:2013 Clause 5.2.9			
Sampling and Testing	See Appendix 1/5			
Other Requirements	-	-		

Reinforced concrete foundation to H4a vehicle parapet between chainages 375 and 410

Requirement	Schedule			
Element	Foundation to H4a vehicle parapet			
Intended Working Life of Structure	120 Yrs			
Nominal Cover to Reinforcement	55			
Applicable Exposure Classes (Excluding DC-class)	XC3/4, XS1, XF4			
DC-class (where appropriate)	-			
Compressive Strength Class of Concrete	C40/50			
Minimum Cement Content (kg/m ³)	380kg/m ³			
Maximum Free Water/Cement Ratio	0.35			
Required Group or Type and Class of Cement or Combination (where a DC-class has not been specified)	IIB-V, IIIA			
Maximum Aggregate Size (mm)	10			
Chloride Content Class	CL 0.30			
Consistence Class	To be confirmed by the Contractor			
Required Source / Special Type of Aggregate	Frost resistant			
Minimum or Maximum Temperature of Fresh Concrete (°C)	In accordance with BS EN 206:2013 Clause 5.2.9			
Sampling and Testing	See Appendix 1/5			
Other Requirements	-			

Appendix 17/3 - Concrete – Surface Finishes (Rev P2, 30/07/18)

- 17.3.1 Requirements for surface finishes are shown on drawings 35944/1501/001 to 011 for the Railway bridge (WSCC Ref. 1741) and on drawings 35944/1502/001 to 010 for Toddington Lane bridge (WSCC Ref. 1740).
- 17.3.2 Requirements for the Allotment Underpass (WSCC Ref. 1753) and reinforced concrete foundation to H4a vehicle parapet between chainages 375 and 410 shall be as indicated below.
- Buried concrete faces in contact with the soil shall have a F1/U1 finish and receive a minimum of 2 coats of out back bitumen.
 - Exposed faces shall have a F4/U3 finish.

Appendix 17/4 - Concrete – General (Rev P2, 30/07/13)

General

- 17.4.1 Ready-mixed concrete shall be obtained from a plant operating a UKAS accredited quality system with product conformity. Each mix must be obtained from only one plant unless otherwise approved. The ready-mixed concrete supplier shall submit written confirmation that all relevant sections of the Specification have been reviewed.
- 17.4.2 Constituent materials shall be obtained from suppliers operating quality system in accordance with BS EN ISO 9002.
- 17.4.3 Permitted cement combination types are as detailed in Appendix 17/1.
- 17.4.4 All reinforcement shall be grade B500B or B500C ribbed bars in accordance with BS 449:2005.
- 17.4.5 Welding of the reinforcement will not be permitted.

Precast prestressed concrete beams

- 17.4.6 The Contractor shall prepare fabrication drawings and bar bending schedules for the designer's approval prior to casting of precast elements.
- 17.4.7 Strands in the precast prestressed beams shall not be relieved until such time as the concrete has attained compressive cylinder strength of 40 N/mm². Two sample cubes taken from the concrete shall be tested and the lower of the two results shall satisfy the minimum compressive strength before relieving commences.
- 17.4.8 Lifting points shall be designed by the Fabricator. Position of lifting points and support locations to be within 1m from the ends of the beams. Additional reinforcement necessary for the lifting devices to be cut as necessary to place deck reinforcement and obtain concrete cover after positioning of beam.
- 17.4.9 The temporary fixing of precast reinforced concrete edge beam to be designed by the precast manufacturer to ensure temporary stability of the precast reinforced concrete edge beam prior to the deck concrete pour. The supports shall be designed for the loads specified on drawings 35944/1501/011 and 35944/1502/011.

Storage of precast concrete units

- 17.4.10 Precast concrete units shall be stored flat and shall be protected from damage and discoloration.

Construction joints

- 17.4.11 Construction joints shall be provided where specifically shown on the construction drawings. Where other construction joints are necessary to fit with the construction methodology proposed by the Contractor these shall be agreed with the Overseeing Organisation prior to construction on site.

Permanent formwork

- 17.4.12 Permanent formwork shall be used for construction of in-situ reinforced concrete deck slab, as detailed on drawings 35944/1501/001 for the Railway bridge (VSCC Ref. 1741) and 35944/1502/001 for Toddington Lane bridge (VSCC Ref. 1740). Permanent formwork shall be in accordance with following requirements:
 - i. The panels shall be Glass Reinforced Plastic (GRP), grey in colour, consisting of a resin mortar filling between two thin sheets of glass reinforced plastic. Details shall be submitted to the Overseeing Organisation for approval.

- ii. One surface of panel shall have projecting steel reinforcing ribs on edge encased within the GRP. There should be no filler materials such as expanded polystyrene placed between the ribs, which would prevent full contact between the concrete and the surface of the ribbed panels.
- iii. The permanent formwork shall be designed and installed in accordance with the Department of Transport's Highways and Transport Advice Note BA 36/90 'The Use of Permanent Formwork'.
- iv. The formwork shall be bedded on an approved preformed flexible strip sealant, making due allowance for any cross fall. The gaps between adjacent panels are to be sealed to prevent loss of grout during construction of the reinforced concrete deck slab. Details shall be submitted to the Overseeing Organisation for approval.

Appendix 17/5 - Buried Concrete (Rev P2, 30/07/18)

Structure Name or Location	Rail Bridge (WSCC Ref. 1741), Toddington Lane bridge (WSCC Ref. 1740) and Allotment Underpass (WSCC Ref. 1753)
ACEC Class for Site	AC-1
Structural Performance Level	High
Design Chemical Class	DC-1
Other Requirements and Design Constraints	-

Appendix 20/1 - Waterproofing for Concrete Structures (Rev P2, 30/07/18)

- 20.1.1 Except where otherwise directed, all general requirements for waterproofing of concrete structures shall comply with Specification for Highway Works, Volume 1, Series 2000 and IAN/96.
- 20.1.2 Waterproofing and sealants to be placed/applied/installed in accordance with the manufactures instructions. Buried surfaces (not visible) not applied with a proprietary waterproofing system shall receive 2 coats of cut-back bituminous paint, to be within 100mm of the finished ground level.
- 20.1.3 Adhesion Test. The waterproofing membrane shall be tested to ensure it has adhered to the concrete sufficiently. 1 test per 100m² shall be undertaken to confirm that the membrane has sufficient adhesion to the deck. Tensile adhesion shall be greater than 0.7 N/mm² or as otherwise approved with the Overseeing Organisation
- 20.1.4 HV Integrity Test. This shall be undertaken by an independent quality approved testing company accredited to the UK Accreditation Service (UKAS) or equivalent. Testing shall be undertaken over the entire area of waterproofing membrane. Any defects shall be repaired to the satisfaction of the Overseeing Organisation. A certificate confirming the integrity of the waterproofing shall be forwarded to the Overseeing Organisation within seven days.
- 20.1.5 The Contractor shall be responsible for conducting tests on the waterproofing materials to confirm the values on which the BBA certification was granted. These tests shall include but not be limited to:
- Tensile strength
 - Elongation at break
 - Dry skin density
- 20.1.6 Tests shall be carried out at the rate of 2 per batch, 1 per day or 2 per structure whichever is the greater. Should the averaged results fail to comply with the BBA certificate the Contractor shall take action as directed by the Overseeing Organisation which may vary from localised making good to complete removal and replacement depending on the extent of the failure.

Appendix 21/1 - Bridge Bearing Schedule (Rev P2, 30/07/18)

21.1.1 The bridge bearings shall be supplied and installed in accordance with EN 1337-3.

Bridge name or reference					Toddington Lane bridge (WSCC Ref. 1740)
Bearing type					Elastomeric type B/C
Number of bearings					32
Location					Two elastomeric per bearing plinth
Function					Free
Seating material		Upper surface			Concrete
		Lower surface			Bearing Grout
Allowable average contact pressure* (N/sq.mm.)		Upper face	Serviceability		-
			Ultimate		-
		Lower face	Serviceability		-
			Ultimate		-
Design load effects (kN)	Serviceability limit state		Vertical	Max.	648
				Permanent	258
				Min	124
			Transverse		-
			Longitudinal		-
	Ultimate limit state		Vertical		868
			Transverse		66
			Longitudinal		132
Translation (mm)	Serviceability limit state	Irreversible	Transverse		-
			Longitudinal		-
		Reversible	Transverse ±		-
			Longitudinal ±		-
	Ultimate limit state	Irreversible	Transverse		-
			Longitudinal		-
		Reversible	Transverse		-
			Longitudinal ±		3.4
Rotation (radians)	Ultimate limit state	Irreversible	Transverse		-
			Longitudinal		-
		Reversible	Transverse ±		-
			Longitudinal ±		0.003

	Maximum rate (radians per 100 kN)	Transverse	-
		Longitudinal	-
Minimum bearing dimensions (mm)	Upper surface	Transverse	400
		Longitudinal	500
	Lower surface	Transverse	400
		Longitudinal	500
	Overall height		92.5
Tolerable movement of bearing under transient loads (mm)		Vertical	-
		Transverse	-
		Longitudinal	-
Allowable resistance to translation under serviceability limit state (kN)		Transverse	-
		Longitudinal	-
Allowable resistance to rotation under serviceability limit state (kN-m)		Transverse	-
		Longitudinal	-
Type of fixing required		Upper face	Friction connection
		Lower face	Cast-in Steel Plate Fixing

Bridge name or reference				Railway Bridge (WSCC Ref 1741)	
Bearing type				Elastomeric type B	
Number of bearings				32	
Location				Two elastomeric per bearing plinth	
Function				Free	
Seating material	Upper surface			Concrete	
	Lower surface			Bearing Grout	
Allowable average contact pressure* (N/sq.mm.)	Upper face	Serviceability		-	
		Ultimate		-	
	Lower face	Serviceability		-	
		Ultimate		-	
Design load effects (kN)	Serviceability limit state		Vertical	Max.	648
				Permanent	258
				Min	124
			Transverse		-
			Longitudinal		-
	Ultimate limit state		Vertical		668
			Transverse		66
			Longitudinal		132
Translation (mm)	Serviceability limit state	Irreversible	Transverse		-
			Longitudinal		-
		Reversible	Transverse ±		-

			Longitudinal ±	-
	Ultimate limit state	Irreversible	Transverse	-
			Longitudinal	-
		Reversible	Transverse	-
			Longitudinal ±	3.4
Rotation (radians)	Ultimate limit state	Irreversible	Transverse	-
			Longitudinal	-
		Reversible	Transverse ±	-
			Longitudinal ±	0.003
	Maximum rate (radians per 100 kN)	Transverse	-	
		Longitudinal	-	
Minimum bearing dimensions (mm)	Upper surface		Transverse	200
			Longitudinal	300
	Lower surface		Transverse	200
			Longitudinal	300
	Overall height			63
Tolerable movement of bearing under transient loads (mm)			Vertical	-
			Transverse	-
			Longitudinal	-
Allowable resistance to translation under serviceability limit state (kN)			Transverse	-
			Longitudinal	-
Allowable resistance to rotation under serviceability limit state (kN-m)			Transverse	-
			Longitudinal	-
Type of fixing required			Upper face	Friction connection
			Lower face	Friction connection

Appendix 26/1 - Concrete for Ancillary Purposes (Rev P2, 30/07/18)

The following concrete grades shall be used for ancillary purposes:-

<u>Purpose</u>	<u>Grade</u>
Bedding and backing to kerbing, edgings and channels	ST1 and ST4
Sign Bollard foundation	ST1
Footing to traffic sign	ST2
Footing to street lighting column	ST4
Bed and haunch to highway drain pipes	ST4

Appendix 30/5 - Grass Seeding, Wild Flower Seeding and Turfing

1. For details of landscaping refer to Landscape consultants drawings (WYG).
2. All highway verges and margins including areas required for visibility shall be covered with a layer of topsoil (minimum 150mm deep) rolled and grass seeded.
3. Seeding shall be carried out in accordance with BS4428:1989 to a rate of spread to be approved by the Project Engineer.
4. Grass seed sowing shall be carried out during March/April or September.
5. The grass seed mix shall be hard wearing amenity grass "Wear and Tear (A24) by Germinal Seeds.
6. Alternative mixes may be presented to WSCC for approval.

Appendix 90/1 - Information for specification of lighting units (Rev P2, 30/07/18)

90.1.1 The lighting units to the Allotment Underpass (WSCC Ref. 1753) shall provide a safe access for users and adequate lighting to the vertical surfaces. Light sources with better colour rendering properties shall be used to improve the colour contrasts and contribute to a better facial recognition.

90.1.2 The lighting shall be designed in accordance with BS 5489-1:2013, BS 13201-1:2004, BS 13201-2:2015 and meet the following minimum requirements:

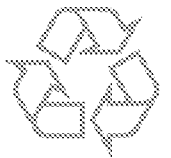
- Minimum impact rating (IK) of 8;
- Minimum ingress protection (IP) of 65;
- Average illuminance (E) of 100lux;
- Lighting source of LED and maintained;
- PIR motion detecting switches with adjustable time lag required at either end of the underpass. Manual override switch also required should PIR fail – switch location to be agreed with the engineer on-site to ensure it is not misused.
- Emergency lighting in accordance with BS 5266-1:2016

SCHEDULE A – Drainage System Manufacturers Details (Rev 27, 05/09/19)



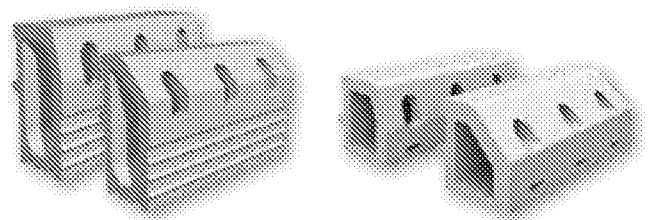
PIPELINE & DRAINAGE SYSTEMS LTD

DEVELOPING PIPELINE & DRAINAGE SOLUTIONS



Envirokerb & Envirobridge

The new and improved range of recycled composite kerb drain solutions.





PIPELINE & DRAINAGE SYSTEMS LTD

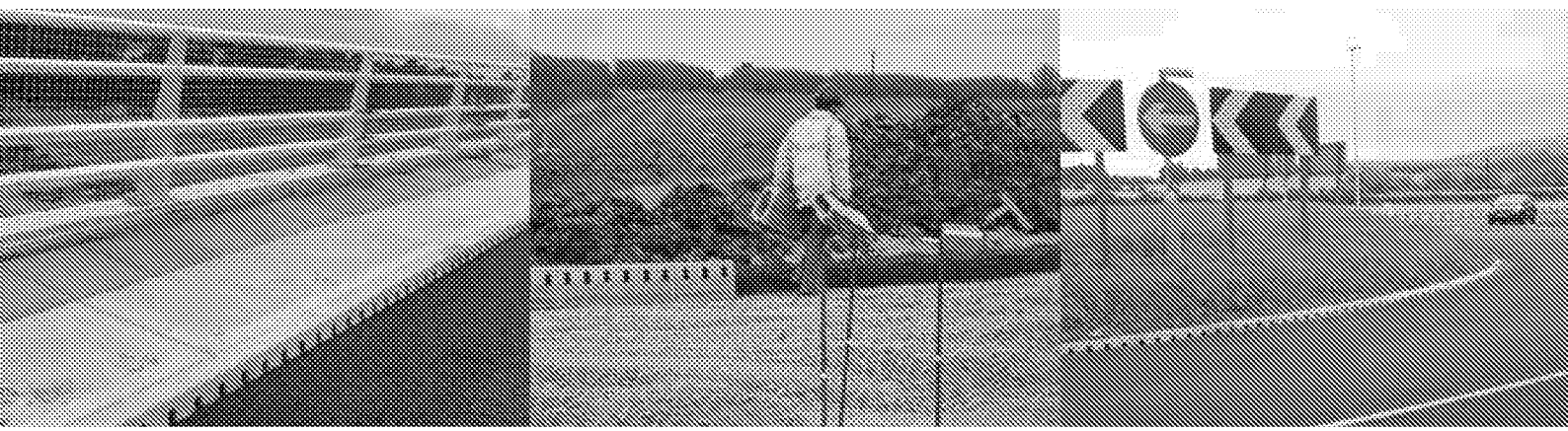
DEVELOPING PIPELINE & DRAINAGE SOLUTIONS

Welcome to Pipeline Drainage Systems Ltd

Founded in 2000 we have successfully established ourselves as market leaders working on major projects throughout the UK, Europe and Worldwide.

PDS continue to be at the forefront of innovative design, solving both traditional problems and devising radical solutions to the challenges we face in the future.

We are very proud of our reputation for excellence.



The Lightweight Envirokerb Range of products conform to Manual Handling Regulations, cutting out the cost of any mechanical handling equipment. Installation time is exceptionally quick on the whole Envirokerb System, as well as reducing the RISK of personal injury.

Reputation built through innovation

Whilst the Envirokerb drainage product range has proven to be a great success as the lightest, yet strongest unit on the market, it has always been the policy of Pipeline and Drainage Systems to continually improve our product ranges.

We have now been able to develop a method of manufacturing the Envirokerb that improves strength to an even greater level, reduces weight over the existing units, but also has the added benefit of dramatically improving the aesthetic finish of the product. Our production time has also improved leading to greater material output as we look to increase our market share.

The full range of units include both Bridge drainage and 305, 385 and 480 depths in Half battered and Splay profile and is complemented by our ENVIROCHANNEL.

Envirokerb

Lightweight

Each Envirokerb component has been designed to be installed manually. The Bridge drainage weighs as little as 9kg. The standard 305mm depth weighs only 15kg, the 385mm weighs 18.5kg and the 480mm weighs 24kg.

Strong and Robust

The material used in manufacture is exceptionally strong and complies with BSEN1433 Group 3 kerb side installations load class D400KN. The product also conforms to the HIGHWAY AGENCY IAN117/08 for combined kerb drainage

Impact Resistant - PRODUCT GUARANTEED!

The product has the added advantage over traditional materials in being virtually unbreakable, offering exceptional strength, provided it is installed correctly and to our specification. In fact, PDS LTD Guarantee the product against breakage - please call for details.

Chemical Resistance

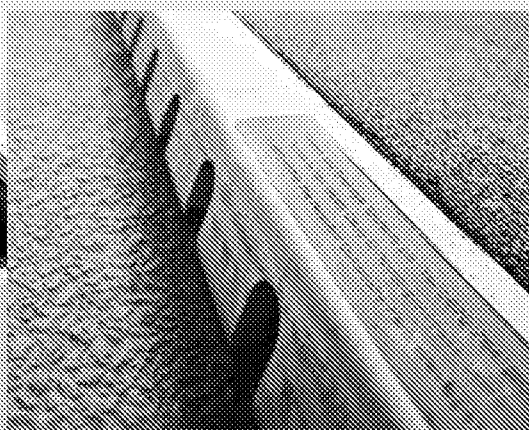
The product is resistant to all forms of effluents found in highway situations such as road-salts, petrol, diesel etc.

Aesthetics

Envirokerb, through a policy of material and process development, has a finish almost identical to a standard concrete kerb. Further large investment in new tooling and production techniques has allowed for improved aesthetics over the original product. We are confident that we now produce a product that cannot be differentiated from concrete- unless you pick it up!!

System components

The Envirokerb system is complemented by a full range of additional components including drop kerbs, centre stones, lightweight gully chamber, rodding access units, radius units and numerous outlet possibilities.



Available in 165mm, 180mm, 210mm (Structures) and 305, 385, 480 depths in both HB2 and 45° slope. The Envirokerb Range has been used on motorways, car parks, traffic calming, urban areas, train stations and now on structures and bridges

Contents

“ The product has proven to be very strong, and to date we have experienced no breakages. Once in-situ the product has the appearance of concrete and blends exactly with existing kerb-lines. We would have no hesitation in recommending the product. ”

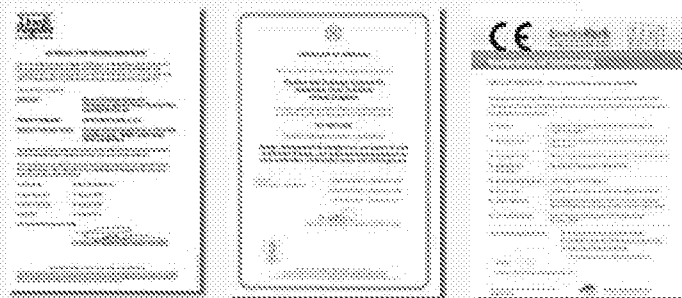
Nottinghamshire County Council

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Quality Assurance /Accreditation

When launching our new product range in 2003 it became apparent that designers and clients require confirmation of the longevity and quality of the Envirokerb range. It was therefore imperative that PDS LTD made large investments in all required standards, Quality Assurance and Accreditation.

Due to success in Ireland where we are the market leader in the supply of Combined Kerb Drainage, and with a clear objective to supply markets in mainland Europe it was essential that any Accreditation we obtained was recognised in Europe and not just the UK. We therefore chose to CE mark all our product ranges.



“Further Benefits - On the A1073 Spalding to Eye contract, the complete range of Envirokerb Units was delivered to site on 20 Artic loads - it was estimated that Traditional Concrete products would have required 80 Artic loads to deliver the same meterage.”

For more information on our products visit www.pds.co.uk

This was done with the guidance of the Highways Agency and in partnership with Lloyds Register Quality Assurance. We are now very proud to hold the following certification:

- EN1433 CERTIFICATION TO D400KN - EN1433 is a European Harmonised standard with an attestation level of 3. This defines how to test products and where to source NOTIFIED BODIES to oversee all tests.
- Tests covered in EN1433 include LOAD TEST (D400KN), WEATHERING TEST (R+) and also watertight test (an essential requirement of EN1433).
- ISO9001 Quality Assurance for the Design, Manufacture and Distribution of Combined Kerb and Line drainage.
- The above allow us to issue a "Declaration of Conformity" and to CE Mark our product range- Under European legislation this is the only Mark relevant under a Harmonised Standard - No other Mark SHOULD BE SPECIFIED as this can undermine the CE mark and lead to confusion.
- ENVIROKERB is fully compliant with all revisions of the HIGHWAYS AGENCY Interim Advice Note IAN117/08 and clause 516 of the Specification for Highways Works.
- PRODUCT ACCEPTANCE - PDS have supplied and are supplying the largest contracts in the UK and Ireland. This includes Highway Agency, National Roads Authority and Department of Environment contracts. Contracts in Germany, Italy, Slovakia, Spain, Switzerland and more recently South Africa. A comprehensive list is available to download on our website.
- Envirokerb is type tested in accordance with 89/106/EEC attestation systems 3. Management system of production location(s) are assessed to the requirements of ISO 9001:2000 and additional product focused audit trails and samples are carried out, to the intent of 89/106/EEC attestation system 1.



Environmental Benefits

We are often asked about our GREEN CREDENTIALS. Initially we felt that any research or figures produced would be very subjective dependant on which organisation was chosen to carry out the tests. Then we were approached by ENVIROLINK NORTHWEST (A public sector organisation) who suggested that a new standard PAS2050 (Publicly Available Standard) would offer clarity to any research.

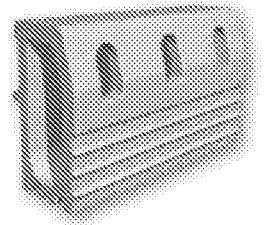
PDS use recycled materials that would otherwise be destined for landfill within the UK & China. If sent to landfill the material we use, for example, to manufacture our Envirokerb range, would take between 750-1000 years to degrade. PDS can help your company decrease its carbon footprint. In the UK it is estimated that we have only 7 years of landfill left! Existing Combined Kerb Drainage systems manufactured in traditional materials rely heavily on natural resources.

There are additional logistical concerns on the transportation of these materials through the smaller countryside communities in the UK. These products are heavy, brittle, difficult to recycle, and carry a number of on-site safety issues associated with their handling and installation. We are happy to supply clients with carbon calculations and carbon costs for haulage on projects using our materials.

PAS2050 - "the assessment of the lifecycle greenhouse gas emissions of goods and services" was developed in response to an industry desire for a consistent method of quantifying CARBON FOOTPRINT cost. PDS LTD successfully completed a lifecycle study as defined by PAS2050 and are proud to be able to claim that our products really are GREEN!

Environmental Considerations

Concrete / Polymer concrete products All raw materials are newly quarried using large machinery.	Envirokerb The UK sourced raw material was originally manufactured for other products. There is therefore no extra carbon cost for our products.
Products include cement or resins which are all manufactured for the process.	Kerbs are manufactured using heat and moulding. This would be our biggest carbon factor.
Products are moved around production facility, and around site using forklifts - less on a pallet than Envirokerb.	Products are moved around production facility and around site using forklifts - but due to light weight we have more units per pallet.
HAULAGE - this is one of the major considerations - There is 26 tonnes of raw material, or finished product on an articulated lorry. The meterage of product is much less than our lightweight product. We would be happy to carry out haulage calculations for your client.	HAULAGE - we can now carry 1320 units per load (660mts), compared to 320 (160mts of Concrete kerb drains). This is the largest factor for consideration.
Most concrete products will be installed by machinery due to excessive weight - this is a high carbon cost	The full Envirokerb range is installed manually. Therefore the carbon cost is greatly reduced over concrete type products.
	Other considerations when using the Envirokerb may include the carbon cost of dumping the waste on landfill sites and its degradation over a 1000 year period. The other consideration would be the incineration of this plastic waste if it was not recycled into a new product.



Combined kerb drainage

Envirokerb is available in a range of depths and kerb profiles to suit all types of contracts including Motorways, Trunk Roads, Car Parks and other urban areas. (for Envirokerb for Bridges and shallow depths see page 18). With the advantage of full accreditation to EN1433 and Clause 516 (SHW) and the added advantage of a 'CE' mark, you can be confident in the 100% recycled combined Envirokerb drainage for your scheme.



“The Envirokerb offers the perfect solution. At 15kg it is lightweight enough for manual installation. Of all the projects we have carried out so far we have not had a single breakage or chipping to kerbs and the product has proven to be stronger in all aspects than the traditional concrete kerbs.”

— Birmingham City Council Highways Dept.

- Lightweight - the lightest product on the market by up to 70% allowing easy installation.
- Durable - high impact resistance greater than traditional materials.
- Manufactured from recycled materials.
- Available in both 300mm, 385mm and 460mm depths in 45° S20/A5 and H32 profile.
- For use on motorways, trunk roads, car parks and most other urban areas.
- Conforms to EN1433 linear drainage systems (4000N loading).
- Full Quality Assurance

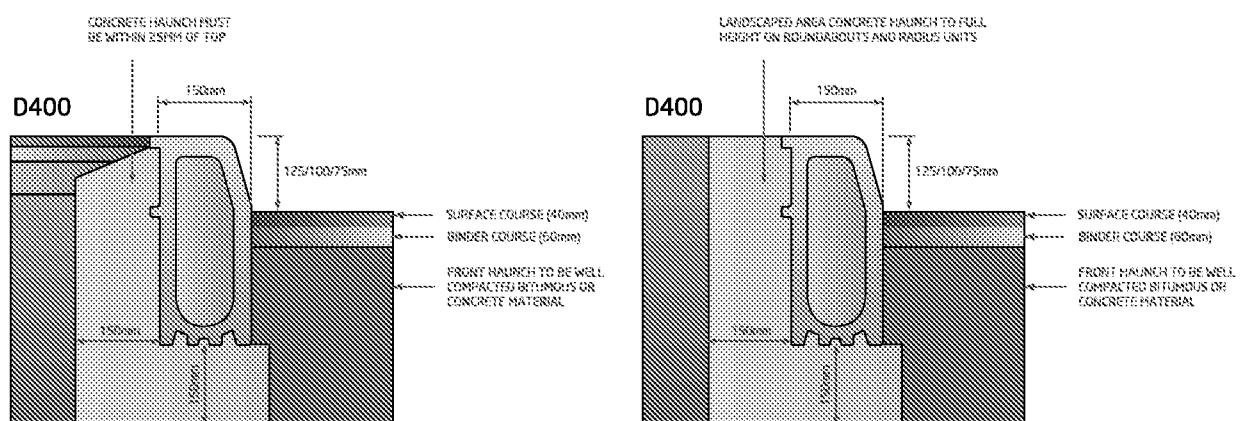
Installation Guide

Envirokerb is manufactured to comply with the D400kn loading requirement of EN1433, an integral part of this standard is the installation detail used and the concrete surround/haunch.

- 1) Risk assessment should be carried out.
- 2) Excavate through to line and level.
- 3) Lay out units prior to installation to ensure all rodding access units and outlets are positioned correctly.
- 4) Start at outfall and work away, finished line and level should be pre-determined.
- 5) Sealant is to be applied to unit not yet laid then butt together - keep joints clean of concrete bedding material.
- 6) Rear haunch - concrete should be a minimum st4 concrete with a 50mm slump to ensure the correct density.
- 7) PDS LTD suggest a very simple shutter system will reduce the amount of concrete used and will enable concrete density.
- 8) Asphalt can be laid to the bottom of outlets for a 125mm kerb-face, or to the watermark for 75mm/100mm kerb face.
- 9) Units should be cleaned prior to hand over.
- 10) Please use our inspection and test plan I.T.P. To ensure installation is correct as specified by the manufacturer. This can be included in your quality assurance manual.
- 11) Designers - to ensure your installation is correct please contact our technical department to request installation video/i.T.P.

It is imperative that the rear haunch is at the correct height, using a concrete with the correct strength and slump. Standard concrete kerb laying material should NOT be used. If you are in any doubt please call the technical Dept. of PDS LTD. PDS LTD have launched an interactive installation guide- this can be viewed on the web, or on a smartphone. Please contact sales or visit www.pds.com.

If asphalt pavement is present at rear of units the concrete can be adjusted accordingly, the concrete haunch can be lower. Any block paving adjacent to the kerbs should be restrained from movement on an epoxy or polymer modified mortar.



Please note: EN1433 is clear and concise. ALL combined kerb products must be tested for Watertightness - therefore units must be sealed to ensure conformity.

Combined kerb drainage

Standard Unit

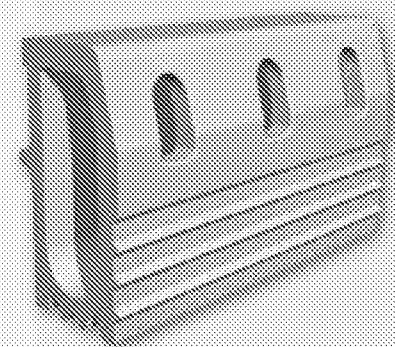
305mm standard unit. Available half battered or splayed profile.

Design Features

A 500mm long one-piece unit designed for ease of installation. At least 34% lighter in weight than conventional combined kerb drainage systems, and yet fully meets the EN1433 load requirements, and has exceptional impact resistance. Applications include trunk roads, car parks, access roads, traffic calming areas and industrial areas.

The product is also 100% recycled.

Product Code	Total Depth	Invert	Width Bore (mm x 4)	Length	Weight
305SU	305mm	275mm	100mm	500mm	15kg



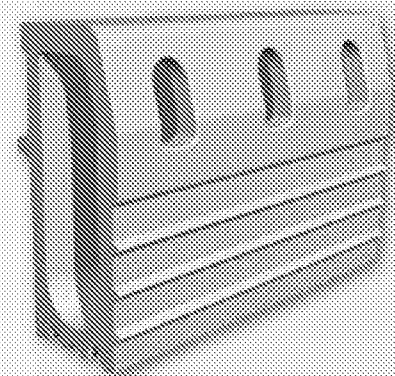
Standard Unit

385mm standard unit. Available half battered or splayed profile.

Design Features

A 500mm long one-piece unit designed for ease of installation. Fills the large Hydraulic gap between the 305 and the 480. This provides much greater flexibility to any designer. The product is also 100% recycled.

Product Code	Total Depth	Invert	Width Bore (mm x 4)	Length	Weight
385SU	385mm	355mm	100mm	500mm	16kg



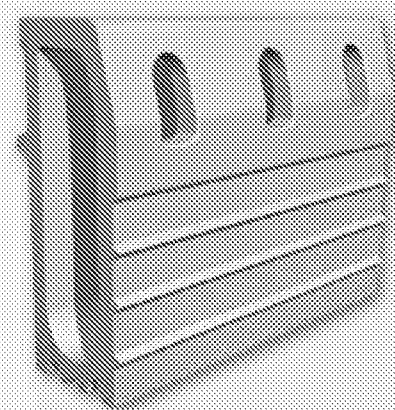
Standard Unit

480mm standard unit. Available half battered or splayed profile.

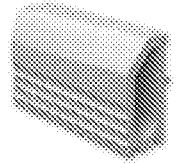
Design Features

A 500mm long one-piece unit designed for ease of installation. At least 25% lighter in weight than conventional combined kerb drainage systems, and yet fully meets the EN1433 load requirements, and has exceptional impact resistance. Designed for areas requiring greater hydraulic capacity.

Product Code	Total Depth	Invert	Width Bore (mm x 4)	Length	Weight
480SU	480mm	450mm	100mm	500mm	24kg



Splay to HB
transitions available.



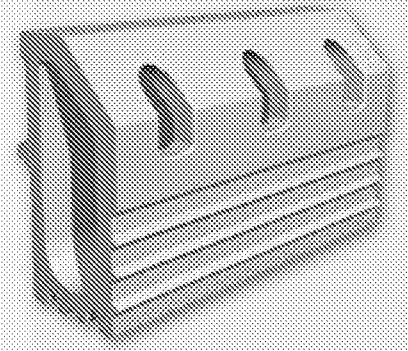
Splayed Unit

305mm splayed unit available offering 75mm, 100mm or 125mm kerb height.

Design Features

A 500mm long one-piece unit, designed for ease of installation. The splay profile has been introduced for requirements on fast moving roads with no pedestrian access. This includes motorways, trunk roads, and many rural roads. We are pleased to be able to offer all three depths (305, 385 and 480) with the splayed profile from stock.

Product Code	Total Depth	Invert	Width Bore (mm x 4)	Length	Weight
305SP	305mm	275mm	100mm	500mm	16kg



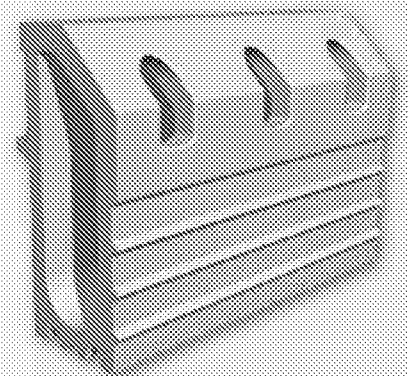
Splayed Unit

385mm splayed unit available offering 75mm, 100mm or 125mm kerb height.

Design Features

The 385mm deep unit fills the 'Hydraulic gap' found on other systems but still offers a lightweight installation.

Product Code	Total Depth	Invert	Width Bore (mm x 4)	Length	Weight
385SP	385mm	355mm	100mm	500mm	18kg



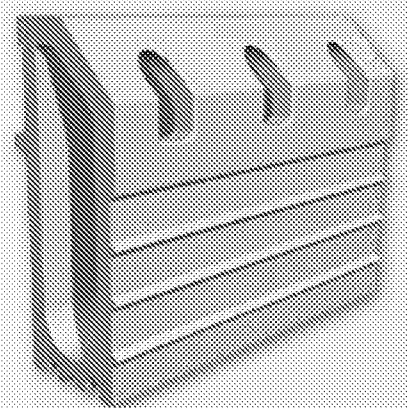
Splayed Unit

480mm splayed unit available offering 75mm, 100mm or 125mm kerb height.

Design Features

The 480mm splay is designed for areas requiring greater Hydraulic flows - we suggest using all three depths on a scheme - increase depth as required.

Product Code	Total Depth	Invert	Width Bore (mm x 4)	Length	Weight
480SU	480mm	450mm	100mm	500mm	24kg



Combined kerb drainage

Solid Head Ductile Iron Rodding Access Unit

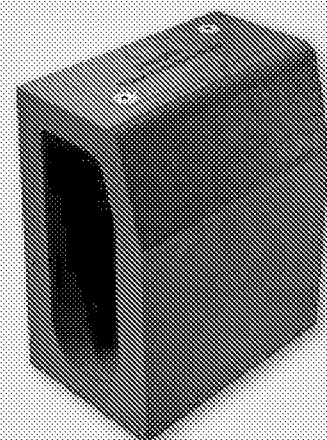
305mm, 385mm and 480mm splayed and HB rodding access unit.

Design Features

Rodding units are installed to allow access for cleaning purposes.

Units should be installed at the run-head or high point and at 40mtr intervals.

Product Code	Total Depth	Invert	Width Bore (mm min)	Length	Weight
305RA	305mm	275mm	100mm	250mm	16.8kg
385RA	385mm	355mm	100mm	250mm	19.5kg
480RA	480mm	450mm	100mm	250mm	22kg



Rodding Access and Outlet Unit Splayed and HB

305mm, 385mm and 480mm outlet unit complete with rodding access.

One outlet of both 110mm dia and 160mm dia are supplied as standard.

Design Features

Pipeline and Drainage Systems LTD have introduced a combined outlet unit with rodding access.

The site installation process is significantly faster using the pre-formed outlets and closing caps (110mm and 160mm rear outlets offered). Other outlet configurations are available upon request. Outlets suit standard BS4660 pipe, but a number of outlet connections are offered to suit site pipework.

Product Code	Total Depth	Invert	Width Bore (mm min)	Length	Weight
305RA/O	305mm	275mm	100mm	500mm	15kg
385RA/O	385mm	355mm	100mm	500mm	17.5kg
480RA/O	480mm	450mm	100mm	500mm	24kg



Due to the nature of installed this unit needs to be supported from side with sufficient depth, greater within the foot path or between the unit. This is shown in the drawing for reference and information.

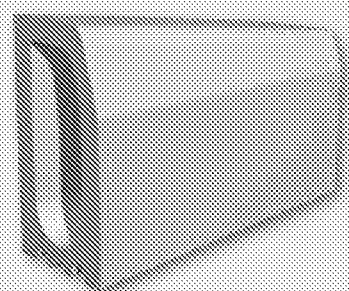
Drop Kerb Outer Unit

305mm and 480mm deep Drop kerb outer unit.

Design Features

A 457.5mm long outer drop unit is installed alongside a 457.5mm inner drop kerb. These will form a 915mm total length to suit existing openings in footpaths within maintenance contracts. The units have been developed at half the length of existing systems to reduce the weight, and ease general handling to speed the installation process.

Product Code	Total Depth	Width Bore (mm min)	Length	Weight
305DO	305-255mm	100mm	457.5mm	15kg
385DO	385-335mm	100mm	457.5mm	16.5kg
480DO	480-430mm	100mm	457.5mm	22kg





Various Outlets,
End Plates and Cable
Loop Units available.

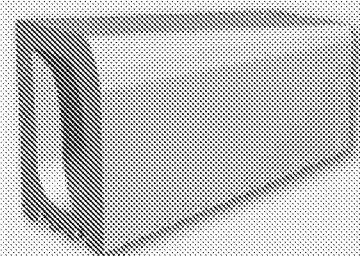
Drop Kerb Inner Unit

305mm and 480mm deep drop kerb inner unit.

Design Features

A 457.5mm long inner drop unit is installed alongside a 457.5mm outer drop kerb. These will form a 915mm total length to suit existing openings in footpaths within maintenance contracts. The units have been developed at half the length of existing systems to reduce the weight, and ease general handling to speed the installation process.

Product Code	Total Depth	Width Bore (mm x 45)	Length	Weight
305DI	255-205mm	100mm	457.5mm	15kg
385DI	335-285mm	100mm	457.5mm	16.5kg
480DI	420-380mm	100mm	457.5mm	22kg



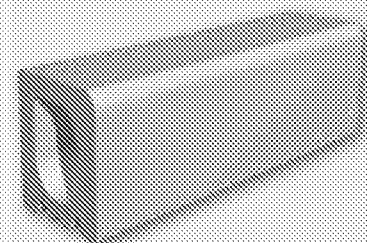
Centre Stone

305mm, 385mm and 480mm centre stones.

Design Features

Centre stones - 305, 385, 480 centre stones with either 25mm upstand or flush/0mm as required dependant on the installation detail. (If the flush/0mm upstand is to be used, a third drop is required.)

Product Code	Total Depth	Width Bore (mm x 45)	Length	Weight
305CS	205-180mm	100mm	457.5mm	11.5kg
385CS	285-260mm	100mm	457.5mm	15kg
480CS	380-355mm	100mm	457.5mm	18.5kg



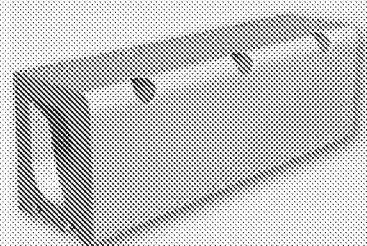
Centre Stones with various inlets

305mm, 385mm and 480mm centre stones.

Design Features

Due to the adaptable nature of the raw material used in the manufacture of Envirokerb we are able to create numerous types of drainage facilities within our centre stones. These have included in the past Holes in the upstand, holes in the centre top, or more popular recently is a number of slots which also offer the "Heel-safe" facility.

Product Code	Total Depth	Width Bore (mm x 45)	Length	Weight
305CS	205-180mm	100mm	457.5mm	11.5kg
385CS	285-260mm	100mm	457.5mm	15kg
480CS	380-355mm	100mm	457.5mm	18.5kg



Combined kerb drainage

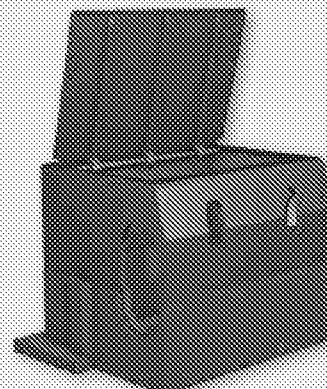
Gully Top Cover and Base

305mm, 385mm and 480mm Gully cover and frame with top section.

Design Features

The Gully top section is manufactured in Ductile Iron to comply with the EN1433 loading of D400KN for kerb side covers and frames. The cover is hinged and locking to ease maintenance, and gully cleaning. The base section has been redesigned to offer greater compressive loads and side wall strength, yet it is still a 100% recycled product. The gully accepts drainage units on both sides.

Product Code	Total Depth	Invert	Width Bore (mm) (min)	Length	Weight
305GMT	505mm	275mm	390mm	500mm	47kg
385GMT	505mm	355mm	390mm	500mm	47kg
480GMT	505mm	450mm	390mm	500mm	47kg



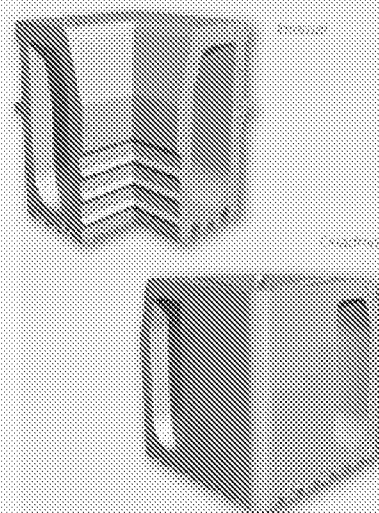
305 90° Quadrant Internal and External angles for all sizes

305mm Internal angle. 305mm Quadrant - for external angles rounded for safety reasons.

Design Features

PDS are able to offer internal and external angles to suit site requirements. We have supplied 90° and 45° on numerous schemes. Enables continuation of hydraulic flow around 90° external angles - we suggest that a rodding access unit (305RA) is installed alongside this product. The top surface has been designed to be slip resistant, and the base has an in-built 'key' for the concrete bed.

Product Code	Total Depth	Invert	Width Bore (mm) (min)	Length	Weight
305QUAD	305mm	275mm	100mm	500mm	15.5kg (approx.)
305ANG	305mm	275mm	100mm	305mm	19kg (approx.)



Internal & External Radius Units

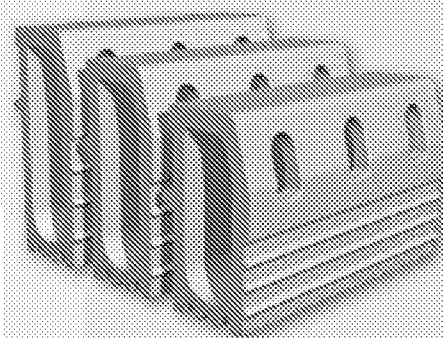
305, 385 and 480 internal and external radius.

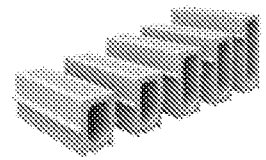
Design Features

PDS are the only manufacturer that supply radius units to suit your site requirements. A wide range of radius from 4Mtr to 14Mtr. Straight units can be used to form a radius in excess of 14mtrs by manipulating the joints as the units are only 500mm long. PDS LTD offer a number of outlets and end caps - please call for full details.

Product Code	Total Depth	Invert	Width Bore (mm) (min)	Length	Weight
305IR/305ER	305mm	275mm	100mm	*500mm	15.5kg
385IR/385ER	385mm	355mm	100mm	*500mm	15kg
480IR/480ER	480mm	450mm	100mm	*500mm	24kg

*effective length along centre line.





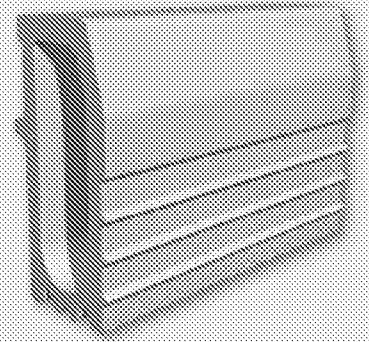
Solid Head Unit

305mm, 365mm and 480mm solid head units.

Design Features

We are often asked for SOLID HEAD units for raised platforms, Traffic calming humps, Super elevated roads, and even for use as Cable Troughs. We are happy to supply SOLID HEAD units in 305mm, 365mm and 480mm depth.

Product Code	Total Depth	Invert	Width Bore (mm x mm)	Length	Weight
305SOLID	305mm	275mm	100mm	500mm	15kg
365SOLID	365mm	355mm	100mm	500mm	18kg
480SOLID	480mm	450mm	100mm	500mm	24kg



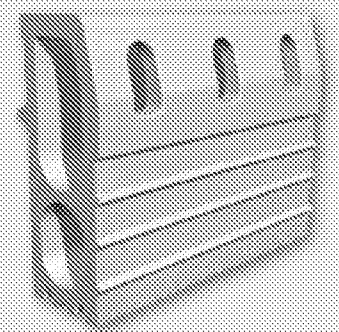
IT Kerb

Drainage kerbs with cable through.

Design Features

A recent addition to the range, the IT-KERB is available in different configurations to allow either Drainage and cables, two cable "ducts" or even a single duct - please call office for details.

Product Code	Total Depth	Invert	Width Bore (mm x mm)	Length	Weight
ITKERB	480mm	Various	100mm	500mm	24kg



Envirochannel

A D400kN one-piece channel drainage - also for crossing.

Design Features

ENVIROCHANNEL was introduced as a cross-over channel for road crossing and access points - It is fully compatible with ENVIROKERB and the drop units and we are happy to supply bespoke designs in all depths - Alternatively ENVIROCHANNEL is a stand alone product - please see further literature or call office.

Product Code	Total Depth	Invert	Width Bore (mm x mm)	Length	Weight
CHANNEL	180-385mm	Various	100mm	500mm	Various



Design and Hydraulics

The designs carried by PDS LTD include the option of schematic schedules and CAD drawings incorporating the preferred product. This can be from a simple layout diagram up to a very complicated computer generated layout.

Online Drawing tool

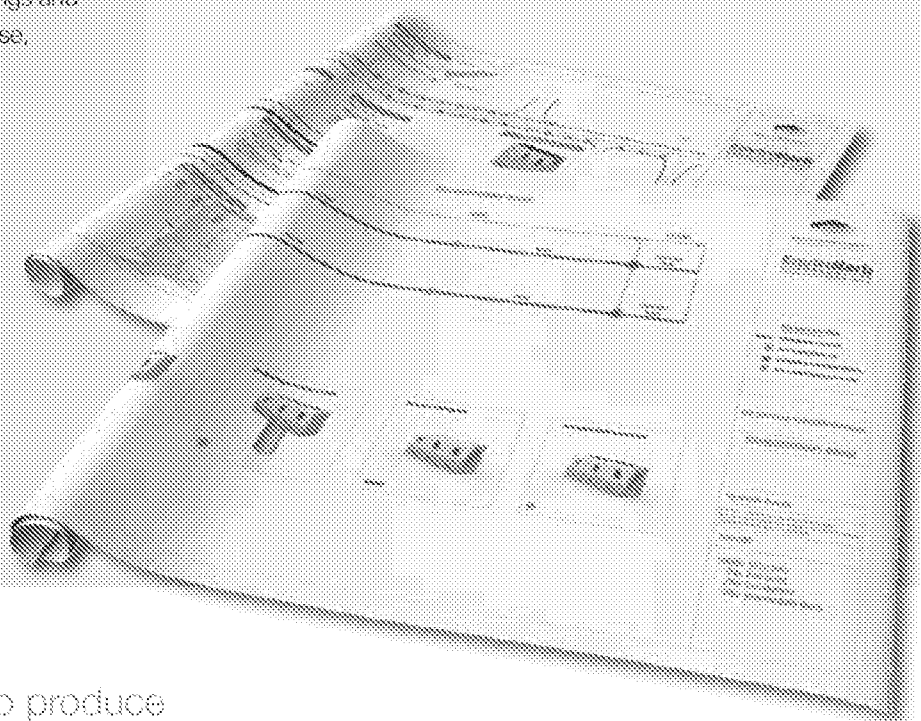
PDS have invested in a state of the art online drawing tool. This can be found at www.pds-plc.com and allows users to access designs for a particular project or a number of projects allocated to one company or individual. All drawings and relevant paperwork can be stored on this database, allowing instant access anytime day or night.

