



**PERSIMMON HOMES THAMES VALLEY
NORTH LITTLEHAMPTON - PHASE 2
FITZALAN LINK ROAD,
LITTLEHAMPTON, WEST SUSSEX**

**S38/278 AGREEMENT HIGHWAY WORKS
SPECIFICATION**

SEPTEMBER 2019

REVISION P7

Ref: PHF-MB-S278-GF-SP-D-01

the journey is the reward

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Ref: PHF-MB-S278-GF-SP-D-01

Project Code:	A/PHFITZ.2
Prepared by:	AB
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List of Contents

Sections

Summary of Revisions	1
Preamble to the Specification (Rev P4, 30/10/18)	4
Appendix 0/1 - Contract Specific Additional, Substitute and Cancelled Clauses, Tables and Figures Included in the Contract (Rev P3, 31/05/18)	7
Appendix 0/2 - Contract Specific Minor Alterations to Existing Clauses, Tables and Figures Included in the Contract (Rev P3, 31/05/18)	9
Appendix 0/3 - List of Numbered Appendices Referred to in the Specification and included in the Contract (Rev P4, 30/10/18)	10
Appendix 0/4 – List of Drawings Included in the Contract (Rev P7, 05/09/19)	16
Appendix 1/1 - Temporary Accommodation and Equipment for Overseeing Organisation..	18
Appendix 1/4 - Working and Fabrication Drawings	19
Appendix 1/5 - Testing to be carried out by the Contractor (Rev P5, 09/04/19)	20
Appendix 1/6 - Supply and Delivery of Samples to the Engineer (Rev P5, 09/04/19).....	64
Appendix 1/7 - Site Extent and Limitations on Use (Rev P5, 09/04/19).....	65
Appendix 1/8 - Operatives for the Engineer	66
Appendix 1/9 - Control of Noise and Vibration	67
Appendix 1/12 - Setting Out and Existing Ground Levels	68
Appendix 1/13 - Programme of Works.....	69
Appendix 1/15 - Accommodation Works.....	71
Appendix 1/16 - Privately and Publicly Owned Services and Supplies (Rev P3, 31/05/18) .	72
Appendix 1/17 - Traffic Safety and Management (Rev P5, 09/04/19)	74
Appendix 1/18 - Temporary Diversions of Traffic (Rev P5, 09/04/19)	77
Appendix 1/19 - Routeing of Vehicles.....	78
Appendix 1/21 - Information Boards	79
Appendix 1/22 - Progress Photographs	80
Appendix 1/23 - Risks to Health and Safety	81
Appendix 2/2 - Filling of Trenches and Pipes (Rev P5, 09/04/19)	82
Appendix 2/3 - Retention of Materials arising from Site Clearance	83
Appendix 2/4 - Explosives and Blasting.....	84
Appendix 3/1 - Fencing, Gates and Stiles (Rev P5, 09/04/19)	85
Appendix 5/1 - Drainage Requirements (Rev P5, 09/04/19)	86
Appendix 5/2 - Service Duct Requirements (Rev P5, 09/04/19).....	88
Appendix 5/4 - Fin Drains and Narrow Filter Drains.....	89
Appendix 5/5 - Combined Drainage and Kerb System.....	90

Appendix 6/1 - Classification and Acceptability of Earthworks Materials Requirements for Earthworks Materials (Rev P5, 09/04/19)	91
Appendix 6/2 - Requirements For Dealing With Class U1B And Class U2 Unacceptable Materials (Rev P3, 31/05/18)	98
Appendix 6/3 - Requirements for Excavation, Deposition, Compaction (Other than Dynamic Compaction) (Rev P5, 09/04/19)	99
Appendix 6/5 - Geotextiles Used to Separate Earthworks Materials (Rev P5, 09/04/19) ..	101
Appendix 6/7 - Sub-Formation and Capping and Preparation and Surface Treatment of Formation (Rev P4, 30/10/18)	102
Appendix 6/8 - Topsoiling	104
Appendix 6/9 - Earthwork Environmental Bunds, Landscape Areas, Strengthened Embankments (Rev P4, 30/10/18)	105
Appendix 6/11 - Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings (Rev P5, 09/04/19)	106
Appendix 6/14 - Limiting Values for Pollution of Controlled Waters (Rev P4, 30/10/18)	107
Appendix 6/15 - Limiting Values for Harm to Human Health and the Environment (Rev P3, 31/05/18)	108
Appendix 7/1 - Permitted Pavement Options - Flexible, Flexible Composite and Surfacing for Rigid Composite Construction (Rev P4, 30/10/18)	111
Appendix 7/2 - Excavation, Trimming and Reinstatement of Existing Surfaces	116
Appendix 7/4 - Bond Coats, Tack Coats and Other Bituminous Sprays	118
Appendix 7/6 - Breaking Up or Perforation of Existing Pavement (Rev P5, 09/04/19)	120
Appendix 7/9 - Cold Milling (Planing) of Bituminous Bound Flexible Pavement	121
Appendix 11/1 - Kerbs, Footways and Paved Areas (Rev P5, 09/04/19)	122
Appendix 12/1 - Traffic Signs: General (Rev P3, 31/05/18)	124
Appendix 12/3 - Traffic Signs: Road Markings and Studs	125
Appendix 12/5 - Traffic Signs: Traffic Signals	126
Appendix 13/1 - Road Lighting Columns and Brackets	127
Appendix 13/2: - (Specification for Highway Works) Typical Column and Bracket Data - Sheet 1	128
Appendix 13/2: - (Specification for Highway Works) Typical Column and Bracket Data - Sheet 2	129
Appendix 13/3 - Instructions for Completion of Lighting Column and Bracket Data Sheets	130
Appendix 14/1 - Site Records	131
Appendix 14/2 - Location of Lighting Units and Feeder Pillars	132

Appendix 14/3 - Temporary Lighting.....	133
Appendix 14/4 - Electrical Equipment for Road Lighting	134
Appendix 26/1 - Concrete for Ancillary Purposes	136
Appendix 30/5 - Grass Seeding, Wild Flower Seeding and Turfing.....	137
Schedule A - WSCC Traffic Signal Design and Installation Standards (Rev P4, 30/10/18).....	
Schedule B - Sign Face Details (Rev P6, 23/07/19)	
Schedule C - Lighting of Developer Promoted Highway Schemes in West Sussex (Rev 13 th August 2018) (Rev P6, 23/07/19)	

Summary of Revisions

Rev P1 - First Issue

Rev P2 - Updated for initial detailed design submission to WSCC and to reflect latest scheme proposals.