This is a free of charge service!

CPD Seminars

PDS are pleased to offer presentations to all Engineering/Civil Contractors and also to end clients/Authorities. This philosophy of working closely with the design engineers ensures that all our new developments and benefits are understood. It also enables PDS to obtain valuable feed-back on your requirements, and assists us in our policy of Continuous Product Development (CPD).

“We design bespoke solutions to contract-specific problems.”



PDS LTD also has the facility to produce Interactive dvd Presentations.

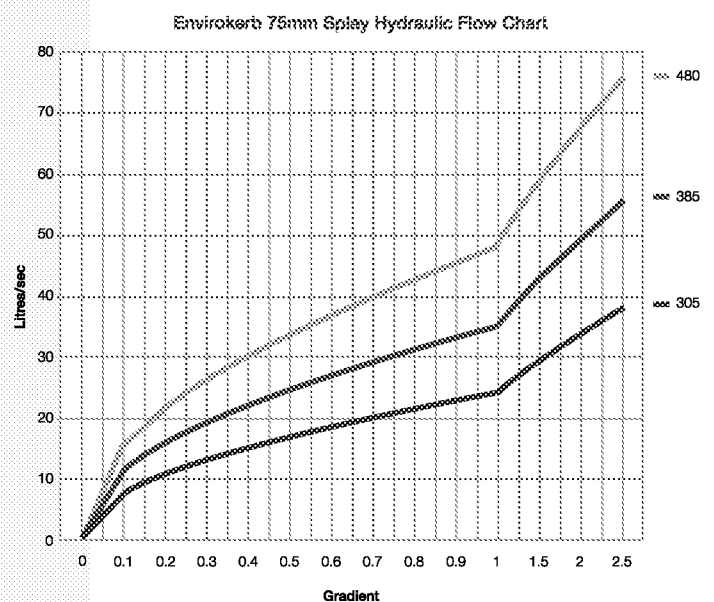
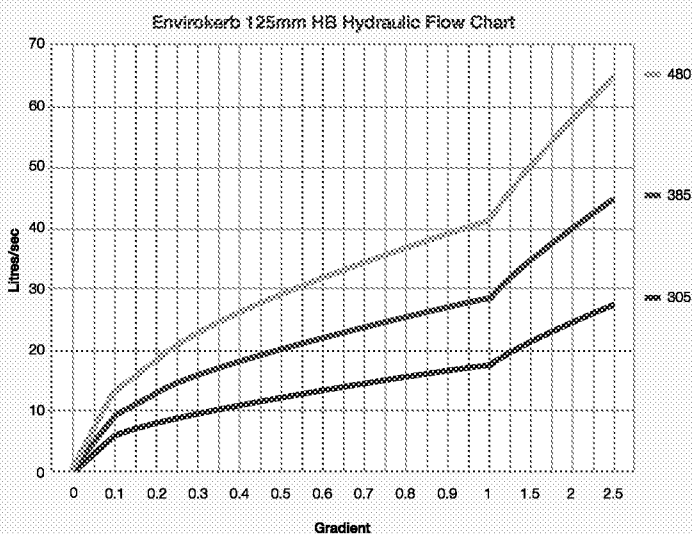
Other products

PDS LTD are now a major manufacturer and supplier of a number of products for the Civil Engineering Industry. These include ENVIROCHANNEL Surface water drainage channels, ENVIRODECK Combined kerb drainage for Bridges and areas of shallow depth, ITKERB a Combined kerb drainage and cable duct system. Please see our website www.pds-plc.com for further information.



Improved hydraulic performance

Due to the composite material used in the manufacture of Envirokerb giving excellent co-efficiency values, the hydraulic performance is improved over traditional materials. We have also incorporated three surface water inlet points offering a higher waterway area, designed to restrict the ingress of large debris.



PDS LTD has always offered a full design service for both bridges and roads.

PDS LTD are pleased (and in fact prefer) to carry out all Hydraulic designs on behalf of both the Designer and the Contractor. This service is free of charge on the Envirokerb road and bridge drainage range Systems. We feel that this ensures the contract incorporates the most cost-effective and hydraulically efficient depth/width drainage unit.

It is a mistake to incorporate units that are 'over sized' in your design as they may be ineffective at obtaining a self-cleansing velocity. Establishing the correct size of unit enables products that offer cost savings over large, heavy drainage units to be installed. In our experience, a large number of contracts are designed using ineffective sizes that struggle to drain the required areas, due to the velocity of run-off being too low.

A quick reference chart is shown for both Splay and Half Battered units.

Intermediate size

PDS have a unique 385mm deep unit within the Envirokerb range. It was noted that there was a large 'Hydraulic gap' between the 305mm and 480mm sizes. The 385mm offers a wider range and yet still weighs in at only 18kg - alternative products have no other option than to offer larger/heavier sizes.

Technical help

PDS LTD have great experience in designing Kerb Drainage Systems, especially ascertaining the most effective sizes required to efficiently drain your scheme. We therefore request your details/drawings are forwarded to our design department for a full Hydraulic review - *This is a free of charge service!*

Method for Calculations

PDS LTD carry out all calculations utilising the Mannings Equation - This has been proven to be the most effective for shallow gradients.

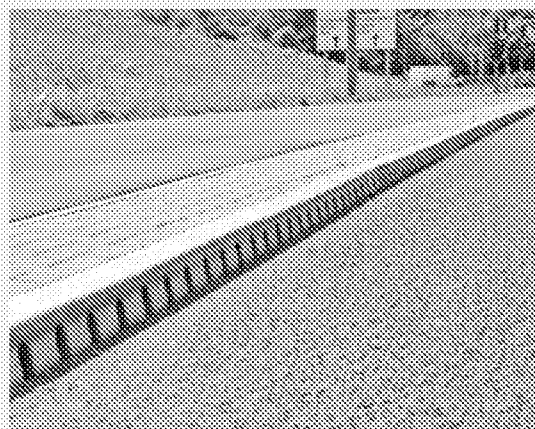
Case Studies

PDS have successfully supplied some of the largest highway contracts in the UK and Ireland in the last 5 years. This includes Highway Agency, National Road Authority and Department of Environment contracts. A comprehensive list is available to download on our website.

We initially contacted the contractor HMCJV on the largest road project in Northern Ireland to discuss Bridge Drainage. At a meeting with Martin O'Neill (Project Manager) we also took the opportunity to offer our Envirokerb Recycled Kerb Drainage for Roads.

Due to the nature of the contract and the very close spacing of the Gully Gratings we found that in certain areas the Lightweight Kerb Drainage offered a cost benefit over the traditional kerb and gully method of construction.

PDS were invited to meet with the designers, Arup to investigate the potential across the whole scheme. Eventually over 6500 mts of Envirokerb and Hydrodeck Bridge Drainage were supplied to HMCJV.



M1 West Link, Belfast

Client	Roads Service
Contractor	HMCJV
Consultant	ARUP

“...the installation rates on this job compared to other products is far superior; it's a one part system instead of the usual two part system. It's also a lot less weight being plastic, the rate you could lay at is twice as much if not more than traditional concrete systems...”

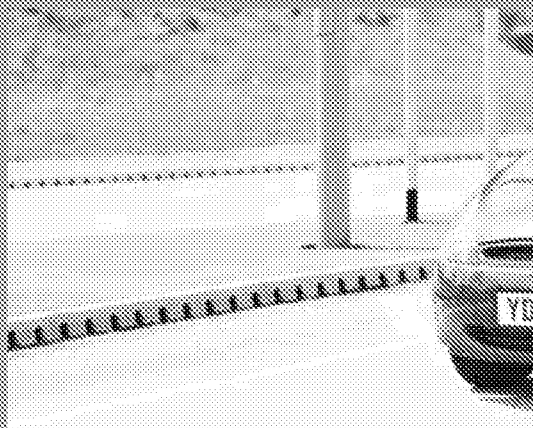
Birse Civils - Video Case Study

This will be the second largest project carried out by this Birse CL site team following on from the Sunderland Radial route.

The site agent, Andy Moore has reported that due to the speed of lay, but mainly due to the lack of breakage the Envirokerb was his chosen product on the Darlington Eastern Transport corridor.

The 100% guarantee against breakage has saved time up to 15% in new purchases but also the saving over 're-laying' when units are broken by site traffic.

BIRSE CL HAVE INSTALLED IN EXCESS OF ENVIROKERB FOR CARLISLE NORTH/EAST DEVELOPMENT ROUTE.



Eastern Transport Corridor Darlington

Client	Darlington MBC
Contractor	Birse Civils
Consultant	Darlington MBC

Increasingly PDS LTD are supplying contracts with various products from our range. The Leeds Inner Ring Road is another project that shows why this benefits both the contractor, client and of course the supplier.

This project has removed traditional concrete kerb drains and replaced them with our Envirokerb lightweight Road Drainage and was also one of the first schemes to utilise the Envirodeck Bridge Drainage System.

The contractor, Alfred McAlpine saw the benefit of using lightweight, non-metallic and strong drainage systems rather than using heavy, brittle and large concrete drainage products. Envirokerb gave them the added benefit of increasing the amount of 100% recycled products used on the scheme.

The savings by 'value engineering' the design has proven to be very worthwhile for Alfred McAlpine who have now purchased these products on numerous other schemes.



Leeds Inner Ring Road

Client	Leeds City Council
Contractor	McAlpine (Carillion 2008)
Consultant	Mouchel

“ Alfred McAlpine take the Health & Safety and their environmental responsibilities very seriously. ”

PDS LTD have built up a number of close relationships with large contractors who use our Design department to 'Value Engineer' schemes to obtain the most cost effective and beneficial solution to their surface water problems.

One of these contractors is CARILLION (Formerly known as Alfred McAlpine) who have recently incorporated our products on some Award Winning schemes. The Envirokerb Recycled Kerb Drainage has been re-designed into Leeds Inner Ring Road, M60 Manchester Widening, A30 Bodmin Scheme, the A1 Scotch Corner contract, the A12 Witham Bypass and the on-going M4 Widening at Cardiff. The Leeds Inner Ring Road also incorporates the Envirodeck Bridge Drainage system.

Both parties have benefitted greatly from these arrangements by improving on design, saving on installation time, improving Environmental impact and of course a cost saving has to be made to make it a worthwhile partnership.



We enjoy a "partnership" arrangement with these contractors and they allow us to offer our Unique products to their clients.



Bridge and shallow depth drainage

Due to the huge success of the Envirokerb Road Drainage product, PDS have developed the NEW Envirokerb BRIDGE Shallow System for Structures and restricted depth construction.

The product has all the advantages of the existing Envirokerb range, including superb impact resistance, Lightweight for

manual handling, aesthetics very similar to concrete and of course the benefit of a product manufactured in 100% Recycled material.



The product is available as 150mm, 220mm and 310mm wide with various depths depending on the Kerb Profile required (75mm, 100mm or 125mm splay or HB).

PDS LTD are the World leaders in Bridge Drainage, supplying over 90% of Structures in the UK and Ireland. Our reputation for quality of product and service has led to orders in Spain, Switzerland, Italy, Abu Dhabi, Singapore, Germany and recently the Czech Republic.

It was always our ambition to increase our range of lightweight, Environmentally friendly products and as our international business grows this becomes much more important.

- Three additions to Envirokerb Range
- Manufactured as a high strength one-piece monolithic unit.
- Ideal for areas where construction depths are limited i.e. concrete slabs, Bridges, roads built as a slab or structure, underpasses and above culverts
- 3 widths dependant on Hydraulic run-off.
- Allows continuity of Envirokerb drainage from carriageways to structures.
- Sub-surface drainage facility to help drain asphalt matrix.
- Fully compliant to EN1433 D400KN for Kerb Drainage Systems.
- Lightweight for installation advantages (19kg for heaviest product).
- Non-Metallic and therefore non-oxidising.

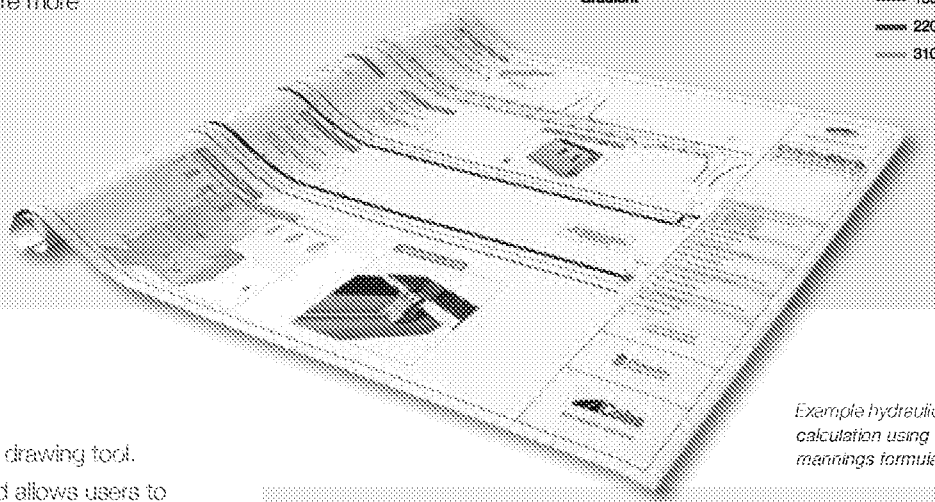
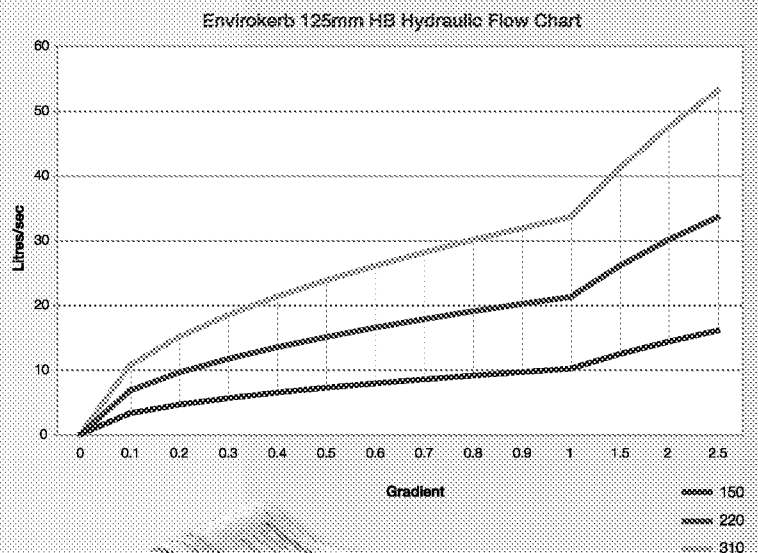
Bridge Design and Hydraulics

The NEW Envirokerb Bridge Drainage unit has been manufactured to supersede Heavy Ductile Units. There are a number of factors we need to establish to very quickly ascertain the width and depth required.

Depth is dependent on the kerb profile and upstand - this will either be 75mm, 100mm or 125mm with the road construction depth determining the final full depth (see installation page 24).

Width is based solely on the Hydraulic flows anticipated in conjunction with the longitudinal gradient on the deck. This is very easy for PDS to determine from a plan layout drawing showing road levels and a cross-section, then using our in house flow calculator we can size the units (chart alongside for quick reference) allowing us to offer the most Hydraulically (and cost) effective width.

Please call our Technical department as we are more than happy to carry out calculations as part of our free of charge design service.



Example hydraulic calculation using mannings formula

Online Drawing Tool

PDS have invested in a state of the art online drawing tool.

This can be found at www.pds-plc.com and allows users to access designs for a particular project or a number of projects allocated to one company or individual. All drawings and relevant paperwork can be stored on this database, allowing instant access any time day or night. (A free of charge service.)

Design Service

Our free design service offers huge benefits!

The designs carried by PDS LTD include the option of schematic schedules and CAD drawings incorporating the preferred product. This can be from a simple layout diagram up to a very complicated computer generated layout. PDS LTD also has the facility to produce INTERACTIVE DVD PRESENTATIONS. We design bespoke solutions to contract-specific problems.

All calculations are based on the Mannings Equation which offers the most effective formula for low gradients.

Mannings Equation:

LENGTH OF RUN = 65MTS
DRAINED WIDTH = 7.3MTS
ALL FLOWS ONE DIRECTION @ 1% GRADIENT

AREA DRAINED = 487.5m²

HYDRAULIC FLOW @ 50mm/hr rainfall
= 6.77 ltr per second.

Conclusion:

ENVIROKERB BRIDGE 150 DRAINS APPROX
10 ltr per second at 1%

Envirokerb Bridge Drainage

150mm Standard Unit

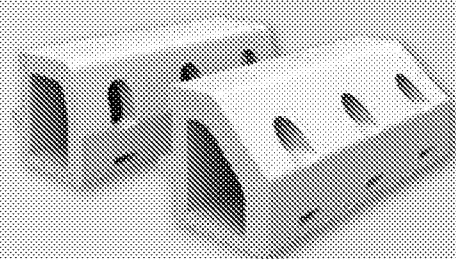
500mm long with surface and subsurface inlets with either splay or Half Battered kerb face.

Design Features

A shallow Combined Kerb Drainage for restricted construction depths or for Bridges.

Available with either HB or Splay profile and depths to suit. Due to the nature of the material and manufacturing process, we are able to produce numerous depths and kerb profiles not shown below. The 150mm wide unit is typically for low flow areas. Please call Sales for more information.

Product Code	Total Depth	Kerb Profile Height	Width Bore	Length	Weight
150mm x 165mm	165mm	75mm	100mm	500mm	9.2kg
150mm x 190mm	190mm	100mm	100mm	500mm	9.6kg
150mm x 210mm	210mm	125mm	100mm	500mm	10kg



220mm Standard Unit

500mm long with surface and subsurface inlets with either splay or Half Battered kerb face.

Design Features

Again available with either HB or Splay profile and depths to suit. Due to the nature of the material and manufacturing process, we are able to produce numerous depths and kerb profiles not shown below. We also have the advantage of the 235mm deep unit for standard roads, or for installation directly on the deck. Please call Sales for more information.

Product Code	Total Depth	Kerb Profile Height	Width Bore	Length	Weight
220mm x 165mm	165mm	75mm	150mm	500mm	12kg
220mm x 190mm	190mm	100mm	160mm	500mm	12.5kg
220mm x 210mm	210mm	125mm	160mm	500mm	13.5kg
220mm x 235mm	235mm	125mm	160mm	500mm	14.5kg



310mm Standard Unit

500mm long with surface and subsurface inlets with either splay or Half Battered kerb face.

Design Features

Again available with either HB or Splay profile and depths to suit. Due to the nature of the material and manufacturing process, we are able to produce numerous depths and kerb profiles not shown below. We also have the advantage of the 235mm deep unit for standard roads, or for installation directly on the deck. Please call Sales for more information.

Product Code	Total Depth	Kerb Profile Height	Width Bore	Length	Weight
310mm x 165mm	165mm	75mm	255mm	500mm	21kg
310mm x 190mm	190mm	100mm	255mm	500mm	22kg
310mm x 210mm	210mm	125mm	255mm	500mm	23kg
310mm x 235mm	235mm	125mm	255mm	500mm	24kg





Sealant and bedding mortar available on request.

End or Intermediate Rodding Access Unit

End Rodding & Intermediate Rodding Access units

Design Features

End Rodding units are either left or right handed to suit the kerb line. Intermediate units are placed approx every 20mts. The access point is sufficient for rodding or jetting.



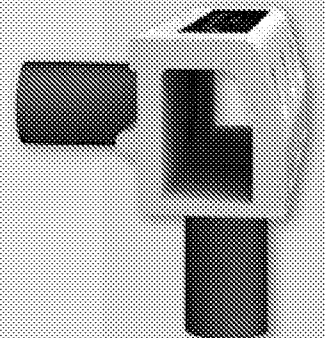
Product Code	Total Depth	Kerb Profile Height	Width Bore	Length	Weight
EUW/U	165/190/210mm	To suit std unit	100mm	500mm	10kg
EUW/U	165/190/210mm	To suit std unit	160mm	500mm	14kg
EUW/U	165/190/210mm	To suit std unit	255mm	500mm	23kg

End or Intermediate Outlet Unit Complete With Rodding Access

End OR Intermediate outlet units.

Design Features

Outlets can be placed on base, at end of run (if space allows) or on the rear. The outlet is usually 110mm or 160mm outside diameter but can be size to suit site. All outlets will always be roddable.



Product Code	Total Depth	Kerb Profile Height	Width Bore	Length	Weight	Outlet size
EUC/UO	165/190/210mm	To suit std unit	100mm	500mm	10kg	110mm/160mm
EUC/UO	165/190/210mm	To suit std unit	160mm	500mm	14kg	110mm/160mm
EUC/UO	165/190/210mm	To suit std unit	255mm	500mm	23kg	110mm/160mm

Expansion Joint Assembly- Sliding or Standard

Either a 2mt expansion joint assembly or a 1mt sliding expansion assembly for small movements

Design Features

Expansion Joint Assemblies are designed to bridge the Expansion joint on bridges.

We have a number of standard units, but are always happy to design and manufacture bespoke assemblies for large or difficult joints. The sliding unit is for buried joints or joints that can be elevated to footpath level behind the kerb-line.



Product Code	Total Depth	Kerb Profile Height	Width Bore	Length	Possible movement
EXP	165/190/210mm	To suit std unit	150/220/310mm	1mt	+/- 40mm
EXP	165/190/210mm	To suit std unit	150/220/310mm	2mt	+/- 120mm
EXP	165/190/210mm	To suit std unit	150/220/310mm	Special cover plate	Please call

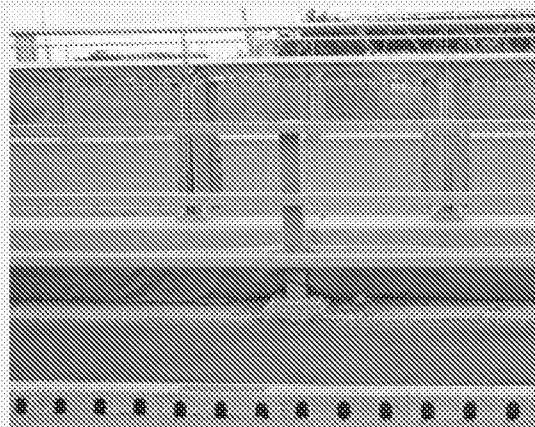
Case Studies

Initially launched to supply the large infrastructure programme in Ireland, the Envirokerb Bridge drainage very quickly became the first choice for bridge builders and engineers. With 3 widths we can now supply the majority of structures with this product range.

Build Phase - Envirokerb is lightweight for installation, impact resistant from on-going site traffic and has long term durability ensuring the product will still look like new 2 years later at the opening ceremony!

The Games Phase - Through the games the product will drain the structures as required. The durability will be evident throughout with no rusting, chipping or spalling.

Legacy Phase - The 2012 Olympics has to deal with the legacy left for future generations. Therefore roads and bridges are either left for the benefit of the local community, or they are demolished and the material disposed of. Envirokerb Bridge Drainage is manufactured from material that takes up to 1000 years to degrade so longevity is not a problem. And any returned products can be recycled into raw material for other products manufactured by PDS LTD.



Bridge 13, 14 and 20.
Stratford Olympic Bridges (300Mtrs)

Client Stratford city developments

Contractor Morgan Est

Consultant Benaim

A £30 million bypass, delivered by Morgan Est on Transport for Scotland's behalf, involved the design and construction of a 3.5 mile road.

The NEW Shallow Envirokerb range was chosen to be incorporated onto the bridges on the A68 Dalkeith Bypass so that it could link directly with the Envirokerb Road Drainage System already installed on carriageways leading up to the structures. To the motorist the Bridge and Road units are indistinguishable. All are non-rust, lightweight, through-coloured, great impact resistance and with the appearance of Concrete they complement the surrounding area.



A68 Dalkeith (4000Mtrs)

Client Transport Scotland

Contractor Morgan Est

Consultant Scott Wilson

The development of ENVIROKERB Bridge Drainage was a direct result of the Irish road building Programme.

Whilst a number of Motorways were built, the existing smaller side roads needed to maintain their course. These roads are usually narrow, and Bridges are short. The Hydraulic Flows were low promoting PDS to produce a smaller, lighter and more cost-effective unit. The M3 project has built 65 new bridges with the majority using ENVIROKERB BRIDGE drainage.

All designs were carried out by PDS LTD who became part of the Design team on the M3. Over 2000mts of bridge drainage has so far been supplied to this contract.

“ We used them on the A64 Hopgrove roundabout in York which is acknowledged internally, by client, consultant and by third parties to be a very successful and well presented project.....In summary I would happily use the product again. ”



M3 Clonoe to Kells, Ireland (2500Mtrs)

Client	NRA
Contractor	Roughan & O'Donovan
Consultant	Hyder Consulting

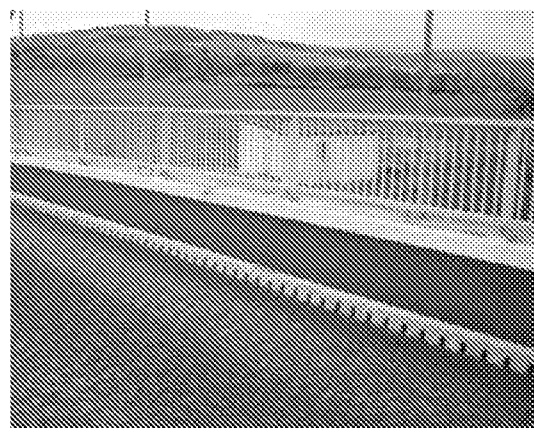
Mark Thornion BEOEL

The present Bonar Bridge was designed by Crouch and Hogg, built by William Tawse Ltd, and opened in 1973.

This bowstring girder bridge (built 1973) measures 339ft (103.4m) in overall length, replaces an 1893 bridge built by Sir William Arrol & Co Ltd, Glasgow.

As part of a refurbishment scheme to this graceful structure in Invernesshire PDS LTD supplied over 500mts of Envirokerb Bridge Drainage installed to both kerblines and at only 10Kg each manual handling risks were drastically reduced for the installers.

Being recycled composite and with an appearance almost identical to concrete the grey kerb line is retained and there are no on-going coating maintenance issues. Photographs taken by our Sales Director Greg Parkin during his recent Lands End to John 'O' Groats cycle ride.



Bonar Bridge (250Mtrs)

Client	Highland Council
Contractor	Balfour Beatty
Consultant	Highland Council

Installation Guide

ENVIROKERB BRIDGE drainage will normally be installed on a concrete deck or slab - This acts as your base. If you are to install on soft ground or compacted stone please see installation details for standard ENVIROKERB. The units will be bedded on ENVIROKERB BRIDGE bedding mortar or similar.

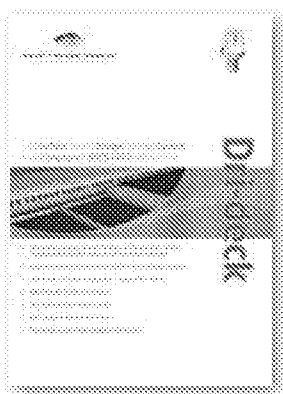
- 1) Layout units prior to installation to ensure all rodding units, outlets and expansion joint assemblies are positioned correctly.
- 2) We suggest that expansion joint assemblies are installed first as these cannot be cut to length.
- 3) Mix Envirokerb Bridge Bedding mortar as described on the bag, or on the product details available from the sales office.
- 4) DO NOT mix too much mortar as it is quick setting. Please experiment with the material first. Do not alter the mix ratio.
- 5) Install to line and level. It is advisable to find deck/structure high point and use this to determine the levels. Therefore reducing thickness of bedding mortar.
- 6) Sealant must be applied to unit yet to be laid and then butt together keeping joints clear of concrete bedding material.
- 7) Units can be cut with a power saw with either masonry or carbon blade. A mask, goggles and ear defenders should be worn. Cutting is much quicker than stone or metal units.
- 8) Units must be cleaned prior to handover.

The product has proven to be very strong, and to date we have experienced no breakages. Once in-situ the product has the appearance of concrete and blends exactly with existing kerb lines. We would have no hesitation in recommending the product. ☺☺

Walsley Parish Council

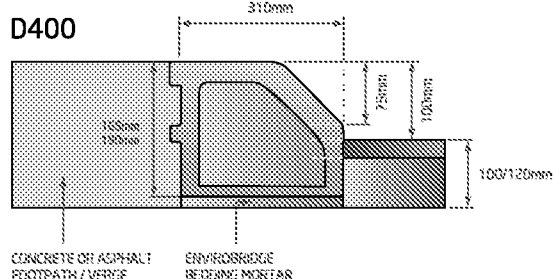
Dri-Deck

PDS LTD also manufacture a range of sub surface channels and through deck drainage. The Dri-Deck brochure is available online at www.pds-plc.com or by contacting our sales department. ENVIRODECK is another Bridge Drainage product where a design requires very large flows or a product with an engineered finish.

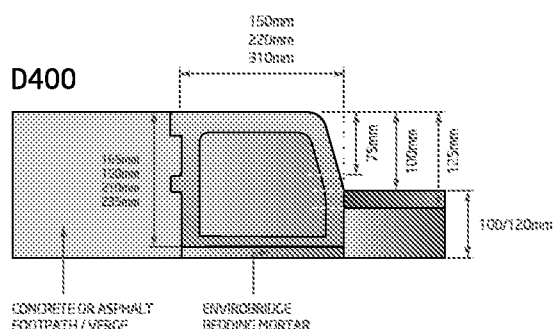


Please note that EN1433 is clear and concise. ALL combined kerb products must be tested for watertightness - therefore units must be sealed to ensure conformity.

Splay Unit



HB Unit



Specification clause (for all products)

Bridge Drainage - The Combined Kerb Drainage system shall be as ENVIROKERB 150/220/310mm wide monolithic unit. All system components shall be from the ENVIROKERB range.

Installation details should be followed by utilising the detail within this brochure, the diagrams and the interactive video available from the technical department. The Inspection and Test Plan ITP must be followed, signed and included in the Clients Quality Manual.

Units will be manufactured from Recycled material, and the units should be below the safe one man handling weights of 25kg.

All products should hold PAS 2050 certification to ensure good Carbon Footprint practices.

Kerb profile will be 75/100/125mm splay/HB. All units will be installed on Envirokerb™ Bridge bedding mortar and sealed with Envirokerb Sealant to conform with EN1433.

Product will be CE marked and quality assured as required under IAN117/08.



Road Drainage - The Combined Kerb Drainage system shall be as ENVIROKERB 305/385/480mm deep monolithic unit. All system components shall be from the ENVIROKERB range.

Installation details should be followed by utilising the detail within this brochure, the diagrams and the interactive video available from the technical department. The Inspection and Test Plan ITP must be followed, signed and included in the Clients Quality Manual.

Units will be manufactured from Recycled material, and the units should be below the safe one man handling weights of 25kg.

All products should hold PAS 2050 certification to ensure good Carbon Footprint practices.

Kerb profile will be 75/100/125mm splay/HB. All units will be sealed with Envirokerb Sealant to conform with EN1433.

Product will be CE marked and quality assured as required under IAN117/08.

PIPELINE & DRAINAGE SYSTEMS LTD

Envirokerb Sealant

One Part Low Modulus Polyurethane Sealant



Description

Envirokerb Sealant is a high performance one part low modulus polyurethane sealant specifically developed for the sealing of contraction and expansion joints in civil engineering and building structures.

Standards Compliance: Conforms to EN 15651-1, B.S. 4254 - 1983, EN 14188: part 2.

Advantages

- One part therefore easy to apply.
- Excellent acoustic ratings.
- Excellent resistance to weathering.
- Permanently flexible.
- Low odour.
- 25% total joint movement

Applications

- Joint sealant for kerb/channel drainage products in accordance with BS EN 1433.
- Movement joints in concrete, brickwork and block work.
- Perimeter pointing around window and door frames.
- Cladding seals within lightweight modular systems.
- Movement and stress relief joints in tiles.
- Acoustic jointing.

Technical Information

Type	Thixotropic Polyurethane	
Colours	Black or Grey	
Application Temperature	5 to 35°C	
Service Temperature Range	-30 to 80°C	
Cure Rate	3mm per 24 hour	
Tack Free Time	60-90 minutes	
Movement Accommodation	25%	
Shore A Hardness	20-25	
Resistance to hydrolysis	25-30	
Chemical Resistance	Weak Acids	Good
	Alkalis	Good
U.V. Resistance	Excellent	
Flash Point	>80°C	

Note: All testing performed at 23°C & 50% RH.

 0074/0071	
Nufins, Kingston House, 3 Walton Road, Pattinson North, District 15, Washington, Tyne & Wear, NE38 8QA 14 000811005	
EN 15651-1 Type F EXT-INT (25LM)	
Polymer base	Polyurethane
Resistance to flow	≤3mm
Loss of volume	≤10%
Adhesion / Cohesion properties after immersion in water	No failure
Durability	Conforms
Fire behaviour	Class E
Dangerous substances	Assessed

Preparation of Substrate

All joints should be dry, sound, free from dirt, dust and grease. Cleaning should be carried out by wire brushing or grinding. Joint sides must be parallel and straight.

Placing of Backer Rod

Following preparation of the joint, place a backer rod or bond breaker tape to regulate the depth of the sealant and prevent adhesion to the expansion joint filler.



Application Instructions

Cut the end of the sachet with a sharp knife and place the sachet into a 600 ml Barrel Gun. Extrude the sealant into the base of the joint and ensure that full contact is made with the sides. Care should be taken to avoid trapping air within the sealant.

Tooling

Select a tool to suit the width of the joint and wet it with clean water containing a little detergent. Working upwards in the case of vertical joints, lightly tool the sealant into the joint. On completion of the tooling remove masking tape, if used, immediately.

Coverage

Shown in metre per litre of sealant

Depth of Joint (mm)	Width of Joint (mm)					
	10	12	15	20	25	30
10	10	8.3	6.7	5	4	3.3
12		6.9	5.5	4.1	3.3	2.7
15			4.5	3.3	2.7	2.2
20				2.5	2	1.7
25					1.6	1.3

Packaging

Envirokerb Sealant is available in 12 No x 600ml sachets per box.

Cleaning of Tools

Tools should be cleaned with solvent as soon as possible after use.

Storage

The shelf life is 12 months when stored away from direct sun light in cool dry conditions, in original un-opened cartons. Protect from frost.

Health & Safety

Product Safety Data Sheets (SDS) are available from PDS. SDS sheets are provided to help customers satisfy their safe handling, use and disposal needs as well as assist with any conformance requirements made locally by health and safety regulations.

SDS are continually updated to provide the latest information to our customers. We therefore recommend contacting our head office to obtain the most recent and accurate SDS before handling and using any product.

Technical Support

Through our technical department and laboratories we can offer a comprehensive service to specifiers and contractors. Technical contacts are available to provide further information and arrange demonstrations.



Pre-Blended, polymer modified, cementious bedding mortar. The product contains a specially selected latex bonding and waterproofing gauging liquid.

Advantages

- Pack contains everything required including gauging liquid.
- Guaranteed low water/cement ratio.
- Can be laid in sections from 5mm to 25mm in one layer.
- Rapid setting enabling successive layers to be built up with minimum delay.
- Excellent adhesion to dense concrete and steel etc.
- Contains no chloride containing additives.
- Aggregate is non-Alkali Silica reactive in accordance with ASTM C289.
- Excellent workability and finishing properties.
- Good resistance to water, frost and salt permeation.

Applications

- Bedding of Bridge Drainage units.

 0086	
Pipeline & Drainage Systems, 361-365 Coleford Road, Darnall, Sheffield, S9 5NF 0844 848 9400	
EN 1504-3 Concrete repair product for structural repair PCC Mortar (based on polymer modified hydraulic cement)	
Compressive strength	Class R3 (>25 MPa)
Chloride ion content	≤0.05 %
Adhesive bond strength	>1.5 MPa
Adhesion after freeze/ thaw (50 cycles with salt)	>1.5 MPa
Elastic modulus	>15GPa
Dangerous substances	Complies with 5.4

Surface Preparation

Substrate must be clean and sound, hence all grease, oil, paint, plaster and laitance must be removed. Oil and grease should be removed by using *Desolve* and laitance should be removed by scarifying. The edges of the repair must be recessed at least 10mm. Where spalling is caused by reinforcement corrosion all steel must be exposed and cleaned to remove all loose scale and rust, preferably by grit blasting. If the reinforcement bar has corroded reducing the bar diameter, then consideration should be given to replacing it.



Technical properties of Hydrodeck/ Envirobridge/ Envirodeck Bedding Mortar.

Properties	Standard	Performance Requirements	Declared Value
Appearance			Grey Powder & White Liquid
Chloride-ion Content	EN1015-17	$\leq 0.05\%$	$\leq 0.05\%$
Maximum Aggregate Size			6mm
Maximum water/cement ratio			0.4
Cement content			$> 400 \text{ kg/m}^3$
Minimum Layer Thickness			25mm
Working time			20-30 Minutes
Temperature for application			5°C to 30°C
Density			2350 kg/m^3
Compressive strength	EN12190	$> 25 \text{ MPa}$	15 MPa @ 4 Hrs 35 MPa @ 24 Hrs 45 MPa @ 7 Days 55 MPa @ 28 Days
Modulus of elasticity in compression	EN13412	$\geq 15 \text{ GPa}$	18 GPa
Tensile strength	BS6319-7		$> 4.0 \text{ MPa}$
Adhesion to concrete	EN1542	$\geq 1.5 \text{ MPa}$	$> 2.0 \text{ MPa}$
Adhesion after:			
freeze/thaw	EN13687-1	$\geq 1.5 \text{ MPa}$	$> 2.0 \text{ MPa}$
thunder/shower	EN13687 -2	$\geq 1.5 \text{ MPa}$	$> 2.0 \text{ MPa}$
Dry cycling	EN13687 -4	$\geq 1.5 \text{ MPa}$	$> 2.0 \text{ MPa}$
CO ₂ Diffusion coefficient			$2.1 \times 10^{-5} \text{ cm}^2/\text{sec}$
u value			7100
R value			140 m
Sc @ 20mm			350 Mm
Sorptivity			$0.01 \text{ mm min}^{-1/2}$
Cl-Diffusion coefficient			$1 \times 10^{-10} \text{ cm}^2/\text{sec}$
Coefficient of thermal expansion	EN1770		7.8×10^{-6}
Water permeability coefficient	28 days		$< 0.01 \text{ ml/m}^2/\text{sec}$
Skid resistance	EN13036-4		Class 1
Carbonation resistance	EN13295	$d_k \leq \text{ref. Concrete}$	Passes
Capillary absorption	EN13057	$\leq 0.5 \text{ kg/m}^2/\text{Hr}^{0.5}$	$\leq 0.5 \text{ kg/m}^2/\text{Hr}^{0.5}$
Cracking tendency	Coutinho ring		No crack after 180 days

Technical data shown are statistical results and do not correspond to guaranteed minima.

Tolerances are those described in appropriate performance standards.

$1 \text{ N/mm}^2 = 1 \text{ MPa}$

$1 \text{ kN/mm}^2 = 1 \text{ GPa}$



Mixing

Mix as per normal concrete, starting with two thirds of the gauging liquid to which the powder is added. The remainder of the gauging liquid can then be added to obtain the required consistency, ensuring the material is thoroughly mixed before use. A forced action pan mixer will ensure thorough mixing.

Curing

Normal methods of curing should be adhered to and precautions taken to avoid frost attack. UV degradable resin based curing agents should not be used if the surface is to receive subsequent treatments.

Health & Safety

Product Safety Data Sheets (SDS) are available from PDS. SDS sheets are provided to help customers satisfy their safe handling, use and disposal needs as well as assist with any conformance requirements made locally by health and safety regulations. SDS are continually updated to provide the latest information to our customers. We therefore recommend contacting our head office to obtain the most recent and accurate SDS before handling and using any product.

Storage

Hydrodeck/ Envirobridge/ Envirodeck Bedding Mortar has shelf life of 12 months, when stored unopened at moderate temperatures. Protect from frost.

Packaging

Mortar is available in 25kg packs (yield 11litres).

Limitations

Minimum application temperature is 5°C, if applying below 5°C please contact PDS technical department.

Technical Support

Through our technical department and laboratories we can offer a comprehensive service to specifiers and contractors. Technical contacts are available to provide further information and arrange demonstrations.



Online Controls

Tank Number	D/S Pipe Number	U/S/MH Name	Control Type	Volume (m ³)
1	1.006	CP.18	Hydro-Brake®	8.4

OK

Cancel

Help

Clear

Clear All

Hydro-Brake® Details

Hydro-Brake® Range

Optimum

Invert Level (m)

3.440

Design Head (m)

2.000

Design Flow (l/s)

10.0

Objective

Minimise upstream storage

Application

Surface

Sump Available

☒

Flush-Flow (l/s)

☐ 0.0

Unit Reference

MD-SHE-0131-1000-2000-1000

Headloss (m)	Flow (l/s)
0.100	4.7
0.200	8.3
0.300	9.2
0.400	9.6

Network Details

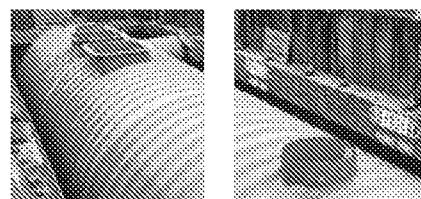
Cover Level (m)

5.820

	Pipe No.	Invert	
Lowest Incoming Pipe	1.005	3.440	(m)
Outgoing Pipe	1.006	3.440	(m)

Select downstream Pipe Number

Section 6
SPEL Stormceptor®
by-pass separators



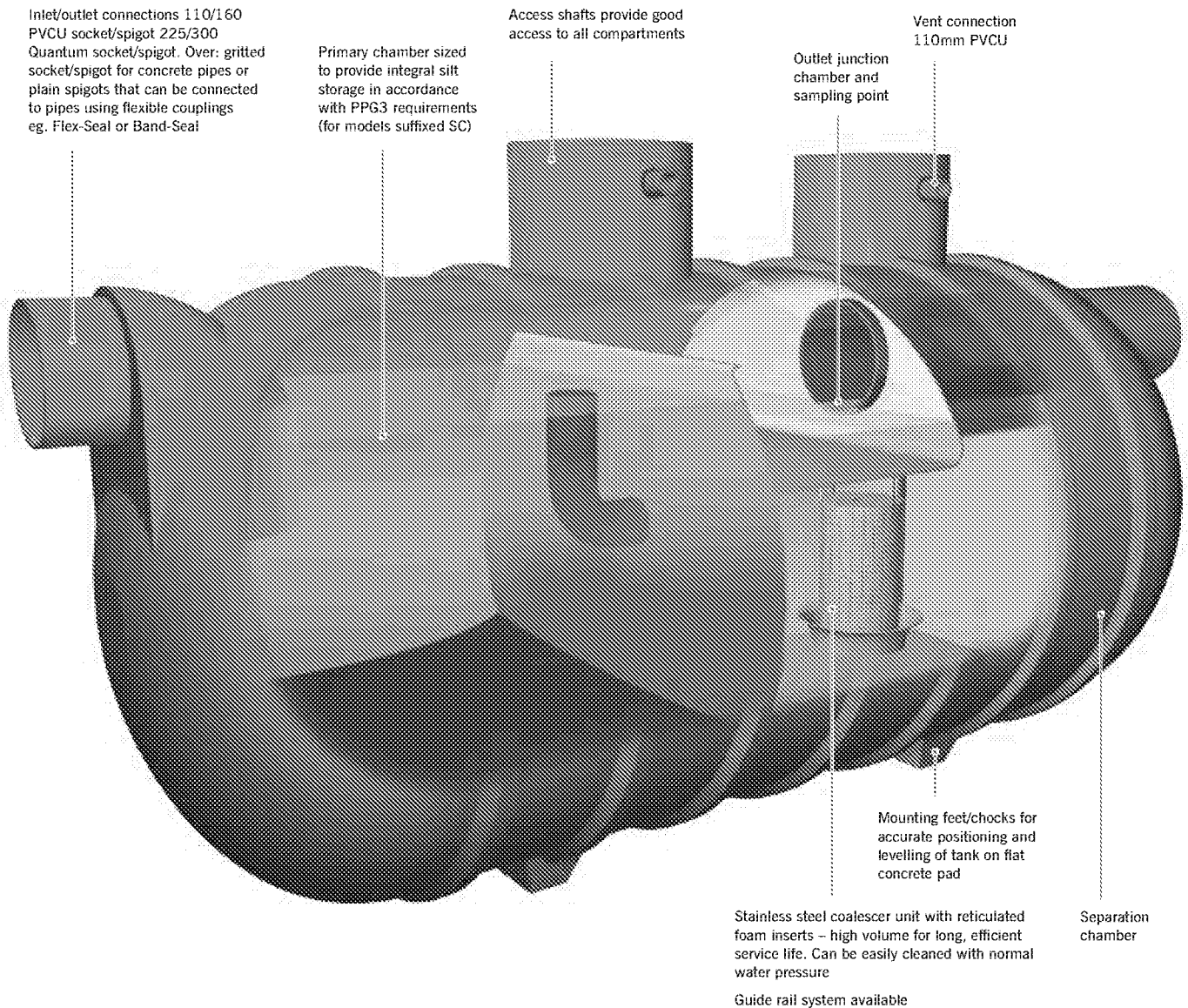
The SPEL Stormceptor is the first Environment Agency listed class 1 by-pass separator to BS EN 858-1:2002.

The Stormceptor provides a very effective means of separating oil and other light liquids from stormwater drainage systems.

Compliant to the European Standard BS EN 858-1, the Environment Agency's Pollution Prevention Guidelines PPG3 and the Construction Products Regulations.

SPEL

Compliant to the European Standard BS EN 858-1, the Environment Agency's Pollution Prevention Guidelines PPG3 and the Construction Products Regulations.



The 'heart' of the SPEL Stormceptor is the unique long life, low maintenance coalescer unit which 'polishes' the final effluent AFTER 90% hydrocarbons of silt have been separated out.

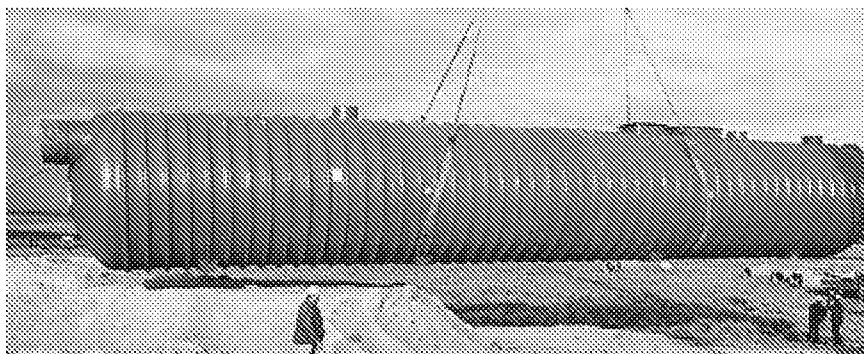
The SPEL Stormceptor is a well proven high quality factory-made unit specially designed and fabricated to provide a very effective means of separating oil and other light liquids from stormwater drainage systems.

The SPEL Stormceptor was the first Environment Agency listed class 1 by-pass separator to BS EN 858-1:2002.

The SPEL Stormceptor has been used effectively throughout the UK and abroad since 1985. All sizes and types of development have been catered for, including industrial development sites, hypermarkets and airports. Areas of up to 30 hectares can be covered with a single unit.