Rev P3 – Preamble	Note 12 added.
Appendix 0/1	Clauses added.
Appendix 0/2	Clauses added.
Appendix 0/3	Updated to suit document.
Appendix 0/4	Dwgs PHF-MB-S278-GF-DR-D-S278-01 and 02 added. Bollard detail 558022-000002001 removed. WSCC detail S278/38/04 removed MB detail PHF-MB-S278-GF-DR-D-C/02 added. MB detail PHF-MB-S278-GF-DR-D-C/03 added. MB Detail PHF-MB-S278-GF-DR-D-C/04 Knee rail removed.
Appendix 1/5	Series 600 amended and foot notes added (PBA input).
Appendix 1/16	Tables in 4 and 5 updated.
Appendix 1/18	Note 5 added.
Appendix 5/1	Note 6 amended. MH Schedule removed and added to drainage dwgs.
Appendix 6/1	Appendix re-written (PBA input).
Appendix 6/2	Appendix re-written (PBA input).
Appendix 6/3	Appendix re-written (PBA input).
Appendix 6/7	Appendix re-written to omit reinforced foundation solution.
Appendix 6/11	Appendix added (PBA input).
Appendix 6/14	Appendix added (PBA input).
Appendix 6/15	Appendix added (PBA input).
Appendix 7/1	NHSS note added, as requested by WSCC. Schedules 3 and 5 updated.
Appendix 11/1	Kerb Type 5 amended. Kerb Type 6 amended and HTR added. Kerb Type 7 added Footway subbase increased and geotextile added. Roundabout runover omitted (now in App 7/1). Grasscrete added. Maintenance path spec added. Celiweb added.
Appendix 12/1	Note 8 amended.
Schedule B	Updated.
Traffic Sign Faces	

Rev P4 – Preamble	Table 0/1 updated.
Appendix 0/3	Appendix updated to suit content.
Appendix 0/4	WSCC Detail S278/38/14 and PHF-MB-S278-GF-DR-D-F/05 added.
Appendix 1/5	612 – method of compaction deleted. Acceptability testing for Class 7 and 9 material deleted.
Appendix 5/1	Reference to infiltration trench removed. Note 1 amended. Notes 14 and 15 added.
Appendix 6/1	Header on first table corrected. Class 2A material info amended.
Appendix 6/3	Reference to filling of redundant water courses removed (old note 8).
Appendix 6/5	Appendix added.
Appendix 6/7	Note 4, 6 & 8 amended.
Appendix 6/9	Appendix added.
Appendix 6/14	Table 6/14 acceptability limits added.
Appendix 7/1	Clause 943 red HRA spec amended to require 'Harden red' chippings and remove texture depth requirements as this is unlikely to be achievable. Requirement to provide geotextile added.
Appendix 11/1	Kerb type 4 detail references amended.
Schedule A	TS Design Standards added
Schedule B	Sign faces TS29A, 48, 49, 50 and 51 updated.

Rev P5 – (09/04/19)	Amended following WSCC comments # 3 received from WSCC and Project Manager (F+G)
• Appendix 1/5	Notes 1 and 5 amended to include Project Manager, as requested by F+G. Testing table 612 updated.
• Appendix 1/6	Note 1 amended to include Project Manager.
• Appendix 1/7	Note 2 (a) and (h) added.
• Appendix 1/17	Note 3(ii) amended to include 'a minimum of'.
• Appendix 1/18	Note 1 amended to include Project Manager and Highway Authority. Note 2 amended to include 'a minimum of'.
• Appendix 2/2	Note 5 amended.
• Appendix 3/1	Note 3 amended to include Project Manager and 'a minimum of'.
• Appendix 5/1	Notes 3 and 14 amended to include ref to Project Manager.
• Appendix 5/2	Note 4 amended to refer to Project Manager.
• Appendix 6/1	Table 6/1 Class 2A compaction requirements added.
• Appendix 6/3	Notes 5 and 8 amended.
• Appendix 6/5	Note 5 amended to include Project Manager.
• Appendix 6/11	Note 2(f) added.
• Appendix 7/6	Notes 1.2, 2.2 and 2.3 amended to refer to Project Manager and/or highway Authority.
• Appendix 11/1	Note 2.2 amended to include 'approved'. Note 4.1 amended to include 'or similar approved'.
• Schedule B	Sign face TS52-86 amended to refer to using pop rivets.

Rev P6 – (23/07/19)	Amended following WSCC meeting on 3 June 2019
• Schedule B	Sign faces TS52 to TS86 removed. TS30 to TS33 amended and TS89 to TS96 added.
• Schedule C	Updated to latest WSCC version.

Rev P7 – (05/09/19) Amended following comments from WSCC dated 05/09/2019

- * Appendix 0/4 PBA Dwgs 35944/1513/002, 003 & 004 added

Preamble to the Specification (Rev P4, 30/10/18)

- 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. 37 Amendment – November 2005
- 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 2016), 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, W1, 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

(05/18) **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 P3, 31/05/18)

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 PBA

- (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 P3, 31/05/18)

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 Numbered Appendices Referred to in the Specification and included in the Contract (Rev P4, 30/10/18)

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
		0/4	List of drawings Included in the Contract
	Not used	0/5	Special National Alterations of the Overseeing Organisations of Scotland/Wales/Northern Ireland
			<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	Testing to be carried Out by the Contractor
		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
	Not used	1/10	Permanent Works to be Designed by the Contractor
	Not used	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	Privately 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 Operations 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>
	Not used	4/1	Road Restraint Systems (Vehicle and Pedestrian)
	Not used	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
		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
	Not used	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
	Not used	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
	Not used	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 (Planing) of Bituminous Bound Flexible Pavement
	Not used	7/10	Not used
	Not used	7/11	Overband and Inlaid Crack Sealing Systems
	Not used	7/12	Arrester Beds
	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 (11/03)
	Not used	7/15	Saw-Cut, Crack and Seal Existing Jointed Reinforced Concrete Pavements (11/03)
	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	Traffic Signs: Road Markings and Studs
		12/4	Traffic Signs: Cones, Cylinders, FTD's and Other Traffic Delineators
	Not used	12/5	Traffic Signs: Traffic Signals
		12/6	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

Page No.	Completed By	Appx. No.	Title
	Not used	16/6	Steel Bearing Piles
	Not used	16/7	Reduction of Friction on Piles
	Not used	16/8	Non-Destructive Methods for Testing Piles
	Not used	16/9	Static Load Testing of Piles
	Not used	16/10	Diaphragm Walls
	Not used	16/11	Hard/Hard Secant Pile Walls
	Not used	16/12	Hard/Soft Secant Pile Walls
	Not used	16/13	Contiguous Bored Pile Walls
	Not used	16/14	King Post Walls
	Not used	16/15	Steel Sheet Piles
	Not used	16/16	Integrity Testing of Wall Elements
	Not used	16/17	Instrumentation for Piles and Embedded Walls
	Not used	16/18	Support Fluids
			<u>STRUCTURAL CONCRETE</u>
	Not used	17/1	Schedule for the Specification of Designed Concrete
	Not used	17/2	Not used
	Not used	17/3	Concrete – Surface Finishes
	Not used	17/4	Concrete – General
	Not used	17/5	Buried Concrete
	Not used	17/6	Grouting and Duct Systems for Post-tensioned Tendons
	Not used	17/7	Precast concrete products
			<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>
	Not used	20/1	Waterproofing for Concrete Structures
			<u>BRIDGE BEARINGS</u>
	Not used	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 STONWORK</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

Page No.	Completed By	Appx. No.	Title
	Not used	25/3	Requirements for Pocket – Type and Grouted – Cavity Reinforced Brickwork Retaining Wall Structures
	Not used	25/4	Environmental Barriers
	Not used	25/5	Requirements 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

List 'B'

List of Contract Specific Numbered Appendices Devised for the Contract

Page No	Appendix No.	Appendix Title
-	Schedule A	WSCC Traffic Signal Design and Installation Standards WSCC Traffic Signal Installation Standards
	Schedule B	Sign Face Details
	Schedule C	Lighting of Developer Promoted Highway Schemes in West Sussex

Appendix 0/4 – List of Drawings Included in the Contract (Rev P7, 05/09/19)

Contract Specific – Mayer Brown Limited Drawings

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
PHF-MB-S278-GF-DR-D-208-01	Topographical Survey Drawing	1:250	A0
PHF-MB-S278-GF-DR-D-208-02	Topographical Survey Drawing	1:250	A0
PHF-MB-S278-GF-DR-D-209-01	Site Clearance Drawing (1 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-209-02	Site Clearance Drawing (2 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-210-01	General Arrangement Drawing (1 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-210-02	General Arrangement Drawing (2 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-211-01	Construction Treatments Drawing (1 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-211-02	Construction Treatments Drawing (2 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-212-01	Drainage Drawing (1 of 3)	1:250	A0
PHF-MB-S278-GF-DR-D-212-02	Drainage Drawing (2 of 3)	1:250	A0
PHF-MB-S278-GF-DR-D-213	Proposed Traffic Signal Crossing	Varies	A1
PHF-MB-S278-GF-DR-D-219-01	String Labels Drawings (1 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-219-02	String Labels Drawings (2 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-220	Longitudinal Sections Along MFTZ and MCL1	Varies	A0
PHF-MB-S278-GF-DR-D-221	Cross Sections along MFTZ (1 of 2)	H = 1:250 V = 1:100	A0
PHF-MB-S278-GF-DR-D-222	Cross Sections along MFTZ (2 of 2) & MCL1	H = 1:250 V = 1:100	A0
PHF-MB-S278-GF-DR-D-230	Stockdale Crown Line Design	Varies	A0
PHF-MB-S278-GF-DR-D-231	Cross Sections Along MCR0 & MCR1	H = 1:200 V = 1:100	A0
PHF-MB-S278-GF-DR-D-232	Cross Sections Along MCR2 & MCR3	H = 1:200 V = 1:100	A0
PHF-MB-S278-GF-DR-D-S278-01	Section 38/278 Agreement Drawing (1 of 2)	1:250	A0
PHF-MB-S278-GF-DR-D-S278-02	Section 38/278 Agreement Drawing (2 of 2)	1:250	A0

Contract Specific – White Young Green Landscaping Drawings

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
A088461 FL1	Landscaping Drawing	1:1000	A3
A088461 FL2	Landscaping Drawing	1:1000	A3

Contract Specific – MK Surveys (Existing Statutory Undertakers Drawings)

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

Contract Specific – SSE Street Lighting Drawings Drawings)

<u>Drawing No</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
SSE-976262-SL-DR-001	Street Lighting Layout Drawing Sheet 1 of 2	1:500	A1
SSE-976262-SL-DR-002	Street Lighting Layout Drawing Sheet 2 of 2	1:500	A1

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
S278/38/09	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 Bollard	As shown	A3
S278/38/18	Street Furniture – Tactile Crossings	As shown	A3
S278/38/19	Street Furniture – Refuge Island	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

Standard Details (Supplied) – Mayer Brown Limited

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
PHF-MB-S278-GF-DR-D-C/01	Proposed Island Over Existing Carriageway	1:10	A3
PHF-MB-S278-GF-DR-D-C/02	Proposed Footway / Cycleway Details	1:20	A3
PHF-MB-S278-GF-DR-D-C/03	Typical Cross Sections along Fitzalan Link Road	1:50	A1
PHF-MB-S278-GF-DR-D-F/01	Drainage Trench Details	1:20	A1
PHF-MB-S278-GF-DR-D-F/02	Beany Kerbs Standard Details Drawing	1:10	A1
PHF-MB-S278-GF-DR-D-F/04	Beany Block Dropped Crossing Detail - Elevation	1:20	A3
PHF-MB-S278-GF-DR-D-F/05	Proposed Attenuation Tank 03 - Details	As shown	A1

Acoustic Fence Details (Supplied) – PBA

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
35044/1513/002	Fitzalan Link Road Acoustic Barrier GA Sheet 2 of 4	As Shown	A1
35044/1513/003	Fitzalan Link Road Acoustic Barrier GA Sheet 3 of 4	As Shown	A1
35044/1513/004	Fitzalan Link Road Acoustic Barrier GA Sheet 4 of 4	As Shown	A1

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

Southern Water (Foul Rising Main) Drawings (Initial Information)

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
JN.670038-27.1C0024	Significant Hazards and High Risk Services Sheet 4 of 8	1:500	A1
JN.670038-27.1C0025	Significant Hazards and High Risk Services Sheet 5 of 8	1:500	A1
JN.670038-27.1C0026	Significant Hazards and High Risk Services Sheet 6 of 8	1:500	A1
JN.670038-27.1C0027	Significant Hazards and High Risk Services Sheet 7 of 8	1:500	A1
JN.670038-27.1C0028	Significant Hazards and High Risk Services Sheet 8 of 8	1:500	A1

GTC HV Network Drawings (Initial Information)

<u>Drawing No.</u>	<u>Title</u>	<u>Scale</u>	<u>Size</u>
EN0015711-1_220517_1 of 8	GTC HV Network	1:2500	A0

Appendix 1/1 - Temporary Accommodation and Equipment for Overseeing Organisation

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 one Resident Engineer 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) as may be required during the course of the works.