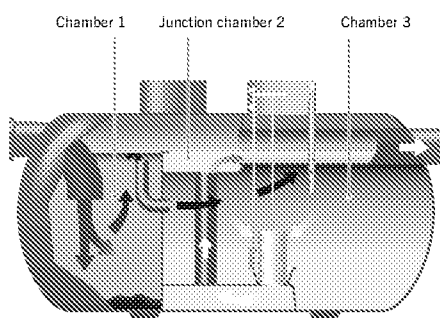
6.2 SPEL Stormceptor® by-pass separators

Operation



Protecting coastal waters

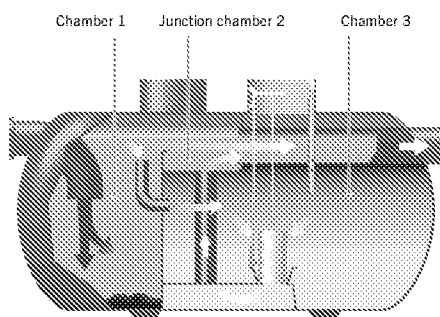
Surface water draining from runways at a busy RAF station in Anglesey is being treated by two SPEL Stormceptor class 1 by-pass separators.



Flows according to nominal size (NSB)

The polluted surface water first enters the primary chamber where silt settles out and is retained. The fuel, oil and other pollutants lighter than water, rise to the surface and are efficiently skimmed off and transferred to the separation chamber.

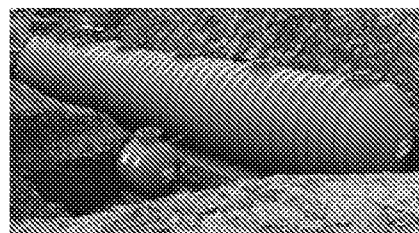
In normal conditions all the flow is through the separation chamber, where the quiescent conditions allow the pollutants to separate out efficiently. Water from the cleanest zone in the separation chamber flows through a coalescer unit, to remove smaller globules of oil, up to the junction chamber and thence to the outlet.



Storm flows above NSB

During a storm the level in the primary chamber rises and the stormwater passes over the weir into the junction chamber and to the outlet.

The design keeps the turbulence within the separation chamber to a minimum which avoids disturbing the contaminants retained.



The reclaimed former opencast coal site at Bermuda Park, Warwickshire. The main contractor – Tarmac Construction Midlands – has installed three SPEL 500 series Stormceptor by-pass separators with Econoskim fuel/oil skimming and separate fuel/oil containment facilities. These cater for an impermeable area of 68 acres.



Above and left:
SPEL Stormceptor series 600 class 1 by-pass separator for a catchment area of 30 hectares.

How to select and specify

1. In accordance with the EA Pollution Prevention Guidelines PPG3:
 - Determine the type of separator – full retention or by-pass.
 - Determine the class of separator – class 1 or 2.
 - Specify whether silt capacity is required integrally or separately upstream of the separator.
2. Against the catchment area within which your requirements fall, the SPEL Separator nominal size can be ascertained.
3. Inlet/outlet pipe connection orientation A-I (see options below).
4. Inlet/outlet diameter in mm.

Selecting size of SPEL Stormceptor

The nominal size (NSB) is obtained by this formula: $NSB = 0.0018A(m^2)$ where A is the catchment area.

	NSB	Model	Class 1 or 2 C1 or C2	Silt Cap. SC	Orientation inlet/outlet	Inlet/outlet diameter
Example 1	20	320	C1	SC	D	600/600
Example 2	50	4100	C2	–	A	900/900

Example 1

SPEL Stormceptor class 1 by-pass separator NSB 20 model 320C1/SC/D 600/600 (with silt capacity).

Example 2

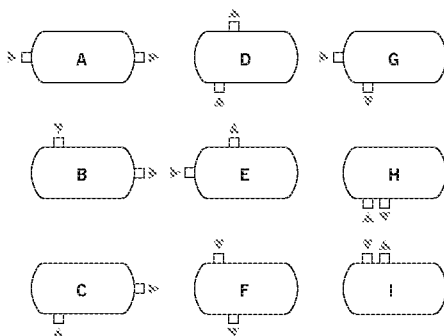
SPEL Stormceptor class 2 by-pass separator NSB 100 model 4100C2/A 900/900 (without silt capacity).

5. SPEL Separators are available in four specifications to suit invert depths and ground water conditions. Standard, Heavy, Extra Heavy and Special, see tables alongside.
6. Optional extras available see 5.6 and 5.7.
 - SPEL coalescer unit guide rail system.
 - SPEL coalescer unit lifting/locating/locking system.
 - SPEL Econoskim® light liquid skimming and separate containment system.
 - SPEL mechanical anchoring system. See 4.11/4.12.
7. SPEL automatic alarm/monitoring system. See 5.7.

Choice of pipe connections

The orientation of inlet/outlet connections indicated depends on the pipe diameter (see under A-I and D-I overleaf) except for Class 2 Stormceptors which accommodate the larger diameter. Any special requirements contact Technical Sales.

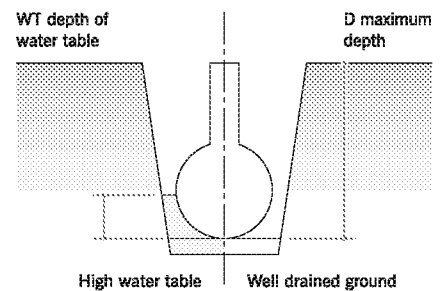
Both inlet and outlet connections are spigots (GRP or PVCU) and can be connected to the site pipework using Flex-Seal, Band-Seal or similar flexible couplings.

**Specification**

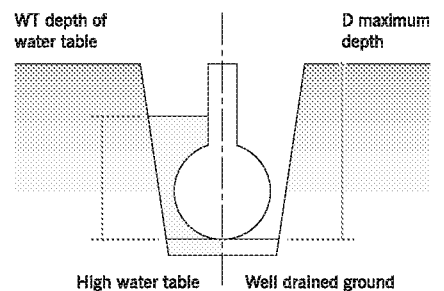
Standard, heavy, extra heavy or special specification available dependent upon tank burial depth and water table level in winter. The tables below refer to tanks with a concrete surround. For extra heavy and special specification range and pea gravel surround refer to section 4 or contact technical sales.

Standard tanks

Series	WT(m)	D(m)
100/200	1.0	4.0
300	0.9	4.0
400	1.3	5.0
500	1.9	5.7
600	2.4	6.2

**Heavy tanks**

Series	WT(m)	D(m)
100/200	2.0	6.0
300	2.8	5.6
400	3.5	6.0
500	4.5	7.25
600	4.7	7.3



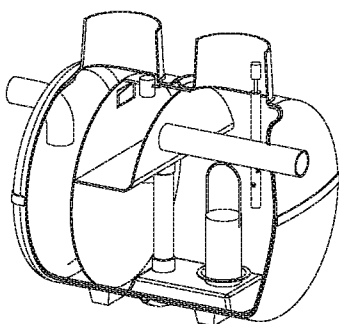
6.4 SPEL Stormceptor® by-pass separators 100 and 200 series, class 1 and 2 models

Compliant to the European Standard BS EN 858-1, the Environment Agency's Pollution Prevention Guidelines PPG3 and the Construction Products Regulations

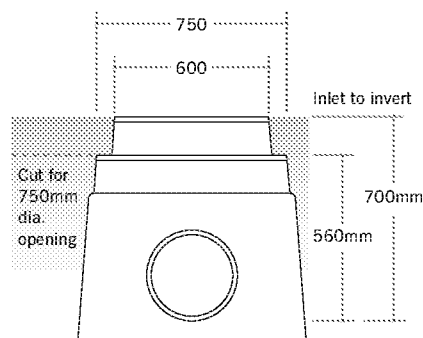
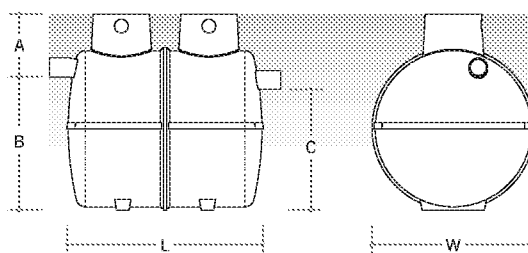
Class 2 models available for 100 and 200 series – change C1 for C2 when quoting model reference.

Model	Nominal size (NSB)	Catchment area a (m ²)	Oil storage (litres)	Silt storage (litres)	Overall length (mm)	Overall diameter (mm)	Inlet Invert (mm)	Base to inlet (mm)	Base to outlet (mm)	Max in/out pipe diameter (mm) for orientation		Number of access shafts diameter (mm)			
					L	W	A	B	C	type A-C	type D-I	450	600	750	900
103 C1/SC	3	1667	45	300	1550	1300	500	1015	965	160	160	2	-	-	-
204 C1/SC	4	2222	60	400	1860	1225	560	1350	1300	300	300	-	*	1	-
206 C1/SC	6	3333	90	600	2110	1225	560*	1350	1300	300	300	-	*	1	-
208 C1/SC	8	4444	120	800	2260	1225	560*	1350	1300	300	300	-	*	1	-
210 C1/SC	10	5556	150	1000	2920	1225	560*	1350	1300	300	300	-	*	1	-
215 C1/SC	15	8333	225	1500	4227	1225	560*	1350	1300	400	400	-	*	1	-

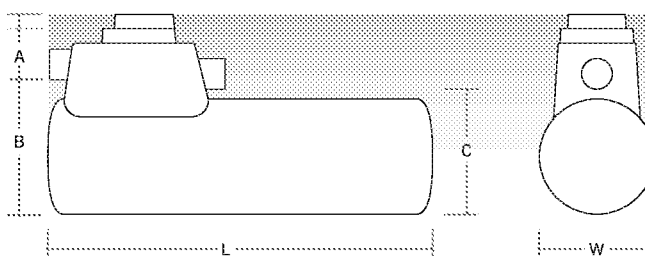
* 200 Series Stormceptors have a dual size access shaft. For units that will collect silt we recommend using the 750mm diameter access which provides enough room for the silt removal hose to be lowered into the tank during maintenance. The value of 'A' here is for the 750mm access – the 600mm access has an 'A' value of 700mm.



100 series



200 series



Dual access shaft openings

For access to desludge primary chamber, cut to 750mm dia. access shaft opening. Where a silt trap is incorporated upstream or silt build up will not occur 600mm diameter access shaft may be adequate.

Refer to 6.7 and 6.8 for more comprehensive data including installation.

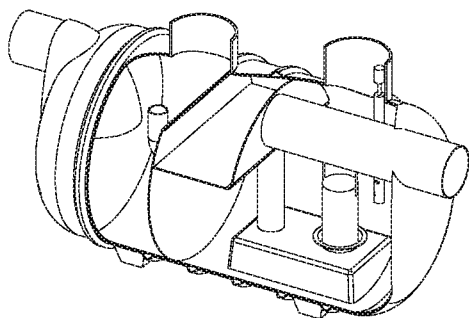
SPEL Stormceptor® by-pass separators 300 and 400 series, class 1 and 2 models

6.5

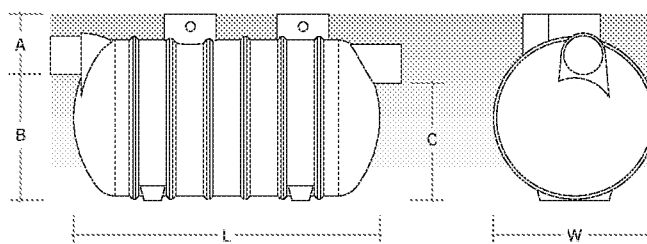
Compliant to the European Standard BS EN 858-1, the Environment Agency's Pollution Prevention Guidelines PPG3 and the Construction Products Regulations

Class 2 models available for 300 and 400 series – change C1 for C2 when quoting model reference.

Model	Nominal size (NSB)	Catchment area a (m ²)	Oil storage (litres)	Silt storage (litres)	Overall length (mm) L	Overall diameter (mm) W	Inlet invert (mm) A	Base to inlet (mm) B	Base to outlet (mm) C	Max in/out pipe diameter (mm) for orientation		Number of access shafts diameter (mm)			
										type A-C	type D-I	450	600	750	900
318 C1/SC	18	10000	270	1800	3200	1875	700	1450	1350	450	600	-	2	-	-
320 C1/SC	20	11111	300	2000	3535	1875	700	1450	1350	450	600	-	2	-	-
325 C1/SC	25	13889	375	2500	4420	1875	700	1450	1350	450	600	-	2	-	-
330 C1/SC	30	16667	450	3000	5070	1875	700	1450	1350	450	600	-	-	1	1
340 C1/SC	40	22222	600	4000	7060	1875	740	1410	1310	450	600	-	1	1	-
345 C1/SC	45	25000	675	4500	7615	1875	740	1410	1310	450	600	-	1	1	-
350 C1/SC	50	27778	750	5000	8255	1875	740	1410	1310	450	600	-	1	1	-

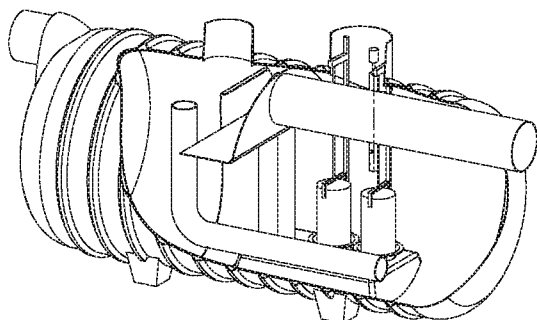


300 series

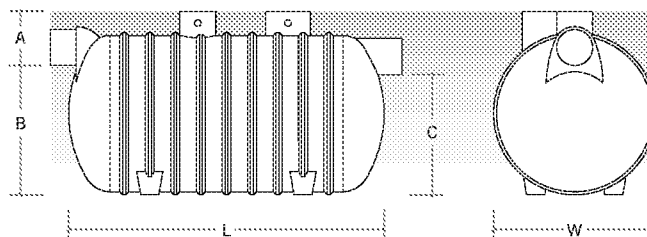


Model	Nominal size (NSB)	Catchment area a (m ²)	Oil storage (litres)	Silt storage (litres)	Overall length (mm) L	Overall diameter (mm) W	Inlet invert (mm) A	Base to inlet (mm) B	Base to outlet (mm) C	Max in/out pipe diameter (mm) for orientation		Number of access shafts diameter (mm)			
										type A-C	type D-I	450	600	750	900
460 C1/SC	60	33333	900	6000	4400	2700	950	2100	2000	600	750	-	1	-	1
470 C1/SC	70	38889	1050	7000	5250	2700	950	2100	2000	600	750	-	1	-	1
480 C1/SC	80	44444	1200	8000	6170	2700	950	2100	2000	600	750	-	1	-	1
4100 C1/SC	100	55556	1500	10000	7400	2700	1100	1950	1850	750	900	-	1	-	1
4125 C1/SC	125	69444	1875	12500	9050	2700	1100	1950	1850	750	900	-	1	-	1
4150 C1/SC	150	83333	2250	15000	9950	2700	1100	1950	1850	750	900	-	-	-	2
4160 C1/SC	160	88889	2400	16000	11830	2700	1250	1800	1700	750	900	-	1	1	1

400 series – models without silt capacity are available if required – details on application.



400 series



6.8 SPEL Stormceptor® by-pass separators

500 and 600 series, class 1 and 2 models

Compliant to the European Standard BS EN 858-1, the Environment Agency's Pollution Prevention Guidelines PPG3 and the Construction Products Regulations

These Stormceptors are individually designed in accordance with specific site requirements according to catchment area, class, silt capacity, inlet/outlet connection size and orientation. The following is an approximate guide to the range of models available. Please contact our technical department for your specific requirements. Class 2 models available – change C1 for C2 when quoting model reference.

Model	Nominal size (NSB)	Catchment drainage area hectares	Oil storage litres NSBx15	Silt** storage litres NSBx100	*Overall length (mm)	*Overall diameter (mm)	Inlet Invert (mm)	Base to Inlet (mm)	Base to outlet (mm)	Max in/out pipe diameter (mm) for orientation	
					L	W				A	B
5180C1SC	180	10	2700	18000	10040	3650	1260	2615	2390	900	1200
5200C1SC	200	11.1	3000	20000	11140	3650	1260	2615	2400	900	1200
5250C1SC	250	13.9	3750	25000	13840	3650	1260	2615	2400	900	1200
6300C1SC	300	16.7	4500	30000	14250	4150	1425	2850	2600	1200	1500
6350C1SC	350	19.4	5250	35000	16635	4150					
6400C1SC	400	22.2	6000	40000	18259	4150					
6500C1SC	500	27.8	7500	50000	22250	4150					
6500C1	500	27.8	7500	Nil	16635	4150				Subject to site drainage requirements	
6600C1	600	33.3	9000	Nil	19899	4150					
6700C1	700	38.9	10500	Nil	23050	4150					
6750C1	750	41.7	11250	Nil	24650	4150					
6800C1	800	44.4	12000	Nil	–	4150					
61000C1	1000	55.5	15000	Nil	–	4150					

*Tank shell – fittings extra. **Where silt capacity required it is available on the models indicated.

Pipe size and orientation designed to suit site pipework and class 1 or 2.

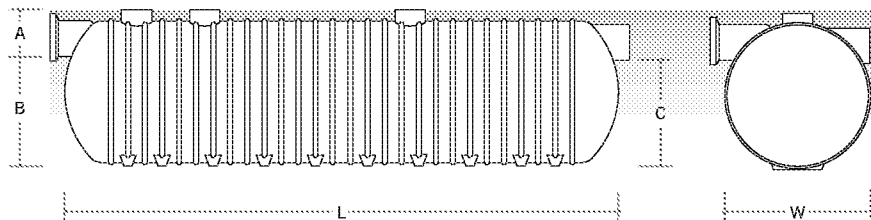
Silt capacity normally provided for integrally in accordance with PPG3.

Series 500

Inside diameter 3500mm, outside diameter 3650mm.

Series 600

Inside diameter 4000mm, outside diameter 4150mm.



Features

Filament wound shells are lightweight but have great strength and durability.

Life expectancy in excess of fifty years.

Smooth, high gloss, corrosion resistant, resin-rich internal surface.

External 'flow coat' water penetration barrier.

25 year warranty.

Stainless steel coalescer units (class 1 separators) with durable high volume reticulated foam inserts for long life and long term efficiency.

SPEL automatic alarm/monitoring system

This is to indicate when separator requires emptying or SPEL Tankstor® with Econoskim®. See 5.7.

Optional extras

SPEL coalescer unit guide rail system. See 9.7.

SPEL coalescer unit lifting/locating/locking system with lifting chains. See 9.6/9.7.

SPEL Econoskim light liquid skimming and separator containment system. Manual or automatic systems which save conventional emptying costs by 90%. Section 11.

SPEL pollution monitoring and containment systems. Section 11.

SPEL mechanical anchoring systems. See 4.11/4.12.

GRP non slip ladder/s with stainless steel fixings.

Regulation/specification compliance as appropriate

Environment Agency's Pollution Prevention Guidelines PPG3.

European Standard; Separator systems for light liquids BS EN 858-1:2002.

British Standard; Specification for design and construction of vessels and tanks in reinforced plastics BS 4994 : 1987.

European Standard; Underground tanks of glass reinforced plastics (GRP) BS EN 976-1 : 1997.

Materials to BS 3532, BS 3691 and or BS 2782 or equivalent standards.

Compliant to the European Standard BS EN 858-1, the Environment Agency's Pollution Prevention Guidelines PPG3 and the Construction Products Regulations.

The 200 Series Stormceptor class 1 by-pass separators are single access shaft units with integral silt capacity. There is complete access to both the primary chamber and the fuel/oil separation chamber for desludging by suction tanker provided the 750mm dia. access shaft is utilised.

If a silt trap is situated upstream of the Stormceptor and/or no build up of silt will occur in the primary chamber the smaller 600mm dia. access shaft can be utilised.

Performance

SPEL Stormceptor class 1 by-pass separators incorporate a coalescer unit and are designed to meet the requirements of the European Standard BS EN 858-1 and the Environment Agency's Pollution Prevention Guidelines PPG3, where the maximum permissible content of residual oil in the outlet is 5mg/l.

The coalescer unit has a robust high volume reticulated foam insert. The insert efficiently coalesces the finer globules of hydrocarbons for gravity separation and due to its large volume, lasts for long periods before requiring cleaning. Cleaning is then a simple operation using normal pressure water. The insert can be reused again and again, rarely requiring replacement.

The inlet/outlet diameters and fall across the separator as indicated ensure optimum performance.

The light liquid storage capacity (fuel, oil etc.) is 15 times the nominal size (NS) in litres, eg. SPEL Stormceptor NSB6 has a light liquid storage capacity of 90 litres.

The first primary chamber can be desludged by a suction tanker providing the 750mm dia. access together with the cover and frame to suit is incorporated.

Specification

SPEL 200 series Stormceptor class 1 by-pass separators incorporate a strong filament wound shell and are manufactured in standard and heavy specification depending on burial depths and water table height as in the table above. See also 6.3.

Inlet/outlet connections

Both inlet and outlet connections are either 225/300/400 dia. Quantum spigots. Flex-Seal/Band-Seal or similar couplings are available for connecting to site pipework if required.

Burial depths for standard and heavy specification tanks

Standard	Maximum burial depth to bottom of tank	4 metres
	Maximum height of water table above bottom of tank	1 metre
Heavy	Maximum burial depth to bottom of tank	6 metres
	Maximum height of water table above bottom of tank	2 metres

Handling

Tanks should be lifted using slings not chains or wire ropes. DO NOT drag tanks along the ground for any distance and avoid jarring or bumps. DO NOT lift with water in the tank. See 4.2.

Preliminary

Remove the plastic tie used to hold the coalescer unit inside the tank.

Insert the coalescer unit securely into the base socket.

Ensure the foam insert is fitted inside the stainless steel coalescer unit.

During installation, it is important the foam inserts are not clogged with dust, debris or drops of wet concrete. To safeguard against this, we recommend covering the access shaft with a sheet of polythene.

Installation guidance notes

Installation should be carried out by a competent contractor in accordance with the following procedures, Health & Safety at Work legislation and good building practice.

For detailed instructions see section 4 or installation instructions supplied with every tank.

1. Determine the size of the excavation allowing for the drain invert depth and a concrete surround. Allowance should be made for consolidating concrete under the unit when backfilling.
2. Pour concrete base to correct depth and level off.
3. When the concrete has set sufficiently, place the tank in position, check for levels (including inlet/outlet inverts) and fill with water to a maximum depth of: 200 series – 200mm, 300 series – 300mm, 400 series – 400mm. Ensure concrete slab is clean ready for placing concrete surround. Surround should preferably be placed within 48 hours of casting the base slab.
4. Place backfill concrete (ST4 mix) up to the depth of the water in the tank ensuring the concrete is properly consolidated under the tank to prevent voids. Consolidate by hand – do not use vibrating poker. Connect up pipework.

5. Continue backfilling with concrete and at the same time filling the tank with water to equalise pressure and resist floatation. Where the tank is divided into chambers ensure all chambers are filled equally.
6. Top up the tank with water to inlet/outlet invert level and place remainder of concrete to a depth of approximately 150-200mm above the top of the tank. Where extension access shaft is fitted, this can be surrounded in concrete once the main tank concrete surround has set. (See Extension access shafts).
7. Where the concrete slab over the tank is to take vehicle loading it should be reinforced in accordance with good practice to take the maximum load and should be extended onto unexcavated ground. It is important that vehicle loading is not transferred to the tank shell or its concrete surround.
8. Incorporate inspection cover and frame.
NOTE: For access to desludge the primary chamber fit only 750mm dia. manihole cover and frame.

Venting

SPEL Separators are governed by the requirements of petroleum regulations: Petrol filling stations: Construction and Operation HS(G)41, ISBN 0-11885449-6. These state in paragraph 45, that each chamber of a petrol interceptor should be vented and vent pipes should extend to not less than 2.4m above ground level, should not be less than 75mm diameter and of a robust construction, and should be manifolded above ground.

Extension access shafts

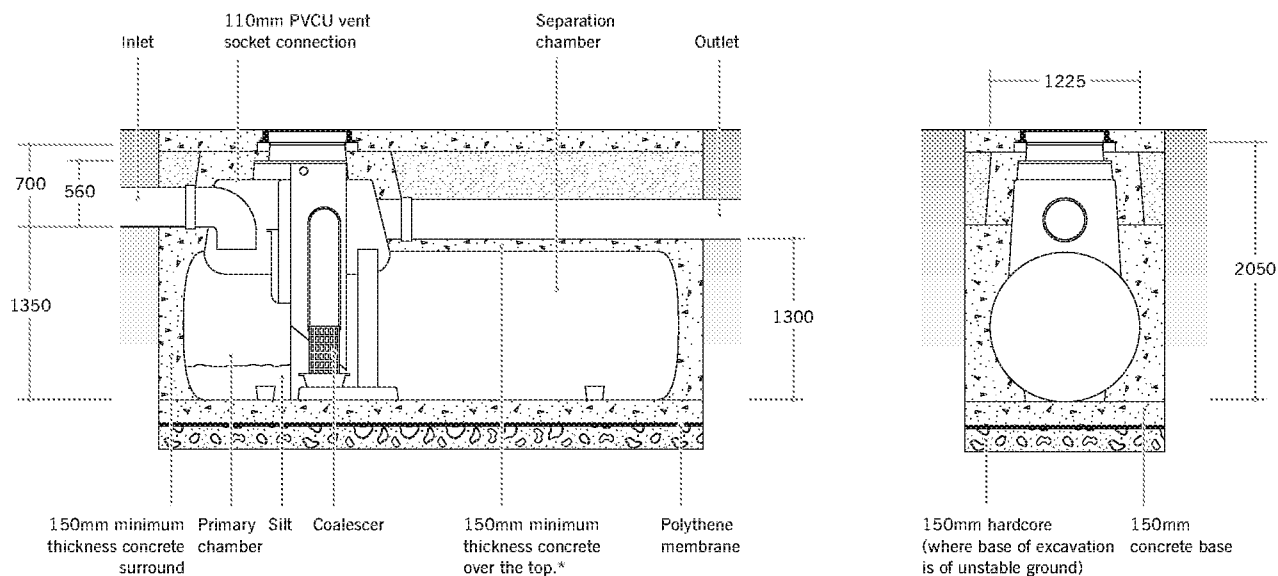
SPEL extension shafts are available in standard lengths of 500mm upwards and 500mm increments. When these should be surrounded with concrete, pour in lifts of approximately 500mm, allowing the concrete to set between each lift.

Commissioning

On completion of installation, check the foam insert is fitted inside the stainless steel coalescer unit, the coalescer unit is inserted securely into the base socket and the tank is free of debris etc.

6.8 SPEL Stormceptor® by-pass separators

200 series, class 1 with silt capacity



* Fabric reinforcement may be necessary where vehicle loading has to be taken into account or where high extension access shafts are to be fitted

SPEL automatic alarm/monitoring system

Requirement of the Environment Agency's Pollution Prevention Guidelines PPG3

The SPEL automatic alarm/monitoring system provides continuous monitoring of the separator contents by sensing when the light liquid within the separator has filled to a predetermined level (with design safety margins), and provides a simple audio-visual warning to alert the operator that the separator needs to be emptied.

Maintenance

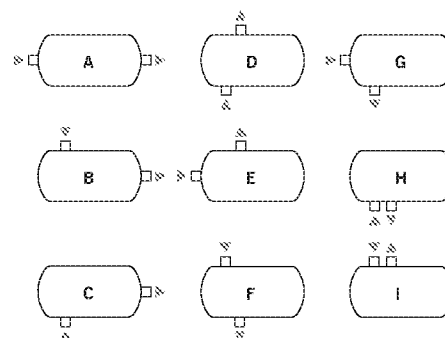
The SPEL 200 series Stormceptor class 1 by-pass separators have good access to both the primary chamber and the light liquid separation chamber for periodic emptying of retained light liquids and silt which is essential to maintain the units optimum performance.

Periods between emptying will have to be determined depending on site conditions but normally at least twice a year.

For detailed instructions see section 9.

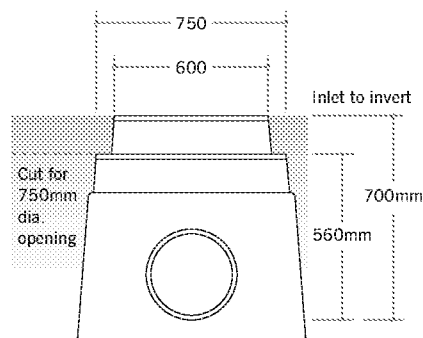
Procedure in brief

1. Lift handle and coalescer unit out of the tank and place ahead of the separator.
2. Remove foam insert and wash with normal water pressure, ensuring the dirty water runs into the separator.
3. Empty light liquids and silt alternating between both chambers to avoid excessive pressure one side of the partition.
4. Re-insert the foam insert into the stainless steel coalescer unit and re-insert the coalescer unit into the separator.



Choice of pipe connections

Orientation of inlet/outlet pipe connections.



Dual access shaft openings

For access to desludge primary chamber, cut to 750mm dia. access shaft opening. Where a silt trap is incorporated upstream or silt build up will not occur 600mm diameter access shaft may be adequate.

Catchment area m ²	SPEL ref	Nominal size NSB	Oil storage litres NSBx15	Silt storage litres NSBx100	Overall length (mm)	Max pipe (mm)
2222	204C1SC	4	60	400	1860	300
3333	206C1SC	6	90	600	2110	300
4444	208C1SC	8	120	800	2260	300
5556	210C1SC	10	150	1000	2920	300
8333	215C1SC	15	225	1500	4227	300

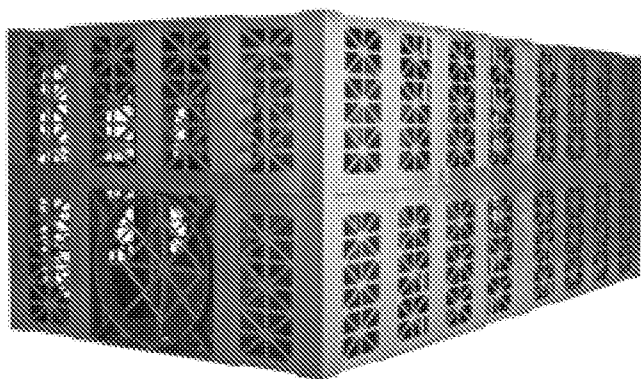
Product Details

AquaCell Core

Application

AquaCell Core has been designed for use in deep applications, subject to both regular and heavy traffic loadings, such as cars and HGV's (for vehicles up to 44 tonnes). In addition AquaCell Core can also be used for deep soakaways and landscaped applications.

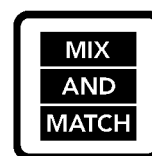
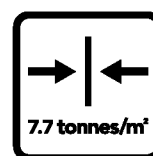
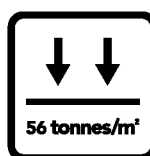
Typically for use down to depths of 4.25m (landscaped), 4.1m (trafficked by cars) and 4m (trafficked by HGV's), to the base of the units from ground level, in best soil conditions.



Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 0.9 metres is in place.

Features and benefits

- ⊗ Suitable for regular and heavy traffic loadings
- ⊗ Proven vertical loading capacity of: 56 tonnes/m²
- ⊗ Proven lateral loading capacity of: 7.7 tonnes/m²
- ⊗ Dark blue in colour, for ease of identification from other AquaCell units
- ⊗ BBA approved – Certificate No 03/4018
- ⊗ Ideal for all types of shallow and deep projects including major attenuation and infiltration schemes



AquaCell Core

Maximum installation depths (to base units)

Typical soil type	Typical angle of shearing resistance (°) (φ)	Maximum depth of installation – to base of units (m)			
		With groundwater at 1m below ground level and units wrapped in geomembrane		Without groundwater below base of units (normal case)	
		Trafficked areas (cars only) ⁽¹⁾	Non-trafficked areas	Trafficked areas (cars only) ⁽²⁾	Non-trafficked areas
Stiff over-consolidated clay (e.g. London clay)	24°	1.65	1.75	2.35	2.50
Normally consolidated silty, sandy clay (e.g. alluvium, made ground)	26°	1.70	1.80	2.50	2.65
Loose sand and gravel	29°	1.80	1.90	2.85	2.95
Medium dense sand and gravel	33°	1.90	2.00	3.30	3.45
Dense sand and gravel	38°	2.05	2.15	4.10	4.25

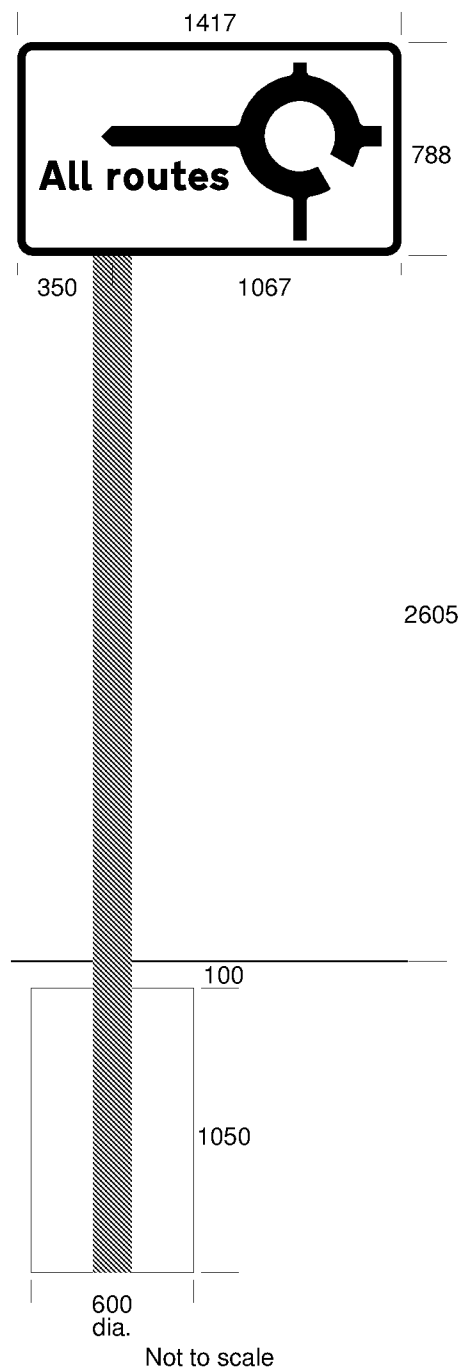
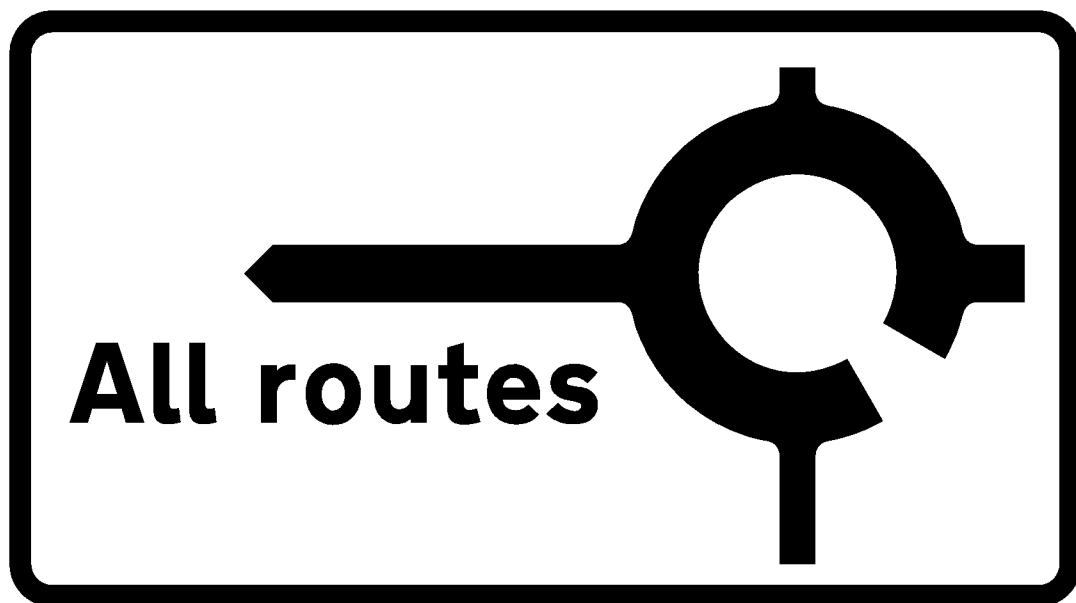
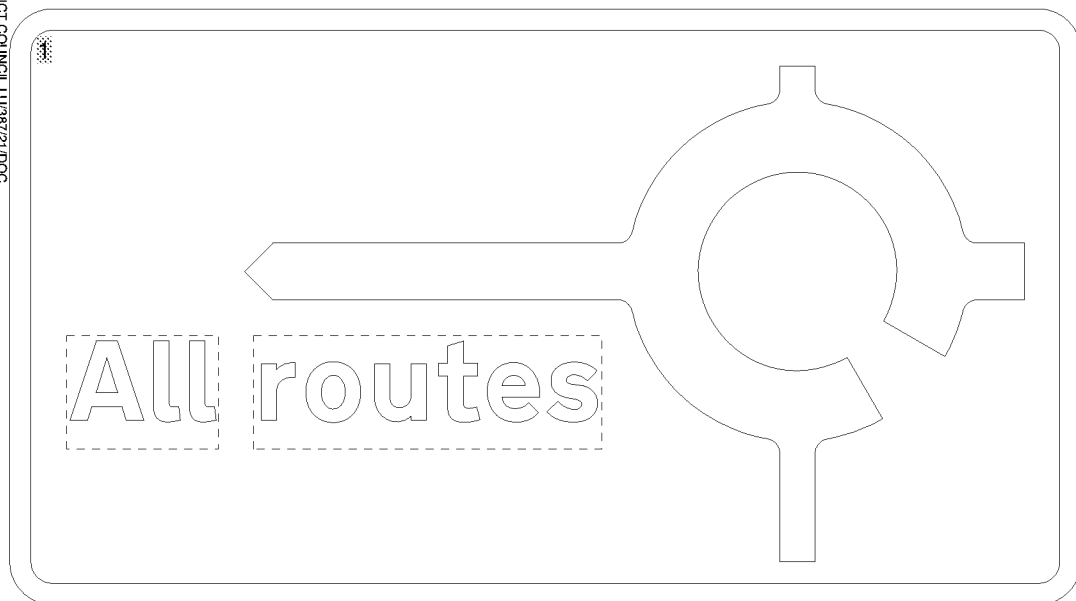
- (1) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.
- (2) The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.
- (3) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).

Assumptions made are:

- ⊗ ground surface is horizontal
- ⊗ shear planes or other weaknesses are not present within the structure of the soil

Source: BBA

SCHEDULE B - Traffic Sign Face Details (Rev P7, 05/09/19)



Job Ref: A/PHLYM.2

Sign Ref: TS301

Scale 1:10

Dimensions (mm):

Width: 1417, Height: 788

x-Height: 75 Area: 1.12 m²

Colours:

■ black on white

Mounting height: 2.605m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL6, TDB4, PL3, PAF1

1200 N/m²

Structure Details:

1 no. Steel circular section S275:

139.7mm O.D. 5mm thick

Support length: 4543 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

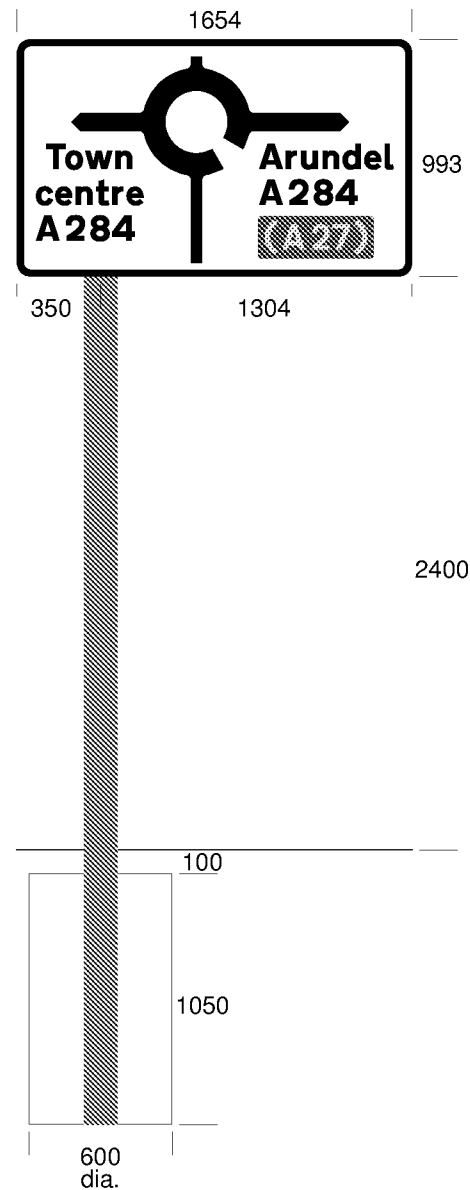
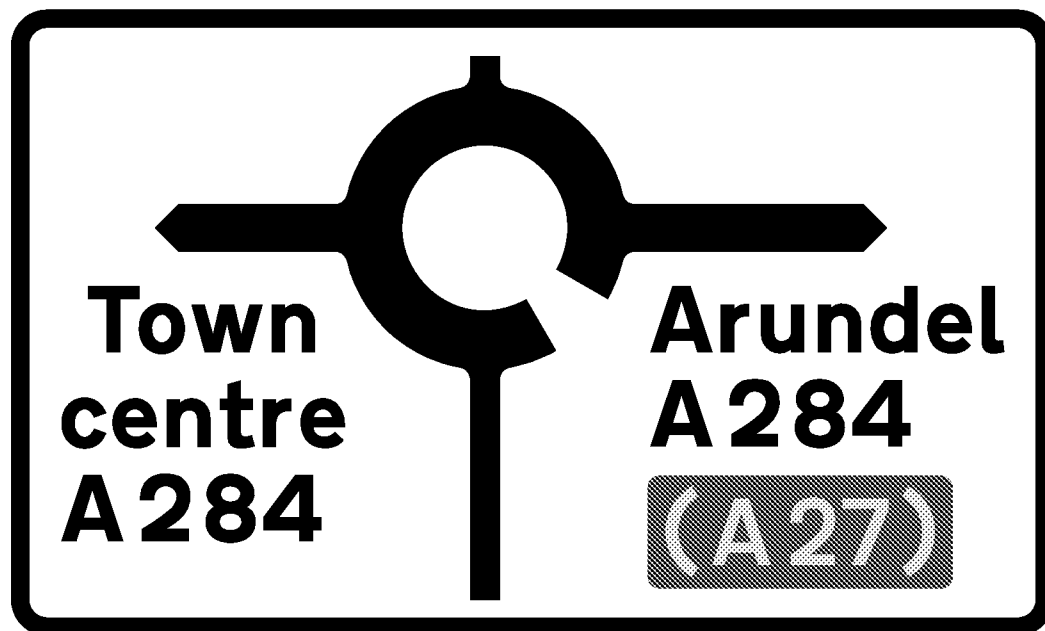
Depth of soft fill: 100 mm

Height of footing: 1050 mm

Diameter of footing: 600 mm

TS301
PHLYM

SignPlot v3.50



Not to scale

Job Ref: A/PHLYM.1**Sign Ref: TS301F**

Scale 1:12

Dimensions (mm):

Width: 1654, Height: 993

x-Height: 75 Area: 1.64 m²

Colours:

 black on white

 yellow on dark green

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB4, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

139.7mm O.D. 5mm thick

Support length: 4543 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

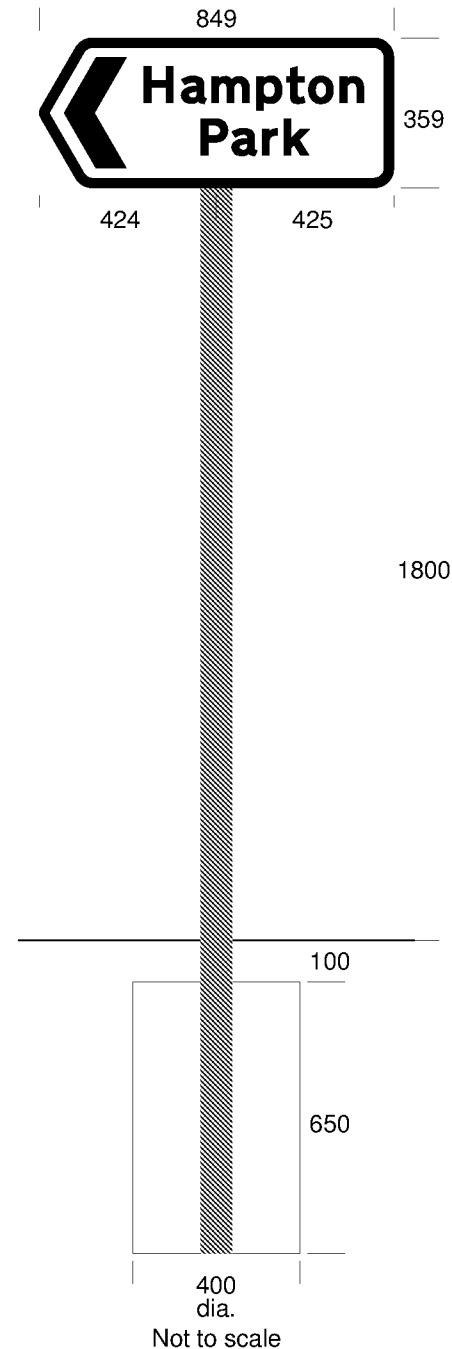
Height of footing: 1050 mm

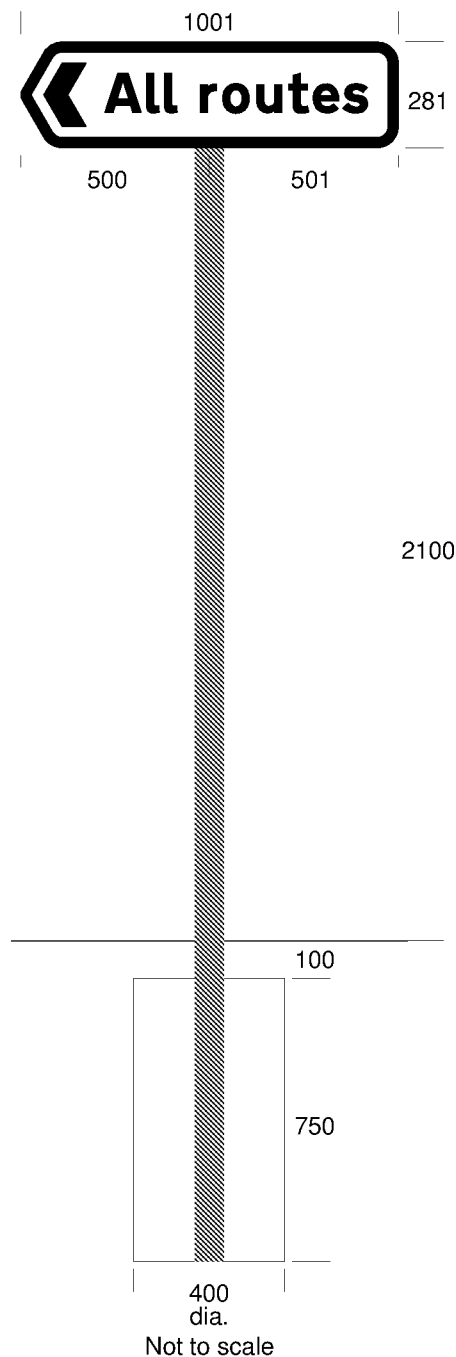
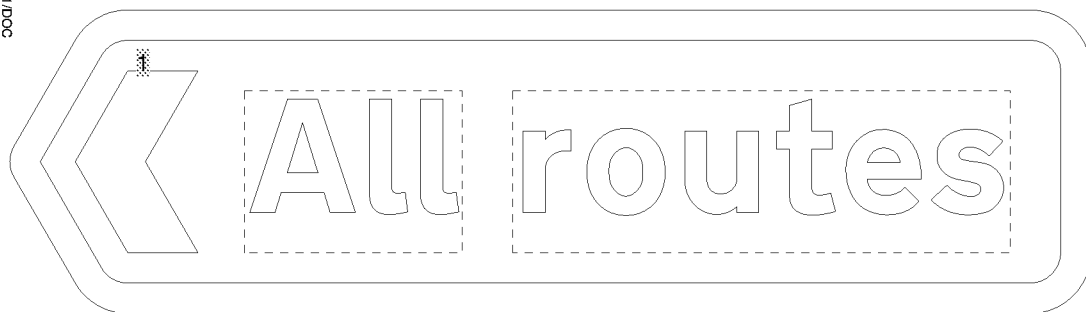
Diameter of footing: 600 mm

Future sign to be implemented by WSCC
when Northern section of bypass is
constructed