Appendix 1/4 - Working and Fabrication Drawings

The Contractor shall provide detailed working and fabrication drawings for the following aspects of the Works, in accordance with Clause 104:

Series	Description of Work
100	Traffic Management
300	Temporary Fencing
1200	Traffic Signs
1200	Traffic Signals
1300/1400	Road Lighting and Cabling

Appendix 1/5 - Testing to be carried out by the Contractor (Rev P5, 03/04/19)

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 For all tests a UKAS test report or certificate is required. For all geoenvironmental/chemical tests a MCERTS test report or certificate is required.
- 3 Unless otherwise stated above, all sampling and testing in this Appendix shall be by the Contractor.
- 4 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).
- 5 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.
- 6 The Contractor should note that surface course surface regularity testing (Clause 702) is included in this Appendix / Schedule.
- 7 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.
- 8 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.
- 9 In areas of new full depth carriageway construction, the CBR value of the placed Capping and Type 1 subbase material shall be tested by Clegg hammer testing or similar 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 [See NG403.15]
404	Anchorage in drilled holes	Loading test on site	As required in Appendix 4/1	Required	
	Post foundations				[See NG 404.3]

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. [See NG 407.1]
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). <i>[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]</i>
	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	BBA certification (or equivalent) applies
503	Pipe bedding	Grading and fines content			[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]
		Water-soluble sulphate (WS) content (N)			[Minimum to allow for natural variability of sulphur compounds]
		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	[For bedding types not falling under the construction Products Regulation (CPR). Results of routine control tests from the factory production control system operated by the producer to be provided – see BS EN 13285] [Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
		Resistance to Fragmentation (N)	1 per source *		<i>[Appropriate tests/samples for the resistance to freezing and thawing (magnesium sulfate) should be scheduled where required, NG 803.4]</i>
		Water-soluble sulphate (WS) content (N)	5 per source		
		Oxidisable sulfides (OS) content and total potential sulphate (TPS) content (N)	5 per source		
		Grading and fines content	1 per week		<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 *		
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				

						[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]
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Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
509	Watertightness of joints	Air test	All pipelines with watertight joints [As required in Appendix 5/1 for partly watertight joints]	Required	
512	Backfill to pipe bays	Grading	1 per 50 tonnes (min of 3)	Required	[Acceptance testing can be scheduled for bedding types not falling under the Construction Products Regulation (CPR)] [Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]
		Water-soluble sulfate (WS) content (N)	5 per source*		
		Oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	5 per source*		
513	Permeable backing to earth retaining structures	Plastic Index (N)	1 per source*	Required	[Acceptance testing can be scheduled for bedding falling under the CPR] [Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]
		Water-soluble sulfate (WS) content (N)	5 per source		
		Oxidisable sulfides (OS) content and total potential sulfate (TPS) content (N)	5 per source		
		Resistance to fragmentation (N)	1 per source*		
		Grading	1 per 200 tonnes (min of 3)*		
		Permeability (N)	1 per source*		
	Precast hollow concrete blocks	(Manufacturers tests)		Required	

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
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*		[Acceptance testing can be scheduled for bedding falling under the CPR]
		Resistance to fragmentation (N)			
		Water-soluble sulfate (WS) content (N)	5 per source		[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]
		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*		
516	Combined drainage and kerb system	Load test			
517	Linear drainage systems	Load test			
518	Thermoplastics structured wall pipes and fittings	(Manufacturers tests)		Required	BBA certification (or equivalent) applies

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments		
Series 600								
601, 631 to 637, 640	Acceptable material				Required	[Acceptance testing can be scheduled for bedding falling under the CPR] [For recycled aggregate see Sub-Clause 601.12 and 601.18] [Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]		
	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*				
	Class	General Description						
	2	General cohesive fill	Grading	Twice a week*	Required	[Cross-reference should be made to any requirements in Appendix 6/1]		
			Mc/MCV/PL Undrained shear strength (N)	2 per 1000m3 up to max of 5 per day*				
			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*
	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 ms				
			Dry density / moisture content relationship	Source approval (3 tests) and then every 800 ms				
			Moisture Content	Source approval (3 tests) and then every 200 ms				
			Los Angeles coefficient	Source approval (3				

				tests) and then every 800 ms		
			Effective angle of internal friction and effective cohesion	Source approval (3 tests) and then every 800 ms		
			Contamination Suite – Note 1	Note 2		
Series 600 (continued)						
	6F4 and 6F5		Size designation and overall grading category	1 per week*		<i>[Acceptance testing can be scheduled for bedding falling under the CPR]</i> <i>[Appropriate contract compliance testing should be scheduled for all products including those falling under CPR]</i>

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments	
Series 600 (continued)							
	Class	General Description					
	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)	1 per 400 tonnes*		<i>[BS EN 1744-1, clause 10, clause 11, clause 13]</i>	
			SMC of chalk (N)	Twice a week*			
			D/L (N)	Daily*			
			Organic matter/water soluble sulfate (WS) (N)	Twice a week* or daily where sulfates are expected			
			Oxidisable sulfides (OS) and total potential sulfate (TPS) content (N)	Twice a week* or daily where sulfates are expected			
			pH/chloride ion content (N)	Weekly*			
			Resistivity (N)	{As required}			
			Undrained and drained shear parameters (N)	{As required}			<i>[Cross-reference should be made to any requirements in Appendix 6/1]</i>
			Permeability (N)	{As required}			
			8	Miscellaneous fill			Mc/MCV (N)
	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)]
	(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	[requirements should be in Appendix 6/5 or 6/9 as appropriate]
			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 and Moisture Content (N)	Every 500 m³ or 1 per day		††
		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
614	Cement stabilisation to form capping	Rate of spread of cement	1 per 500 square metres of lime spread ²	Required	
616 641 643	Lime stabilisation to form capping	Rate of spread of lime	1 per 500 square metres of lime spread ²	Required	
		Available lime content	Each course of lime weekly during stabilisation operation ²		†

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)					
622 638 639	Earthworks for reinforced soil and anchored earth structures	Redox potential	5 locations within the affected area*	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] †
	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	[As appropriate to properties stated in Appendix 6/10]	1 per 400 squaremetres*		
642	Earthworks materials for corrugated steel buried structures	Constrained soil modulus (M*)	3 on each side of each structure*	Required	
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	BBA certification (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*		]
		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)	[As required]		
		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