TS301F
PHLYM

SignPlot v3.50





Job Ref: A/PHLYM.2

Sign Ref: TS304

Scale 1:7

Dimensions (mm):

Width: 1001, Height: 281

x-Height: 75 Area: 0.28 m²

Colours:

■ black on white

Mounting height: 2.1m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 4mm thick

Support length: 3231 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

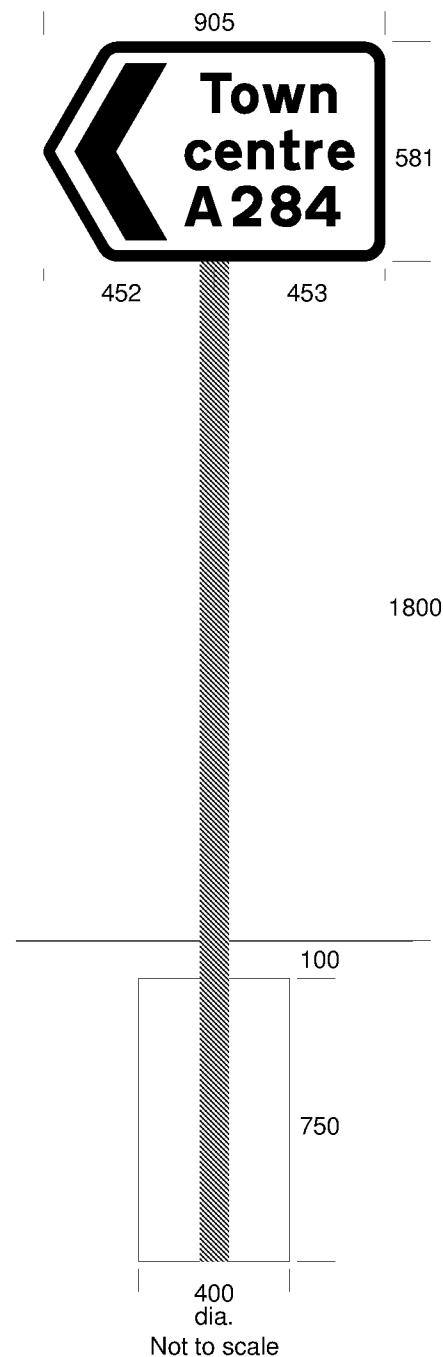
Height of footing: 750 mm

Diameter of footing: 400 mm

Passively safe to BS EN 12767:2007

TS304
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS304F

Scale 1:7

Dimensions (mm):

Width: 905, Height: 581

x-Height: 75 Area: 0.53 m²

Colours:

☐ black on white

Mounting height: 1.8m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 4mm thick

Support length: 3231 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 750 mm

Diameter of footing: 400 mm

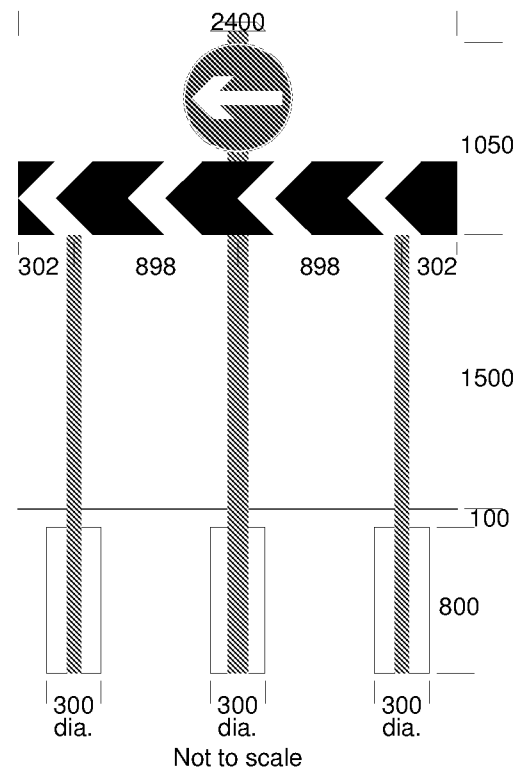
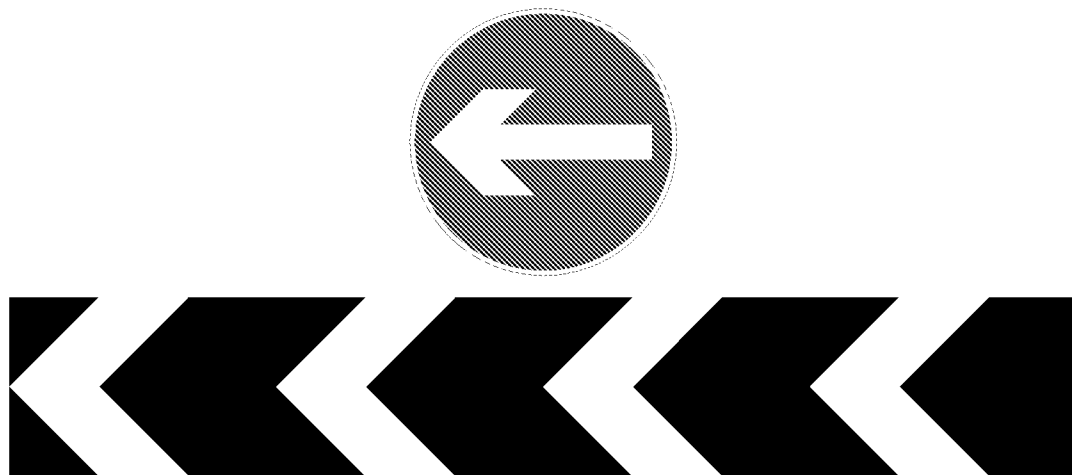
Future sign to be implemented by WSCC
when Northern section of bypass is
constructed

Passively safe to BS EN 12767:2007

TS304F

PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2
Sign Ref: TS305 & 306

Scale 1:17

Dimensions (mm & m²):

Width: 600, Height: 600, Area: 0.28

Width: 2400, Height: 400, Area: 0.96

x-Height: (100) Total area: 1.24 m²

Colours:

Mounting height: 1.5m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

2 no. Steel circular section S275:

76.1 mm O.D. 2.6 mm thick and

1 no. Jerol passive post with door:

Jerol 114

Support length (longest): 3550 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

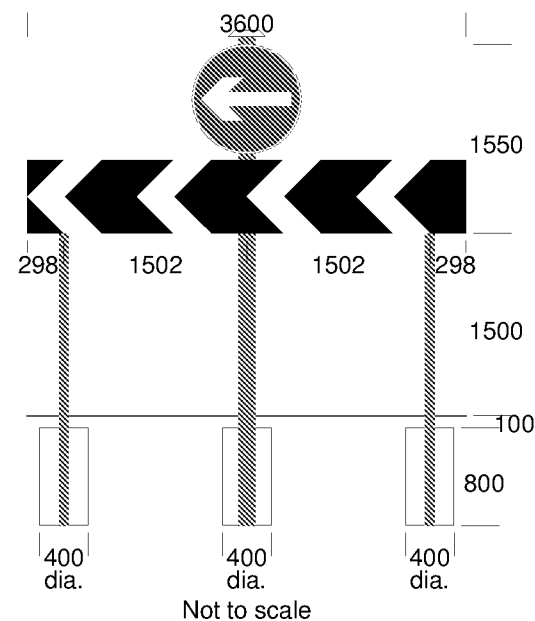
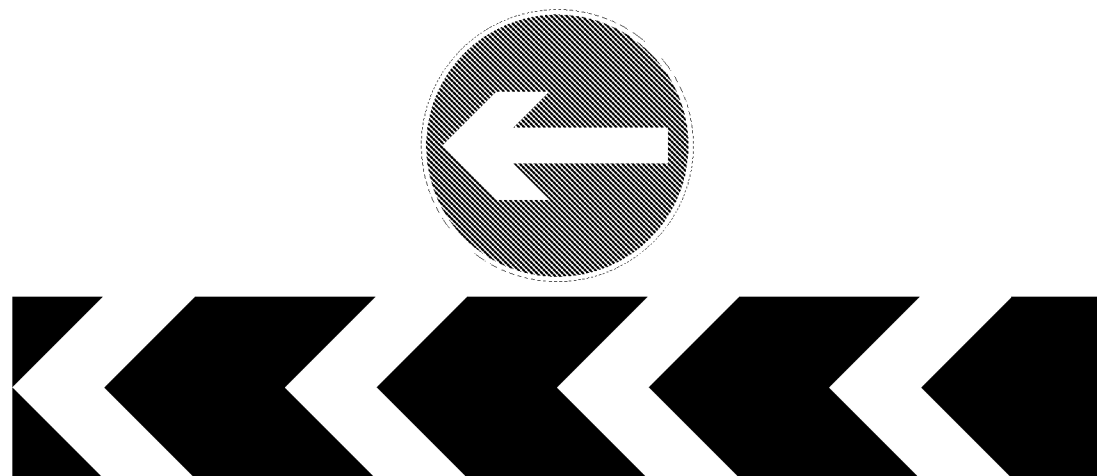
Height of footing: 800 mm

Diameter of each footing: 300 mm

Passively safe to BS EN 12767:2007

TS305&6
 PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2
Sign Ref: TS307 & 308

Scale 1:25

Dimensions (mm & m²):

Width: 900, Height: 900, Area: 0.64

Width: 3600, Height: 600, Area: 2.16

x-Height: (100) Total area: 2.80 m²

Colours:

Mounting height: 1.5m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL5, TDB5, PL3, PAF1

1000 N/m²

Structure Details:

2 no. Steel circular section S275:

76.1 mm O.D. 5mm thick and

1 no. Jerol passive post with door:

Jerol 140

Support length (longest): 4050 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

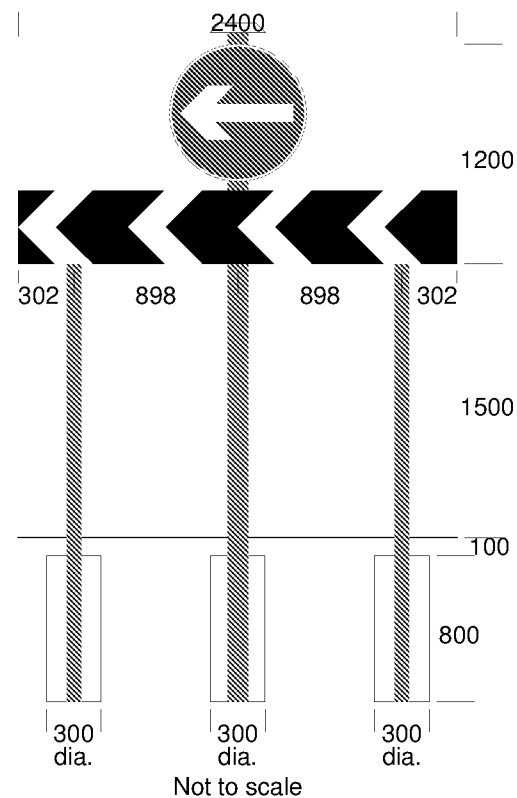
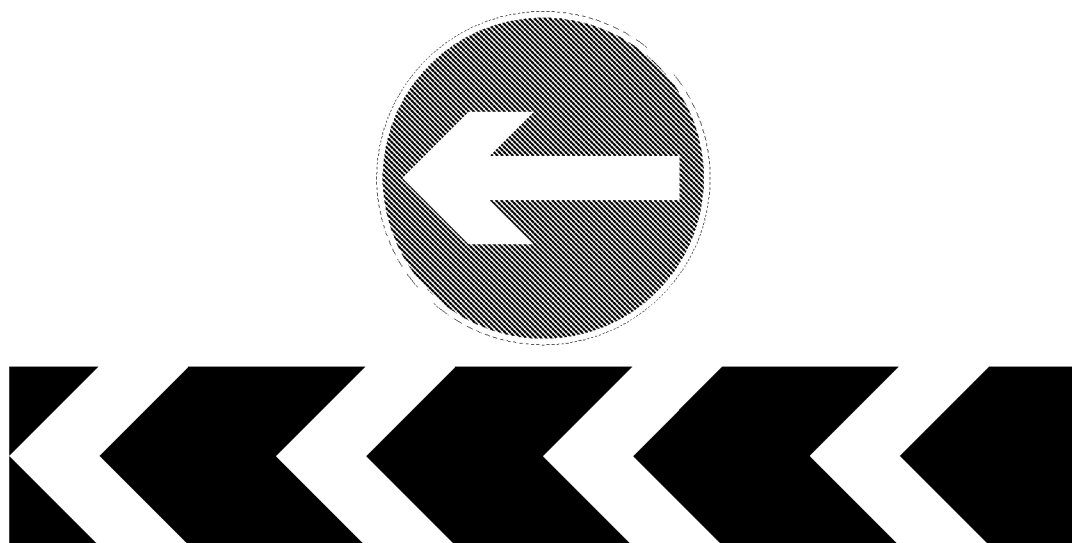
Diameter of each footing: 400 mm

Passively safe to BS EN 12767:2007

TS307&8

PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS311 & 312

Scale 1:17

Dimensions (mm & m²):

Width: 750, Height: 750, Area: 0.44

Width: 2400, Height: 400, Area: 0.96

x-Height: (100) Total area: 1.40 m²

Colours:

Mounting height: 1.5m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

2 no. Steel circular section S275:

76.1 mm O.D. 3mm thick and

1 no. Jerol passive post with door:

Jerol 114

Support length (longest): 3700 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

Diameter of each footing: 300 mm

Passively safe to BS EN 12767:2007

TS311-12

PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS313

Scale 1:4

Dimensions (mm):

Width: 496, Height: 518

x-Height: 50 Area: 0.26 m²

Colours:

■ white on blue

Material: BS EN 12899-1:2007

Class: RA2/R2

TS313
PHLYM

SignPlot v3.45



Job Ref: A/PHLYM.2
Sign Ref: TS314-326, 331&332

Scale 1:2

Dimensions (mm):

Width: 270, Height: 270

Area: 0.06 m²

Colours:

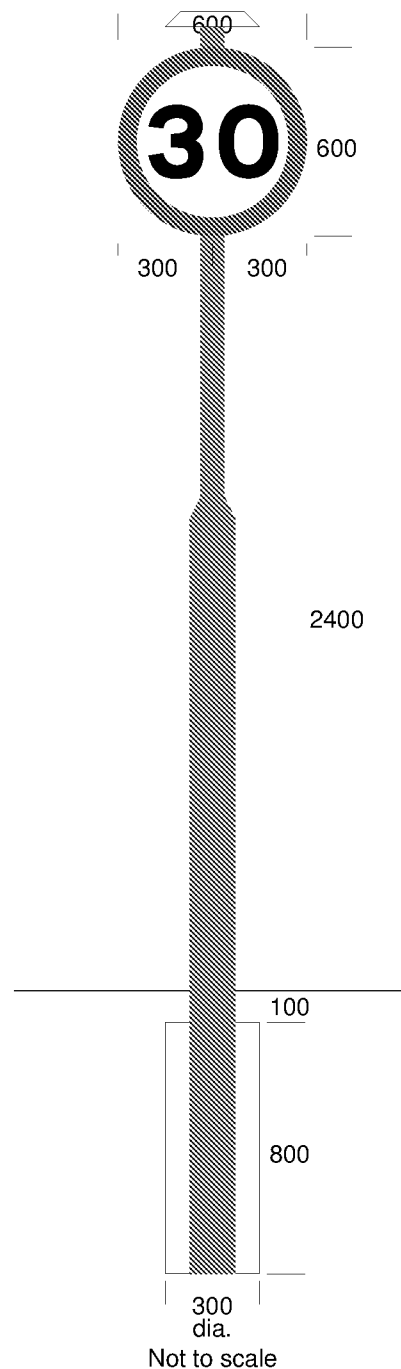
Material: BS EN 12899-1:2007

Class: RA2/R2

Signs TS314 to 326, 331 & 332 mounted
on proposed lighting columns

TS314-26
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2
Sign Ref: TS327 & 330

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

Colours:

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Sapa Pole with reinforced door:

145-76x3

Support length: 4000 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

Diameter of footing: 300 mm

Passively safe to BS EN 12767:2007

TS327
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2
Sign Ref: TS328 & 329

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

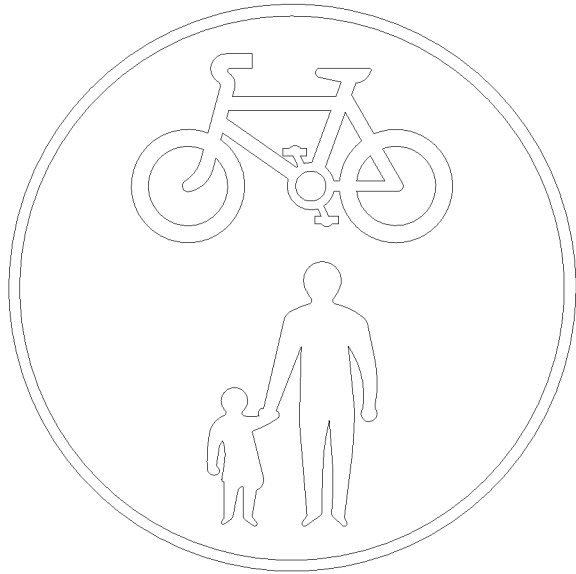
Colours:

Material: BS EN 12899-1:2007

Class: RA2/R2

TS328
PHLYM

SignPlot v3.45



Job Ref: A/PHLYM.2

Sign Ref: TS333

Scale 1:2

Dimensions (mm):

Width: 150, Height: 150

Area: 0.02 m²

Colours:

Material: BS EN 12899-1:2007

Class: RA2/R2

TS333&4

PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.1

Sign Ref: TS335&6

Scale 1:5

Dimensions (mm & m²):

Width: 679, Height: 600, Area: 0.24

Width: 436, Height: 188, Area: 0.08

x-Height: 50 Total area: 0.32 m²

Colours:

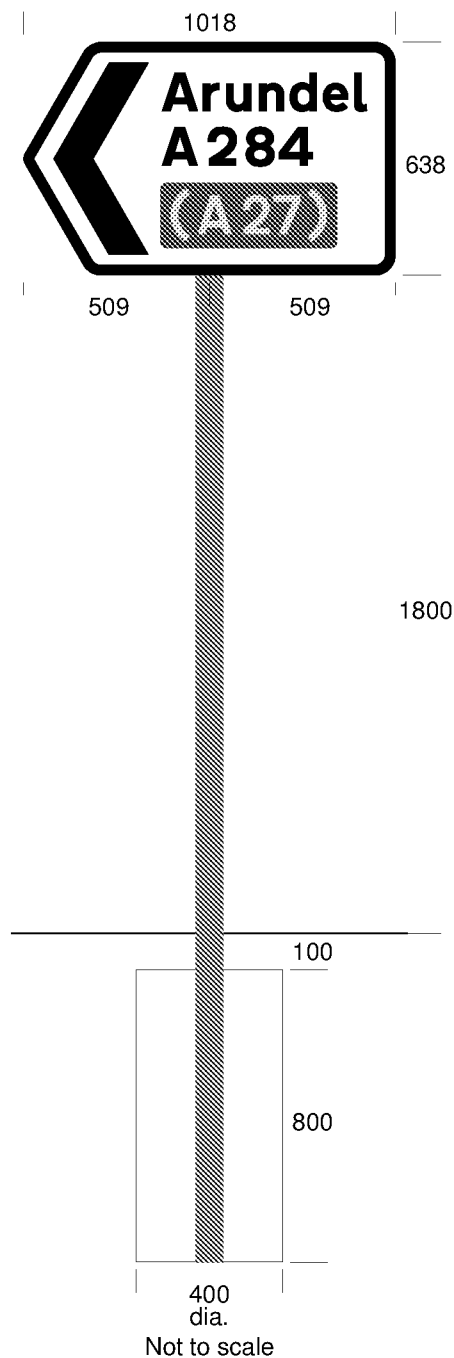
☐ black on white

Material: BS EN 12899-1:2007

Class: RA2/R2

TS335
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS337

Scale 1:7

Dimensions (mm):

Width: 1018, Height: 638

x-Height: 75 Area: 0.65 m²

Colours:

1 black on white

2 yellow on dark green

Mounting height: 1.8m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 5mm thick

Support length: 3338 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

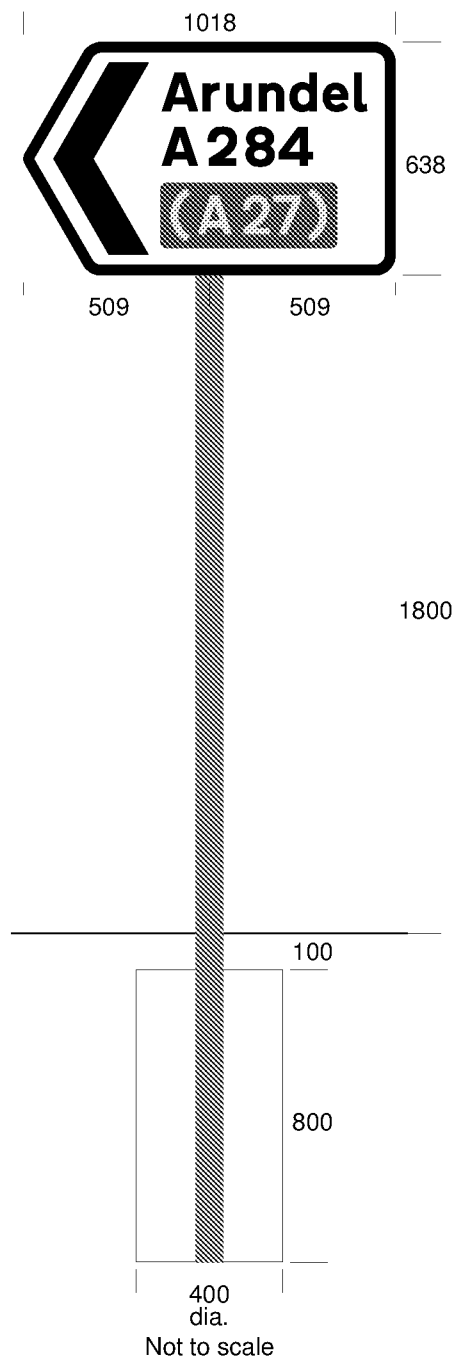
Height of footing: 800 mm

Diameter of footing: 400 mm

Passively safe to BS EN 12767:2007

TS337
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS337

Scale 1:7

Dimensions (mm):

Width: 1018, Height: 638

x-Height: 75 Area: 0.65 m²

Colours:

black on white

yellow on dark green

Mounting height: 1.8m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 5mm thick

Support length: 3338 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

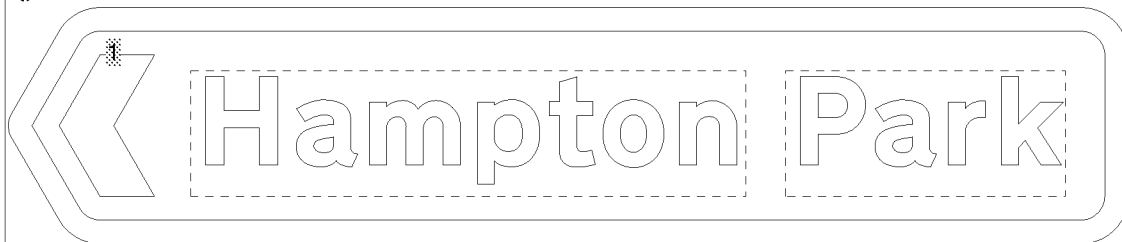
Diameter of footing: 400 mm

Only post and foundation to be installed. Sign to be installed by WSCC at a later date.

Passively safe to BS EN 12767:2007

TS337
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS401

Scale 1:9

Dimensions (mm):

Width: 1333, Height: 281

x-Height: 75 Area: 0.37 m²

Colours:

black on white

Mounting height: 2.212m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

2 no. Steel circular section S275:

76.1mm O.D. 4mm thick

Support length: 3393 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

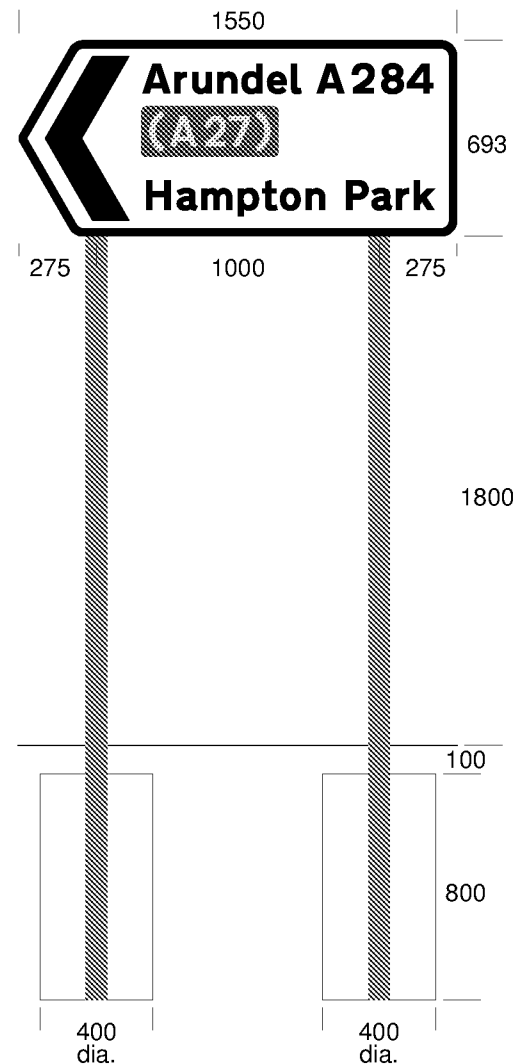
Depth of soft fill: 100 mm

Height of footing: 800 mm

Diameter of each footing: 400 mm

TS401
PHLYM

SignPlot v3.50



Not to scale

Job Ref: A/PHLYM.2**Sign Ref: TS401F**

Scale 1:11

Dimensions (mm):

Width: 1550, Height: 693

x-Height: 75 Area: 1.07 m²

Colours:

 black on white

 yellow on dark green

Mounting height: 1.8m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

2 no. Steel circular section S275:

76.1mm O.D. 4mm thick

Support length: 3393 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

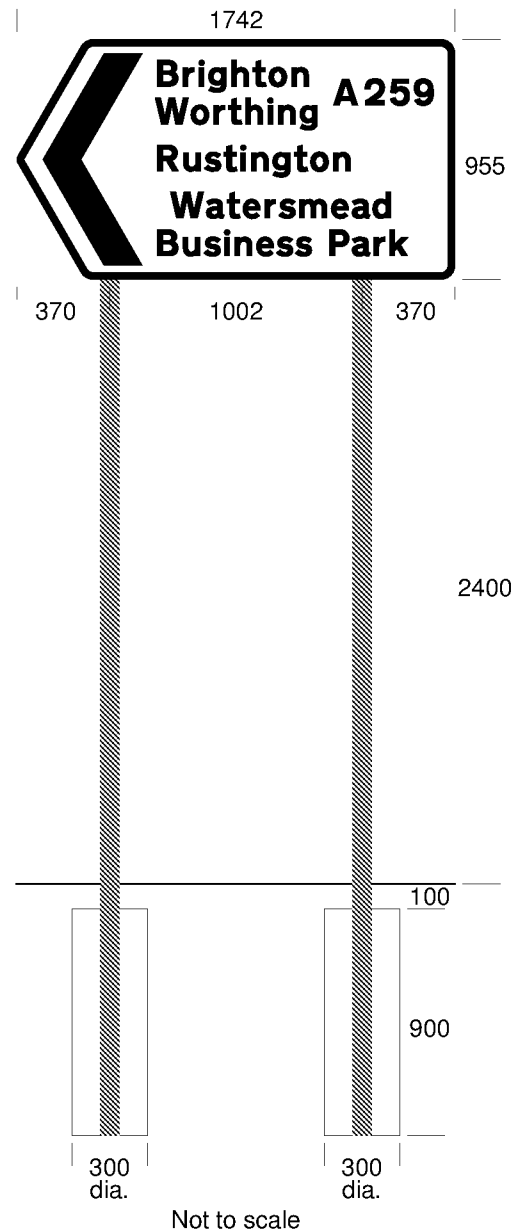
Height of footing: 800 mm

Diameter of each footing: 400 mm

Future sign to be implemented by WSCC
with Northern section of bypass is
constructed

TS401F
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS402

Scale 1:12

Dimensions (mm):

Width: 1742, Height: 955

x-Height: 75 Area: 1.66 m²

Colours:

black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL5, TDB5, PL3, PAF1

1000 N/m²

Structure Details:

2 no. Steel circular section S275:

76.1 mm O.D. 5mm thick

Support length: 4355 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 900 mm

Diameter of each footing: 300 mm

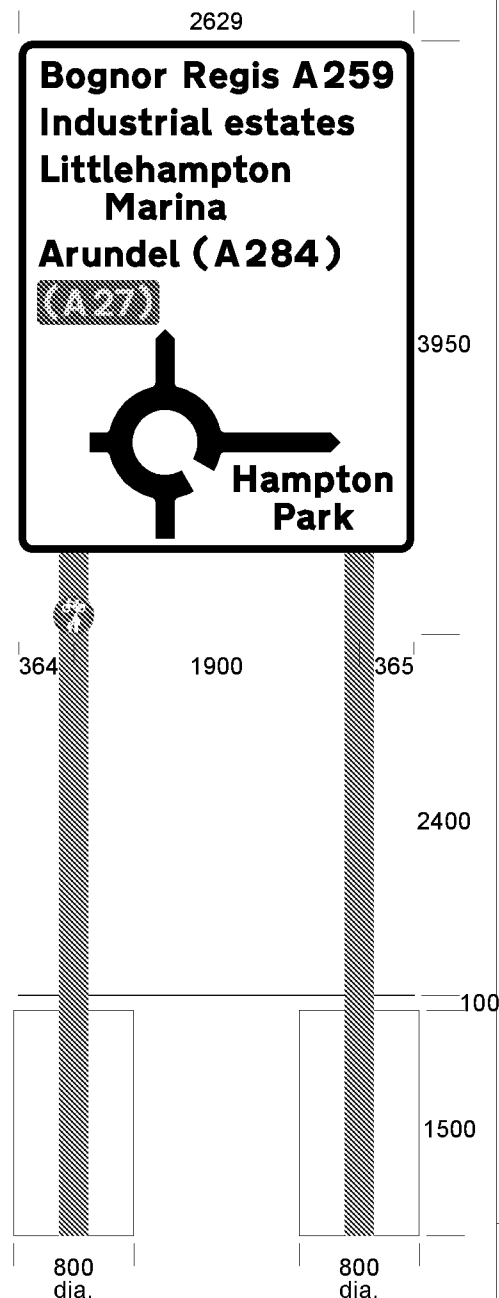
TS402
PHLYM

SignPlot v3.50

Bognor Regis A259
Industrial estates
Littlehampton
Marina

Arundel (A284)

(A27)



Job Ref: A/PHLYM.2

Sign Ref: TS403 & 417

Scale 1:20

Dimensions (mm & m²):

Width: 2629, Height: 3406, Area: 8.95

Width: 270, Height: 270, Area: 0.06

x-Height: 125 Total area: 9.01 m²

Colours:

black on white

yellow on dark green

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

Structure Details:

2 no. Steel circular section S275:

193.7mm O.D. 8mm thick

Support length: 7950 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

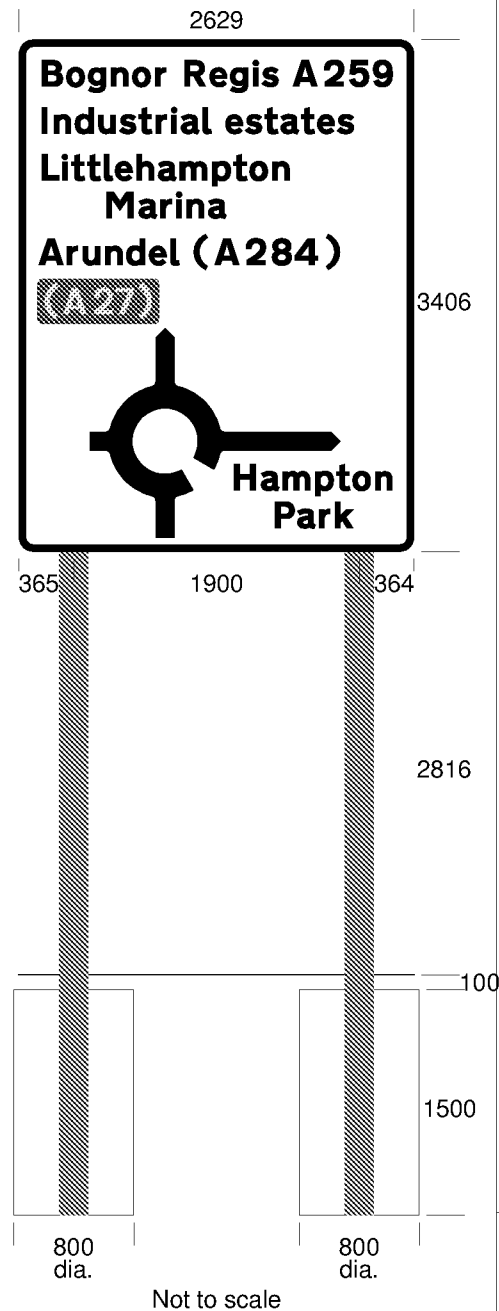
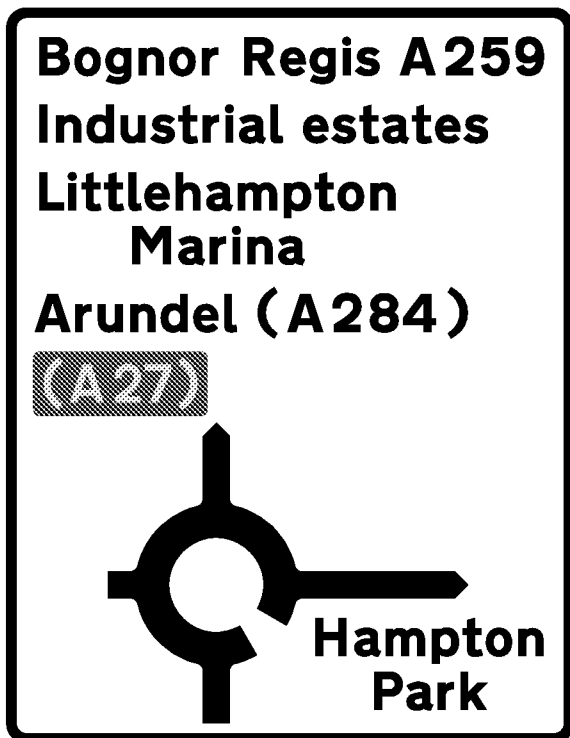
Depth of soft fill: 100 mm

Height of footing: 1500 mm

Diameter of each footing: 800 mm

TS403-17
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS403

Scale 1:35

Dimensions (mm):

Width: 2629, Height: 3406

x-Height: 125 Area: 8.95 m²

Colours:

1 black on white

2 yellow on dark green

Mounting height: 2.816m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL6, TDB4, PL3, PAF1

1200 N/m²

Structure Details:

2 no. Steel circular section S275:

193.7mm O.D. 8mm thick

Support length: 7822 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

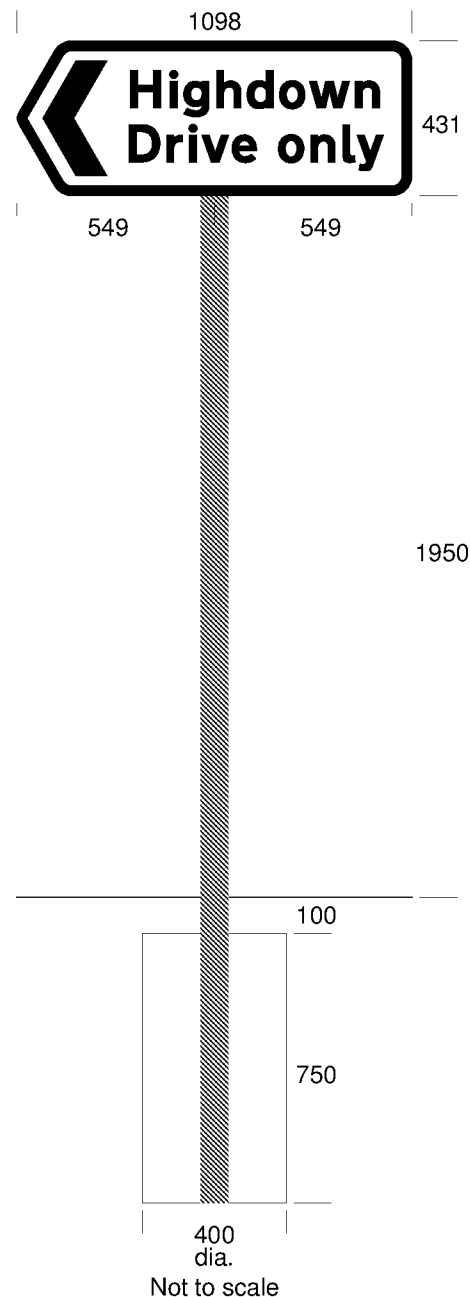
Height of footing: 1500 mm

Diameter of each footing: 800 mm

TS403
PHLYM

SignPlot v3.50





Job Ref: A/PHLYM.2

Sign Ref: TS404

Scale 1:8

Dimensions (mm):

Width: 1098, Height: 431

x-Height: 75 Area: 0.47 m²

Colours:

■ black on white

Mounting height: 1.95m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 4mm thick

Support length: 3231 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

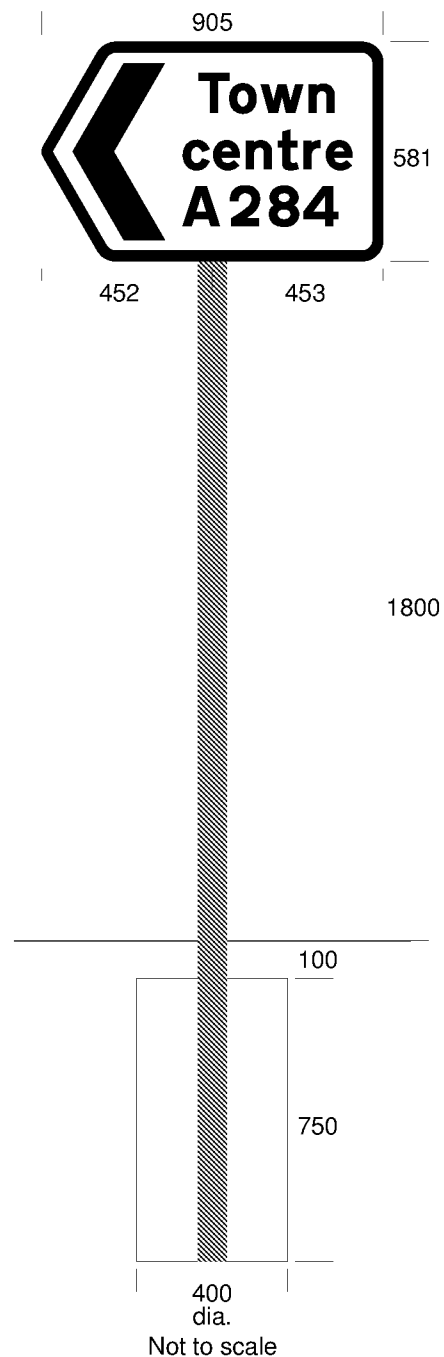
Height of footing: 750 mm

Diameter of footing: 400 mm

Passively safe to BS EN 12767:2007

TS404
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS404F

Scale 1:7

Dimensions (mm):

Width: 905, Height: 581

x-Height: 75 Area: 0.53 m²

Colours:

☐ black on white

Mounting height: 1.8m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 4mm thick

Support length: 3231 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 750 mm

Diameter of footing: 400 mm

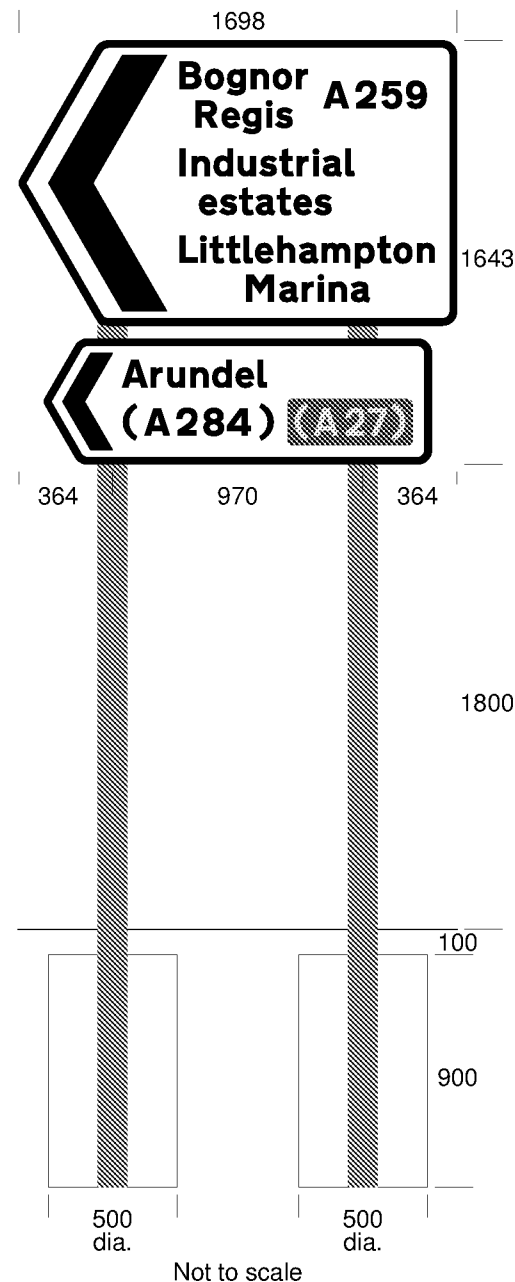
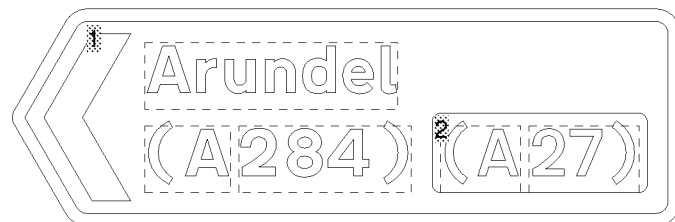
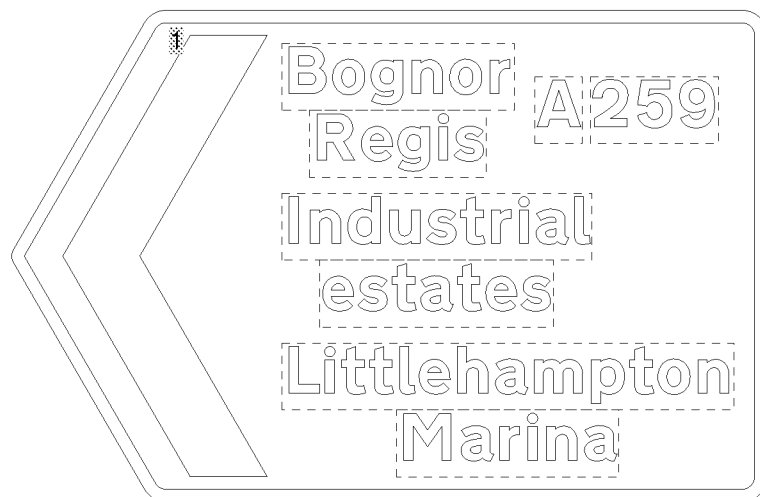
Future sign to be implemented by WSCC
when Northern section of bypass is
constructed

Passively safe to BS EN 12767:2007

TS404F

PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS405A&B

Scale 1:17

Dimensions (mm & m²):

Width: 1698, Height: 1105, Area: 1.88

Width: 1503, Height: 488, Area: 0.73

x-Height: 75 Total area: 2.61 m²

Colours:

1 black on white

2 yellow on dark green

Mounting height: 1.8m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL6, TDB4, PL3, PAF1

1200 N/m²

Structure Details:

2 no. Steel circular section S275:

114.3mm O.D. 3.2mm thick

Support length: 4443 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

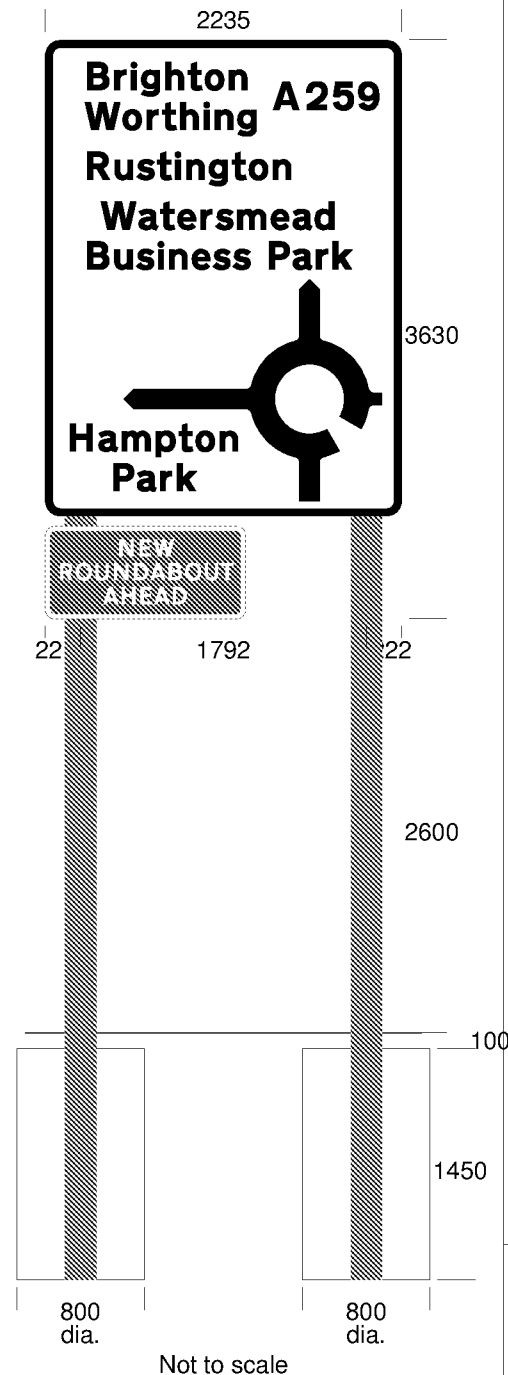
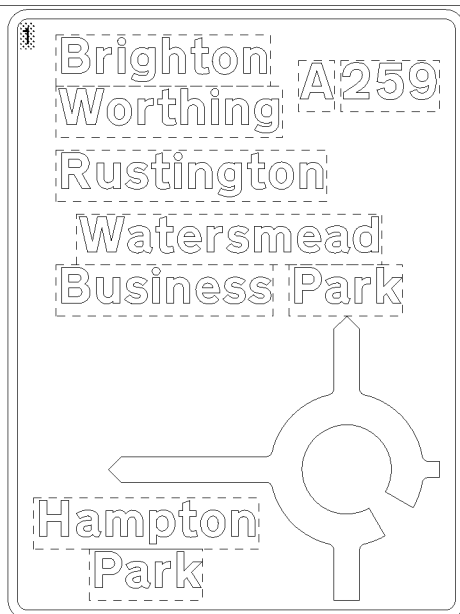
Depth of soft fill: 100 mm

Height of footing: 900 mm

Diameter of each footing: 500 mm

TS405
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2
Sign Ref: TS406 & TMP01

Scale 1:37

Dimensions (mm & m²):

Width: 2235, Height: 2985, Area: 6.67

Width: 1256, Height: 581, Area: 0.73

x-Heights: 125, 75 Total area: 7.40 m²

Colours:

1 black on white

2 white on red

Mounting height: 2.6m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL6, TDB4, PL3, PAF1

1200 N/m²

Structure Details:

2 no. Steel circular section S275:

193.7mm O.D. 8mm thick

Support length: 7780 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 1450 mm