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
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)			
920	Bond coats, tack coats and other bituminous sprays				
		Binder			
		Product identification			
		Vialit cohesion			
		Accuracy of spread			
		Rate of spread			
919 922	Surface Dressing				
		Binder			
		Product Identification			
		Vialit cohesion (N)			
		Accuracy of spread			
		Rate of spread			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
		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
Series 1000					
1001	Cement				
1030					
1044					
					Product Acceptance Scheme applies for microsilica

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)					
	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			[Appropriate tests/samples should be scheduled where not included under other Clauses]
	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

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200 (continued)					
	Flat traffic delineators			Required	
		Test specific in Appendix 12/4	<i>[As require]</i>		† <i>[Where required]</i>
	Other traffic delineators			Required	Certification that delineators have been tested and comply with Clause 1214 is required
		Test specific in Appendix 12/4	<i>[As require]</i>		† <i>[Where required]</i>
	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
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		

Clause	Works, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 1200 (continued)						
		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			
		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	<i>[As required]</i>		†

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1300 (continued)					
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	1 per batch		
		Surface hardness	2 per batch		
		Apparent bulk density			
		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]
			2 cubes from each of two samples of each batch		
		Density	[As required]		[Requirements should be given in Appendix 17/1 as appropriate]
	Fresh concrete	Consistence (slump or compacting factor or Vebe) (N)	Each batch	Required	[See sub-Clause 1707.2]
		Air content	Each batch		
		Density	[as required]		
		Water/cement ratio			
1710	Concrete packing Mortar packing Epoxy resin bonding agent				[Appropriate tests/samples should be scheduled]
	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
Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
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 <table><tr><td>Steel bars</td></tr><tr><td>Steel wire</td></tr><tr><td>Steel fabric</td></tr><tr><td>Stainless steel</td></tr></table>	Steel bars	Steel wire	Steel fabric	Stainless steel				Product certification scheme applies
Steel bars									
Steel wire									
Steel fabric									
Stainless steel									
Required (BS 4449)									
Required (BS 4482)									
Required (BS 4483)									
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]
Series 1800 (continued)					
1805	1805.2 Metallic products			Required according to BS EN 1090-2:2008+A1:	[Give type of metallic product and document required, noting specific]

				2011 Table 1	<i>requirement for steel grade S355 JR and J0 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 by a welding process that has not been used	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>

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 – representative testing</i>		
	Coating system adhesion	Pull of adhesion test in accordance with ASTM D4541 – Type 3	<i>Required – representative 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 – representative 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 contract 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			

Clause	Works, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2400					
2401	Masonry cement				
2402	Sand				
2403	Water	Test Specified in BS EN 1008	[As required]		
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	Product acceptance scheme or equivalent applies
	Zinc coating				
	Protective coating				
	Paved invert system				
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 5007S E	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: 09/04/19)

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

Appendix 1/7 - Site Extent and Limitations on Use (Rev P5, 09/04/19)

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 Fitzalan Link 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 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 Engineer

1. During periodic inspections of the works by the Engineer, the Contractor shall make available on request the services of a survey operative (chainman) for the purpose of assisting in checking measurements.

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 1/12 - 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) 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 (Rev P3, 31/05/18)

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.

Name

Address

Contact/Tel.No

BT

GTC

Instalcom Limited

SGN

Southern Water

UKPN

5. Services and Supplies Affected by the Works are as indicated on the **Service Consultants' drawings and Documents** (to be provided in due course). A summary of the new services / 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>
<u>GTC HV Network</u>	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			
<u>UKPN</u> Electrical Feeder Pillar / Connection to Traffic Signals	E	TBC	TBC
<u>UKPN</u> Electrical supply and connections to street lighting and illuminated street furniture	E	TBC	TBC
<u>Southern Water</u> Foul rising main	TBC	TBC	TBC
<u>BT</u> PSTN Line (Contractor to agree exact requirements with WSCC)	E	TBC	TBC
<u>Vodafone (or other agreed)</u> GSM Sim Card Remote Monitoring (Contractor to agree exact requirements with WSCC)	E	TBC	TBC

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, 09/04/19)

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 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 Diversions of Traffic (Rev P5, 09/04/19)

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.
5. The Contractor shall be aware of the existing PROW's 3103 and 3654 and shall liaise with PHTV and the relevant authority to ensure that any temporary or permanent diversion/realignment of the routes are effected in accordance with PROW requirements.

Appendix 1/19 - Routeing of Vehicles

1. Permitted Access Routes To and From the Site

- a) The Contractor shall agree access routes to the site with the Engineer, Highway Authority 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 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

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.

- 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 ten days 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 erected on the public highway by the Contractor or by any sub-contractor shall require the prior written approval of the Highway Authority.
- 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, 05/04/19)

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 P5, 09/04/19)

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

1. For location and specification of proposed permanent fencing refer to the General Arrangement Drawings and WYG Acoustic Fence Detail.

Appendix 5/1 - Drainage Requirements (Rev P5: 03/04/13)

- For locations and details of highway drainage refer to drawings numbered PHF-MB-S278-GF-DR-D-212-01 and 02 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 one 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 PHF-MB-S278-GF-DR-D-212-02. For details refer to detail PHF-MB-S278-GF-DR-D-F/05.

Hydrobrake Flow Control

- The scheme includes the provision of a flow control chamber limited to 5 l/s with 1.25m of design head. The location of the chamber is indicated on drawing PHF-MB-S278-GF-DR-D-212-02. For design criteria refer to Micro Drainage calculations and WSCC detail numbered S278/38/14. The contractor

shall confirm details with the manufacturer, Hydro-International (or similar approved by WSCC), prior to supply and installation.'

Appendix 5/2 - Service Duct Requirements (Rev P5, 09/04/19)

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 A** at the rear of this document.

Appendix 5/4 - Fin Drains and Narrow Filter Drains

1. The location of the trench soakaway is indicated on the drainage drawing PHF-MB-S278-GF-DR-D-212-01.
2. Details of the trench soakaway is indicated on the drainage detail PHF-MB-S278-GF-DR-D-F/01.

Appendix 5/5 - Combined Drainage and Kerb System

1. Kerb drainage system to be minimum width 430mm in accordance with WSCC detail numbered S278/38/02.
2. For details of combined drainage and kerb system refer to Beany kerb details numbered PHF-MB-S278-GF-DR-D-F/02, 03 and 04.