Diameter of each footing: 800 mm

TS406-TM
PHLYM

SignPlot v3.50

**Brighton
Worthing A 259**

Rustington

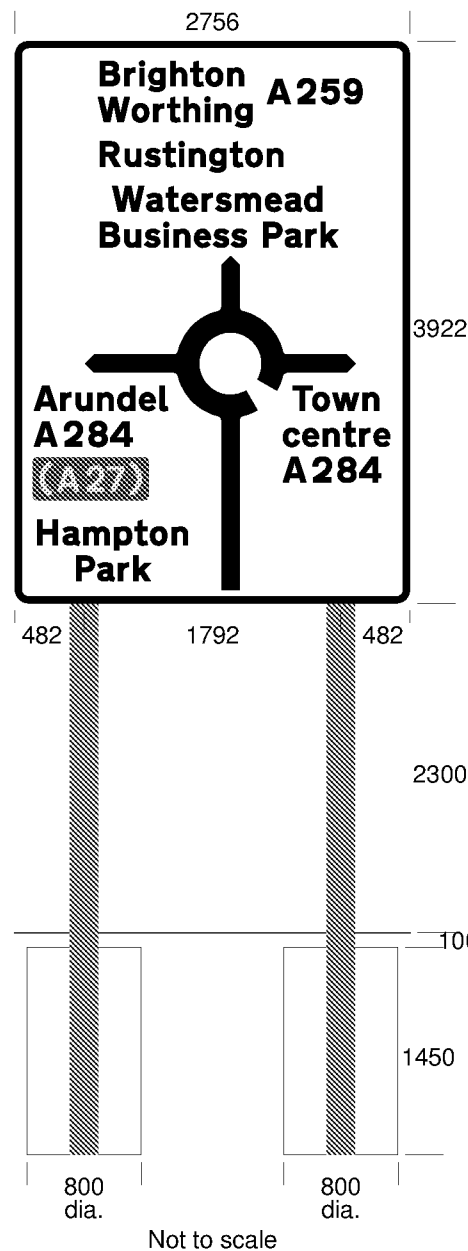
**Watersmead
Business Park**

**Arundel
A 284**

(A 27)

**Hampton
Park**

**Town
centre
A 284**



Job Ref: A/PHLYM.2

Sign Ref: TS406F

Scale 1:20

Dimensions (mm):

Width: 2756, Height: 3922

x-Height: 125 Area: 10.81 m²

Colours:

black on white

yellow on dark green

Mounting height: 2.3m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL6, TDB4, PL3, PAF1

1200 N/m²

Structure Details:

2 no. Steel circular section S275:

193.7mm O.D. 8mm thick

Support length: 7772 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 1450 mm

Diameter of each footing: 800 mm

Future sign to be implemented by WSCC
when Northern section of bypass is
constructed

TS406F
PHLYM

SignPlot v3.50





Job Ref: A/PHLYM.2
Sign Ref: TS415-418, 421-428

Scale 1:2

Dimensions (mm):

Width: 270, Height: 270

Area: 0.06 m²

Colours:

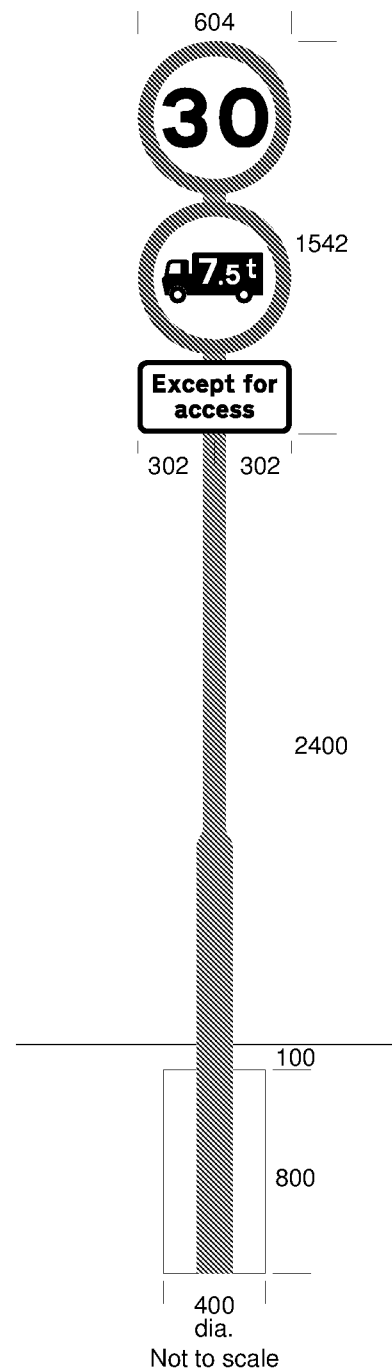
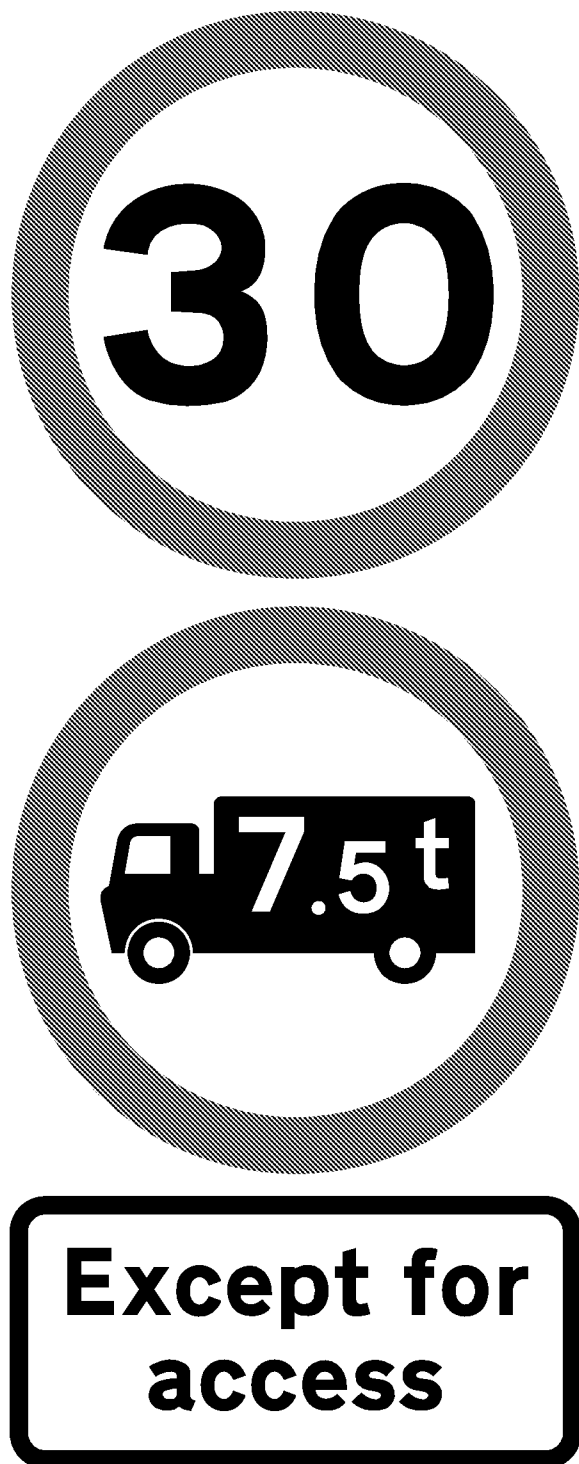
Material: BS EN 12899-1:2007

Class: RA2/R2

Signs TS415 - 418, 421 - 428 mounted
on proposed lighting columns

TS415
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2
Sign Ref: TS433, 434 & 435

Scale 1:8

Dimensions (mm & m²):

Width: 600, Height: 600, Area: 0.28

Width: 600, Height: 600, Area: 0.28

Width: 604, Height: 288, Area: 0.17

x-Height: 50 Total area: 0.74 m²

Colours:

☐ black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

Structure Details:

1 no. SPS wide base post:

139.7x3.6 & 88.9x3.0

Support length: 4842 mm

Planted foundation to BD 94/07:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

Diameter of footing: 400 mm

TS433&4
 PHLYM

SignPlot v3.45



Job Ref: A/PHLYM.2

Sign Ref: TS436

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

Colours:

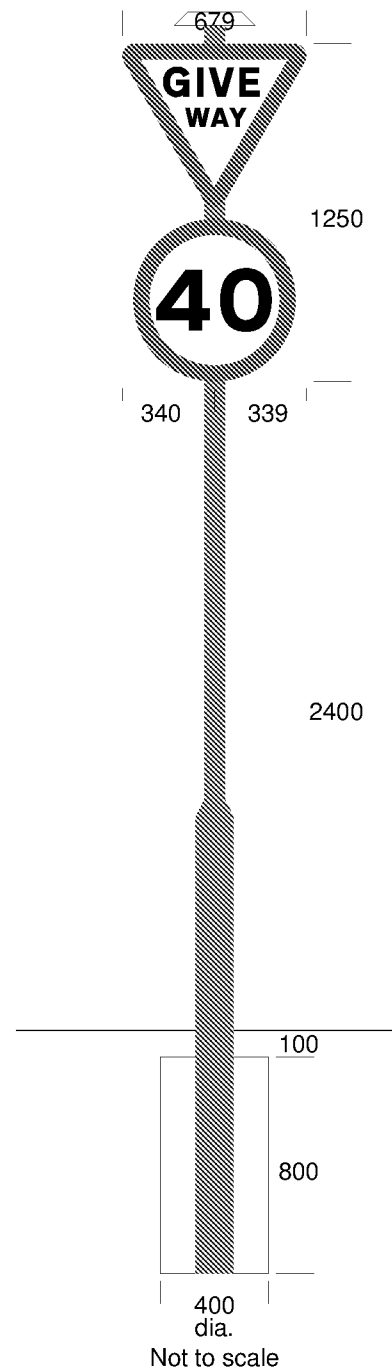
Material: BS EN 12899-1:2007

Class: RA2/R2

Sign to be mounted on
reverse of TS433

TS436
PHLYM

SignPlot v3.45



Job Ref: A/PHLYM.2
Sign Ref: TS437 & 439

Scale 1:7

Dimensions (mm & m²):

Width: 679, Height: 600, Area: 0.24

Width: 600, Height: 600, Area: 0.28

x-Height: (100) Total area: 0.52 m²

Colours:

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL6, TDB4, PL3, PAF1

1200 N/m²

Structure Details:

1 no. SPS wide base post:

139.7x3.6 & 76.1x3.0

Support length: 4650 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

Diameter of footing: 400 mm

TS437
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TS438

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

Colours:

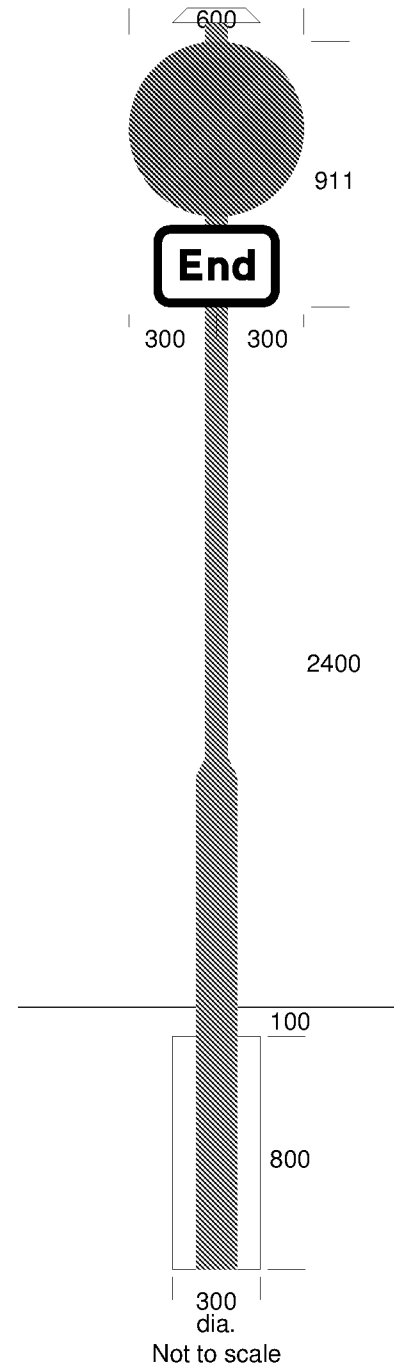
Material: BS EN 12899-1:2007

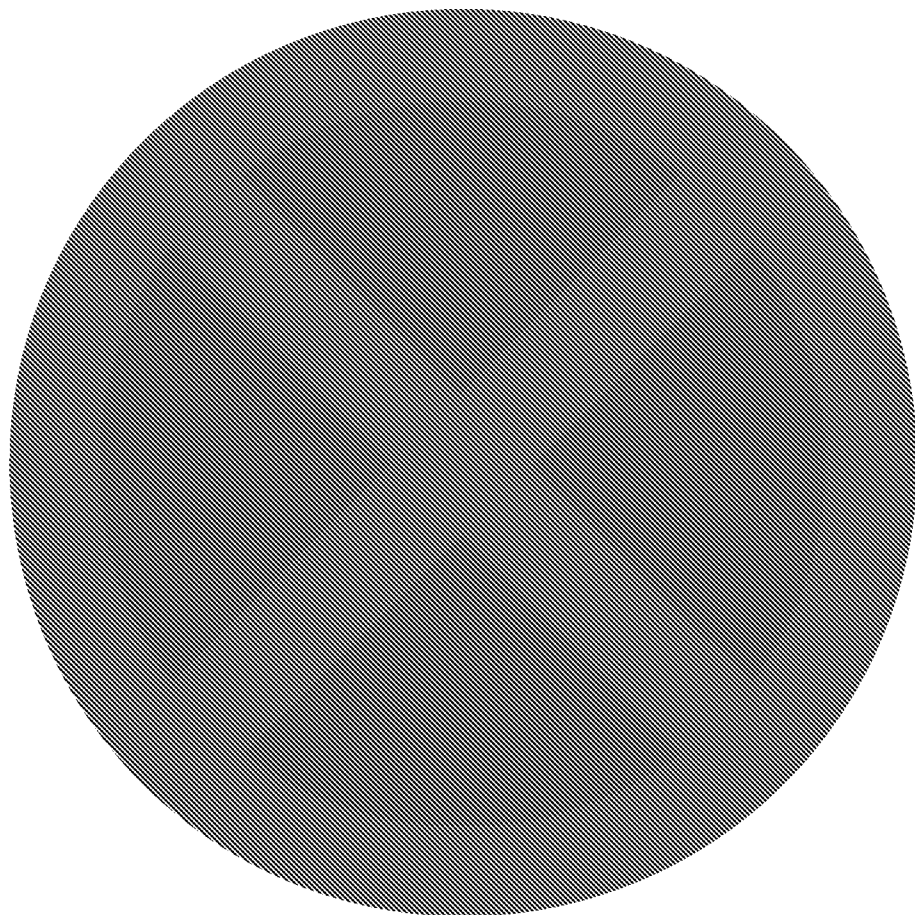
Class: RA2/R2

Sign mounted on the reverse of TS433
and above TS436

TS438
PHLYM

SignPlot v3.50





Job Ref: A/PHLYM.2

Sign Ref: VARIOUS

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

Colours:

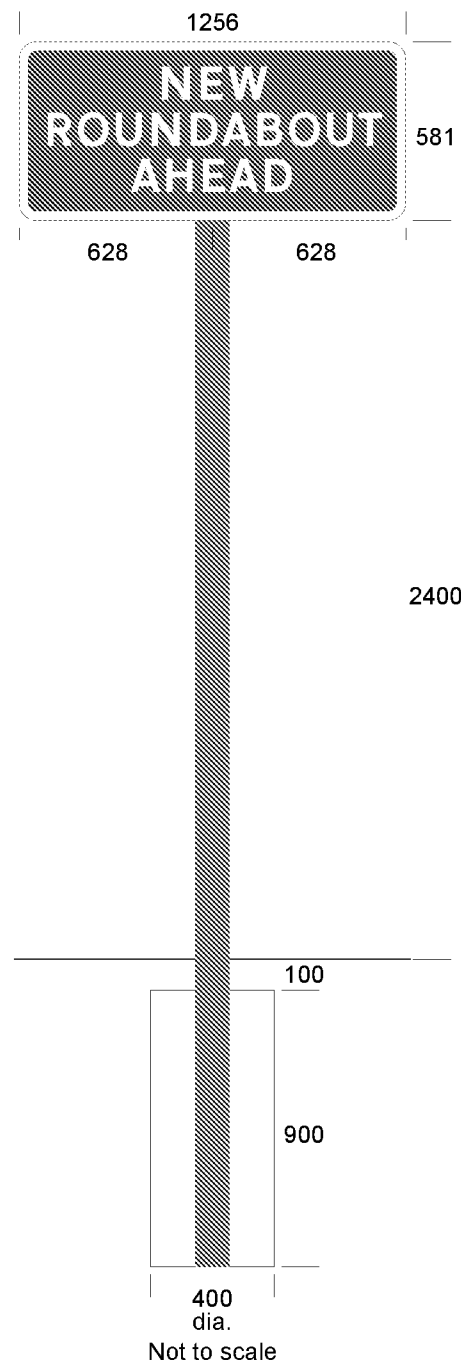
Material: BS EN 12899-1:2007

Class: RA2/R2

Signs TS446, 449, 450 & 453

TS446
PHLYM

SignPlot v3.50

**Job Ref: A/PHLYM.2****Sign Ref: TMP02**

Scale 1:9

Dimensions (mm):

Width: 1256, Height: 581

x-Height: 75 Area: 0.73 m²

Colours:

white on red

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: R3B (microprismatic)

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Jerol passively safe post:

Jerol 114

Support length: 3981 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

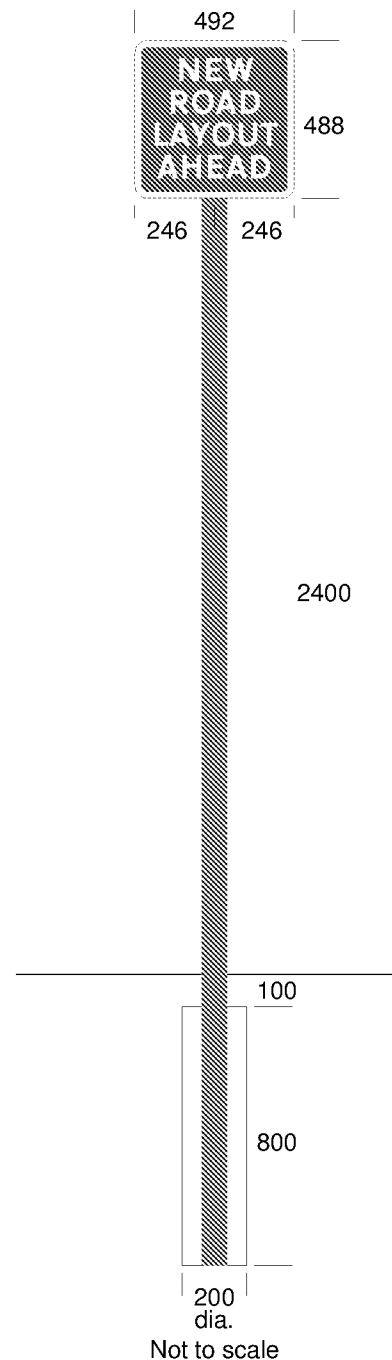
Depth of soft fill: 100 mm

Height of footing: 900 mm

Diameter of footing: 400 mm

Passively safe to BS EN 12767:2007TMP02
PHLYM

SignPlot v3.50



Job Ref: A/PHLYM.2

Sign Ref: TMP03

Scale 1:4

Dimensions (mm):

Width: 492, Height: 488

x-Height: 50 Area: 0.24 m²

Colours:

white on red

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: R3B (microprismatic)

BS EN 12899-1:2007 classes:

WL9, TDB5, PL3, PAF1

1600 N/m²

Structure Details:

1 no. Steel circular section S235:

76.1mm O.D. 3mm thick

Support length: 3788 mm

Planted foundation to BD 94/07:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

Diameter of footing: 200 mm

Passively safe to BS EN 12767:2007

TMP03

PHLYM

SignPlot v3.45

SCHEDULE C - WSCC Traffic Signal Design and Installation Standards (Rev P4, 16/11/18)

West Sussex County Council Highways and Transport

Traffic Signal Installation Standards

July 2017

Issue 4

	Prepared by	Checked by	Date
Original issue 1	J Greenough	S Found	January 2004
Issue 2	B Edmunds	S Found	July 2012
Issue 3	M Wylie	B Edmunds	January 2016
Issue 4	A Norris	B Edmunds	July 2017

Requirements for Installation of Permanent Traffic Signal Equipment in West Sussex

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Appendix A - Cable Specification

Annex A – Test Certificate for Cabling, Earthing and Insulation Test Certificate

Annex B – Specification for Cable and Cable Core Identification

Annex C – Test Certificates

Annex D – Standard detail drawings

1. Introduction

- 1.1 The aim of this document is to provide a guide to enable promoters of schemes to prepare signal installations which address the specific requirements of West Sussex County Council.
- 1.2 Although this document is not in the form of an “ APPENDIX 12/5:TRAFFIC SIGNS : TRAFFIC SIGNALS AND ASSOCIATED EQUIPMENT” scheme promoters should ensure that items covered within this document are replicated within any Appendix 12/5 that they produce for work on Traffic signals in West Sussex.
- 1.3 Traffic signals for both vehicle and pedestrians control, in West Sussex are required to meet a number of standards in both function and installation. As a result this guide should be read with reference to West Sussex County Councils standard detail drawings. The most relevant of which are contained within the appendix of this document.
- 1.4 The National Code of Practice TA 84/06 (formally MCH 1869A) shall apply throughout the design and installation cycle. In addition, the “Guide to Good Practice” shall be used as a reference (when published by EITAC).
- 1.5 All designs and installations shall be subject to Safety Audit in accordance with the latest WSCC Safety Audit Policy. This shall include the completed Signal Controller Specification (TR2500 forms). The completed and Audited specification shall be signed and dated by the Engineer who carries out the Audit. The Original of all Audits shall be retained in the WSCC Traffic Signal section site file.
- 1.6 In Addition, where appropriate, modelling data from Linsig version 2 or higher shall be submitted in electronic format (.lsg files), to demonstrate the proposed signal arrangements can operate satisfactorily. This must include sufficient information to allow the design to be audited, and any assumptions used in the design, for example a pedestrian phase appearing once every other cycle, shall be fully documented and justified.
- 1.7 The installation of traffic signal equipment shall only be undertaken by a Contractor certificated to BS EN ISO 9000 : 2000 or equivalent , and in line with the current edition of the IEE wiring Regulations for electrical installations
- 1.8 The Works contained in this appendix shall refer to the installation of traffic signals, Pelican crossings, Puffin crossings, Toucan crossings, Equestrian Crossings and cycle facilities.
- 1.9 Installers shall at all times conform to Health and Safety at Work Acts, the Electricity at Work Regulations, the Construction Design & Maintenance Regulations and all other relevant legislation. Installers shall also ensure that installation procedures conform with all relevant DfT advice notes and directives, especially signing and guarding shall conform to Chapter 8 of the Traffic Signs Manual.
- 1.10 All systems should be designed to minimise energy consumption and utilise ELV controllers and associated equipment. Where this is not possible written approval from WSCC Traffic Signals must be obtained.
- 1.11 Any deficiencies found in the design or in the operation of the equipment shall remain the responsibility of the promoter of the scheme for a period of 1 year from the date of the take-over of the site following a successful site commissioning or for a year following the date that the associated development is opened and the initial impact of the full traffic and pedestrian flows are realised, whichever is the later. It is therefore the responsibility of the promoter to ensure that all data regardless of source is correct, and that the consequence of any imposed conditions are well documented and acknowledged.

2. Standards, specifications and regulations

2.1 All works shall be undertaken in accordance with the following:

- (a) EN 12368:2006
- (b) IEE Regulations for Electrical Installations (current edition) BS 7671 : 2015
- (c) Current Department of the Environment, Transport and the Regions (DfT) Specifications relating to traffic signals and associated equipment
- (d) Highways Agency Manual of Contract Documents for Highways Work Volume 1 Specification for Highways Works Series 1400. 'Electrical Work for Road Lighting and Traffic Signs'.
- (e) Current DfT Standards relating to traffic signals and associated equipment
- (f) Current DfT Advice Notes relating to traffic signals and associated equipment
- (g) The Traffic Signs Regulations and General Directions 2 or later
- (h) The Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997
- (i) DfT Local Transport Note 1/98 The Installation of Traffic Signals and Associated Equipment
- (j) DfT Specification TR2500
- (k) The Traffic Signs Manual
- (l) The Health and Safety at Work Act, 1974
- (m) Electricity at Work Regulations 1989
- (n) Code of Practice for Traffic Control and Information Systems TA 84/06
- (o) MCH 1815 A System Certification
- (p) New Roads and Street Works Act (NRSWA) 1991
- (q) Construction (Design Management) Regulations 2015
- (r) Highways Act 1980
- (s) Road Traffic Regulations Act 1984

3. Equipment

3.1 General

- 3.1.1 The Works shall be monitored using the Urban Traffic Control system or Remote Monitoring system as specified by WSCC. The monitoring equipment shall be supplied and installed by the WSCC traffic signal term maintenance provider and the costs for this shall be covered by the scheme contractor, unless prior written agreement is obtained from West Sussex Traffic Signals Section. All other equipment shall be supplied by the Contractor.
- 3.1.2 The Contractor is to store, deliver to the Site at a time specified, install, test and commission the equipment associated with the Works unless otherwise agreed by West Sussex Traffic Signals Section.
- 3.1.3 All street furniture must comply with the appropriate TOPAS specification number and in accordance with the latest standards. If it is proposed to use street furniture without approval, the supplier shall state the level of approval and what, if any conditions or limitations have been imposed on use or operation. Except with the prior written permission of WSCC traffic signals engineer the street furniture shall be supplied by the WSCC traffic signal term maintenance contractor.
- 3.1.4 Signals installed on roads with a speed limit of 50mph plus shall use passively safe low access poles with a quick disconnect system.
- 3.1.5 Any equipment not to WSCC Traffic Signals Engineers approval identified up to the signing and acceptance of final Site Acceptance Certificates shall be replaced by the Contractor at their own expense.
- 3.1.6 With the exception of LED aspects all equipment, materials and workmanship shall be covered by a 12 month warranty by the Contractor which shall take effect from the date of the Site Acceptance Certificate. During this time the Contractor shall be responsible for rectifying any failure of equipment, materials or workmanship, with the exception of lamp failures. At the Engineer's discretion, the Contractor shall at his own expense attend the site within 48 hours of notification and rectify the fault or replace / repair the faulty equipment and return it within 1 week.
- 3.1.7 All LED aspects shall be covered by a 6 year warranty by the contractor which shall take effect from the date of the Site Acceptance Certificate. During this time the Contractor shall be responsible for rectifying any failure. At the WSCC Traffic Signals Engineer's discretion, the Contractor shall at his own expense attend the site within 48 hours of notification and rectify the fault or replace / repair the faulty equipment and return it within 1 week.
- 3.1.8 All street furniture shall be set out at the positions shown on the drawings which shall be approved in advance by WSCC Traffic Signals Engineer and in accordance with the Engineer's siting instructions. An Engineer from West Sussex Traffic Signals section shall confirm the position of all traffic signal street furniture and detection on site matches the drawing before the equipment is installed. Where engineering difficulties necessitate alternative positions the Contractor shall inform the WSCC Traffic Signals Engineer and gain their consent prior to installing the furniture and provide amended drawings to show all new positions.
- 3.1.9 Unless otherwise specified, the installation of ducts, drawpits, controller base, pole retention sockets and the feeder pillar will be undertaken by the main civil engineering Contractor for the Works.
- 3.1.10 Signal dimming, will be required and is to operate from a Photocell. The photocell shall be located as shown on the drawing or in a position furthest away from overhead lighting units.

3.2 Controller and Controller Functions

- 3.2.1 Except with the prior written permission of WSCC traffic signals engineer the controller shall be supplied by the WSCC Traffic Signal term maintenance contractor.
- 3.2.2 If the controller type supplied is new to WSCC then a full set of documentation and facilities offered for the training of Engineers from WSCC and their Maintenance Contractors shall be supplied free of charge.
- 3.2.3 If the controller type supplied has less than 5 units in WSCC then a full set of spares will be supplied.
- 3.2.4 The operation of traffic signal installations shall be in accordance with TR2500 - General Specification Form
- 3.2.5 The Controller shall be fitted as a minimum with a 20 amp double pole switch fuse.
- 3.2.6 The controller shall be constructed on a foundation all in accordance with the manufacturers/suppliers recommendations. Excepting where the 'root' is an integral part of the controller cabinet, the controller base shall be levelled by the Civils contractor and stable prior to installation of the controller cabinet.
- 3.2.7 The controller base shall be sealed immediately after installation is completed and accepted. The installer shall accept responsibility for damage caused by failure to seal the equipment properly.
- 3.2.8 The Contractor shall provide up to 2 EPROM reconfigurations at the Engineer's request within 12 months of the issuing of the final Site Acceptance Certificate. The reconfigurations shall not result from a non-compliance at the Factory Release Test nor subsequently from the equipment failure
- 3.2.9 Controllers are to be installed so that the DFM lamp may be readily seen from the carriageway and such that all normal maintenance and checking can be readily carried out without encroachment on the carriageway by equipment or personnel and with minimum obstruction to pedestrians.
- 3.2.10 Controllers mounted on a root based plinth shall be sealed at base level and controllers mounted on a post shall be sealed just below the post access door. Following the termination of all signal cables the Contractor shall backfill the controller void with dry compacted sand. This shall be sealed by a 6mm thick epoxy resin to form a water and airtight seal.
- 3.2.11 Where a controller cabinet base seal has been broken for removal or installation of cables the fine dry sand backfill shall be reinstated and an epoxy resin base seal repair shall be made.
- 3.2.12 The Contractor shall ensure that a separate 50mm diameter duct for a telemetry connection has been provided before sealing the base. The duct shall link between the main controller pit and shall terminate above the final base seal level within the controller. The duct entry shall be sealed to prevent the ingress of moisture but the seal shall be removable to allow telemetry equipment to be installed subsequently.
- 3.2.13 The controller to be supplied shall meet the appropriate TOPAS specification, TR2500 and all relevant appendices for traffic signal junctions, Pelican crossings, Puffin crossings, Toucan crossings and cycle facilities.
- 3.2.14 The controller shall include a Master Time Clock System (MTCS) to permit the use of alternative maximum timings, fixed time plans, etc.
- 3.2.15 The controller shall have a back up power supply for all detector commands, timing details and MTCS.

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- 3.2.16 Manual push buttons shall be labelled to indicate the stage number/letter using the facility panels standard lettering.
 - 3.2.17 Where practical a scheme drawing shall be laminated and attached to the inside door of the controller.
 - 3.2.18 Where practical the MOVA link diagram shall be laminated and attached to the inside door of the controller
 - 3.2.19 A staging diagram should be provided on the inside of the manual panel door, with clearly labelled stages and phases, by means of silk-screening or adhesive label.
 - 3.2.20 The controller shall include a 3U equipment rack(s) with sufficient void space to accommodate an Outstation Monitoring Unit, Outstation Transmission Unit and/or a camera surveillance unit as specified in the WSCC specification. The minimum void space within the 3U equipment rack shall be 300mm wide by 300mm deep for each module stated above. The Contractor should satisfy himself that the controller contains adequate void space within the rack to accommodate the stated modules prior to tendering. Subsequent failure to meet this requirement shall result in the Contractor replacing the controller cabinet, and internal hardware, as necessary, and undertaking all remedial works at his own expense.
 - 3.2.21 Two 13 amp 3 pin electricity sockets to BS 1363 shall be provided inside the controller cabinet, protected by a residual current device of maximum rating 30mA residual current. The sockets shall be marked for maintenance use only and be connected via a dual lockable isolator switch to the controller mains.
 - 3.2.22 Provision shall be available within the controller to supply two devices via a separately fused auxiliary supply.
 - 3.2.23 On sites where bus priority is to be installed (ACIS) a separate power supply controlled via a dedicated RCD is required
 - 3.2.24 Sufficient terminals and termination points are required at the controller to accommodate all Neutral and Earth connections.
 - 3.2.25 Two complete sets of keys to all parts of the apparatus, including 'T' bars, as required, shall be provided at the time of commissioning.
 - 3.2.26 The controller access door(s) shall be fitted with a door stay.
 - 3.2.27 A suitable fixed facility to store controller documentation & drawings shall be provided within the cabinet, where this is not a welded plate on the inside of the door approval should be sought for it from WSCC.
 - 3.2.28 The Controller cabinet shall have front and rear opening doors or a swing frame in order to provide access to the rear of the equipment.
 - 3.2.29 The controller shall include a location at which to securely fix a telemetry termination unit.

3.3 Signal Heads General

- 3.3.1 The lowest part of any signal head assembly including brackets shall have a minimum clearance above the finished ground level of 2.1 metres.
- 3.3.2 All entry points into signal heads for cables shall have a secure and permanent watertight seal.

- 3.3.3 Backing boards shall be securely attached to all vehicular signal heads. The composite head including any additional signs shall be bordered on the front by a high intensity white retroreflective tape between 45mm and 55mm wide.
- 3.3.4 There shall be a minimum clearance of 450mm between the edge of the signal head and the edge of the carriageway. Where the minimum clearance cannot be achieved the Contractor shall notify WSCC Traffic Signals immediately.
- 3.3.5 Puffin/Toucan/Equestrian crossings, unless otherwise shown on the design, all vehicle signal head cowls shall be Primary, to maximise the angle of view of the optics.
- 3.3.6 The Contractor shall align all signal heads in accordance with the Contract drawing and as required by WSCC Traffic Signals Engineer at the site commissioning.
- 3.3.7 All vehicular signal aspects shall include cowls. The primary signal shall include cut away cowls and the secondary heads shall include full length cowls. In addition where specified the Contractor shall supply and install louvred cowls.
- 3.3.8 Adjustable horizontally louvred cowls designed to reduce the driver's visibility to the aspect shall only be used on the amber and green aspects of the primary or secondary signals. The angle of the slats shall be capable of being adjusted on site by the Contractor to the Engineer's requirements. The cowl shall be a minimum of 300mm long and include a minimum of 5 slats.
- 3.3.9 Fixed vertically louvred cowls designed to reduce the driver's visibility to the opposing secondary aspect shall be used on all the aspects of the secondary signals. The cowl shall be a minimum of 500mm long and include a minimum of 3 slats.
- 3.3.10 Where signal heads include additional filter or right turn arrow signals or box signs the configurations shall be as specified in the signal head schedule on the Contract drawing.
- 3.3.11 All signal aspects shall be monitored Central Light Source (CLS)-type extra low voltage (ELV) LED's with a minimum 6 year warranty, unless otherwise agreed and written approval obtained from WSCC Traffic Signals Engineer. (ELV = 50 Volts maximum)
- 3.3.12 The Contractor shall be responsible for installing LED vehicular signal heads on overhead mast arms and tall signal poles (exceeding 4 metres length) including the hiring of lifting equipment and traffic management.
- 3.3.13 Where two signal heads (twin) are positioned adjacent to each other on the same signal pole the Contractor shall ensure the structural stability of signal pole and provide a base plate where necessary.

3.4 Pedestrian Far Side Signal Heads

- 3.4.1 The lowest part of any pedestrian signal head assembly including brackets shall have a minimum clearance of 2.1 metres above the finished ground level.
- 3.4.2 All entry points into pedestrian signal heads for cables shall have a secure and watertight seal.
- 3.4.3 All pedestrian far sided signals shall be fitted with hoods and where required louvres to restrict see through at crossings.
- 3.4.4 All far sided signal heads shall be monitored CLS-type ELV LED's with a minimum 6 year warranty, unless otherwise agreed and written approval obtained from WSCC Traffic Signals Engineer

3.5 Pedestrian Near Side Signal Heads

- 3.5.1 Near side pedestrian aspects and combined units shall meet the appropriate TOPAS specification and shall comply with the Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997 Schedule 3 Part I.
- 3.5.2 To reduce the risk of 'see through', narrow field of view display units to be installed as standard on dual crossings and signalised junctions. Deviation from this standard will need justification and written agreement from WSCC Traffic Signal Engineer.

3.6 Pedestrian Demand Units

- 3.6.1 Push button units shall include both an audible and tactile devices unless specified elsewhere in the Contract or if an audible device can not be fitted for safety reasons then just a tactile device need be supplied. The facility shall exist to inhibit the audible signal between 22:00 and 07:00 each day or at any other times as required by the Engineer.
- 3.6.2 Pedestrian push button units shall be positioned in accordance with the orientation shown on the Contract drawing.
- 3.6.3 All entry points into pedestrian demand units for cables shall have a secure and watertight seal.
- 3.6.4 Push-button units shall not contain cables carrying mains or any other low voltage.
- 3.6.5 The centre of all pedestrian push button units shall be positioned between 1.0 and 1.1 metres above the finished ground level. The push button units shall be securely fixed to the signal pole so that no movement occurs.
- 3.6.6 Where tactile devices are to be installed in pedestrian push-button units as specified on the drawing they shall be of a type approved by the Engineer.

3.7 Signal Heads For Cyclists

- 3.7.1 The lowest part of any cycle signal head assembly including brackets shall have a minimum clearance of 2.4 metres above the finished ground level.
- 3.7.2 All entry points into cycle signal heads for cables shall have a secure and watertight seal.
- 3.7.3 All cycle signals shall be fitted with primary or secondary cowls and shall be fitted with anti-phantom screens and hoods.

3.8 Additional Signs

- 3.8.1 Internally illuminated 'box' signs shall be provided as specified on the drawing. The configuration shall be as specified on the drawing signal head schedule.
- 3.8.2 The lowest part of the signal head assembly including any additional signs and brackets shall have a minimum clearance of 2.1 metres above the finished ground level.
- 3.8.3 Regulatory signs on signal heads shall comply with BS 873: Part 5: 1983 "Specification for Internally Illuminated Signs and External Lighting Luminaires".
- 3.8.4 Regulatory signs on signal heads shall be individually fused within the head.
- 3.8.5 Green arrows and regulatory signs which are side mounted on signal heads shall be secured, after alignment, with stay bars.

- 3.8.6 There shall be a minimum lateral clearance of 500mm between the outer edge of all additional signs including backing board and the edge of the carriageway.
- 3.8.7 Backing boards shall be securely attached to all additional signs to form a composite signal head.

3.9 Traffic Signal Poles

- 3.9.1 All traffic signal poles shall be installed using the NAL pole retention system or a similar system that has WSCC approval that allows the pole to be removed following a knockdown. The pole retention system is to have at least two bolts to securely fix the pole in place, to reduce the risk of rotation. See Standard drawing in Annex D for installation.
- 3.9.2 All traffic signal poles that are not installed in a retention socket shall have a slot to provide cable entry access and shall be installed in a pole box.
- 3.9.3 All poles are to be set to ensure that the centre of the ambers are between 2.4 and 4.0 metres above finished ground level.
- 3.9.4 All traffic signal poles shall be galvanised prior to the application of a grey plastic coating unless otherwise specified by WSCC for specific locations. Poles shall not be supplied with pre drilled holes for push buttons. Holes shall be drilled on site as required and shall be treated with a suitable zinc rich paint or other suitable rust inhibiting paint as agreed by the Engineer.
- 3.9.5 Stub poles shall be of a one piece, welded top, construction and shall be galvanised prior to the application of a grey plastic coating.
- 3.9.6 Signal head extension brackets ('D' type) shall be galvanised prior to the application of a black final coating. Brackets shall only be used where specified (in position and length) on the relevant site drawings, or following approval of the WSCC traffic signals engineer.
- 3.9.7 Signal head mounting brackets ('L' type) shall be galvanised prior to the application of a black final coating. All brackets shall be long enough to provide sufficient rotational movement to allow correct alignment of heads, with a minimum movement of 120 degrees.
- 3.9.8 Responsibility for checking the vertical alignment of signal posts rests with the Contractor who shall also ensure that there is adequate stability before fitting signal heads. The Contractor shall notify the Engineer immediately if any signal poles fail to satisfy the aforementioned requirements.
- 3.9.9 Where necessary to achieve the correct location for the pedestrian push buttons and achieve not less than 500mm clearance to the side of the signal head/heads, formed swan neck signal poles shall be used, welded cranked type will not be accepted. Consideration to matching other poles for cosmetic reasons shall be made.
- 3.9.10 Location of poles in relationship to the tactile paving can be found on standard drawing in Annex D
- 3.9.11 All traffic signal poles must be of spigot low access design. An example of this can be supplied on request

3.10 Vehicle Detection

- 3.10.1 Unless otherwise specified all detector packs shall be housed within the controller cabinet.

- 3.10.2 Detection shall be supplied as 2 or 4 channel detection cards. System D, MOVA, UTC or speed loops are not to be mixed on the same detector card.
- 3.10.3 All new loop detector cards shall be of automatic self-tuning multi-channel microprocessor type and shall be fully type-approved and in accordance with the latest issue of MCE 01/08.
- 3.10.4 System D and Stopline detector loops are shown schematically on the relevant site drawings and shall be cut to the standard configuration shown on the attached drawing: "Standard Detail for the Configuration of Loop Detectors". The location of detector loops shall conform with the latest issue of MCE 108B "Siting of Inductive Loops for Vehicle Detecting Equipments at Permanent Road Traffic Signal Installations", incorporating all released amendments.
- 3.10.5 Special facility loops e.g. SCOOT, MOVA, Call/Cancel, presence or red light camera loops or where specific conditions require, shall be sited under the instruction of the WSCC traffic signals engineer. Where this is necessary, the position and size of loops shall be set out on site by the Engineer with the Contractor in attendance prior to slot cutting work commencing.
- 3.10.6 Where the use of Microwave Vehicle Detectors and infra-red detectors are specified these shall be Type Approved and shall comply with TR2505 "Above ground vehicle detector systems for use at permanent traffic signal installations". The use of the above ground detection shall be in accordance with the manufacturer's instructions. The alignment of all pedestrian above ground detection shall be set up as required by the Engineer at the site commissioning.
- 3.10.7 Subject to the prior approval of WSCC the use of suitable wireless linking equipment may be considered where there would be practical difficulties with the installation or maintenance of hard wired links or loops.
- 3.10.8 Subject to the prior approval of WSCC the use of a suitable camera detection system may be considered where there would be a cost benefit or there are practical difficulties with the installation or maintenance of the loops.

3.11 Pedestrian Detection

- 3.11.1 Kerbside and On Crossing detection of pedestrians are now standard on all WSCC sites. The type of detection shall be agreed with WSCC and supplied as per the relevant site drawing.
- 3.11.2 Requirements for test and configuration equipment for programmable devices shall again be agreed with WSCC and the appropriate number of test units supplied. Any relevant training shall be part of the training requirements.

4. Loop Detection Installation

- 4.1 All detector channels shall be labelled to indicate the detector name. The label shall be waterproof and marked adjacent to the detector channel.
- 4.2 Loop feeder cables shall be kept clear of main switch and maintenance sockets within the cabinet.
- 4.3 The standard dimension for the width of the loop slots shall be 10.0mm (+1mm/-0mm). The formula for the overall depth of the slots shall be $50+7n$ mm (+10mm/-0mm), where 'n' is the number of layers of cable in the slot. In general the depth shall allow for 50mm of cover above the uppermost cable in the slot.

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- 4.4 Where a surface comprises black top overlaying concrete, the installer shall ensure that all loops are laid within one material, subject to a minimum cover which may be discussed with WSCC traffic signals engineer.
- 4.5 Slot cuts between adjacent 'System D' loops (where required) shall be made along the centre line of single carriageways or the offside of dual carriageways (not along the gutter edge).
- 4.6 Detector loops are to be connected via individual pairs of feeder cables or where agreed with WSCC twin pairs.
- 4.7 No feeder cable shall be jointed unless it is to connect a detector loop.
- 4.8 All joints shall be made using a reusable joints system conforming to IP68 Cat 1 (BS EN60529) and in accordance with the manufacturer's instructions and recommendations.
- 4.9 Detector feeder cables shall be jointed to the detector loop within the specially provided connection chamber in the footway/verge. No additional joints between the detector loop and detector unit shall be permitted unless agreed with the Engineer prior to commencement of works. Individual cores shall be jointed by means of insulated crimp connectors using a ratchet type of crimping tool and staggered to avoid the possibility of any short circuits. The joint shall be waterproof and able to withstand a vigorous "pull-test" of approximately 3kg.
- 4.10 Loop tails shall be cut directly back to the under kerb ducting and cabled into the connection chamber. See standard drawing in Annex D for under kerb installation. Slots through kerb edges are **not** acceptable and loops and loop tails so cut shall be re-cut and the kerbs replaced at no cost to WSCC
- 4.11 Where partial excavation of the footway is required to access stub-duct ends, then the exposed loop tails shall be covered with resin and then bitumen in several layers as necessary, after sealing the end of the stub duct and prior to re- instatement of the footway with cold setting asphalt and sealing with hot pour bitumen.
- 4.12 Working Practice when Cutting Slots and Laying Loop Cable
- (a) Slots shall be cut at least one metre from any ferrous objects or areas of poor surfacing unless otherwise approved by the Engineer.
 - (b) Slots shall be properly dried and cleared of all debris before laying loop or detector feeder cable and the slots shall be kept clean and dry before the backfill is complete.
 - (c) The depth of the slot shall be checked with a depth gauge along the whole length of the slot.
 - (d) All cable shall be dry before laying in slots.
 - (e) Sharp implements shall not be used to seat cable in slots.
 - (f) Where the corners of the slot are at an angle of less than 100 degrees then this angle shall be rounded with the use of a cold chisel or the corners of the loop shall be crosscut.
 - (g) After backfilling, which shall be hot pour bitumen, excessive spillages of bitumen shall be removed from the road surface and loose asphalt shall be swept clear of the road surface and disposed of off site.
 - (h) The type of bitumen used shall not embrittle at temperatures above 5 degrees Celsius. The temperature of the 'kettle' shall be in accordance with the suppliers instructions.
 - (i) Loop cable shall conform with Departmental Specification TR2031.

- (j) The Contractor shall be responsible for erecting, maintaining and dismantling all Chapter 8 Traffic signing including traffic control required to complete the slot cutting. The method of traffic control is to be stated by the Engineer and may include the use of temporary traffic signals at the Contractor's own expense.
- (k) Loop cable shall be taken through a length of orange colour plastic ducting marked Traffic Signals with a minimum diameter of 50mm leading to a chamber situated in the footway/verge where the loop tails and detector feeder cables shall be jointed. The Contractor shall include for excavation (the minimum necessary) at the channel to access this duct and for reinstatement with bitumen (as used for sealing slots). The holes shall then be backfilled with hot rolled asphalt or cement. The depth of cover for the duct end at back of footway shall be 60mm. If practical constraints prevent this any alternative arrangement must be agreed with WSCC. (See standard drawing in Annex D for under kerb installation details)
- (l) All slot cutting shall be carried out only once appropriate Chapter 8 signing and traffic control has been put in place.
- (m) Where the bitumen backfill is below the road surface, the Contractor shall be responsible for topping up the bitumen backfill to achieve a level finish with the road surface. The Contractor shall be responsible for additional backfilling of the slots should the level of backfill fall below the road surface within 28 days of the issue of the Taking-Over Certificate.
- (n) Where the contract drawing indicates the application of new special surfacing on the carriageway, the contractor shall complete all slot cutting and backfilling of cables in these areas prior to the application of the special surfacing.

5. Cabling

- 5.1 Pedestrian push button units and all other extra low voltage equipment on all LV installations are to be wired on a separate core cable(s) to the vehicle signal cables.
- 5.2 Cables shall be terminated in the controller at the appropriate terminal block and in the correct terminal position.
- 5.3 Detector feeder cables shall be terminated in an appropriate terminal block and "soft wired" to the correct labelled detector unit, using light gauge stranded wire, twisted in pairs.
- 5.4 With stranded conductors or with conductors having a diameter less than 2.5mm sq, a crimped pin or protective leaf shall be used in the terminal.
- 5.5 All labels shall be permanent and marked in ink.
- 5.6 Cable sheath and cable core identification is to be undertaken on all signal cables within the controller as per ANNEX C.
- 5.7 Cable sheath identification only is to be undertaken on all signal cables, at the pole tops as per ANNEX C.
- 5.8 All loop feeders shall be labelled with the detector name or conductor function at both ends as near as is possible to the appropriate terminal or connection.
- 5.9 All loop conductor wire pairs shall be connected together with zip ties or similar, and labelled as close to the point they enter the drawpit as possible.

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- 5.10 All cables shall be armoured in multibanded steel and covered in an outer sheath of orange coloured PVC.
- 5.11 All Cables including loop feeder cables shall comply with or exceed the WSCC specification shown in Appendix A and comply with the requirements of B.S.505 as amended by TR0102.
- 5.12 Detector signals shall not be brought back on the same cable carrying the supply to signal heads or push buttons.
- 5.13 The core provision shall provide not less than the greater of 25% or 4 spare cores overall to each pole.
- 5.14 Each signal pole shall be cabled directly to the controller. The looping of any cables between signal poles will not be accepted. ONLY in exceptional circumstances, as directed by the Engineer, will alternative means of cabling be acceptable.
- 5.15 Unused cores at the controller shall be left for future expansion but isolated to ensure no earth loops can be created.
- 5.16 Unused cores between poles shall be connected to Earth at one pole top.
- 5.17 Unused cores between the pole and the controller shall be connected to Earth at the pole top.
- 5.18 Signal cables shall not pass through ducts or boxes used for any other service and no other services may utilise the traffic signals ducts or boxes.
- 5.19 Duct shall be in accordance with NJUG Standards, Orange 100 mm diameter with 'traffic signals' stamped at regular intervals.
- 5.20 A mixture of extra low voltage (ELV) and low voltage (LV) circuits in multicore cables is not acceptable in any circumstances.
- 5.21 Cables carrying 230v lamp power shall occupy separate ducts from cables carrying extra low voltage (push button/audible, detection etc) although they will use the same chambers. This will not apply to the individual duct directly feeding each pole.
- 5.22 One duct shall be left empty on all road crossings.
- 5.23 Draw strings will be provided in all duct runs and to the pole tops by the main civil engineering contractor. The Contractor shall be responsible for ensuring that a drawstring is retained in each duct run and pole following the installation of the cables.
- 5.24 Pulling of cables will be the responsibility of the Contractor. All cabling shall be installed as shown on the relevant site drawing
- 5.25 Cables shall not be bent to a radius of less than 12 times their diameter or less than a radius recommended by the manufacturer, whichever is the greater.
- 5.26 Low voltage and extra low voltage cables shall not be terminated in the same position in the pole tops.
- 5.27 Where possible all cable runs shall include 1 metre of slack cable in each drawpit, along the full length of the run.
- 6. Electricity Supply**
- 6.1 The mains input shall be to a Haldo or equivalent pillar positioned close to the controller, in a location where the chance of impact by vehicles leaving the carriageway is minimised. The Mains Electricity supply shall incorporate a protective earth. The supply will be 230 V 50Hz. (See standard drawing in Annex D for installation details)

- 6.2 The feeder pillar shall be a minimum size to ensure that the electrical apparatus can be installed. A typical size approximately 560 mm high, by 250 mm wide by 160 mm thick above the ground, with an installation depth of approximately 250 mm
- 6.3 Connection to the DNO supply must only be made by the DNO's authorised staff with a fuse rating between 16 and 40 amp (specific rating is determined by the DNO)
- 6.4 The traffic signals equipment must be protected by a lockable double pole safety isolator switch rated at 32 amp cut-out with a 25 amp fuse for a Traffic Signal junction, and 16 amp fuse for Pedestrian Crossings in accordance with BS 88 Part 2. (TOFCO DP1 or equivalent)
- 6.5 Traffic signals installation should not normally commence until the feeder pillar has been installed and connected.

7. Testing of Installed Cables and Marking of Cable Drawing

- 7.1 The Contractor shall supply to WSCC at the site commissioning the relevant electrical test certificates. The Contractor's failure to supply the test certificate will cause the switching on of the signals to be delayed until the certificate is produced. The Contractor shall be liable for all expenses involved with re-attending the subsequent site commissioning.
- 7.2 The electrical test certificates shall be in accordance with the format shown in Annex A.
- 7.3 The Contractor shall notify WSCC prior to tests being undertaken so that the Engineer or his representative may be present to verify the tests.
- 7.4 The following tests shall be carried out:
 - 7.4.1 Series resistance of loop and feeder. The resistance shall not exceed 5 ohms.
 - 7.4.2 Impedance to earth of the armouring of every feeder cable and connecting cable before the armouring is bonded to earth. The reading shall not be less than 10 megohms.
 - 7.4.3 Impedance to earth of cable armouring after the armouring has been connected to earth. The reading shall not exceed 0.5 ohms.
 - 7.4.4 Impedance to earth of loop and feeder conductors with both feeder conductors connected together, using at least 500 volts DC applied for at least one minute. The cable shall be disconnected at both ends during the taking of this reading.
 - 7.4.5 Impedance to earth of connecting cable conductors with all conductors connected together, using at least 500 volts DC applied for at least one minute. The reading shall not be less than 10 megohms. The cable shall be disconnected at both ends during the taking of this reading.
- 7.5 Any loop or feeder or connectable cable which fails any of the tests shall be replaced by the Contractor before the site is commissioned.
- 7.6 The Contractor shall reset the detector card power supply where necessary and shall observe and monitor the LED for the correct operation of each loop connected to the detector card. Any defects or malfunction shall be reported immediately to the WSCC. This work shall be carried out for all detectors which have been affected by the Works.
- 7.7 Measurement of linear meterage may be carried out with a measuring wheel that has been calibrated within the previous 12 months. WSCC shall have the right to check any measurement and request that any electrical test be repeated at the contractors expense during commissioning.

8. Testing and Commissioning

- 8.1 The contractor shall translate the TR2500 specification into a controller configuration and give WSCC at least 10 days notice of a simulated Configuration Acceptance Testing (CAT). The contractor will allow for WSCC attendance at those tests by the Engineer's representative or they will be conducted by a WSCC approved consultant. (For approved supplier list contact Traffic.signals@westsussex.gov.uk) The test will verify operation of the signals and will be conducted on an emulator to allow various scenarios to be tested.
- 8.2 On completion of the simulation test the Configuration Acceptance Test shall be documented on the WSCC forms shown in Annex C
- 8.3 The Contractor shall give WSCC at least ten working days notice of the controller(s) being ready for Factory Acceptance Testing (FAT) and shall allow for attendance at those tests by the Engineer's representative. The location of the acceptance test is to be at the contractors premises.
- 8.4 The installer shall supply the WSCC traffic signals engineer with a copy of the controller specification prior to or at the above tests.
- 8.5 Suitable signal lamp mimics and means of simulating inputs shall be required and the test shall demonstrate compliance with the operational specification, including necessary green conflict monitoring. Any non-compliances identified by the Engineer shall be rectified by the Contractor at his own expense.
- 8.6 The Factory Acceptance Test shall be documented on the WSCC forms shown in Annex C
- 8.7 The Contractor shall supply suitable opaque signal head covers. The Contractor shall use these to completely cover all signal head assemblies including pedestrian heads and push-buttons that are not controlling traffic during installation. The covers shall only be removed by the Contractor when commissioning the signals.
- 8.8 The SCN of the site shall be displayed on the controller cabinet in characters approximately 50 mm high. (i.e. 3621) The method of application shall be approved by WSCC.
- 8.9 All signal poles shall be numbered as specified on the design drawing or starting with the pole closest to the controller and proceeding in a clockwise direction around the facility.
- 8.10 On completion of the installation the site shall be left clean and tidy and all rubbish shall be removed.
- 8.11 After installation of the equipment, site testing shall be carried out by the Contractor prior to the commissioning in order to demonstrate compliance with the specification. The Contractor shall test the operation of all lamps, detectors and push buttons. Only after the tests have proved satisfactory shall WSCC or their representative be asked to attend the installation in order that it may be commissioned. The Contractor shall supply all equipment necessary for testing purposes.
- 8.12 The Contractor shall give at least one week advance notice to WSCC traffic signal section's traffic signal engineer to attend the commissioning tests. WSCC reserve the right to invite their maintenance contractor to attend the site commissioning.
- 8.13 The Site Acceptance Test shall be documented on the WSCC forms shown in Annex C
- 8.14 Any non-compliances identified by WSCC shall be resolved at the commissioning by the Contractor. If after taking all reasonable action the Contractor is unable to rectify the outstanding non-compliances and at the commissioning the Engineer considers that the non-compliances are such that the signal equipment cannot be switched on the Contractor shall re-attend the site to resolve the non-compliances immediately the following day and each day thereafter until the item is rectified. Where the non-compliances are not deemed by the

Engineer to affect the switching on of the signal equipment and the Contractor has taken all reasonable measures at the commissioning, the outstanding non-compliance items must be resolved within 5 working days. All labour, plant and materials required to resolve the non-compliant items shall be undertaken at the Contractor's own expense.

- 8.15 Following a successful site commissioning the installation will be handed over to the Engineer's maintenance contractor. For a period of 12 months following adoption of signals works the WSCC maintenance provider shall be responsible for maintaining the site, in the event of a fault with any of the equipment, other than lamps, shall inform the Contractor of the faulty equipment and return for said equipment for repair or replacement, or shall instruct the Contractor to attend the site and to rectify the fault.
- 8.16 In addition to any faults that occur following site acceptance the maintenance responsibilities and liability for any traffic signal equipment shall not be accepted by the Engineer until final Site Acceptance Certificates have been signed and accepted by WSCC. If during this period a fault develops, WSCC's maintenance provider shall attend the site, to rectify the fault at the Contractor's expense.

9. Documentation

- 9.1 The following documents are to be supplied by the Contractor and retained in the controller at commissioning:
- (i) A Log Book
 - (ii) A copy of the controller specification.
 - (iii) RAM data sheet
- 9.2 The Contractor shall supply to WSCC at the site commissioning the relevant electrical test certificates. The Contractor's failure to supply these test certificates will cause the switching on of the signals to be delayed until the certificate is produced. The Contractor shall be liable for all expenses involved with re-attending the subsequent site commissioning.
- 9.3 Within 30 days of the commissioning the contractor is to supply three "as built" cable and signal drawings. One shall be retained within the controller, the remaining two shall be sent to WSCC. The Contractor is in addition to supply the "as built" drawing in Autocad format.
- 9.4 Within 7 days of the commissioning the contractor is to supply an electronic PDF version of the EPROM specification and the relevant data files.

10 Connection to Urban Traffic Control (UTC) SCOOT

- 10.1 Where UTC facility and/or connection is specified the Contractor should ensure that the following requirements are met.
- 10.2 The controller is to be modified as necessary for UTMC including a UTMC interface with a 3U rack including sufficient void space and back wiring to an approved unit which provides the UG405 communication protocol.
- 10.3 The modification wiring is to include all sockets for connection to the UG405 communication unit.
- 10.4 The bit pattern shall be as specified in the UTC database sheet(s) of the General Specification forms.
- 10.5 The manual panel is to be fitted with a 'computer on' LED operated by the presence of force bits from the UTC computer and with a remote reconnect switch. The manual panel LED shall be labelled 'UTC on'.
- 10.6 The Contractor is to provide self tuning multi-channel detector units for all SCOOT loops which are to be mounted and wired in the UTMC detector rack

- 10.7 It is the Main Contractor's responsibility to arrange for a telemetry line to be fitted in the controller cabinet and to liaise with WSCC signal engineer to determine the exact telephone requirements.
- 10.8 It's the main contractor's responsibility to arrange for an approved supplier to input all UTC/SCOOT data into the WSCC in-station, in an agreed format.
- 10.9 The Contractor shall be responsible for commissioning the SCOOT detection control and reply bits. The Contractor shall be responsible for supplying all necessary equipment for testing purposes.
- 10.10 The Contractor is responsible for validating the SCOOT region and supplying a report verifying validation and identifying any observations.
- 10.11 Any unused data transmission bits shall be strapped out.
- 10.12 A UTC/SCOOT drawing and any data configuration will be recorded on an appropriate sheet will be left in the controller and within 7 days of commissioning a electronic

11 Connection to Remote Monitoring (RMS)

- 11.1 Unless specified otherwise by the Engineer in writing the installation will be connected to West Sussex County Council's Remote Monitoring System supplied by Telent. The following requirements are to be met.
- 11.2 The preferred option is the installation of an integral OMU, therefore reducing wiring and ensuring direct communication with the controller. If this is not feasible a standard 3U rack is to be provided for an Outstation Monitoring Unit (OMU) to be fitted in the controller cabinet containing a 300mm wide by 300mm deep void space.
- 11.3 It is the Main Contractor's responsibility to arrange for an agreed communication connection to be installed and connected. This could be in the form of an ADSL line, GSM modem (sim card to be supplied by WSCC Traffic signals) or a telemetry line connected to the Public Switched Telephone Network to be fitted in the controller cabinet.
- 11.4 The OMU must report any identified fault back to the Instation.
- 11.5 The OMU must be linked to enable full interrogation of the controller via handset commands.
- 11.6 A separately fused supply shall be provided solely for use of the OTU/OMCU.
- 11.7 The OMU equipment shall be of a type approved by WSCC Traffic Signals Engineer to ensure compatibility with the Instation operating system.
- 11.8 The OMU shall be connected with phase indications in order, followed by phase wait lamps in order. The detectors shall be connected in the order in which they appear in the controller input.

12 Connection to Microprocessor Optimised Vehicle activation (MOVA)

- 12.1 Unless specified otherwise by WSCC Traffic Signals in writing the installation will be connected to MOVA and the following requirements are to be met.
- 12.2 An integral MOVA system shall be installed thus eliminating the need for separate detector wiring and ensuring direct communication with the controller. If this is not feasible written permission must be obtained from WSCC Traffic Signals and a standard 3U rack is to be provided for a MOVA/ Outstation Monitoring Unit to be fitted in the controller cabinet containing a 300mm wide by 300mm deep void space.

- 12.3 A UTC interface is provided inside the controller for MOVA control. The Contractor shall test the output of all UTC bits at the Site commissioning.
- 12.4 All controller detector inputs shall be capable of being remotely monitored. All control and reply bits shall be capable of being wired to the MOVA unit.
- 12.5 The manual panel shall include a 'computer on' LED which shall indicate when the controller is operating under MOVA control. The LED shall be labelled 'MOVA on-line'.
- 12.6 The MOVA equipment shall be of a type approved by the Engineer to ensure compatibility with the WSCC Site interrogation software and Instation operating system.
- 12.7 The latest version of the MOVA software shall be supplied, including all relevant licences to operate MOVA.
- 12.8 WSCC currently operate Telent integral MOVA and Siemens MOVA via Gemini Units.

Appendix A Cable Specification

A) Loop Cable

2.5mm² 30/0.25 tinned annealed copper conductor, insulated with 0.8 mm radial thickness of EPR and sheathed with 1.4 mm radial thickness of PCP. Overall diameter 6.8 mm (minimum), 7.2mm (maximum)

B) Feeder Cable

2.5mm² 1/1.38 plain annealed circular copper conductor, steel wire armoured, 0.7 mm radial polyethylene insulation, 2 or 4 cores with cores laid up with 5 turns per metre

C) Power Cable (low voltage or extra low voltage)

1.5mm², 8, 12 or 16 core steel wire armoured, with orange PVC sheathing and colour coded cores according to requirements, noting the need for spare cores:-

Black	Green	} 8 core	} 12 core	} 16 core		
Red	White					
Blue	Orange					
Brown	Yellow					
Red/Brown	Red/Yellow	} 8 core				
Red/Grey	Red/White					
Red/Blue	Red/Black					
Purple	Grey					

TEST CERTIFICATE FOR CABLING AND EQUIPMENT

[illegible]

ANNEX B**SPECIFICATION FOR CABLE AND CABLE CORE IDENTIFICATION**

This Schedule is issued to ensure that all cable and cable cores in traffic signal installations are identified by the same method and code.

1 CABLE IDENTIFICATION

1.1 All cables entering any equipment housing shall be identified by a 'Pull-Tite' tag fixed around the inner sheath immediately above the Steel Wire Armouring (SWA) termination gland.

1.2 The tag shall be marked, using an approved waterproof, indelible, black marker pen, in the following manner:-

(a) Low Voltage Signal Cables

The tag shall be red and shall be clearly marked with the number of the pole, serviced by the cable.

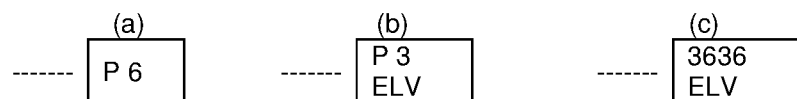
(b) Extra Low Voltage Cables (Pedestrian Push Buttons, etc)

The tag shall be yellow and shall be clearly marked with the pole number serviced by the cable, in addition the letters ELV shall be added.

(c) Extra Low Voltage Cables (Linking Cables)

The tag shall be yellow and shall be marked with the Site reference number of the linked equipment and in addition the letters ELV shall added.

Examples:-



Note: The pole numbers referred to above are as shown on the contract drawing.

(d) Loop Feeder Cables

The identification of these cables is as follows:-

One side of the yellow tag shall be marked with the detector and arm designation - the other side shall be marked with the Street or Road name.

Example:-

**2 CABLE CORE IDENTIFICATION**

2.1 All individual cable cores in cables used in a traffic signal installation shall be identified using coloured PVC grip type markers with black lettering. The markers shall be positioned on the core adjacent to the termination point in such a way that they can be read easily.

2.2 Three types of identification marker shall be used:-

- (a) Numbered markers indicating poles numbers. These will be colour coded in accordance with the international resistor colour code. The number shall indicate the pole fed by that cable ie the next pole to which the cable runs.
- (b) Legend markers indicating the function of the core as shown below.
- (c) Lettered markers indicating the phase of the core.

2.3 The colours, numbers, function, letters and arrangement of the markers shall be as follows:-

2.3.1 (a) Low Voltage Signal Cables - This arrangement shall be used for all cables in the controller and for all cables leaving a signal pole.

Colour:-	First Marker		Second Marker			Third Marker	
	(Pole)	(Function)	(Phase)				
	Colour Coded	Red	White				
1	Brown	RED	AMBER	GREEN		A	
2	Red	R/MAN	G/MAN	WAIT		B	
3	Orange	I.G/A	F.G/A	SIGN		C	
4	Yellow	P/EL	PE/N	PE/SW		D	
5	Green	SIG/N	SIGN/N	SPARE		E	
6	Blue					F	
7	Violet	Note:-	Functions not covered by the above to be written onto blank markers with an approved pen. (Two Markers)			G	
8	Slate (Grey)					H	
9	White					etc	
10	Brown and Black						

2.3.1. (b) Low Voltage Signal Cables - This arrangement shall be used for all cables arriving at a signal pole or equipment housing.

Only two markers shall be used ie the Second and Third marker as in 2.3.1 (a) above.

2.3.2 (a) Extra Low Voltage Cables - This arrangement shall be used for all cables in the controller and for all cables leaving a signal pole.

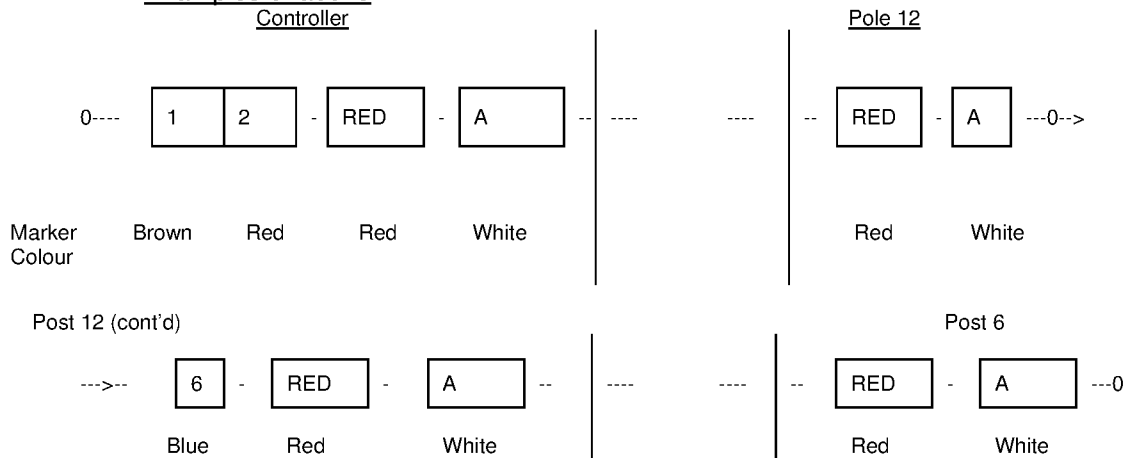
Colour:-	First Marker		Second Marker			Third Marker	
	(Pole)	(Function)	(Phase)				
	Colour Coded	Yellow	White				
1	Brown	PUSH/B	BLEEP	TACT		A	
2	Red	COMM	INHIB	LINK		B	
3	Orange	T/O	PB/COM			C	
4	Yellow	DET+	DET-			D	
5	Green	MVD	IRD	SPARE		E	

6	Blue				F	
7	Violet	Note:-	Functions not covered by the above to be written onto blank markers with an approved pen.			G
8	Slate (Grey)					H
9	White					etc
10	Brown and Black		(Two Markers)			

- 2.3.2 (b) Extra Low Voltage Cables - This arrangement shall be used for all cables arriving at a signal pole or equipment housing.

Only two markers shall be used ie the Second and Third marker as in 2.3.2 (a) above.

Examples of above:-



ANNEX C - TEST CERTIFICATES

1) Configuration Acceptance Test for a Telent Controller: -

CONFIGURATION ACCEPTANCE TEST SCHEDULE FOR TELENT TR2500 CONTROLLER

CUSTOMER :	
SITE NAME :	
SITE REFERENCE :	
CONTROLLER TYPE :	<i>TELENT MTC / SENTINEL/Optima</i>
CONFIG REFERENCE :	
CONFIG ISSUE :	

CONFIGURATION ACCEPTANCE TESTS

General:

	Pass/Fail
Check Configuration Serial Number & Issue with the Specification (RSN)	
Check controller starts up in correct stage and that the correct indications are given	
Check the starting inter-green time (IGS)	
Check that the controller serves all specified phases after start-up	
Check phase appearance and termination types	
Use the handset commands to check the following basic parameters are as specified:-	
Minimum Green times (MIN)	
Maximum Green times (MAX)	
Pedestrian Blackout times (PBT or PSQ)	
Pedestrian Window times (PWN)	
Intergreen times (IGN)	
Phase Delay times (DPG)	
Timetable Entries and Event Parameters (TTI & TEL)	
BST Changeover Weeks (BST)	
Handset Limit Values – try setting some times outside limit values	
Pedestrian Sequence times (PSQ)	

Mode Priority:

Check that the mode priority operates as specified (MOD)	
--	----------------------

Manual Mode:

Check manual disable via handset, if specified (MND)	
Select each configured manual button & check stage/phase relationship is correct	
Check any optional appearance phases under manual mode are as specified	
Check permitted stage to stage movements	
Check that non-permitted movements give the correct indication	
Check that leaving manual mode inserts demands for all specified phases	
Check operation of all other buttons/switches on the manual panel	

CONFIGURATION ACCEPTANCE TESTS – continued

Detection:

Check DFM times are as specified (DFA & DFI)
 Check Call/Cancel times are as specified (DCL & DCN)
 Check for correct active states on each detector input (DAC)
 Check for correct DFM force states on each detector input (DAC)
 Check Detector times are as specified (EXT)
 Check that all inputs perform the correct functions, e.g. latched/unlatched demands, green extensions, light wait indicators, etc (PHS)
 Check SD/SA loop spacing is as specified (controlled by SD/SA logic unit)
 Check SD/SA Extension times are as specified (controlled by SD/SA logic unit)
 Check SD/SA Extra Intergreen times are as specified (MIG & IGX)
 Check SD/SA operation

Pass/Fail

FT Mode:

Select fixed time mode and check for correct stage sequence
 Check fixed time stage durations, if specified (FIX)
 Check fixed time runs to current phase maximums (if specified)
 Check any demand dependant stages/phases
 Check that leaving fixed time mode inserts demand for all specified phases

VA Mode:

Check the VA logic for each stage change is correct (i.e. stages are only demanded/extended by the appropriate phases)
 Check that arterial reversion occurs to the correct stage/phase if no demands/extensions present (if specified)
 Check that correct revertive phase demands occur if extension running when maximum green expires (PHS)
 Check stage movement constraints (i.e. permitted, prohibited, alternative moves)
 Check operation of signals with permanent demands on all detectors ensuring that all phases are satisfied

CLF Mode:

Check plan timings/influences are as specified (CLC, CLD, CLO & CLI)
 Check that all plans operate, especially demand dependant stages
 Check CLF permitted movements by writing a plan with a non-permitted move in it

CONFIGURATION ACCEPTANCE TESTS – continued

UTC Mode (or add-on MOVA):

	Pass/Fail
Check mode changes when force bit is active, with TC bit if specified (MOD)	
Check operation of non-demand dependant force bits	
Check operation of demand dependant force bits with both street demands and D-bits and check that any stage demand reply bits are returned correctly	
Check that the UTC stage change logic is correct	
Check for correct operation with multiple force bits	
Check stage to stage movement restrictions (i.e. permitted, prohibited, alternative)	
Check DX bit runs specified stages/phases to maximum in VA mode	
Check operation of any other miscellaneous control bits	
Check that the correct G-bit replies are returned for each stage	
Check that any phase confirm bits are correctly returned	
Check reply bits for specific controller conditions (lamps off, DFM, manual, etc)	
Check operation of any other miscellaneous reply bits	
Check operation of serial MOVA detectors	

Part Time Mode:

Check timetable change points by altering the clock (TOD)	
Check that signals switch off in correct stage, once minimums have expired (MOD)	
Check queue detector operation	
Check minimum on/off operating timers (PTH & PTP)	
Check operation of part-time inhibit switch	

Hurry Call Mode:

Check Hurry Call Delay times are as specified (HCD)	
Check Hurry Call Hold times are as specified (HCH)	
Check Hurry Call Prevent times are as specified (HCP)	
Check operation of request detectors	
Check operation of cancel detectors	
Check that correct stage is called in relation to the detector (MOD)	

MOVA Mode (Integral only):

Check that all MOVA data is as specified (DS)	
Check that all MOVA IN, X and Stopline detectors call the appropriate phases	
Check that all push button inputs call the appropriate phases	
Check that stage selection logic (SDCODE's) operates as intended	

CONFIGURATION ACCEPTANCE TESTS – continued

Vehicle Priority Mode:

	Pass/Fail
Check Priority unit basic requirements are as specified (PAI, PRA, PRF, PRR, DSR)	
Check Priority Extension times are as specified (PRE)	
Check Priority Maximum times are as specified (PRM)	
Check Inhibit times are as specified (PRI)	
Check Phase Compensation times are as specified (PRC)	
For each priority unit check operation of priority demands/extensions, inhibit periods and compensation periods (MOD, PHS, PRS, PUO)	

All Red Extensions:

Check All Red Extension times are as specified (RXD)	
Check All Red Maximum times are as specified (RMX)	
Check that appropriate detectors extend appropriate stage moves	
Check all red extensions are operative or auto-extend to max in the appropriate modes	

Intergreen Extensions:

Check Maximum Intergreen times are as specified (MIG)	
Check Intergreen Extensions are as specified (IGX)	
Check operation of intergreen extensions	

Variable Maximum:

Check Variable Maximum Additional Period times are as specified (VMP)	
Check Variable Maximum Threshold Flow values are as specified (VMT)	
Check operation of phases with variable maximum	

Pedestrian Linking:

Check Pedestrian Link timings are as specified (SCT or LNK)	
Check operation of pedestrian link	
Check operation of override timer	

Red Lamp Monitoring:

Check that 1 red lamp out extends appropriate intergreens by the specified duration	
Check that 2 reds out inhibit conflicting ped phases or shutdown part-time streams	
Check that red lamp failure actions cease when lamps are replaced, (if required)	

CONFIGURATION ACCEPTANCE TESTS – continued

Green Conflict Monitoring:

Check all green/green conflict data is correct

Pass/Fail

Special Conditioning:

Check operation of any special conditioning not already covered (SCV & SCT)

Miscellaneous:

Perform any other miscellaneous tests that may be required (define below):-

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

2) Configuration Acceptance Test for a Telent Controller: -

CONFIGURATION ACCEPTANCE TEST SCHEDULE FOR SIEMENS TR2500 CONTROLLER

CUSTOMER :	
SITE NAME :	
SITE REFERENCE :	
CONTROLLER TYPE :	<i>SIEMENS T400 / ST800 / ST900/ST950</i>
CONFIG REFERENCE :	
CONFIG ISSUE :	

CONFIGURATION ACCEPTANCE TESTS

General:

* Indicates commands that only apply to the ST800/ST900.

	Pass/Fail
Check Configuration Identity Code Number & Issue with the Specification (CIC)	
Check controller starts up in correct stage and that the correct indications are given	
Check the starting inter-green time (IGS)	
Check that the controller serves all specified phases/stages after start-up	
Check phase appearance and termination types	
Use the handset commands to check the following basic parameters are as specified:-	
Minimum Green times (MIN)	
Green Extension times (EXT, IPX*)	
Maximum Green times (MAX, MBX, MCX, MDX, MEX*, MFX*, MGX*, MHX*)	
Pedestrian Blackout times (PBT)	
Pedestrian Window times (PWN)	
Intergreen times (IGN)	
Phase Delay times (DPG, DMV, DFZ, DMF*, DMT*)	
Timetable Entries and Event Parameters (TSW, TDY*)	
Handset Limit Values (MTV, ITV) – try setting some times outside limit values	
Pedestrian Sequence times (PAR*, PIT*, PBT, CMX*, CDY*, CRD*)	

Mode Priority:

Check that the mode priority operates as specified (MOD, STS*)	
--	----------------------

Manual Mode:

Check manual disable via handset, if specified (MND)	
Select each configured manual button & check stage/phase relationship is correct	
Check any optional appearance phases under manual mode are as specified	
Check permitted stage to stage movements	
Check that non-permitted movements give the correct indication	
Check that leaving manual mode inserts demands for all specified phases/stages	
Check operation of all other buttons/switches on the manual panel	

CONFIGURATION ACCEPTANCE TESTS – continued

Detection:

Check DFM times are as specified (DFD, DGP*, DSA*, DSI*)
 Check Call/Cancel times are as specified (DCL & DCN)
 Check for correct active states on each detector input (IPS*)
 Check for correct DFM force states on each detector input (DFA)
 Check Input Extension times are as specified (IPX*)
 Check that all inputs perform the correct functions, e.g. latched/unlatched demands, green extensions, light wait indicators, etc (SPH)
 Check SD/SA loop spacing is as specified
 Check SD/SA Extension times are as specified
 Check SD/SA Extra Intergreen times are as specified (SCT)
 Check SD/SA operation

Pass/Fail

FT Mode:

Select fixed time mode and check for correct stage sequence
 Check fixed time stage durations, if specified (FIX, FTS*, LFT*)
 Check fixed time runs to current phase maximums (if specified)
 Check any demand dependant stages/phases
 Check that leaving fixed time mode inserts demand for all specified phases/stages

VA Mode:

Check the VA logic for each stage change is correct (i.e. stages are only demanded/extended by the appropriate phases)
 Check that arterial reversion occurs to the correct stage/phase if no demands/extensions present (if specified)
 Check that correct revertive phase demands occur if extension running when maximum green expires (SPH)
 Check stage movement constraints (i.e. permitted, prohibited, alternative moves)
 Check operation of signals with permanent demands on all detectors ensuring that all phases are satisfied

CLF Mode:

Check plan timings/influences are as specified (PLT, PLI, IFA, IFB, IFC, IFD, CYC*, PLE*, PLX*, OFF*, IFN*, IFS*)
 Check that all plans operate, especially demand dependant stages
 Check CLF permitted movements by writing a plan with a non-permitted move in it

CONFIGURATION ACCEPTANCE TESTS – continued

UTC Mode (or add-on MOVA):

	Pass/Fail
Check mode changes when force bit is active, with TC bit if specified (MOD, STS*)	
Check operation of non-demand dependant force bits	
Check operation of demand dependant force bits with both street demands and D-bits and check that any stage demand reply bits are returned correctly	
Check that the UTC stage change logic is correct	
Check for correct operation with multiple force bits	
Check stage to stage movement restrictions (i.e. permitted, prohibited, alternative)	
Check DX bit runs specified stages/phases to maximum in VA mode	
Check operation of any other miscellaneous control bits	
Check that the correct G-bit replies are returned for each stage	
Check that any phase confirm bits are correctly returned	
Check reply bits for specific controller conditions (lamps off, DFM, manual, etc)	
Check operation of any other miscellaneous reply bits	
Check operation of serial MOVA detectors	

Part Time Mode:

Check timetable change points by altering the clock (STM, CKL, TOD*)	
Check that signals switch off in correct stage, once minimums have expired (MOD, STS*)	
Check queue detector operation	
Check minimum on/off operating timers if specified	
Check operation of part-time inhibit switch	

Hurry Call Mode:

Check Hurry Call Delay times are as specified (DHC)	
Check Hurry Call Hold times are as specified (HHC)	
Check Hurry Call Prevent times are as specified (PHC)	
Check operation of request detectors	
Check operation of cancel detectors	
Check that correct stage is called in relation to the detector (MOD, STS*)	

Vehicle Priority Mode:

Check Priority unit basic requirements are as specified (PUT, PUP, PMT, PDE, PRE, PRI, PDR, PUI, PSE, PSA, PVG)	
Check Priority Extension times are as specified (PVE)	
Check Priority Maximum times are as specified (PVM)	
Check Inhibit times are as specified (PVI)	
Check Phase Compensation times are as specified (PCn)	
For each priority unit check operation of priority demands/extensions, inhibit periods and compensation periods (PVU, PVP, PVS, PIA, PDS, PIU)	

CONFIGURATION ACCEPTANCE TESTS – continued

All Red Extensions:

Check All Red Extension times are as specified (REX)
 Check All Red Maximum times are as specified (RMX)
 Check that appropriate detectors extend appropriate stage moves
 Check all red extensions are operative or auto-extend to max in the appropriate modes

Pass/Fail

Pedestrian Linking:

Check Pedestrian Link timings are as specified (PIR, CDT*)
 Check operation of pedestrian link
 Check operation of override timer

Red Lamp Monitoring:

Check that 1 red lamp out extends appropriate intergreens by the specified duration (SIE, RLT*)
 Check that 2 reds out inhibit conflicting ped phases or shutdown part-time streams
 Check that red lamp failure actions cease when lamps are replaced, (if required)

Green Conflict Monitoring:

Check all green/green conflict data is correct

--

Special Conditioning:

Check operation of any special conditioning not already covered

--

Miscellaneous:

Perform any other miscellaneous tests that may be required (define below):-

Pass/Fail

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

3) Factory Acceptance Test for a Telent Controller: -

FACTORY ACCEPTANCE
TEST SCHEDULE
FOR TELENT TR2500 CONTROLLER

CUSTOMER :	
SITE NAME :	
SITE REFERENCE :	
CONTROLLER TYPE :	<i>TELENT MTC / SENTINEL/Optima</i>
CONFIG REFERENCE :	
CONFIG ISSUE :	

If a Configuration Acceptance Test has been conducted the items identified in Blue Italics are not required unless specified by the WSCC Engineer.

DATE OF TEST :		PASSED / FAILED (delete as appropriate)
TEST METHOD:	CONTROLLER / TEST RIG	
COMMENTS		
LATEST DATE FOR CORRECTIVE ACTION :		
SUPPLEMENTARY FAT REQUIRED YES / NO (delete as appropriate)		
TRAFFIC SIGNAL ENGINEER :	Name: Signature:	
SIGNAL COMPANY ENGINEER OR CONSULTANT :	Name: Signature:	

FACTORY ACCEPTANCE TESTS

General:

Pass/Fai

I

Check Configuration Serial Number & Issue with the Specification (RSN)

Note serial number of controller

Set all detectors to Off, all computer bits to Off, select Normal on the Manual Panel
Switch on mains supply, initialise RAM (RCP), check time/date (TOD, CAL, DAY, WEK) and switch signals on

NB. Use PWD to obtain level 3 access if using TR2500 software

Check controller starts up in correct stage and that the correct indications are given

Check the starting inter-green time (IGS)

Check that the controller serves all specified phases after start-up

Check phase appearance and termination types

Use the handset to check the following basic parameters are as specified:-

*Minimum Green times (MIN)**Maximum Green times (MAX)**Pedestrian Blackout times (PBT or PSQ)**Pedestrian Window times (PWN)**Intergreen times (IGN)**Phase Delay times (DPG)**Timetable Entries and Event Parameters (TTI & TEL)*

BST Changeover Weeks (BST)

*Handset Limit Values – try setting some times outside limit values**Pedestrian Sequence times (PSQ)*

Mode Priority:

Check that the mode priority operates as specified (MOD)

Manual Mode:

Check manual disable via handset, if specified (MND)

Select each configured manual button & check stage/phase relationship is correct

Check any optional appearance phases under manual mode are as specified

Check permitted stage to stage movements

Check that non-permitted movements give the correct indication

Check that leaving manual mode inserts demands for all specified phases

Check operation of all other buttons/switches on the manual panel

FACTORY ACCEPTANCE TESTS – continued

Detection:

Pass/Fail
|

Check DFM times are as specified (DFA & DFI)
Check Call/Cancel times are as specified (DCL & DCN)
Check for correct active states on each detector input (DAC)
Check for correct DFM force states on each detector input (DAC)
Check Detector times are as specified (EXT)
Check that all inputs perform the correct functions, e.g. latched/unlatched demands, green extensions, light wait indicators, etc (PHS)
Check SD/SA loop spacing is as specified (controlled by SD/SA logic unit)
Check SD/SA Extension times are as specified (controlled by SD/SA logic unit)
Check SD/SA Extra Intergreen times are as specified (MIG & IGX)
Check SD/SA operation
Check Operation of Dimming

FT Mode:

Select fixed time mode and check for correct stage sequence
Check fixed time stage durations, if specified (FIX)
Check fixed time runs to current phase maximums (if specified)
Check any demand dependant stages/phases
Check that leaving fixed time mode inserts demand for all specified phases

VA Mode:

Check the VA logic for each stage change is correct (i.e. stages are only demanded/extended by the appropriate phases)
Check that arterial reversion occurs to the correct stage/phase if no demands/extensions present (if specified)
Check that correct revertive phase demands occur if extension running when maximum green expires (PHS)
Check stage movement constraints (i.e. permitted, prohibited, alternative moves)
Check operation of signals with permanent demands on all detectors ensuring that all phases are satisfied

CLF Mode:

Check plan timings/influences are as specified (CLC, CLD, CLO & CLI)
Check that all plans operate, especially demand dependant stages
Check CLF permitted movements by writing a plan with a non-permitted move in it

FACTORY ACCEPTANCE TESTS – continued

UTC Mode (or add-on MOVA):

Reset all detectors to off and select Normal on the Manual Panel
 Check mode changes when force bit is active, with TC bit if specified (MOD)
 Check operation of non-demand dependant force bits
 Check operation of demand dependant force bits with both street demands and D-bits and check that any stage demand reply bits are returned correctly
Check that the UTC stage change logic is correct
 Check for correct operation with multiple force bits
Check stage to stage movement restrictions (i.e. permitted, prohibited, alternative)
 Check DX bit runs specified stages/phases to maximum in VA mode
 Check operation of any other miscellaneous control bits
 Check that the correct G-bit replies are returned for each stage
 Check that any phase confirm bits are correctly returned
 Check reply bits for specific controller conditions (lamps off, DFM, manual, etc)
 Check operation of any other miscellaneous reply bits

Pass/Fail

Part Time Mode:

Check timetable change points by altering the clock (TOD)
 Check that signals switch off in correct stage, once minimums have expired (MOD)
 Check queue detector operation
Check minimum on/off operating timers (PTH & PTP)
 Check operation of part-time inhibit switch

Hurry Call Mode:

Check Hurry Call Delay times are as specified (HCD)
Check Hurry Call Hold times are as specified (HCH)
Check Hurry Call Prevent times are as specified (HCP)
 Check operation of request detectors
 Check operation of cancel detectors
Check that correct stage is called in relation to the detector (MOD)

MOVA Mode (Integral only):

Check that all MOVA data is as specified (DS)
 Check that all MOVA IN, X and Stopline detectors call the appropriate phases
 Check that all push button inputs call the appropriate phases
Check that stage selection logic (SDCODE's) operates as intended

FACTORY ACCEPTANCE TESTS – continued

Vehicle Priority Mode:

Pass/Fail

Check Priority unit basic requirements are as specified (PAI, PRA, PRF, PRR, DSR)
Check Priority Extension times are as specified (PRE)
Check Priority Maximum times are as specified (PRM)
Check Inhibit times are as specified (PRI)
Check Phase Compensation times are as specified (PRC)
 For each priority unit check operation of priority demands/extensions, inhibit periods and compensation periods (MOD, PHS, PRS, PUO)

All Red Extensions:

Check All Red Extension times are as specified (RXD)
 Check All Red Maximum times are as specified (RMX)
 Check that appropriate detectors extend appropriate stage moves
 Check all red extensions are operative or auto-extend to max in the appropriate modes

Intergreen Extensions:

Check Maximum Intergreen times are as specified (MIG)
Check Intergreen Extensions are as specified (IGX)
 Check operation of intergreen extensions

Variable Maximum:

Check Variable Maximum Additional Period times are as specified (VMP)
Check Variable Maximum Threshold Flow values are as specified (VMT)
 Check operation of phases with variable maximum

Pedestrian Linking:

Check Pedestrian Link timings are as specified (SCT or LNK)
 Check operation of pedestrian link
 Check operation of override timer

Red Lamp Monitoring:

Check that 1 red lamp out extends appropriate intergreens by the specified duration
 Check that 2 reds out inhibit conflicting ped phases or shutdown part-time streams
 Check that failure of all (or 2) monitored reds on a channel of a stand-alone pedestrian stream causes shutdown
 Check that red lamp failure actions cease when lamps are replaced, (if required)

FACTORY ACCEPTANCE TESTS – continued

Green Conflict Monitoring:

Check all green/green conflicts using a test box (or the Simulator)
Check fault log for correct conflict data (FLF & HFL)

Pass/Fail

Special Conditioning:

Check operation of any special conditioning not already covered (SCV & SCT)

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Miscellaneous:

Perform any other miscellaneous tests that may be required (define below):-

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4) Factory Acceptance Test for a Siemens Controller: -

FACTORY ACCEPTANCE
TEST SCHEDULE
FOR SIEMENS TR2500 CONTROLLER

CUSTOMER :	
SITE NAME :	
SITE REFERENCE :	
CONTROLLER TYPE :	<i>SIEMENS T400 / ST800 / ST900/ST950</i>
CONFIG REFERENCE :	
CONFIG ISSUE :	

If a Configuration Acceptance Test has been conducted the items identified in Blue Italics are not required unless specified by the WSCC Engineer.

FACTORY ACCEPTANCE TEST RESULTS

DATE OF TEST :		PASSED / FAILED (delete as appropriate)
TEST METHOD:	CONTROLLER / TEST RIG	
COMMENTS		
LATEST DATE FOR CORRECTIVE ACTION :		
SUPPLEMENTARY FAT REQUIRED YES / NO (delete as appropriate)		
TRAFFIC SIGNAL ENGINEER :	Name: Signature:	
SIGNAL COMPANY ENGINEER OR CONSULTANT :	Name: Signature:	

FACTORY ACCEPTANCE TESTS

General:

* Indicates commands that only apply to the ST800/ST900.

Check Configuration Identity Code Number & Issue with the Specification (CIC)
Note serial number of controller

Pass/Fail

Set all detectors to Off, all computer bits to Off, select Normal on the Manual Panel
Switch on mains supply, initialise RAM (PME, TKE, LRN, CNN), check time/date
(STM, CKL, TOD, DAY, WEK) and switch signals on

Check controller starts up in correct stage and that the correct indications are given
Check the starting inter-green time (IGS)
Check that the controller serves all specified phases/stages after start-up
Check phase appearance and termination types

Use the handset to check the following basic parameters are as specified:-

Minimum Green times (MIN)
Green Extension times (EXT, IPX)*
Maximum Green times (MAX, MBX, MCX, MDX, MEX, MFX*, MGX*, MHX*)*
Pedestrian Blackout times (PBT)
Pedestrian Window times (PWN)
Intergreen times (IGN)
Phase Delay times (DPG, DMV, DFZ, DMF, DMT*)*
Timetable Entries and Event Parameters (TSW, TDY)*
Handset Limit Values (MTV, ITV) – try setting some times outside limit values
Pedestrian Sequence times (PAR, PIT*, PBT, CMX*, CDY*, CRD*)*

Mode Priority:

Check that the mode priority operates as specified (MOD, STS)*

Manual Mode:

Check manual disable via handset, if specified (MND)
Select each configured manual button & check stage/phase relationship is correct
Check any optional appearance phases under manual mode are as specified
Check permitted stage to stage movements
Check that non-permitted movements give the correct indication
Check that leaving manual mode inserts demands for all specified phases/stages
Check operation of all other buttons/switches on the manual panel

FACTORY ACCEPTANCE TESTS – continued

Detection:

Check DFM times are as specified (DFD, DGP, DSA*, DSI*)*
Check Call/Cancel times are as specified (DCL & DCN)
Check for correct active states on each detector input (IPS)*
Check for correct DFM force states on each detector input (DFA)
Check Input Extension times are as specified (IPX)*
 Check that all inputs perform the correct functions, e.g. latched/unlatched demands, green extensions, light wait indicators, etc (SPH)
Check SD/SA loop spacing is as specified
Check SD/SA Extension times are as specified
Check SD/SA Extra Intergreen times are as specified (SCT)
 Check SD/SA operation
 Check Operation of Dimming

Pass/Fail

FT Mode:

Select fixed time mode and check for correct stage sequence
Check fixed time stage durations, if specified (FIX, FTS, LFT*)*
Check fixed time runs to current phase maximums (if specified)
Check any demand dependant stages/phases
Check that leaving fixed time mode inserts demand for all specified phases/stages

VA Mode:

Check the VA logic for each stage change is correct (i.e. stages are only demanded/extended by the appropriate phases)
Check that arterial reversion occurs to the correct stage/phase if no demands/extensions present (if specified)
Check that correct reverte phase demands occur if extension running when maximum green expires (SPH)
Check stage movement constraints (i.e. permitted, prohibited, alternative moves)
Check operation of signals with permanent demands on all detectors ensuring that all phases are satisfied

CLF Mode:

Check plan timings/influences are as specified (PLT, PLI, IFA, IFB, IFC, IFD, CYC, PLE*, PLX*, OFF*, IFN*, IFS*)*
Check that all plans operate, especially demand dependant stages
Check CLF permitted movements by writing a plan with a non-permitted move in it

FACTORY ACCEPTANCE TESTS – continued

UTC Mode (or add-on MOVA):

Reset all detectors to off and select Normal on the Manual Panel
 Check mode changes when force bit is active, with TC bit if specified (MOD, STS*)
 Check operation of non-demand dependant force bits
 Check operation of demand dependant force bits with both street demands and D-bits and check that any stage demand reply bits are returned correctly
Check that the UTC stage change logic is correct
 Check for correct operation with multiple force bits
Check stage to stage movement restrictions (i.e. permitted, prohibited, alternative)
 Check DX bit runs specified stages/phases to maximum in VA mode
 Check operation of any other miscellaneous control bits
 Check that the correct G-bit replies are returned for each stage
 Check that any phase confirm bits are correctly returned
 Check reply bits for specific controller conditions (lamps off, DFM, manual, etc)
 Check operation of any other miscellaneous reply bits
 Check operation of serial MOVA detectors

Pass/Fail

Part Time Mode:

Check timetable change points by altering the clock (STM, CKL, TOD)*
 Check that signals switch off in correct stage, once minimums have expired (MOD, STS*)
 Check queue detector operation
Check minimum on/off operating timers if specified
 Check operation of part-time inhibit switch

Hurry Call Mode:

Check Hurry Call Delay times are as specified (DHC)
Check Hurry Call Hold times are as specified (HHC)
Check Hurry Call Prevent times are as specified (PHC)
 Check operation of request detectors
 Check operation of cancel detectors
Check that correct stage is called in relation to the detector (MOD, STS)*

Vehicle Priority Mode:

Check Priority unit basic requirements are as specified (PUT, PUP, PMT, PDE, PRE, PRI, PDR, PUI, PSE, PSA, PVG)
Check Priority Extension times are as specified (PVE)
Check Priority Maximum times are as specified (PVM)
Check Inhibit times are as specified (PVI)
Check Phase Compensation times are as specified (PCn)
 For each priority unit check operation of priority demands/extensions, inhibit periods and compensation periods (PVU, PVP, PVS, PIA, PDS, PIU)

FACTORY ACCEPTANCE TESTS – continued

All Red Extensions:

Check All Red Extension times are as specified (REX)
 Check All Red Maximum times are as specified (RMX)
 Check that appropriate detectors extend appropriate stage moves
 Check all red extensions are operative or auto-extend to max in the appropriate modes

Pass/Fail

Pedestrian Linking:

Check Pedestrian Link timings are as specified (PIR, CDT)*
 Check operation of pedestrian link
 Check operation of override timer

Red Lamp Monitoring:

Check that 1 red lamp out extends appropriate intergreens by the specified duration (SIE, RLT*)
 Check that 2 reds out inhibit conflicting ped phases or shutdown part-time streams
 Check that failure of all (or 2) monitored reds on a channel of a stand-alone pedestrian stream causes shutdown
 Check that red lamp failure actions cease when lamps are replaced, (if required)

Green Conflict Monitoring:

Check all green/green conflicts using a test box (or CFZ* on IC4 Emulator)
 Check fault log for correct conflict data (FLF, FLD, FFS*, FDS*, LOG*)

Special Conditioning:

Check operation of any special conditioning not already covered

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FACTORY ACCEPTANCE TESTS – continued

Miscellaneous:

Perform any other miscellaneous tests that may be required (define below):-

Pass/Fail

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5) Site Acceptance Test: -

SCHEME/ LOCATION :

Controller Make	Type	Pass/ Fail
1. GENERAL ARRANGEMENT		
1.1	Check that the poles have been installed in the correct positions and are upright.	
1.2	Check lantern arrangements are correct and include backing boards and HI tape.	
1.3	Check that the base of the controller has been sealed and that any spare ducts have also been sealed.	
1.4	Check above ground detectors have been installed using nyloc nuts	
1.5	Check that the white lining are in the correct positions.	Stoplines Studs Zig Zags Other
1.6	Perform visual inspection for neat wiring, ancillary equipment fitted, etc	
1.7	Check that the paving has been installed to the correct layout	Tactile Corduroy
1.8	Check that permanent/temporary Advanced Warning Signs have been erected.	
1.9	Check that a phone line has been installed if specified, and note the line number : _____	
2. ELECTRICAL		
2.1	Check that correct fuse has been fitted in cut-out.	Amp
2.2	Flash Test and if successful Switch the Signals ON.	
2.3	Check that box signs are illuminated.	
2.4	Check that all the lamps are operational.	
2.5	Check the alignment of the signal heads.	
2.6	Check dimming operation	
2.7	Check that a conflict shuts down the controller	
3. TIMINGS		
3.1	Check that time and date are correct Telent = TOD, CAL, DAY, WEK Siemens = STM, CKL, TOD, DAY, WEK	
3.2	Check British Summer Time settings Telent = BST Siemens = BSA, BSR, CKA*, CKR*	

4. CONFIGURATION

If PROM has been signed off by a FAT or is the standard WSCC crossing config the following checks are not required:

	TELENT	SIEMENS	
4.1 Minimum Green Period, including Handset Limit Values	MIN	MIN	
4.2 Maximum Green Period, including Handset Limit Values	MAX	MAX, MBX, MCX, MDX, MEX*, MFX*, MGX*, MHX*	
4.3 Detector Extension Times	EXT	EXT, IPX*	
4.4 Intergreen Values, including Handset Limit Values	IGN	IGN	
4.5 Start Up Intergreen Period	IGS	IGS	
4.6 Detector Call/Cancel Values	DCL & DCN	DCL & DCN	
4.7 Phase Delays	DPG	DPG, DMV, DFZ, DMF*, DMT*	
4.8 Pedestrian Blackouts	PBT or PSQ	PBT	
4.9 Pedestrian Window times	PWN	PWN	
4.10 Timetable entries and events	TTI & TEL	TSW, TDY*	
4.11 CLF data	CLC, CLD, CLO, CLI	PLT, PLI, IFA, IFB, IFC, IFD, CYC*, PLE*, PLX*, OFF*, IFN*, IFS*	
4.12 Pedestrian sequence times	PSQ	PAR*, PIT*, PBT, CMX*, CDY*, CRD*	

5. DETECTION

5.1 Check all loops have been cut in the correct positions and have been sealed.	SDE/SA System D SCOOT MOVA	
5.2 Check all loop detector packs for correct settings		
5.3 Check that all loops are connected to the correct controller input Telent = DET or IPD Siemens = IOP or DET*		
5.4 Check that all above ground detectors are connected to the correct controller input		
5.5 Check that all push button units are connected to the correct controller input		
5.6 Check SD/SA for correct operation with Soundmark Testset		

6. HURRY CALL

6.1 Check the operation of detection or loops		
6.2 Check that the correct stage is called in relation to the detector. Telent = MOD Siemens = MOD or STS*		

6.3 Check call delay period.

Talent = HCD

Siemens = DHC

6.4 Check hold period.

Talent = HCH

Siemens = HHC

6.5 Check prevent period.

Talent = HCP

Siemens = PHC

7. OPERATION

7.1 Check VA operation, ensuring vehicle gaps terminate max timer.

7.2 Check alignment and operation of on-crossing detectors

7.3 Check operation of kerbside detectors:

(a) check alignment

(b) check demand lock-in

(c) check demand cancel

7.4 Check the operation of the crossing indications.

(a) Check that the wait indicator units are at the correct angle

(b) Check the wait indicator operates as specified

(c) Check the audible signal operates at the correct volume and by time of day.