Appendix 6/1 - Classification and Acceptability of Earthworks Materials Requirements for Earthworks Materials (Rev F5: 09/04/19)

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 12642.

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		
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 (Note: Testing of compacted material required in accordance with App 1/5 Series 600)
				plastic limit (PL)	BS 1377: part 2	-	-	
				Mc (see note 4)	BS 1377: part 2	PL -4%	omo+2%	
				MCV	Clause 632	App 6/4	App 6/4	
				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	-	-	-	-	-

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	
6F1	Selected granular material (fine grading)	Capping	Any material, or combination of materials - including recycled aggregates with not more than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials that contain tar and tar-bitumen binders, unburnt colliery spoil, argillaceous rock and chalk. Property (vi) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less.	(i) grading	BS 1377 : Part 2	Tab 6/2	Tab 6/2	Table 6/4 Method 6
				(ii) optimum mc	BS 1377 : Part 4 (vibrating hammer method)	-	-	
				(iii) mc	BS 1377 : Part 2	Optimum mc – 2%-	Optimum mc	
				(iv) Los Angeles coefficient	Clause 635	-	60	
				(v) Class Ra (asphalt) content	Clause 710	-	50%	
				(vi) bitumen content	BS EN 12697-1 or BS EN 12697-39	-	2.0%	
6F2	Selected granular material (coarse grading)	Capping	Any material, or combination of materials - including recycled aggregates with not more than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials that contain tar and tar-bitumen binders, unburnt colliery spoil and argillaceous rock. Property (i) in the next column shall not apply to chalk. Property (vi) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less.	(i) grading	BS 1377 : Part 2	Tab 6/2	Tab 6/2	Table 6/4 Method 6
				(ii) optimum mc	BS 1377 : Part 4 (vibrating hammer method)	-	-	
				(iii) mc	BS 1377 : Part 2	Optimum mc – 2%-	Optimum mc	
				(iv) Los Angeles coefficient	Clause 635	-	50	
				(v) Class Ra (asphalt) content	Clause 710	-	50%	
				(vi) bitumen content	BS EN 12697-1 or BS EN 12697-39	-	2.0%	

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	
6F4	Selected granular material (fine grading) - imported on to the Site	Capping	Unbound mixture complying with BS EN 13285. Any material, or combination of materials - including recycled aggregates with not more than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials that contain tar and tar-bitumen binders, unburnt colliery spoil, argillaceous rock and chalk. Property (x) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less.	(i) Size designation and overall grading category	BS EN 13285 - 0/31.5 and GE	Tab 6/5	Tab 6/5	Table 6/4 Method 6
				(ii) Maximum fines and oversize categories	BS EN 13285 - UF15 and OC75	Tab 6/5	Tab 6/5	
				(iii) Los Angeles coefficient	BS EN 13242 - LA60	-	60	
				(iv) Volume stability of blast furnace slag	BS EN 13242 - free from dicalcium silicate and iron disintegration	-	-	
				(v) Volume stability of steel (BOF) and EAF) slag	BS EN 13242 - V5			
				(vi) Other aggregate requirements	BS EN 13242 - Category NR (no requirement)			
				(vii) Laboratory dry density and optimum water content	BS EN 13285, clause 5.3 - declared values			
				(viii) Water content	BS EN 1097-5	Optimum wc - -2%	Optimum wc	
				(ix) Clas Ra (asphalt) content	Clause 710	-	50%	
				(x) bitumen content	BS EN 12697-1 or BS EN 12697-39	-	2.0%	

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	
6F5	Selected granular material (coarse grading) - imported on to the Site		Unbound mixture complying with BS EN 13285 containing aggregate conforming to BS EN 13242 comprising natural aggregates, or crushed concrete bricks, or masonry – except chalk, shale, siltstone or slate, see Notes 7 and 8 Any material, or combination of materials - including recycled aggregates with not more than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials that contain tar and tar-bitumen binders, unburnt colliery spoil, argillaceous rock and chalk. Property (x) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less.	(i) Size designation and overall grading category	BS EN 13285 - 0/80 and GE	Tab 6/5	Tab 6/5	Table 6/4 Method 6
				(ii) Maximum fines and oversize categories	BS EN 13285 - UF12 and OC75	Tab 6/5	Tab 6/5	
				(iii) Los Angeles Coefficient	BS EN 13242 - LA50	-	50	
				(iv) Volume stability of blast furnace slag	BS EN 13242 - free from dicalcium silicate and iron disintegration	-	-	
				(v) Volume stability of steel (BOF) and EAF slag	BS EN 13242 - V5	-	-	
				(vi) Other aggregate requirements	BS EN 13242 - Category NR (no requirement)	-	-	
				(vii) Laboratory dry density and optimum water content	BS EN 13285, clause 5.3 - declared values	-	-	
				(viii) Water content	BS EN 1097-5	OMC - 2%	OMC	
				(ix) Clas Ra (asphalt) content	Clause 710	-	50%	
				(x) bitumen content	BS EN 12697-1 or BS EN 12697-39	-	2.0%	

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 (Rev P3, 31/05/18)

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, 09/04/15)

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 effects 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 prepared formation shall be subject to approval by the Project Manager prior to placing any fill material.

Watercourses

8. The Contractor shall be responsible for any temporary or permanent protection of watercourses, including ditches.

Embankment Construction

9. The following requirements relate to the embankments to be constructed using conventional earth fill.
10. The fill material to be used to form the embankment will be determined in agreement with the appointed contractor for the works.
11. 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.

12. 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.
13. 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.
14. 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, 03/04/19)

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

Appendix 6/7 - Sub-Formation and Capping and Preparation and Surface Treatment of Formation (Rev P4, 30/10/18)

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)

9. Preparation and surface treatment of the formation in soil shall be to levels in accordance with Clause 616.

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 (Rev P4, 30/10/18)

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,

09/04/19)

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 6/14 - Limiting Values for Pollution of Controlled Waters (Rev P4, 30/10/18)

- 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	0.06
Arsenic	mg/kg	0.01	0.5
Barium	mg/kg	0.01	20
Cadmium	mg/kg	0.01	0.04
Total Chromium	mg/kg	0.03	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	0.03	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	60	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 C0 (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 (Rev P3, 31/05/18)

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) CLAIRES (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.
2. The guideline values shall be modified as required to restrict maximum values to below the hazardous waste criteria.
3. 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	2300 ^{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	13 000 ¹
Vanadium	mg/kg	0.8	9000 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 8}			
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 6% 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	190 ²
Phenanthrene	mg/kg	0.1	1000 ²
Pyrene	mg/kg	0.1	1000 ²