(d) Check tactile devices operate.

7.5 Check operation of manual panel

(a) Auxiliary Switches

(b) Operation, particularly noting the operation of green arrows

7.6 Check the operation of CLF.

7.7 Check the operation of any Local Link/Ped Link Facility.

8. RED LAMP MONITORING

8.1 Check that 1 red lamp out extends appropriate intergreens by the specified duration

8.2 Check the DFM lamp

8.3 Check that 2 reds out inhibit conflicting pedestrian phases or shutdown part-time streams

8.4 Check that failure of all (or 2) monitored reds on a channel of a stand-alone pedestrian stream causes shutdown

8.5 Check that red lamp failure actions cease when lamps are replaced, (if required)

8.6 Check that general lamp failures are detected and reported correctly

9. REMOTE MONITORING

9.1 Commission OMU using WSCC commissioning sheets

10. MOVA

10.1 Validate MOVA data set

11. UTC

11.1 Check the operation of any SCOOT loops.

11.2 Check that all control bits are connected to the correct controller inputs

Telent = IPD

Siemens = IOP

11.3 Check that all reply bits are connected to the correct controller inputs

Telent = OPD

Siemens = IOP

12. DOCUMENTATION

12.1 Check Controller Identification Number and Helpline sticker are in place

12.2 Check that the electrical tests have been carried out and the correct forms provided

12.3 Check the following documentation is in the controller

(a) TR2500

(b) Site drawing

(c) Log book

(d) RAM sheet

(e) OTU set up sheets

(f) SCOOT loop identification and layout sheet

(g) UTC junction configuration

13. INVENTORY (enter quantity)**Poles**

Straight - 4m		5m	
6m		Stub	
Swan neck		Cranked welded	
Nal Sockets			

Vehicle Heads - (assumed LED unless specified)

RAG		RAGA	
Add. Green		Box Signs	

Pedestrian Heads

Far Side Ped		Far Side Tou	
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Push Buttons

Puffin		Puffin Combi	
Toucan		Toucan Combi	
Pegasus		Pegasus Combi	
Small Wait		Pelican	
Addit Puffin (High Mounted)		Addit Toucan (High Mounted)	
Addit Pegas (High Mounted)			

Pedestrian Equipment

Audibles		Tactile Cones	
Kerbside Dets		On Crossing	

Detection (check type)

MVDs		IRDs	
VA	Y / N	MOVA loops	
SD	Y / N	SA	Y / N
SCOOT loops		Detector Pack	

Remote Monitoring & Other

MSL	Y / N		
CCTV	Y / N	CCTV Make & Model	
PE Cell	Y / N		
Bus Priority	Y / N	Bus Priority Make & Model.....	

COMMISSIONED BY :

Date :.....

COMMENTS :

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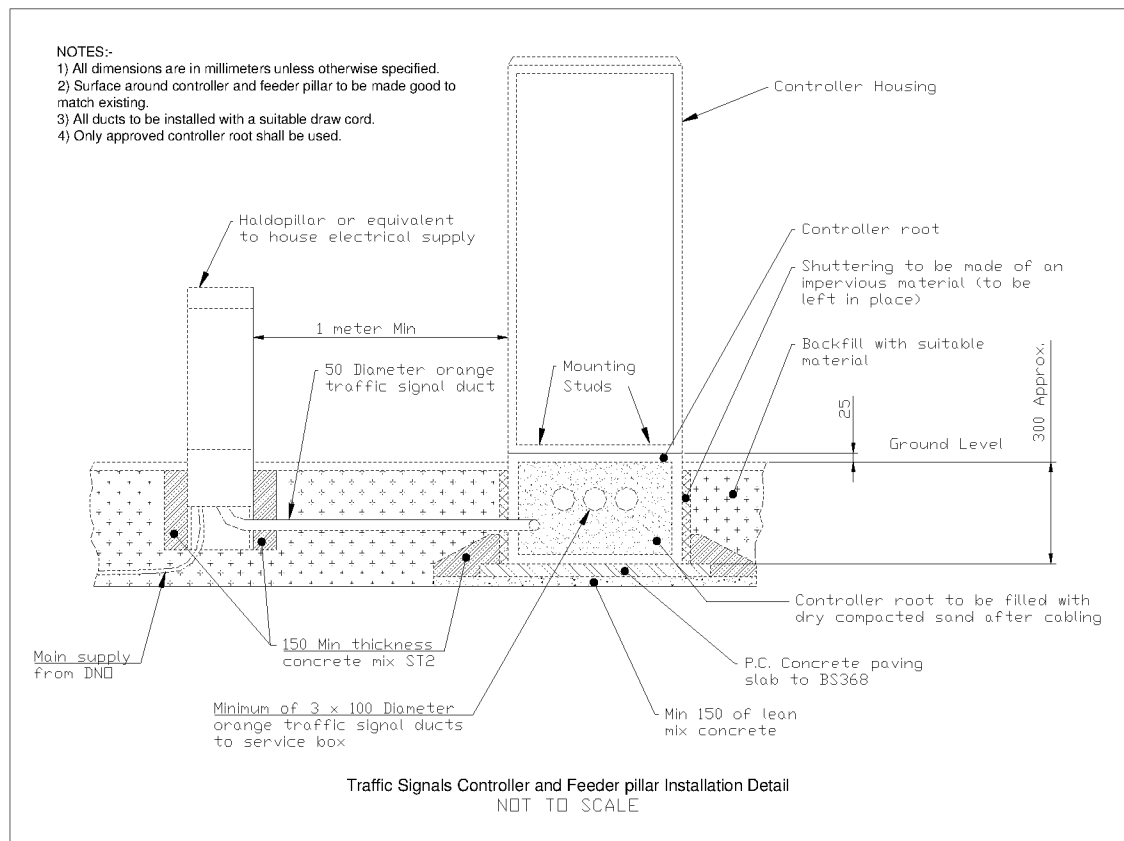
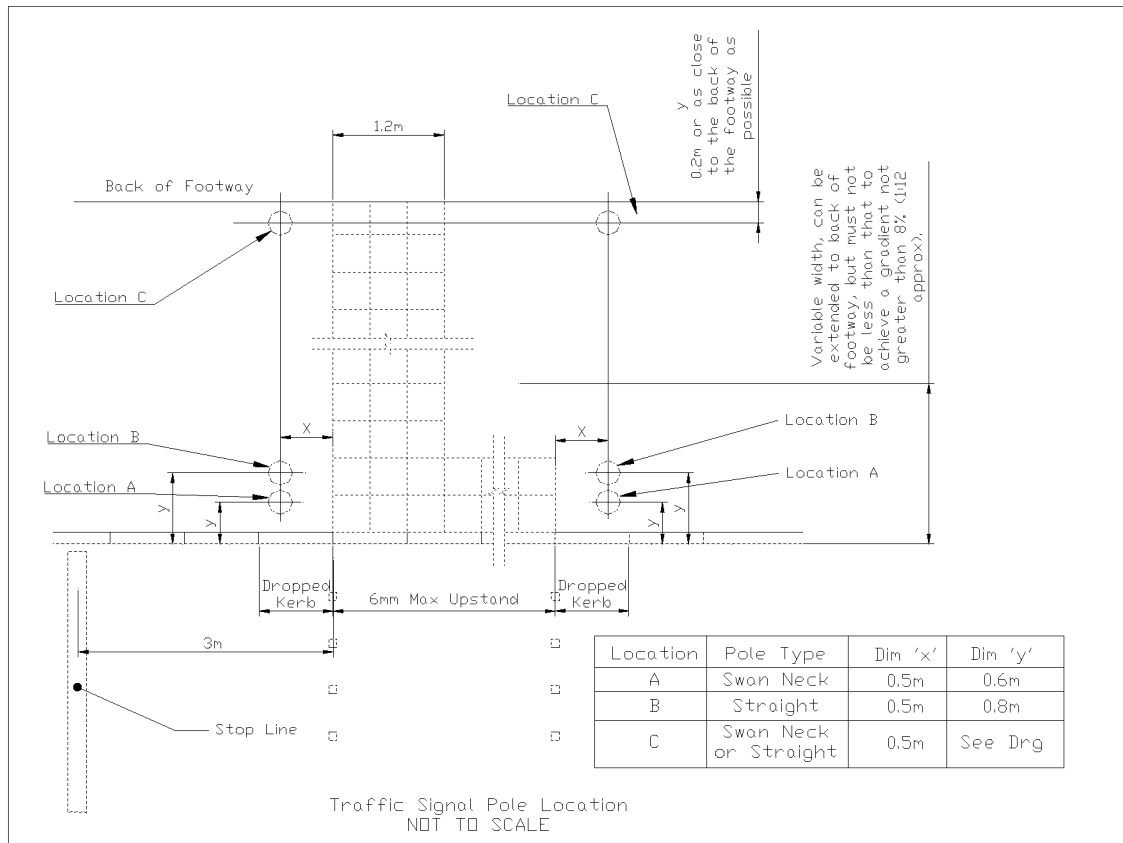
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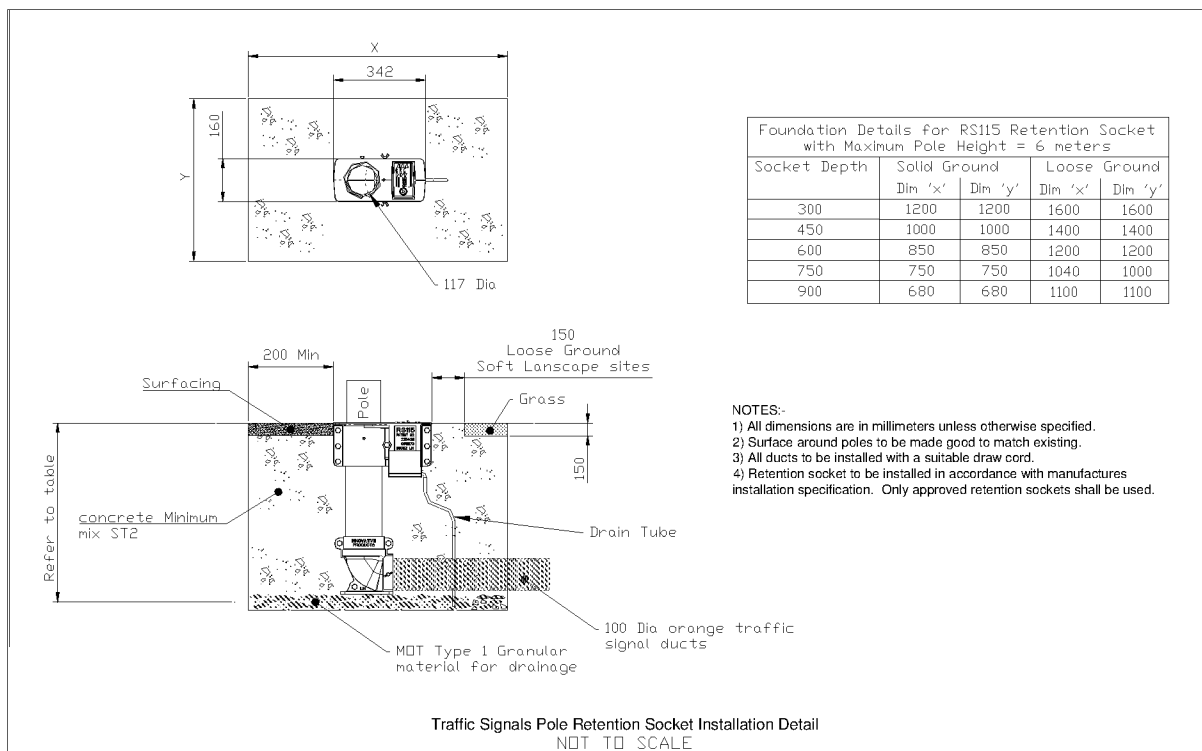
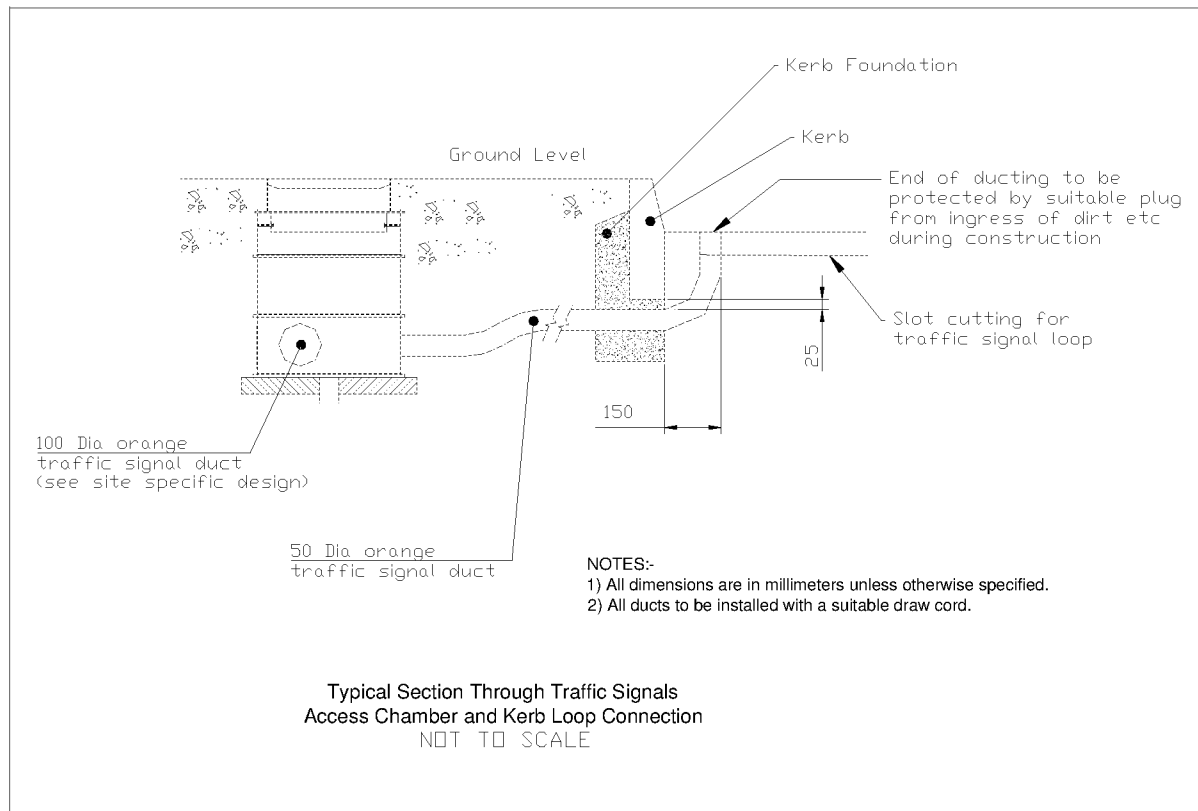
WSCC Traffic Signal Engineer

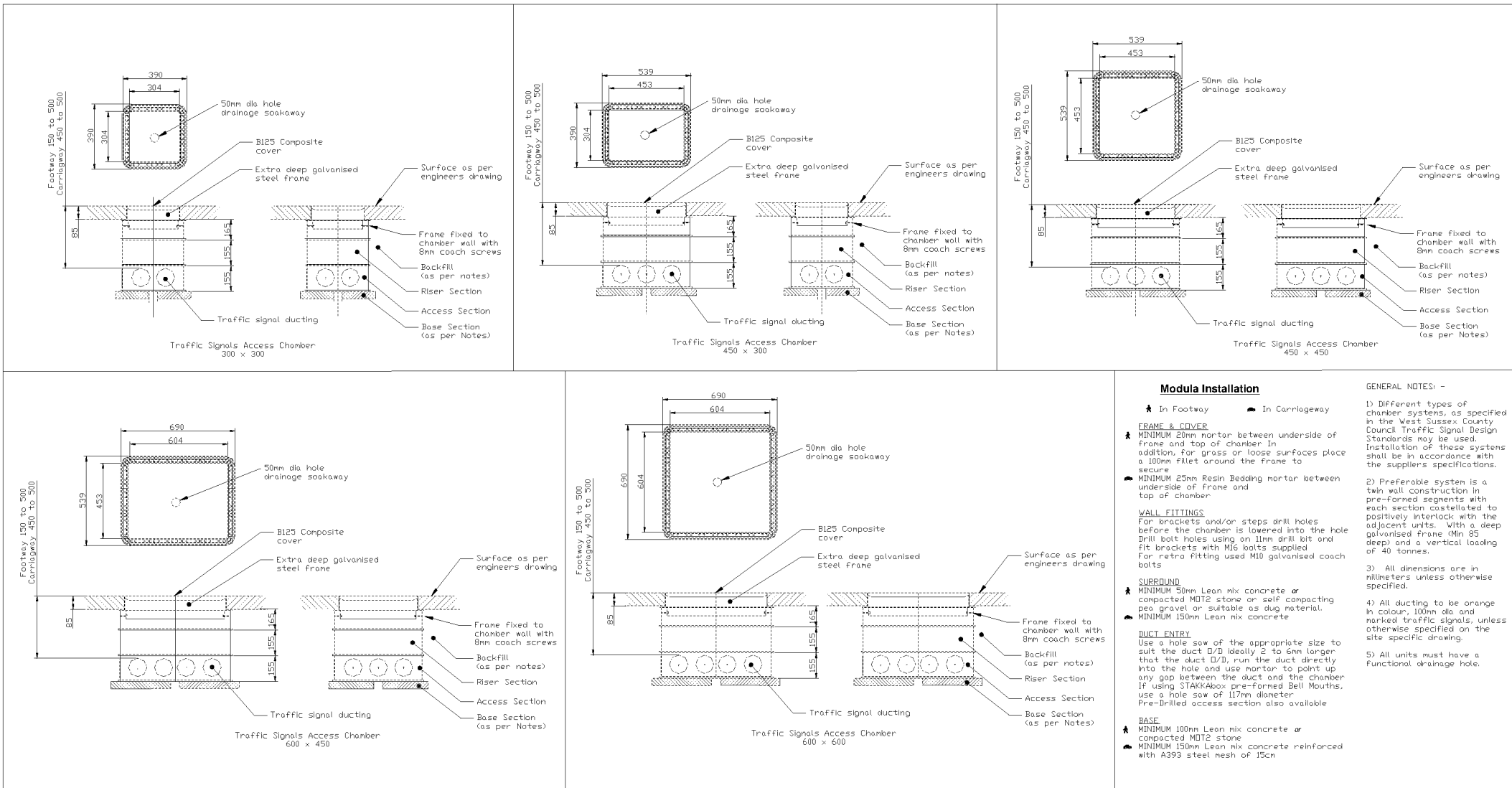
Name..... Signature.....

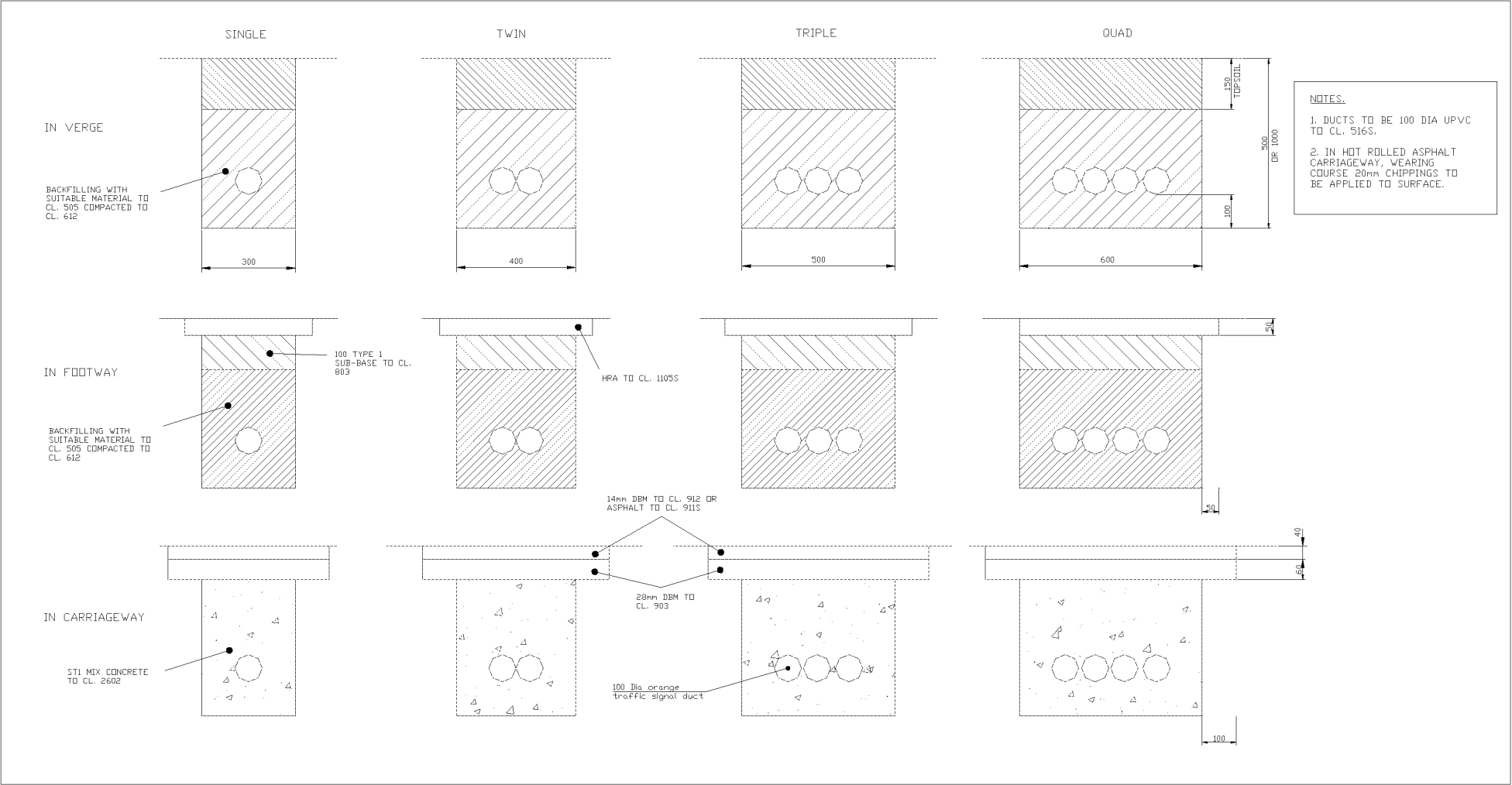
Client Representative

Name..... Signature.....

ANNEX D - STANDARD DRAWINGS







West Sussex County Council

Highways and Transport

Signal Design Standards

July 2017

Issue 7

	Prepared by	Checked by	Date
Original issue 1	J Greenough	S Found	January 2004
Issue 2	S Found	B Edmunds	January 2009
Issue 3	B Edmunds	S Found	September 2010
Issue 4	B Edmunds	S Found	June 2011
Issue 5	B Edmunds	S Found	June 2013
Issue 6	M Wylie	B Edmunds	January 2016
Issue 7	A Norris	B Edmunds	July 2017

Requirements for Installation of Signal Equipment in West Sussex

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- 2. Method of Control**
- 3. Signal Staging**
- 4. Timings**
- 5. Detection**
- 6. Cable and Duct Requirements**
- 7. Controller Requirements**
- 8. SCOOT Loop Design**
- 9. Signal Layout**
- 10. Controller UTC Interface**
- 11. Presentation of Designs**
- 12. Approved Suppliers Addresses**
- 13. References**

Requirements for Installation of Signal Equipment in West Sussex

1. Introduction

- 1.1 The aim of this note is to provide a guide to enable promoters of schemes to prepare traffic signal designs which address the specific requirements of West Sussex County Council.
- 1.2 Traffic signals for both vehicle and pedestrians control, in West Sussex are required to meet a number of requirements in both function and installation, to produce a consistency of approach for the benefit of the public who use the signals and to aid in maintenance. As a result this guide should be read with reference to West Sussex County Councils standard detail drawings. The most relevant of which are contained within the appendix of this document.
- 1.3 The National Code of Practice MCH 1969 shall apply throughout the design and installation cycle. In addition, the "Guide to Good Practice" shall be used as a reference (when published by EITAC)
- 1.4 The standards complement, but do not replace, Department of Transport the Environment and the Regions (DETR) Advice Notes, guidelines, manuals etc.
- 1.5 Any deficiencies found in the design shall remain the responsibility of the promoter of the scheme for a period of 1 year from the date of the take-over of the site following a successful site commissioning or for a year following the date that the associated development is opened and the initial impact of the full traffic and pedestrian flows are realised, whichever is the greater. It is therefore the responsibility of the promoter to ensure that all data regardless of source is correct, and that the consequence of any imposed conditions are well documented and acknowledged.
- 1.6 On completion of the installation a site acceptance test (SAT) will be conducted with a representative from WSCC Traffic Signals and WSCC's term contractor. The following documentation will be required: -
 - i. SAT form
 - ii. Electrical test certificate
 - iii. Take over certificate
 - iv. On completion of the SAT, site validation will be required to verify bus priority, remote monitoring, CCTV operation, timing parameters and/or UTC/MOVA setup.
 - v. To complete the design package an as built drawing, controller configuration and a validation report must be supplied to the WSCC traffic signals team

2. Method of Control

2.1 The method of control to be adopted will be determined by the location of the signal installation having specific regard to its proximity to other installations and to the operational envelope, traffic patterns etc, the site is required to serve. Consideration should be given, for example, to sudden surges in flow from entertainment facilities, abnormal patterns from other activities in the area and any other feature of traffic pattern and behaviour, which the signals will be required to serve.

2.2 The method of control used for signals are:-

- (a) UTC (Urban Traffic Control) normally SCOOT.
- (b) MOVA – latest software specification
- (c) Compact MOVA – latest software version
- (d) VA (Vehicle Actuated)

2.3 The method of control in use for pedestrian signals are:-

- (a) UTC
- (b) VA
- (c) MOVA

In all cases either Puffin, Pegasus, or Toucan with nearside Puffin type presentation shall be used.

2.4 UTC is adopted for all signal installations, which relate to existing areas of control and for new installations where proposals to implement the use of SCOOT exist. Or where proposals form part of or create a natural SCOOT region. Currently only the signals in Crawley and parts of Worthing and Horsham are controlled by UTC. (For detailed information on which sites are controlled by UTC please contact WSCC Traffic Signals on 01243 642105 or email traffic.signals@westsussex.gov.uk). The addition of a new site may require modification of existing equipment, particularly SCOOT loops, to take account of the changes to the network.

2.5 UTC signalised junctions will use MOVA as the fallback mode, although if justified VA will be considered.

2.6 MOVA is the preferred method of control for signalised junction sites, which do not form part of the UTC network.

2.7 VA shall be used as a fall back at all MOVA sites and may be adopted as the main method of operation for sites which have characteristics, which will not be best served by the adoption of MOVA. Such proposals will require justification.

2.8 UTC is adopted for pedestrian crossings using the same criteria as for signals, with the additional rider that there may be circumstances where linking to adjacent signals, rather than direct control by UTC is appropriate. All crossings within the UTC system shall be VA in method and operation.

2.9 For non UTC pedestrian crossings, the method of control is dependent upon the speed limit and the 85thile approach speed. The recommended operation will be as per Local Transport Note 2/95, although MOVA should be considered for 85thile >35mph and would be the preferred method of control for 85thile >45mph

2.10 All signalised junctions must incorporate the installation of CCTV cameras located in suitable positions to enable all approaches to the junction to be remote monitored. The system must conform to the latest WSCC CCTV standard and will be connected via an ADSL line or 3G SIM. Details of equipment can be obtained from WSCC Traffic signals on 01243 642105 or email traffic.signals@westsussex.gov.uk

3. Signal Staging

- 3.1 Complex staging of the signals shall be avoided, because it causes inflexibility in control.
- 3.2 The requirement for pedestrian facilities shall always be considered and included where appropriate. Unless otherwise agreed they shall be to the Puffin format, to allow the cycle time to be minimised and thus the service to pedestrians maximised. The use of an all red stage will usually cause serious delay in the form of an excessively long cycle time and would require detailed justification.
- 3.3 Where signals are under UTC control and have an all red pedestrian stage, there shall be provision for a “dummy” phase and hurry call for the stage, activated by time of day, with UTC over-ride. If the design Engineer is unfamiliar with the technique, guidance may be obtained from WSCC Traffic Signal staff. If appropriate, the same methodology shall be used for other pedestrian phases.
- 3.4 Where significant numbers of buses are operating, special assistance to public transport shall be considered. This may include:-
 - (a) Bus Lanes
 - (b) Selective Detection
 - (c) Bus by-passes
- 3.5 If the proposed signal facility is part of a cycle route, special provision for cyclists shall be made, but this will not include a separate cycle stage unless a detailed justification is provided.
- 3.6 Parallel Stage Streaming and alternative stage selection by time of day or week, are both techniques, which should be used as appropriate.
- 3.7 The use of early starts is not common in the South of England. The adoption of an early start may be subject to detailed questions and require justification.
- 3.8 For Mid block crossings – Puffin and Toucan, in all cases a VA or MOVA controller build shall be supplied.
- 3.9 Pre-timed max shall be used where appropriate on non UTC mid-block crossings.

4. Timings

- 4.1 Minimum green times shall be 7 seconds for normal traffic phases, 4 seconds for indicative right turn green arrows. Dummy phases shall be given minimums appropriate for their purpose.
- 4.2 Vehicle intergreen times shall be calculated for the conflict points of the worst case in accord with TA/16/07 ref TAL 1/06
- 4.3 Where a phase has an 85th percentile of more than 35 mph or the posted speed limit is more than 30 mph, on a maximum change, the intergreen shall be extended by 2 seconds.
- 4.4 Intergreen's to pedestrian phases shall be calculated on the basis of the conflict point being just past the most remote pedestrian movement of the pedestrian phase that gains right of way.
- 4.5 Pedestrian Green Man times at signals shall be calculated as for a Puffin crossing of the same width and as specified in TAL 1/06
- 4.6 Pedestrian clearance times shall be calculated using the clearance times as for a Puffin. Whether the pedestrian clearance is extendable shall depend on the location of the site within the highway network. The decision shall be justified.
- 4.7 Any phase intergreen less than 5 seconds will be subject to audit, unless the phase gaining right of way is an indicative green arrow phase.
- 4.8 Phase delays shall be used to minimise overall delay, whilst having regard to safety and interpretation of movements on other phases by drivers. On occasion it may be necessary to sacrifice a few seconds of theoretical capacity in the interest of safety e.g. where two or more traffic phases should sensibly start together.
- 4.9 Ripple changes are permitted, however the need for the UTC system to be able to monitor the operation of the site shall be considered. This may impose some restriction on the use of this feature.
- 4.10 To standardise part of the controller specification (TR2500) the following settings should be used unless otherwise justified: -
 - British Summer Time Start Week 13, End 43
 - Min Green Limit for Traffic Phase = 7, Pedestrian Phase = 5 and Intergreen = 5
 - Pedestrian Sequence Timings
 - o Gap = 1
 - o FRC = 1
 - o Min = 3
 - o Max = Width of crossing / 1.2
 - o CLR = 0
 - o XTR = 0
 - o Demand Extension = 1
 - o Push button, kerbside and on crossing extension = 1
 - Starting Intergreen = Maximum intergreen – 3
 - Detector names as below
 - Loops = (Phase letter)(Loop type)(sequential number if required)
Eg. AX1, AX2, BSL, BX, BY, BZ
 - MVD's = MVD (Phase Letter)(sequential number if required)
Eg. MVDA, MVDB1, MVDB2
 - Detector = (Type)(Phase letter)(sequential number if required)
Eg. IRDA1, IRDA2, ONCB3, ONCB8, KSB, PBB1, PBB4, AR
 - Bus input = BUS (Phase)(sequential number if reqd)(R = Request, C = Cancel)
Eg. BUSA1R, BUSA2R, BUSAC
 - DFM times as below

-
- | | | | |
|----------------------|---|---------------|-------------------|
| Loops & MVD's | = | Active 30 Min | Inactive 18 Hours |
| Push Buttons (PB) | = | Active 1 Hour | Inactive Not Set |
| On Crossings (ONC) | = | Active 30 Min | Inactive 18 Hours |
| Kerb Side (KS) | = | Active 1 Hour | Inactive 72 Hours |
| Bus inputs (BUS) | = | Active 5 Min | Inactive Not set |
| IRD's & All Red (AR) | = | Active 1 Hour | Inactive 18 Hours |
- Bleeper drivers to be timetable controlled – On = 7:00 Off = 22:00
 - Special conditioning
 - o Kerbside safety feature to be included on all pedestrian facilities with push button and kerbside detectors paired.
 - o Auxiliary 1 switch to be configured as VA select
 - o MOVA mode running lights AUX1 LED

Table 1 active/inactive states in DFM

Detector	Active	Inactive
Loops	A	A
MVD	A	A
BUS	I	N
Pushbutton	N	N
Kerbside	N	N
On-crossing	A	A

5. Detection

- 5.1. Stages that are not always required shall be demand dependant including when under UTC control.
- 5.2. Pedestrian phases may be non demand dependent when walk with traffic as long as there is no additional delay to vehicles. If an all red stage is required type 0 appearance should be considered but will be site specific and cyclic DFM's must be taken into account.
- 5.3. Where "on crossing" detection is provided, each crossing shall be a separate phase and monitored accordingly, and each detect will have a separate input to allow independent monitoring.
- 5.4. Far side pedestrian push buttons shall generally be mounted at 45 degrees for mid block crossings. For dual crossings and junctions angles are site specific and shall be specified on site by WSCC.
- 5.5. Near sided pedestrian push buttons on mid-block crossings shall be 'narrow angle of view' positioned to maximise convenience for the user. They shall be installed at an angle of 22.5 degrees from the pedestrian stud line, 67.5 degrees from the line of the carriageway.
- 5.6. Near sided pedestrian push button angles at dual crossings and signal junctions will require greater consideration and shall be 'narrow angle of view', due to the chance of motorists viewing the red man green man signal, in these circumstances angles are site specific and shall be specified on site by WSCC signal engineer. Consideration should also be given to using far side signals in certain circumstances.
- 5.7. Detection may be by any type of detector. The use of above ground detection (AGD) is encouraged, providing the detection characteristics are appropriate for the application. For SCOOT, the use of AGD must be justified for each location to demonstrate that it will give satisfactory results. The Highways England specifications MCE 0108 Issue C, TR 2123A, TR 2504, TR 2506, TR 2182B shall be applied as appropriate. The use of secondary or tertiary standard configurations will require justification.
- 5.8. Loop placement shall take account of ironworks, covers and drains in the carriageway during the design and not leave this to be determined during installation.
- 5.9. Presence detectors shall normally be 3m long in the direction of travel of the vehicles passing over them, to allow for a 2m separation between vehicles. This shall be adjusted as appropriate in special circumstances. The location of the loop shall be justified, but for an early cut off it is expected that it will normally be forward of the stopline.
- 5.10. Pedestrian detection shall use the appropriate device for both on crossing and footway detection. It will be necessary to justify the adoption of a specific type or model, if it is not in common use.
- 5.11. Footway detection for pedestrians is not mandatory, but is normal and omission shall be justified. It is the responsibility of the designer to ensure that the coverage of the detection is appropriate for the width of the crossing and the safety interlock feature is configured.
- 5.12. All above ground detection shall be connected up using standard plug and sockets, not wired direct. If the installers remove the plug sockets during installation, they will be required to replace them.
- 5.13. Slot cutting requires 50 mm of cover, with single part backfill. All slots shall be air dried before the backfill is poured. Loops may be laid in the base course of the carriageway, providing that the finished depth of cover does not exceed 60 mm.
- 5.14. All detector feeder cables laid in the carriageway, which exceed 5m, shall be armoured.

- 5.15. Standard bus detection for hurry calls or green waves utilise the ACIS priority system. Details of detection equipment can be obtained from WSCC Traffic signals on 01243 642105 or email traffic.signals@westsussex.gov.uk

6. Cable and Duct Requirements

- 6.1 Pedestrian push button units and all other extra low voltage equipment on all LV installations are to be wired on a separate core cable(s) to the vehicle signal cables.
- 6.2 Each signal pole shall be cabled directly to the controller. The looping of any cables between signal poles will not be accepted. ONLY in exceptional circumstances, and as directed by the Engineer, will alternative means of cabling be acceptable. Signals Installed on roads with a speed limit of 50mph plus shall have passively safe low access poles and quick disconnect system.
- 6.3 A separate 16 core cable shall be used to each push button pole for the push button and audible, and for future detection for Puffin type facilities, except where 2 poles for one pedestrian phase are on the same side of the carriageway, in which case they may be linked.
- 6.4 A cable drawing shall be incorporated within the construction drawing, showing clear distinction between LV and ELV.
- 6.5 Signal cables shall not pass through ducts or boxes used for any other service.
- 6.6 Mains and extra low voltage shall not be mixed in the same cable.
- 6.7 Detector inputs shall not be brought back on the same cable carrying the LV supply to signal heads or push buttons.
- 6.8 The core provision shall provide not less than 25% spare cores overall to each pole.
- 6.9 Where a signal controller is controlled by a remote OTU there shall be two 16-core cables provided for UTC control purposes.
- 6.10 Where Puffin/Toucan controllers are linked / controlled from a remote controller/OTU, there shall be a 16-core cable provided, for every crossing.
- 6.11 All poles shall be mounted in a retention socket. A suitable system, the RS-Retention socket system can be obtained from N.A.L. Limited, (Weir Lane, Worcester, WR2 4AY). Alternatives of equivalent specification will only be accepted if prior written agreement is obtained from West Sussex Traffic Signal Section.
- 6.12 All footway chamber lids shall have a Skid Resistance Value (SRV) of not less than 45.
- 6.13 Where the miss-use of the footway by goods vehicles is anticipated, heavy-duty frames and lids rated to 25 tonne or greater shall be used.
- 6.14 A length of duct (minimum 50 mm diameter) should run from each loop jointing chamber under the kerb and up through the road surface at the edge of the carriageway at the point where the loops will enter.
- 6.15 Chamber base section is to be set on a 150mm x 50mm concrete edging with 6mm clean gravel infill as a soak away.
- 6.16 Ducting shall be designed on the basis of a completely closed system and take note of the following:-
 - (a) Cables carrying 240v lamp power shall occupy separate ducts from cables carrying extra low voltage (push button/audible, detection etc) although they will use the same chambers.
 - (b) One spare duct shall be supplied on each road crossing.

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- (c) Not more than eight cables shall be laid in each duct.
 - (d) The designer shall demonstrate that there is sufficient capacity in the ducts for the number of cables proposed.
 - (e) Each road crossing shall terminate in a chamber.
 - (f) Any corner with an angle less than 135 degrees shall be turned in a chamber.
 - (g) No straight run shall exceed 50m between chambers.
- 6.17 Chambers of the following sizes should generally be used:-
- (a) Immediately by a pedestrian controller 600 x 600 x 600
 - (b) Immediately by a junction controller a minimum of 600 x 600 x 600
 - (c) At the end of road crossings, intermediate chambers in runs 450 x 450 x 600 mm
 - (d) For detector jointing 450 x 300 x 300
- Any variations from these sizes shall be noted on the drawing
- 6.18 Duct shall be in accordance with NJUG Standards, Orange 100 mm diameter with 'traffic signals' stamped at regular intervals. All carriageway crossing shall have not less than two ducts. Draw cords shall be left in ducts on completion of cable installation.
- 6.19 Ducts and chambers shall be obtained from IDS Integrated Ducting Systems (Peter Savage Limited, Liberty House, Liberty Business Park, Attleborough, Nuneaton, Warwickshire, CV11 6RZ), or STAKKAbOX available from N.A.L. Limited, (Weir Lane, Worcester, WR2 4AY), or Centurion Access Systems available from Civils and Lintels (Viking Way, Church Manoway Industrial Estate, Erith, Kent, DA8 1EW). Alternatives of equivalent specification will only be accepted if prior written agreement is obtained from West Sussex Traffic Signal Section.
- 6.20 All traffic signal poles must be of spigot low access design. An example of this can be supplied on request.

7. Controller Requirements

- 7.1 The controller shall be the latest specification of TR 2500 (formerly TR2210 & MCE 0141) and will incorporate an externally visible DFM lamp which can be readily seen from the carriageway.
- 7.2 There shall be provision for the supply of a second controller configuration within twelve months of commissioning, to embody detail changes to timings and set up found necessary in the post-commissioning phase.
- 7.3 The mains input shall be to a Haldo pillar positioned close, but no closer than 1 meter, to the controller, in a position where the chance of impact by vehicles leaving the road is minimised.
- 7.4 Where a BT connection for UTC is required it shall be to BT keyline premier 4-wire circuit, or the latest equivalent.
- 7.5 All non UTC junction controllers and pedestrian facilities shall be provided with an Outstation Monitoring Control Unit (OMCU), which is compatible with a RMS in-station as specified by WSCC Traffic Signals. Communication will normally be via GSM or broadband, however where the GSM signal is unacceptable then consideration will be given to installing a standard domestic BT circuit.
- 7.6 All non UTC junction controllers should be fitted with integral MOVA running version 6 or greater.
- 7.7 All UTC junctions and pedestrian facilities shall be provided with a Outstation Transmission Unit (OTU), which is compatible with the WSCC Siemens UTC system.
- 7.8 The SCN of the site shall be displayed on the controller cabinet in characters approximately 50 mm high. (i.e. 3621) The method of application shall be approved by WSCC.
- 7.9 On completion of installation all cabinets, BT pillars, Haldo and other similar devices, shall be base sealed.
- 7.10 On sites where bus priority is to be installed (ACIS) a separate power supply controlled via a dedicated RCD is required.
- 7.11 On all signalised junctions the controller must accommodate the installation of the CCTV equipment including a dedicated power supply and a broadband line. Details of equipment can be obtained from WSCC Traffic signals on 01243 642105 or email traffic.signals@westsussex.gov.uk
- 7.12 Controller and associated equipment to be manufactured by the WSCC traffic signals term maintenance contractor. Alternatives of equivalent specification will only be accepted if prior written agreement is obtained from West Sussex Traffic Signal Section.
- 7.13 The controller configuration to be created by an approved WSCC supplier (i.e. TCT Consultancy Ltd)
- 7.14 Factory acceptance test (FAT) to be conducted on the new controller with a representative from WSCC Traffic Signals and their maintenance contractor represented..

8. Loop Design

- 8.1 All loops shall be cut per lane. The only exception to this is the Y and Z loops of the system D loops, which may have their loop cable joined in the loop pits. Otherwise where a multiple lane approach is encountered, loops shall be cut individually and if necessary can then be joined at a terminal block within the controller.
- 8.2 The use of soft loops to adjust the saturated flow, shall require justification if specified at all SCOOT UTC sites.
- 8.3 SCOOT loop design shall take account of:-
- (a) Adjacent signal installations. (This may include requirements for the modification of adjacent installations, required as a consequence of the addition of the new site.)
 - (b) Sinks and sources between nodes.
 - (c) Lane use and width.
 - (d) Opposing flows, including the need for uni-directional detection link journey time.
 - (e) The need to separately identify vehicles for different phases as necessary.
 - (f) Good reflection of journey times and '**MAX**' queues,

Where compromises to the above are necessary, the reasons shall be recorded with any special requirements for system operation.

- 8.4 The need for unidirectional detection shall form part of the detector design and used as appropriate, for SCOOT, MOVA and stopline detection.
- 8.5 The need for exit loops and short link lengths, may be dictated by site performance, vehicle pathways and the junction design.
- 8.6 On MOVA sites each vehicle phase shall have separate stopline detection.
- 8.7 On MOVA sites where the loop positions are determined by vehicle speed, which can not be measured before the site is operational, permission can be sort from WSCC traffic signal section to cut the loops post commissioning. In these circumstances the duct network shall extend to an extent agreed with the WSCC traffic signal engineer.
- 8.8 There is a potential danger of loops cut in footways being a trip hazard therefore any loops, especially cycle loops in cycleways or footways shall be enclosed in 25mm plastic conduit which is laid in the hardcore base prior to the surfacing of the footway. In general the depth shall allow for 50mm of cover above the conduit surround.
- 8.9 All phases not in the reversion stage will require stop line detection.
- 8.10 Where advanced cycle stop lines are installed on phases not included in the reversion stage, these will include loop or IRD detection, any sites where they are omitted will require justification and written approval from a WSCC traffic signals engineer.