Table 6/15c: Limiting Values of Carbon Banded Hydrocarbons ^{Note 4}

Determinand	Units	Detection Limit	Limiting Values
<i>Aliphatics</i>			
>C5-8	mg/kg	0.1	1000 ^{3a}
>C8-8	mg/kg	0.1	1000 ^{3a}
>C8-10	mg/kg	0.1	1000 ^{3a}
>C10-12	mg/kg	1.5	1000 ^{3a}
>C12-16	mg/kg	1.2	1000 ^{3a}
>C16-21	mg/kg	1.5	1000 ^{3a}
>C21-35	mg/kg	3.4	1000 ^{3a}
>C35-40	mg/kg	5.0	1000 ³
<i>Aromatics</i>			
>C5-7	mg/kg	0.05	1000 ³
>C7-8	mg/kg	0.05	1000 ³
>C8-10	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	0.8	1000 ³
>C21-35	mg/kg	1.4	1000 ³
>C35-44	mg/kg	1.4	1000 ³

4. The frequency of acceptability testing shall be according to Appendix 1/5 of the Specification.
5. 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, 30/10/18)

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
All Areas	Carriageway	Schedule 2	LD1

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:	B
Interval for measurement of longitudinal regularity		Continuous
Interval for measurement of transverse regularity		5m

Schedule 3: Permitted Construction Materials		
All Other Areas Pavement Option [LD1]		
Pavement Layer	Material Ref.	Thickness (mm)
Surface Course	SC1	50
Binder Course	BC1	60
Base	RB1	150
Sub-Base	SB1	450*
Subgrade Improvement Layer	-	Min 500mm to achieve 2.5% CBR
Geotextile	GG1	-
Total (Min) Thickness		1,210

Notes:-

* The thickness of subbase is based on a subbase only design for a capping and subbase design option 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 and Binder Course (Performance-Related Design Mixtures)	BS EN 13108-4, PD 6691, BS 594987, to CI 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% 14/20mm pre-coated chippings 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 to be 65. Maximum AAV: 12. Minimum Target Binder Content Bact = 1.5%
-	943	<i>Roundabout Runover Strip only</i> Red Coloured Hot Rolled Asphalt Surface Course (Performance Related Design Mixtures)	BS EN 13108-4, PD 6691, BS 594987, to CI 943 of SHW Red Coloured 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% Harden Red chippings 14/20mm pre-coated chippings. 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 to be 55. Maximum AAV: 12. Minimum Target Binder Content Bact = 1.5% Exact material and spread rate for chippings shall be agreed in writing in advance with the WSCC Proper officer. A 500g sample of chippings shall be retained and provided to the proper officer to allow spread rates to be checked

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 (α) 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

1. The Contractor shall take all necessary precautions to protect all works and materials which may be subject to damage or injury by inclement weather.
2. 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 (03/08)			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 secs)					
Penetration at 5°C 0,1 mm (200g and 60 secs)					
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, 09/04/19)

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, 08/04/19)

1 Kerbs

- 1.1 Proposed kerb lines 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	Linear Drainage Kerb System, in accordance with drawing numbered PHF-MB-S278-GF-DR-D-212-01, 02 and F04.
Kerb Type 5	125x255mm type BN precast concrete kerb laid with 15mm max upstand with mix ST1 concrete bed and backing.
Kerb Type 6	125x255mm type SP precast concrete kerb laid with 70mm upstand to Figure NA.1(b) of BS EN 1340:2003 with mix ST1 concrete bed and backing.
Kerb Type 7	40x100x2000 Long Timber edging with 50x50x450mm long pointed timber stakes at 1m centres. Timber for the path edging stakes shall be Larch or Douglas Fir preserved in compliance with Clause 311. Stakes shall be driven not greater than 1m centres and edging timber fixed to each stake by 2 No. 80mm long galvanised nails.
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.
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- 2.3 All cycleway surface courses are to be machine laid.
- 3.1 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.
- 3.2 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.
- 3.3 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.
- 3.4 Tactile Corduroy Warning paving shall be grey coloured flags, size 400x400x50mm thick laid in accordance with WSCC detail S278/38/18.
- 4 Grasscrete Maintenance Bay
 - 4.1 Grasscrete or similar approved maintenance bay to be installed in strict accordance with manufacturers recommendations.
- 5 Maintenance Path between boundary fences and Acoustic Fencing
 - 5.1 The land behind the acoustic fence is required for access and hence shall be cleared, stripped of topsoil, levelled, rolled and treated with weed killer granules, then topped with a proprietary weed proof membrane and surfaced with 100mm min of type 1, (where necessary retained by wooden edging).
- 6 Cell Web Footway Construction in Root Protection Areas
 - 6.1 Refer to detail PHF-MB-S278-GF-DR-D-C/02. Cellweb to be installed in accordance with manufacturers recommendations.

Appendix 12/1 - Traffic Signs: General (Rev P3, 31/05/18)

1. New permanent traffic signs are indicated on the general arrangement drawings numbered PHF-MB-S278-GF-DR-D-210-01 and 02.
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

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 2002 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.
6. Exact location of road markings and tie-ins to be agreed on site with the Engineer.

Appendix 12/5 - Traffic Signs: Traffic Signals

1. Traffic signal installation shall be in accordance with the WSCC *Traffic Signal Installation Standards*, provided at **Schedule A** at the rear of this document.

Appendix 13/1 - Road Lighting Columns and Brackets

1. Street lighting columns shall be provided as indicated on SSE drawing SSE-976262-SL-DR-001 and SSE-96262-SL-DR-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 the manufacturer's recommendation for the ground / soil type. Access doors should face away from the oncoming traffic when positioning units in the footway or verge.
3. Planting depth and distance to the bottom of the door opening from finished ground level shall be in accordance with the manufacturer's recommendation. This shall be exact to achieve the correct mounting height above ground level and the correct cable depth.
4. Columns to be painted BS12C39 (Sherwood green).

Unit Numbering

5. All adoptable columns, illuminated signs, illuminated bollards and feeder pillars require to be numbered. Numbers will be allocated on approval of street lighting design where road names and / or extents are known. 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)

Acceptable positions of bracket arms relative to door position

Column material

Material design strength

(N/mm²)

No. of door openings

Door opening size - Height

(mm)

- Width

(mm)

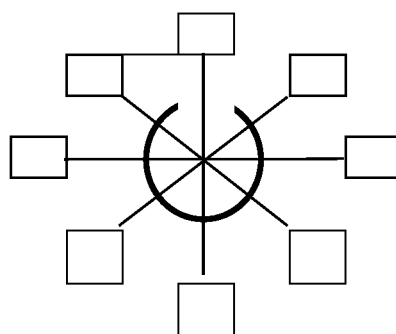
Cross-section of base compartment

Height
(mm)

Width
(mm)

Depth
(mm)

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)

Standard Soil Type Factor G

630

390

230

Diameter of concrete surround (if any)

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

- 1 The Contractor is responsible for preparing electrical record drawings for the Highway Authority.