9. Signal Design

- 9.1 WSCC standard details shall be used where appropriate. Any variation to these shall be noted on the drawing
- 9.2 All optics shall be single light source ELV LED with a minimum 6 year warranty, not tungsten filament lamps.
- 9.3 On all two lane carriageways, the norm shall be both a Primary and Off Side Primary Signal Heads.
- 9.4 Separately signalled phases facing in the same direction shall not be included unless there is sufficient physical separation to allow the inclusion of a nearside primary signal on both phases.
- 9.5 Where there are three lanes on one approach, high level Primary optics shall be specified. All optics shall be single light source ELV LED with a minimum 6 year warranty, not tungsten filament lamps. High level optics may also be required where approach speeds are high or the topography indicates the need. The introduction of high level optics may introduce the need for similar provision at an existing installation, to minimise the risk of confusion between the two sites. This shall be considered as part of the design and safety audit.
- 9.6 Where there are three lanes near side and offside Secondary signals shall be specified. Secondary signals shall be not less than 7 m from the stopline.
- 9.7 Where an early cut off is used the secondary for the phase which is terminated early, shall normally be on the "near side" of the junction.
- 9.8 Where opposing phases on a junction appear simultaneously, arrows shall not be used for the ahead or right turn movements, because drivers expect to have right of way, when these are used. They may be used for segregated left turn movements.
- 9.9 Specific attention shall be given to the presentation of the signals to both drivers and pedestrians, to maximise the effective presentation of the signals and minimise the risk of confusion. In particular the potential for 'see through' for pedestrian optics shall be considered (including the standard use of narrow view pedestrian units). Where appropriate, special cowls, tunnel, cut away louvre etc may be used. Each shall be specified in detail. Where long tunnel cowls are used, any louvre's shall be mounted at the outer end only (100 mm) and not for the whole length to minimise reflection within the cowl. In appropriate situations, cut away cowls will give better performance than louvres because there can be no reflection from the cut away side.
- 9.10 Clearance for all street furniture shall be at least to Design Manual Road and Bridges Standard. Where there is the regular presence of special vehicles, such as car transporters, which have special overhang requirements, these shall be taken into account.
- 9.11 All movements subject to Heavy Goods Vehicle turns shall be checked using proprietary software. These checks are required to show that sufficient road space is available to enable the movement to be carried out safely.
- 9.12 On routes subject to regular use by special loads, any necessary provision shall be included in the design. This shall include requirements for removable poles or special clearances.
- 9.13 It is Council policy that sight lines shall be preserved. Where relevant grass or hard surfaces shall be used, shrubs that obstruct sight lines shall be removed. Each tree within the sight lines, shall be considered on its' merits, and any which it is proposed to remove should be checked for tree preservation orders.
- 9.14 Where formal pedestrian facilities are provided (i.e. red & green man) then tactile paving, (red, 400mm square), shall be laid in 'L shape' with the stem on the right hand side nearer the

- approaching traffic. For one-way streets where the traffic approaches from the left consideration shall be given for the stem to be on the left.
- 9.15 A pedestrian push button shall be supplied no more than 400mm from the outside right hand edge of the tactile paving. An additional push button will be required if the stem of the tactile paving is on the left.
- 9.16 If the crossing passes through an island, where it is not intended for pedestrians to wait, or where it does not form part of a staggered system, then generally tactile paving should not be laid within this island.
- 9.17 The width of the crossing shall be consistent throughout and shall normally be between 2.4 m and 3m unless it is to be shared with cyclists when it shall be a minimum of 4.0 m. Any deviation from these widths will require justification and written approval from a WSCC traffic signals engineer.
- 9.18 The outside edge of the pedestrian studs shall be in line with that of the tactile paving.
- 9.19 The footway slope to the dropped kerb shall be preferably 1 in 20 and no steeper than 1 in 12.
- 9.20 The drop kerb shall be flush with the carriageway surface with an absolute maximum permissible up stand of 6mm. It is the designer's responsibility to address any issues that may arise due to surface water run off, and to include for them in the design.
- 9.21 Where signal poles and guard rail are immediately adjacent, the poles shall be installed in line with the guard rail to minimise obstruction to pedestrians. This will probably require the use of cranked poles to maintain adequate clearance for signal heads.
- 9.22 The pedestrian heads shall be placed so that pedestrians on the crossing look toward traffic approaching on the far side of the road.
- 9.23 Tactile devices shall be fitted at all push button units. In addition an audible device should be fitted where allowed.
- 9.24 Staggered pedestrian facilities shall be considered on all crossings over 14m wide. The stagger shall normally be to the left and additional push buttons will be installed at the opposite side to the approaching vehicles. Only in exceptional circumstances will a right hand stagger be accepted. In these circumstances the designer shall fully justify the use of right hand stagger, and shall demonstrate that full care has been taken to ensure that pedestrian indications cannot be wrongly interpreted.
- 9.25 An absolute minimum clear width of 2.0m shall exist throughout the pedestrian area within the cage created by the guardrail. This shall be increased to 3.0m if cyclists share the facility
- 9.26 The distance between the limits of crossing shall be at least 3m, only in exceptional circumstances will a distance less than this be accepted. In these circumstances the designer shall fully justify the departure and include sufficient measures such as louvers to ensure that issues such as see through have been addressed.
- 9.27 There shall be preferably 3.0m between the stop line and the studs. If this needs to be reduced to a minimum of 2m the designer shall fully justify the departure from standard.
- 9.28 Each design shall include an area of hard standing, typically in the form of grasscrete, to allow for a maintenance vehicle to park. This area shall be accessed by 45 degree kerb units or similar. Where this is not achievable the designer shall carry out a risk assessment to assess if any measures are required to enable safe access by the maintenance engineer, which shall include identifying a suitable parking location that allows easy access to the controller.

10 Controller UTC Interface

10.1 The mode priority on a controller shall normally be:

Selected Manual Control	1
Selected Manual FT	2
UTC	3
Priority	4
CLF	5
VA	6

A hurry call shall be priority 2 if used and MOVA shall rank as UTC.

Bus priority will be configured within SCOOT using a BD bit which is activated by an input from the ACIS equipment. If a hurry call is used for bus priority when the junction is under local control this will be below UTC on the mode priority (ie 4).

If MOVA and UTC are configured special conditioning will be used to determine which UTC inputs are used.

10.2 An AUX lamp shall be labelled and light when the controller is under UTC / MOVA control

10.3 The Manual Panel Signal On/Off switch shall be set to As Start Up.

10.4 On the UTC interface there shall be:

One "F" bit for each stage, with a "G" bit in a matching position on the reply word.

The "DX" bit followed by as many "D" bits as is necessary. The "DF" bit in the reply word shall match the position of the "DX" bit.

No bit in the control word, with the "RR" bit in the reply.

No bit in the control word, with the "LF1" bit in the reply to denote any lamp fault.

No bit in the control word, with the "LF2" bit in the reply to denote a second red lamp fault.

The "TS" bit in the control word, shall be matched by the "CS" bit in the reply

Other bits such as "LL" shall be added as necessary, to suit the needs of the controller.

Separate phase reply bits shall be provided for demand dependant phases, though there may be restrictions on the bit availability. These shall be discussed with WSCC.

For Puffin/Toucans, the control bits shall be PV, PX, and LL if appropriate, matched by, GV, WC, LO

10.5 Where the interface is to be used for more than one controller, the bits of the remote controller shall be marked up on the interface specification of the controller which will house the OTU and the separate controller bit sets marked up with the SCN of each. The bits should follow the same pattern on the remote interface as on the signal controller interface. For Puffins, the bit pattern on the remote interface shall be as described in 10.3, irrespective of the controller sequence.

10.6 The SCN (System Code Number) will be supplied on request by WSCC Traffic Signals section Tel No 01243 642105.

10.7 Example:

The example is for a three stage set of signals, stages 2 and 3 demand dependant, with a linked Puffin.

	← 3646 →											← 3672 →				
Bit No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Control Bits	FA	FB	FC	DX	DB	DC				TS			PV	PX		
Reply Bits	GA	GB	GC	DF	DR B	DR C	RR	LF 1	LF 2	CS			GV	WC	LO	

10.8 UTC control is required when Force bits are present.

10.9 G1/G2 on the reply denotes No Lamp Power / Signal Off.

10.10 RR on the reply denotes that Manual Mode is selected.

10.11 Bus priority will be configured within SCOOT using a BD bit which is activated by an input from the ACIS equipment. If a hurry call is used for bus priority when the junction is under local control this will be below UTC on the mode priority.

10.12 Changes required to the UTC/SCOOT database and the resulting validation will be conducted by Siemens or WSCC Traffic signals.

11. Presentation of Designs

- 11.1 All designs shall be prepared using Autocad and Keysignals. On completion of works, a copy of the “as installed” drawing shall be supplied in an Autocad format agreed by WSCC Traffic Signals . The file may be ‘zipped’ when supplied on disk. All files supplied in electronic format shall be certified as virus checked and the software used with generation number, shall be quoted.
- 11.2 The drawing shall include a cable drawing and a staging drawing (if appropriate).
- 11.3 Special requirements relating to street furniture and signalling detail (special mounting arrangements, four-in-line heads, long cowls, louvres etc.) shall be outlined on the drawings and within notes accompanying the drawings.
- 11.4 Standard BS EN12368 (formerly BS 505) symbols shall be used.
- 11.5 All designs and installations shall be subject to Safety Audit either in accordance with HD 19/03 or IHT Standards. This shall include the completed Signal Controller Specification. The completed and Audited specification shall be signed and dated by the Engineer who carries out the Audit. The Original of all Audits shall be retained in the WSCC Traffic Signal section site file.
- 11.6 The drawing shall be accompanied by notes as dictated by the Code of Practice detailing all alternative signal designs that have been considered and reasons for choosing the design presented.
- 11.7 Specific reference to any design detail that does not comply with these standards or the appropriate DETR Advice Notes etc.
- 11.8 All signal poles shall be numbered, starting with the pole closest to the controller and proceeding in a clockwise direction around the facility.

12 Approved Suppliers Addresses

Ducts and chambers

IDS Integrated Ducting System
Garner Street Business Park
Garner Street
Etruria
Stoke On Trent
ST4 7BH



Civils and Lintels
Viking Way,
Church Manorway Industrial Estate,
Erith,
Kent,
DA8 1EW



N.A.L. Limited,
Weir Lane,
Worcester,
WR2 4AY



Pole retention systems

N.A.L. Limited,
Weir Lane,
Worcester,
WR2 4AY



Controller

Telent Ltd
Unit N Acorn Industrial park
Crayford Road
Crayford
Kent
DA1 4AL

Controller Configuration

TCT Consultancy Ltd
11 Noon Gardens
Verwood
Dorset
BH31 7WQ



**SCHEDULE D - WSCC document Lighting of Developer
Promoted Highway Schemes in West Sussex (Rev 13th August
2018)**

Lighting of Developer Promoted Highway Schemes in West Sussex

Contents

1. Process for Technical Approval of the design of Street Lighting and other illuminated equipment through the Section 278/38 Process
2. Development Standard for Highway Lighting – The 'Accrual Required Standards'
3. Part Night Lighting Areas Plan
4. Road Lighting Column Erection Details
5. Paint Colours by Parish
6. Process for Adoption of Street Lighting Equipment

1. Process for Technical Approval of the design of Street Lighting and other illuminated equipment through the Section 278/ 38 Process

All street lighting and illuminated equipment in West Sussex is adopted and maintained under a PFI contract with Tay Valley Lighting (TVL).

The County Council does not offer free design checks or a design service. All third party designs and installations shall be approved and the County Council will ask TVL to review your design and inspect your installation and recover their costs through the agreement process.

The street lighting design submission must be completed and provided as a standalone set of documents that can be issued to our PFI contractor for checking. It shall include:

- (i) A written notice including:
 - (A) Details of the proposed agreement. –Whether S278/38, location, description of highway works, PSI reference number
 - (B) the identity of the parties involved;
 - (C) written confirmation by the developer that the design complies with the 'Accrual Required Standards'.
 - (D) details of any special requirements by the Planning Authority in addition to the Standard Development Specification with which the proposed development or works must comply;
 - (E) the lighting classes which shall apply to each item of Apparatus and/or each road, footpath or cycle track within the proposed development or works;
- (ii) A copy of the proposed design of the Apparatus, including:
 - (A) A drawing showing the road layout the proposed development and works and details of the types of relevant apparatus including lighting columns positions (including their set-back from the carriageway edge). The drawing shall normally be at 1:500 scale supplied in PDF and in DWG or DXF format. The drawing must include trees and other features that might obstruct lighting, if this is not shown and subsequently added it could invalidate the design approval. For S278 there must also be a site clearance drawing. The drawing must show the new unit numbers and the existing equipment numbers.
 - (B) Details of which signs are going to be illuminated. Illuminated signs must be shown on the drawing and have appropriate schedules. For S278 there must also be a site clearance drawing and schedule. (Please note that TVL are only approving the specification and materials and WSCC will approve sign types, size and location).

- (C) A lighting design file which includes all relevant road and area calculations. These shall be in electronic format. The preferred lighting design programme is Lighting Reality. Any other format must be either readily available for free download or the programme supplied with the design. We also require a PDF version of the lighting design output file.
- (D) For CDM requirements a Designers Risk assessment/hazard elimination list.
- (E) Passive Safety Assessment – a risk assessment detailing whether passively safe equipment is required, and reasoning for the chosen class of passively safe apparatus in each situation. Evidence shall be provided that your design accords with TD 89/08 (Use of Passively Safe Signposts, Lighting Columns and Traffic Signal Posts to BS EN 12767:2007).

2. Development Standard for Highway Lighting - The 'Accrual Required Standards'

The basic start position of the design philosophy is West Sussex is considered a rural county with most subsidiary roads being considered as quiet with slow moving vehicles.

The following notes shall appear on the design drawings:

- All equipment is to be fitted to manufacturer's guidelines.
- All lanterns are to be supplied 'Constant Light Output' (CLO) enabled,
- All apparatus shall be new at the time of installation and be supported by relevant manufacturer's guarantees. Such guarantees must be transferred to Tay Valley Lighting (West Sussex) Limited at the point of adoption.
- All apparatus shall be sited so as to minimise, in so far as is reasonable and practical, nuisance, danger and obstruction to all residents, businesses and users of the highway.
- All columns and sign posts installed must be manufactured in accordance with BSEN40 and be able to accept an attachment of 0.3m² in area at height and offset on the apparatus.
- All illuminated apparatus must be installed and tested in compliance with BS7671 at the time of adoption. Lamps must be no more than 6 months old at the time of adoption.
- All installations must be installed in such a way that trees or any other foliage on the site does not interfere with the level of lighting.

Equipment:

Subsidiary Roads BS5489-1:2013 Class S6/ P6 - S4/ P4

Standard Lanterns: Philips 'Micro Luma' post top mounted, 12-20 LED, lumen outputs as required for design, Cool White (5700K), wired for Dali control and fitted with Mayflower six pin NEMA socket, post-top mounted, maximum tilt 5 degrees.

Heritage Lanterns: (Subject to specific prior approval of the County Council) Metcraft Victoria, Addington or Newton, LED 1-3 modules Philips FastFlex Neutral White (4000K) 350mA or Zeta SmartScape, LED. Set to required flux. Wired with Mayflower internal GPS node.

Architectural Lanterns: (Subject to specific prior approval of the County Council)
DW Windsor DW 400 Set to required flux Neutral White (4000K) set to required flux level. Wired with Mayflower internal GPS node.

Lighting columns: Subsidiary Roads 6 metre straight shaft (no outreach bracket), Coating Amercoat

71P/PSX 700 polysiloxane and Amercoat 4560 GF epoxy glass flake root protection.
Columns designed to take an additional loading of a 0.6 metre square sign plate.
Colour as specified by the Authority.

Footpaths and other access limited sites, 6 metre Abacus post top root
counterbalance RLS168 - White

10kg Coating Amercoat 71P/PSX 700 polysiloxane

Switch controls:

Subsidiary Roads (Part Night areas)

Standard:: Mayflower Complete Lighting Control DALI GPS Node to plug into six-pin NEMA socket in each lantern. Switching to 35/18 part night (12-5:30 off)

Heritage: Mayflower Complete Lighting Control DALI internal GPS node in each lantern. Programmed for switching levels 35/18, part night (12-5:30 off)

Subsidiary Roads (All Night areas)

Standard: Mayflower Complete Lighting Control DALI external GPS node in each lantern. Switching to 35/18

Dimmed 12-5:30 to 60% light output).

Heritage: Mayflower Complete Lighting Control DALI internal GPS node in each lantern.

Switching to 35/18

Dimmed 12-5:30 to 60% light output).

Every lighting scheme is required to install one Mayflower Complete Lighting Control DALI Sub-master unit to control Nodes and link to Central Management System. (This shall be installed outside the Heritage lantern areas)

Secondary Isolator: Where units are on statutory cable connections, in addition to the double pole supply cut-out every lighting point shall be fitted with a Tofco type 1 isolator.

Internal wiring: The cable from secondary isolator to the lantern 1.5mm² 3 core flex (3183Y) on columns greater height than 10m the cable size will increase to 2.5mm²

Lanterns Traffic Routes BS5489-1:2013 Classes M5 to M3 and C

Standard Lanterns: Philips Luma Versions Mini, 1 to 3 post top mounted, (as the number of LED's and lumen outputs is required for the design), Neutral White (4000K), wired for Dali control and fitted with Mayflower six pin NEMA socket and post-top mounted, max tilt 5 degrees.

Lanterns Heritage: (Subject to specific prior approval of the County Council) Metcraft Gladstone/Newton – LED 3-5 modules Philips FastFlex Neutral White (4000K), set to required flux. Specific column design is required for this lantern with its bracket combination.

Lanterns Architectural: (Subject to specific prior approval of the County Council)

DW Windsor DW 400 LED Neutral White (4000K), set to required flux. Wired with Mayflower internal GPS node.

Lighting columns: Traffic Routes -8/10/12 metre straight shaft (no bracket), Coating Amercoat 71P/PSX
700 polysiloxane and Amercoat 4560 GF epoxy glass flake root protection. Columns designed to take an additional loading of a 1metre square sign plate. Colour as specified by the Authority.

Passive Safe Lighting Columns: All Passive Safe equipment must be on a private electrical supply with above ground NAL electrical disconnection system. All Passive Safe equipment to be installed in NAL sockets. Sensor Cable LOOP2X2/5SWA 1X2X2.5mm² (1) PE,PE,SWA,PE OR 0.6/1KV - BS6346, Orange. Preferred manufacturers of passive lighting columns; NE and LE SAPA with HE Valmont Stainton. Foundations shall be in accordance with NAL Retention Socket Foundation Details below. Foundation dimensions shall be indicated on design drawings. Installation shall be in accordance with the manufacturers guidelines: www.nal.ltd.uk

Painted colour as specified by the Authority.

Switch controls: Traffic Routes Mayflower Complete Lighting Control DALI internal GPS node in each lantern. Switching to 35/18 part night (Dimmed to 60% light output).

Every lighting scheme is required to install one Mayflower Complete Lighting Control DALI Sub-master unit to control Nodes and link to Central Management System. (This shall be installed outside the Heritage lantern areas).

Secondary Isolator: Where units are on statutory cable connections, in addition to the double pole supply cut-out every lighting point will be fitted with a Tofco type 1 isolator.

Internal wiring: The cable from secondary isolator to the lantern 1.5mm² 3 core flex (3183Y) on columns greater height than 10m the cable size will increase to 2.5mm².

Subways and Under passages.

Simmons Single LED high frequency controlled Safeway subway light unit with Mayflower internal GPS node in each unit and Dali Ballast. Every lighting scheme is required to install one Mayflower Complete Lighting Control DALI Sub-master unit to control nodes and link to Central Management System

Externally Illuminated Road signs:

Sign Posts – Standard: Galvanised steel post painted in conservation areas to match lighting columns.

All Centre island post mid hinge (for safe access).

Sign Posts – Passive: All Passive Safe equipment must be on a private electrical supply with above ground NAL electrical disconnection system. All Passive Safe equipment to be installed in NAL sockets. Sensor Cable LOOP2X2/5SWA 1X2X2.5mm² (1) PE,PE,SWA,PE OR 0.6/1KV - BS6346, Orange. Preferred manufacturers of Passive sign posts will be wide base posts - SAPA. Foundations shall be in accordance with NAL Retention Socket Foundation Details below. Foundation dimensions shall be indicated on design drawings. Installation shall be in accordance with the manufacturers guidelines:
www.nal.ltd.uk

Lanterns: Simmonsins LUA (up to 750mm Sign) LED with low voltage HF electronic ballast (Note on centre islands Extra Low Voltage 24 volt circuit). Above 750mm Simmonsins LUB 2 x LED with low voltage HF electronic ballast)

Switch controls: Mayflower Complete Lighting Control DALI internal GPS node in each lantern. Switching to 35/18 part night.

Illuminated Bollards:

Bollard type: Simmonsins SIMBOL base light bollard LED with electronic gear 24 volt supply

Switch control: Internal Royce Thompson 2000 BL mini one part lowlight bollard photocell.

Centre Island Illuminated Beacons:

Beacons type: Simmonsins White LED beacon 24 volt supply.

Globe mounting height: 4m as standard, or as specified within highways design.

Switch controls: 24 hour operation.

Signs type (where reflective bollards are fitted):
Internally Illuminated Simmonsins Invinca, 24 volt supply.

Posts:

On roads up to 30mph: Mid hinged (for safe access) galvanised steel post. In conservation areas painted to match the Lighting columns.

Over 30mph Roads: Simmonsins Passafe system

Zebra Crossing lighting

Side of road:

Post: Installed on 6 metre column "black" with white 3m bands

Lantern: Philips/WRTL 'Mini Luma' post top mounted, DPR1 Pedestrian Crossing Optics 12-40 LED, lumen outputs as design, Neutral White, wired for Dali control and fitted with Mayflower six pin NEMA socket, post-top mounted, maximum tilt 5 degrees.

Amber/ white beacons: Simmons Signs Midubel

Centre of road (where required):

Post: Installed on 4 metre (standard height) mid hinge (for safe access) column "black" with white bands for 3 metre of post.

Amber beacon: Simmons Signs Post Top Amber beacon Modubel, 24 volt supply if in centre of road. Switch controls: 24 hour operation

Electricity Supplies to Lighting Columns and Lit Sign Units

District Network Operator (DNO): Power Supplies

Unless agreed otherwise with the Service Provider and Highway Authority prior to approval of the design, **all** lighting columns and lit sign units are required to have individual power supplies supplied by the **District Network Operator (DNO)** via service connections from the Low Voltage mains network. There are 14 DNOs that cover Great Britain - the DNO's for West Sussex geographical area are Scottish & Southern Electricity Networks and UK Power Networks.

Independent Distribution Network Operators (IDNOs): Power Supplies

As part of the overall development the Developer may use an alternative to the DNO Network and use an IDNO – there are currently a number of Licensed IDNOs, details of which can be found on the Ofgem website www.ofgem.gov.uk. IDNOs own and operate smaller networks located within the areas covered by the DNOs. IDNO networks are mainly extensions to the DNO networks serving new housing and commercial developments;

Should the development be covered by an IDNO Network, the Developer is required to ensure that a Service Level Agreement (SLA) is in place between the following prior to formal adoption of the development:-

- ☐ Service Provider : SSE Enterprise;
- ☐ Highway Authority : West Sussex County Council;
- ☐ Independent Distribution Network Operator (IDNO);

The SLA shall cover factors including;-

- ☐ Agreed Costs for engaging the IDNO to cover a variety of works – new connections, disconnection of services, transference of services and the like;
- ☐ Agreed timescales for engaging the IDNO to undertake new connections, disconnection of services, transference of services and the like;
- ☐ Liability following the failure of power supplies;
- ☐ Duties of Responsibility for the Site;
- ☐ Emergency Services – Agreed extent of services covered by such works, Contact Details, Costs and Timescales for carrying out works;

The SLA **MUST** be presented prior to adoption of site

Private Underground Service Cabling

All private cabling Low Voltage and Extra Low Voltage will be laid in orange duct marked "Street Lighting". SWA cable will be terminated into the base of the column Tofco cut-out via B21 Extension box fitted with IP7 Plate and 5 x Encapsulated Terminals. Glands used will be CW and be covered by shroud.

Column Alignment

Lighting columns will be installed to the rear or footpath or in verge to clearance of BS5489. Columns and signs where possible will be installed with the door aperture aligned so looking at it you will be facing oncoming traffic. Access must be unrestricted from the highway.

Design speed See TD9/93 for corresponding speed limits	Min Horizontal clearance/m
50kph or less	0.8
80kph	1.0
100kph	1.5
120kph	

Design Information

S/P ratios;

	Luma Cool White 5700 S/P Ratio 1.96		
Class	E _{ave}	E _{ave} Max	E _{min}
S4	3.42	5.13	0.68
S5	1.82	2.73	0.40
S6	1.12	1.68	0.40

Design Maintenance Factors

Light Source	Lamp Wattage	Overall Maintenance Factor
Luma's LED Lx=90	All classed E1/E2	0.83
Other Lx		As calculated

South Downs National Park requirements

Within the National Park ambient luminance shall be considered as very low and lower lighting levels for traffic routes are justified.

Numbering of electrical equipment:

Letters and numerals shall be 50mm high black on white on adhesive labels suitable for exterior use.

Generally the numbering of the road will follow the same direction as the house numbering although this may not be practical in the instances of one way streets and this would be an exception.

If an additional piece of equipment is erected into an existing numbering system then the preference is to renumber the whole road again incorporating the new equipment.

Columns:

The Columns shall be numbered consecutively per road starting with 1 through to the conclusion of the road as per WSCC Gazetteer.

Numbers shall be positioned at 90 degrees to the carriageway, 2.5m above ground level (no suffix is required).

Signs and Bollards:

Signs and bollards shall be numbered consecutively per road starting with 1 through to the conclusion of the road as per WSCC Gazetteer. In addition to this the sign or bollard shall bear the first letter of the road as a suffix. **For new roads where the road name is not determined please use the letter X as a temporary placeholder for design purposes and substitute the correct suffix on installation.**

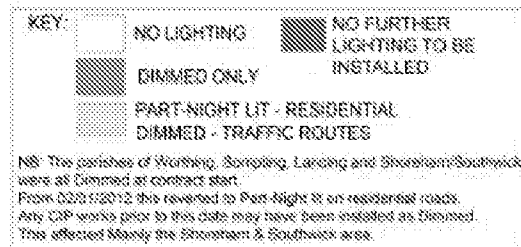
For signs positioned facing the carriageway, numbers and letters shall be placed at 45 degrees to oncoming traffic.

For bollards, letters and numbers shall be positioned on the rear of the bollard.

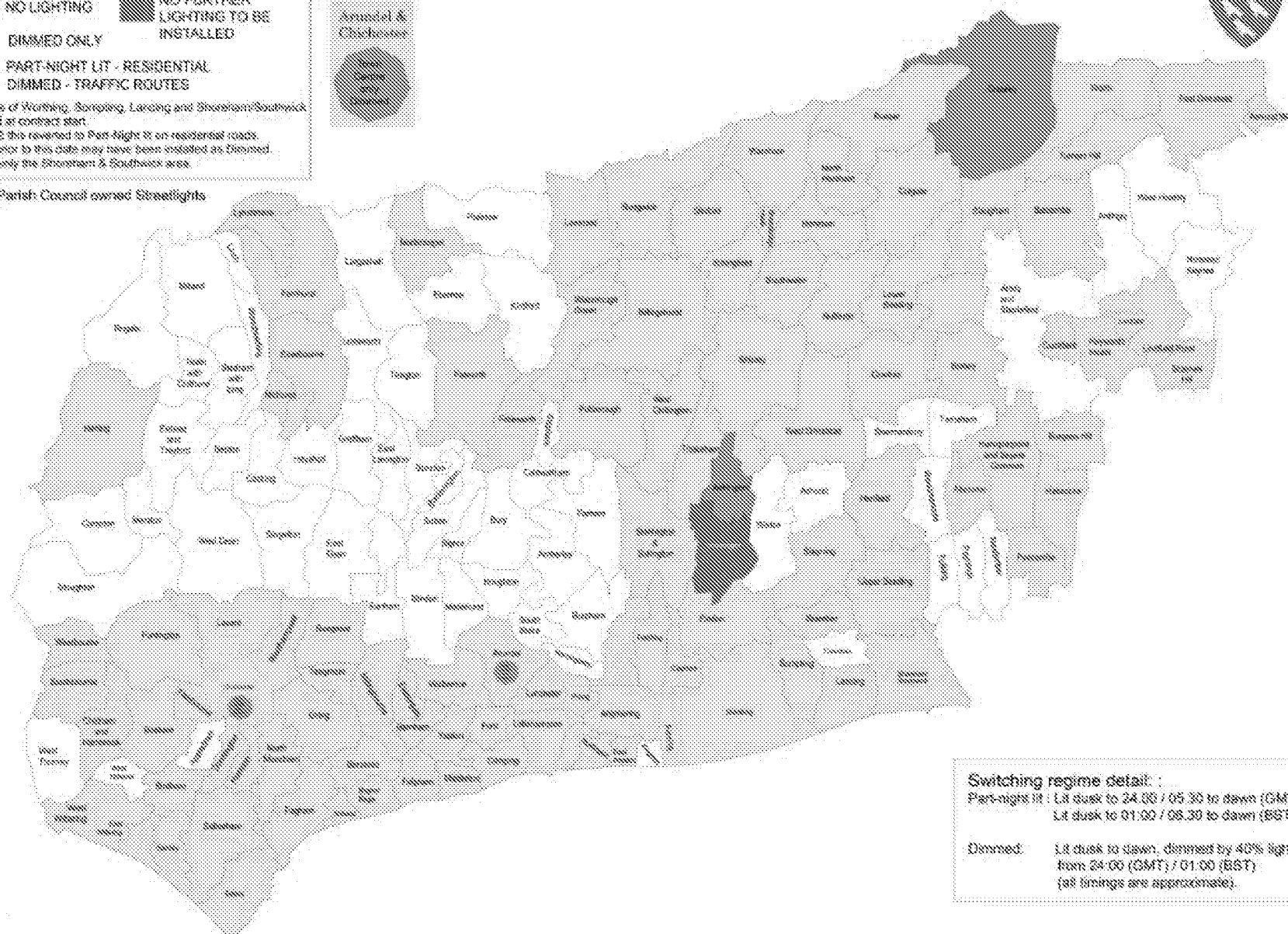
Mounting of signs on painted columns

Painted surfaces shall be protected by 5mm thick solid neoprene banding placed between the sign mounting clips and the painted surface.

3. Part Night Lighting Areas Plan

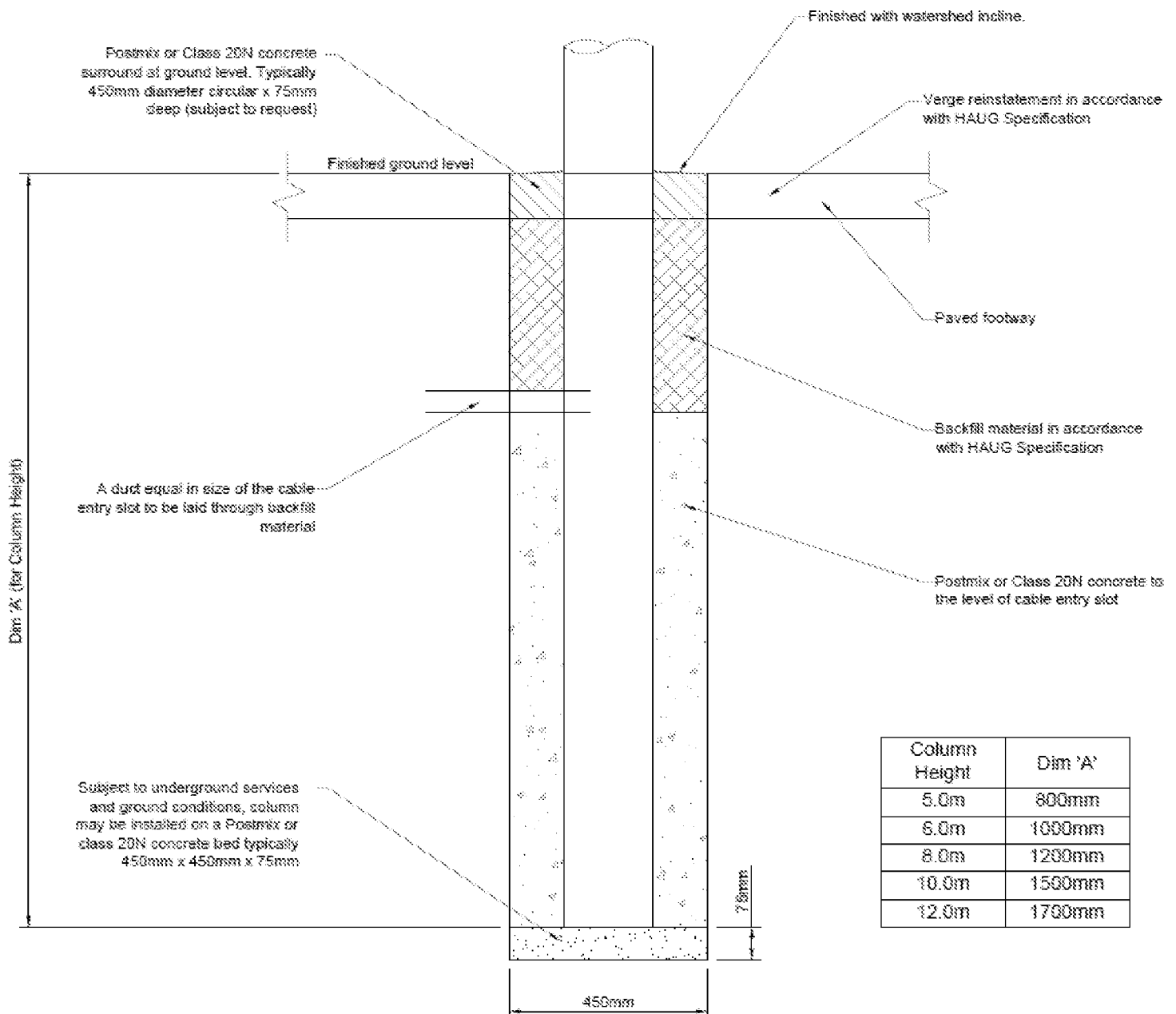


Not including Parish Council owned Streetlights

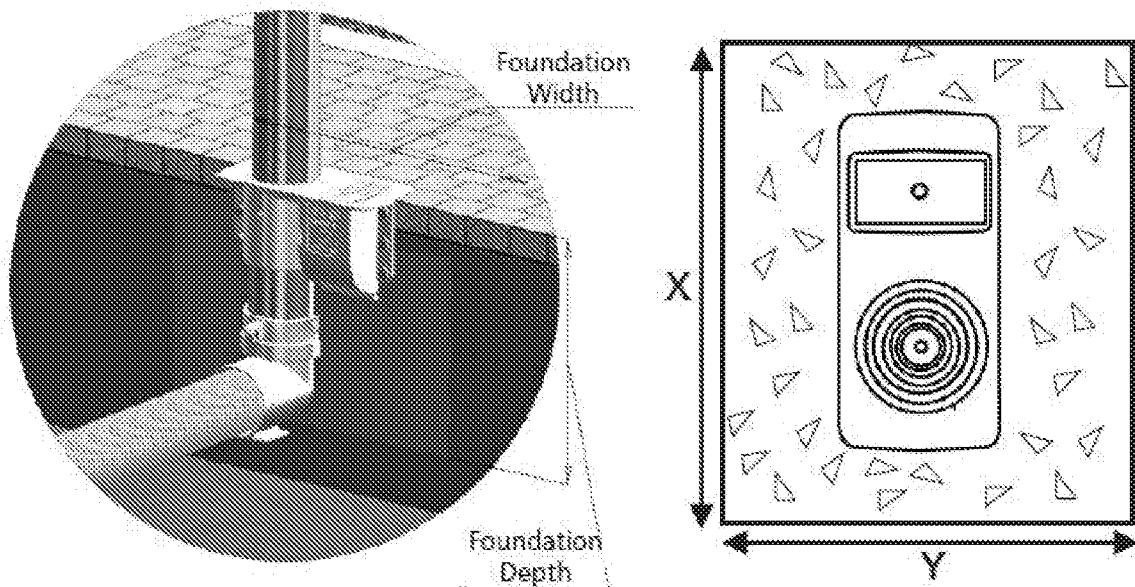
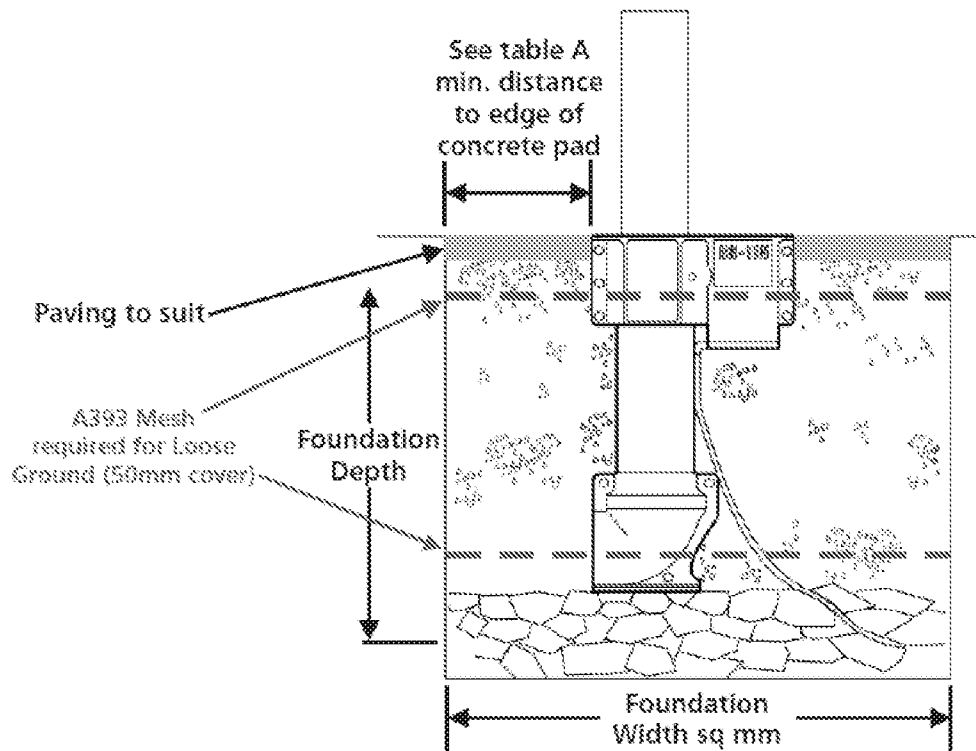


4. Road Lighting Column Erection Details - Not to Scale

Standard columns



NAL Retention Socket Foundation Details



NAL Retention Socket Foundation Details – Continued

The following foundation dimensions make worst case assumptions about wind loading etc. In the absence of site specific calculations these dimensions shall be used.

Solid Ground - Retention Socket Foundation Details

Retention Socket Depth		300mm		450mm		600mm		750mm		900mm		1050mm		Table A
Retention Socket Size	Max Post Height	Foundation Width mm												
		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	
RS115	6m	1200 x 1200		1000 x 1000		850 x 850		750 x 750		680 x 680		-		200mm
RS140	8m	1390 x 1390		1190 x 1190		1080 x 1080		1000 x 1000		940 x 940		-		200mm
RS145	10m	1680 x 1680		1450 x 1450		1320 x 1320		1220 x 1220		1150 x 1150		-		200mm
RS159	10m	1730 x 1730		1500 x 1500		1360 x 1360		1260 x 1260		1190 x 1190		-		250mm
RS168	10m	1760 x 1760		1520 x 1520		1380 x 1380		1280 x 1280		1210 x 1210		-		250mm
RS177	10m	1780 x 1780		1550 x 1550		1400 x 1400		1310 x 1310		1230 x 1230		-		250mm
RS193	12m	1820 x 1820		1590 x 1590		1440 x 1440		1340 x 1340		1270 x 1270		1210 x 1210		300mm
RS200	12m	2130 x 2130		1850 x 1850		1690 x 1690		1570 x 1570		1480 x 1480		1410 x 1410		300mm
RS219	12m	2190 x 2190		1900 x 1900		1740 x 1740		1620 x 1620		1520 x 1520		1450 x 1450		300mm
RS226	14m	2440 x 2440		2130 x 2130		1950 x 1950		1810 x 1810		1710 x 1710		1620 x 1620		300mm
RS250	14m	2520 x 2520		2200 x 2200		2000 x 2000		1850 x 1850		1750 x 1750		1660 x 1660		300mm

Loose Ground - Retention Socket Foundation Details

Retention Socket Depth		300mm		450mm		600mm		750mm		900mm		1050mm		Table A
Retention Socket Size	Max Post Height	Foundation Width mm												
		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	
RS115	6m	1600 x 1600		1400 x 1400		1200 x 1200		1040 x 1040		1100 x 1100		-		200mm
RS140	8m	1600 x 1600		1400 x 1400		1280 x 1280		1200 x 1200		1140 x 1140		-		200mm
RS145	10m	1900 x 1900		1670 x 1670		1530 x 1530		1430 x 1430		1360 x 1360		-		200mm
RS159	10m	1940 x 1940		1720 x 1720		1570 x 1570		1480 x 1480		1400 x 1400		-		250mm
RS168	10m	1970 x 1970		1740 x 1740		1590 x 1590		1490 x 1490		1420 x 1420		-		250mm
RS177	10m	2000 x 2000		1760 x 1760		1620 x 1620		1520 x 1520		1440 x 1440		-		250mm
RS193	12m	2040 x 2040		1800 x 1800		1660 x 1660		1550 x 1550		1480 x 1480		1410 x 1410		300mm
RS200	12m	2350 x 2350		2070 x 2070		1910 x 1910		1780 x 1780		1690 x 1690		1620 x 1620		300mm
RS219	12m	2410 x 2410		2120 x 2120		1960 x 1960		1830 x 1830		1740 x 1740		1660 x 1660		300mm
RS226	14m	2430 x 2430		2140 x 2140		1980 x 1980		1850 x 1850		1750 x 1750		1680 x 1680		300mm
RS250	14m	2500 x 2500		2200 x 2200		2020 x 2020		1890 x 1890		1790 x 1790		1720 x 1720		300mm

Columns shall be erected in accordance with the manufacturers installation guide
www.nal.ltd.uk

Paint Colours by Parish

Heritage columns shall be painted black, except in Park Place Horsham.

Otherwise paint colours shall be as indicated on the chart below.

In conservation areas illuminated sign posts shall be painted to match the columns. Paint to be factory applied.

Where a scheme straddles a parish boundary, or where the intention is that a boundary will change to encompass the new development the designer shall seek further guidance on which paint colour to apply.

Town	Colour	BS number	Town	Colour	BS number
Albourne	Sherwood Green	BS12C39	Hailsham	Sherwood Green	BS12C39
Aldingbourne	Sherwood Green	BS12C39	Hunston	Sherwood Green	BS12C39
Aldwick	Cupress	BS14C39	Hurstpierpoint	Sherwood Green	BS12C39
Angmering	Black	BS00E53	Hurstpierpoint (High Street)	Silver	BS00A01
Arundel	Sherwood Green	BS12C39	Lancing	Sherwood Green	BS12C39
Ashington	Black	BS00E53	Lavant	Sherwood Green	BS12C39
Barnham	Sherwood Green	BS12C39	Linchmere	Sherwood Green	BS12C39
Barsted	Cupress	BS14C39	Lindfield	Sherwood Green	BS12C39
Billingshurst	Sherwood Green	BS12C39	Littlehampton	Sherwood Green	BS12C39
Birdham	Sherwood Green	BS12C39	Lymington	Sherwood Green	BS12C39
Bognor Regis	Cupress	BS14C39	Manningtree Heath	Sherwood Green	BS12C39
Bognor Regis seafront	Cream	BS08C31	Middleton-on-sea	Cupress	BS14C39
Bolney	Sherwood Green	BS12C39	Midhurst	Sherwood Green	BS12C39
Bosham	Sherwood Green	BS12C39	North Horsham	Sherwood Green	BS12C39
Boxgrove	Sherwood Green	BS12C39	Northchapel	Sherwood Green	BS12C39
Bramber	Sherwood Green	BS12C39	Oving	Sherwood Green	BS12C39
Broadbridge Heath	Sherwood Green	BS12C39	Pagham	Cupress	BS14C39
Burgess Hill	Black	BS00E53	Partridge Green	Sherwood Green	BS12C39
Chichester	Sherwood Green	BS12C39	Patching	Sherwood Green	BS12C39
Chidham	Sherwood Green	BS12C39	Pease Pottage	Sherwood Green	BS12C39
Christ's Hospital	Sherwood Green	BS12C39	Petworth	Juniper	BS12B29
Clapham	Sherwood Green	BS12C39	Poling	Sherwood Green	BS12C39
Climping	Sherwood Green	BS12C39	Pulborough	Sherwood Green	BS12C39
Copthorne	Sherwood Green	BS12C39	Pyecombe	Sherwood Green	BS12C39
Cowfold	Sherwood Green	BS12C39	Rose Green	Cupress	BS14C39
Crawley	Juniper	BS12B29	Rudgwick	Sherwood Green	BS12C39
Cuckfield	Sherwood Green	BS12C39	Rustington	Sherwood Green	BS12C39
Dial Post	Sherwood Green	BS12C39	Sayen Common	Sherwood Green	BS12C39
Donnington	Sherwood Green	BS12C39	Selsey	Sapphire	BS20D45
East Grinstead	Silver	BS00A01	Shoreham	Sherwood Green	BS12C39
East Preston	Sherwood Green	BS12C39	Shoreham Beach	Sherwood Green	BS12C39
East Wittering	Sherwood Green	BS12C39	Slaugham	Sherwood Green	BS12C39
Eastergate	Sherwood Green	BS12C39	Slimfold	Sherwood Green	BS12C39
Felpham	Cupress	BS14C39	Sompting	Sherwood Green	BS12C39
Fernhurst	Sherwood Green	BS12C39	Southwater	Sherwood Green	BS12C39
Ferring	Sherwood Green	BS12C39	Southwick	Sherwood Green	BS12C39
Findon	Sherwood Green	BS12C39	Steyning	Sherwood Green	BS12C39
Fishbourne	Sherwood Green	BS12C39	Storrington	Sherwood Green	BS12C39
Ford	Sherwood Green	BS12C39	Tangmere	Sherwood Green	BS12C39
Goddards Green	Sherwood Green	BS12C39	Upper Beeding	Sherwood Green	BS12C39
Handcross	Sherwood Green	BS12C39	Walberton	Sherwood Green	BS12C39
Hassocks	Sherwood Green	BS12C39	West Grinstead	Sherwood Green	BS12C39
Haywards Heath	Sherwood Green	BS12C39	West Wittering	Sherwood Green	BS12C39
Haywards Heath Main Road	Black	BS00E53	Westbourne	Sherwood Green	BS12C39
Henfield	Sherwood Green	BS12C39	Westhampnett	Sherwood Green	BS12C39
Hickstead	Sherwood Green	BS12C39	Worthing	Grey	BS22B17
Horsham	Sherwood Green	BS12C39	Worthing (conservation areas)	Black	BS00E53

5. Process for Process for Adoption of Street Lighting Equipment

All street lighting and illuminated equipment in West Sussex is adopted and maintained under a PFI contract with Tay Valley Lighting (TVL).

The County Council does not offer free installation checks. All installations shall be approved and the County Council will ask TVL inspect your installation and recover their costs prior to certifying works for the release of bonds or deposits.

Following construction the street lighting accrual package must be completed and provided as a standalone set of documents that can be issued to our PFI contractor. It shall include:

- (i) A written notice including:
 - (A) Details of the proposed agreement. –Whether S278/38, Location, description of highway works, PSI reference number
 - (B) the identity of the parties involved;
 - (C) written confirmation by the developer that the apparatus complies with the 'Accrual Required Standards'.
- (ii) Details of all equipment to be adopted:
 - (A) As built drawings showing the road layout the development and works and details of the types of apparatus including all adoptable lighting equipment, illuminated signs and distribution networks. - normally 1:500 scale paper copies and pdfs. Drawings must show the new unit numbers and the existing equipment numbers.
 - (B) Full details of any cable distribution networks.
 - (C) Electrical test certificates for all adoptable equipment. – Certificates shall reference the new numbering system.
 - (D) A copy of the 'Development Standard for Highway Lighting' current at the time the design was approved.
- (iii) A copy of the IDNO (Independent Distribution Network Operator) Service Level Agreement, if applicable.
- (iv) Any other documentation required to satisfy legislation at the time of the accrual.