Process for 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 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.

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

1. The position of new lighting units are as indicated on SSE drawing SSE-976262-SL-DR-001 and SSE-976262-SL-DR-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

Street lighting and electrical equipment shall be as indicated on SSE drawings numbered SSE-976262-SL-DR-001 and SSE-96262-SL-DR-002 and be in accordance with the 'Lighting of Developer Promoted Highway Schemes in West Sussex' included at **Schedule C**.

1. Lantern and Lamps (Clause 1407 and 1408)

Lanterns shall be as indicated on the street lighting drawings and as indicated below:

Type of luminaire	Location	No of Units
Single Philips WRTL Luma R5 with 80 No. Cool White LED's	Fitzalan Link Road	Refer to dwgs

2. Ancillary Equipment

Control Gear

- Shall accord with 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 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.

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 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).

b) 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.

Appendix 26/1 - Concrete for Ancillary Purposes

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
Sign Bollard foundation	ST1
Footing to traffic sign	ST2
Footing to street lighting column	ST4
Bed and haunch to highway drain pipes (type Z)	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.

Schedule A - WSCC Traffic Signal Design and Installation Standards (Rev P4, 30/10/18)

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

Index

- 1. Introduction**
- 2. Standards, specifications and regulations**
- 3. Equipment**
 - 3.1 General**
 - 3.2 Controller and Controller Functions**
 - 3.3 Signal Heads General**
 - 3.4 Pedestrian Far Side Signal Heads**
 - 3.5 Pedestrian Near Side signal Heads**
 - 3.6 Pedestrian Demand Units**
 - 3.7 Signal Heads For Cyclists**
 - 3.8 Additional Signs**
 - 3.9 Traffic Signal Poles**
 - 3.10 Vehicle Detection**
 - 3.11 Pedestrian Detection**
- 4. Loop Detection Installation**
- 5. Cabling**
- 6. Electricity Supply**
- 7. Testing of Installed Cables and Marking of Cable Drawing**
- 8. Testing and Commissioning**
- 9. Documentation**
- 10. Connecting to Urban Traffic Control (UTC) SCOOT**
- 11. Connecting to Remote Monitoring System (RMS)**
- 12. Connecting to Microprocessor Optimised Vehicle Activation (MOVA)**

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.

- 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					

ANNEX A

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.

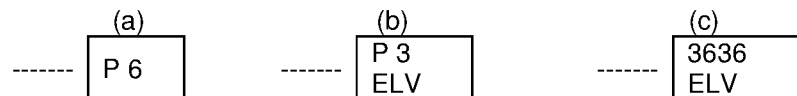
(b) Extra Low Voltage Cables (Pedestrian Push Buttons, etc)

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.

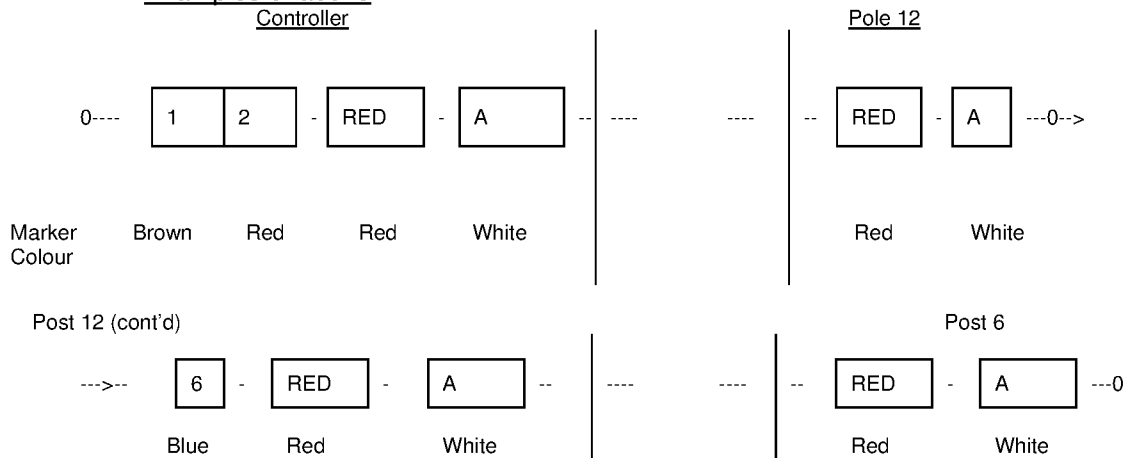
Colour:-	First Marker		Second Marker			Third Marker	
	(Pole)	(Function)	(Phase)				
	Colour Coded	Yellow	White				
1	Brown	PUSH/B	BLEEP	TACT		A	
2	Red	COMM	INHIB	LINK		B	
3	Orange	T/O	PB/COM			C	
4	Yellow	DET+	DET-			D	
5	Green	MVD	IRD	SPARE		E	

6	Blue				F
7	Violet	Note:-	Functions not covered by the above to be written onto blank markers with an approved pen.		
8	Slate (Grey)		(Two Markers)		
9	White		etc		
10	Brown and Black				

- 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.

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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):

	Pass/Fail
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	
<i>Check that the UTC stage change logic is correct</i>	
Check for correct operation with multiple force bits	
<i>Check stage to stage movement restrictions (i.e. permitted, prohibited, alternative)</i>	
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:

<i>Check timetable change points by altering the clock (STM, CKL, TOD*)</i>	
Check that signals switch off in correct stage, once minimums have expired (MOD, STS*)	
Check queue detector operation	
<i>Check minimum on/off operating timers if specified</i>	
Check operation of part-time inhibit switch	

Hurry Call Mode:

<i>Check Hurry Call Delay times are as specified (DHC)</i>	
<i>Check Hurry Call Hold times are as specified (HHC)</i>	
<i>Check Hurry Call Prevent times are as specified (PHC)</i>	
Check operation of request detectors	
Check operation of cancel detectors	
<i>Check that correct stage is called in relation to the detector (MOD, STS*)</i>	

Vehicle Priority Mode:

<i>Check Priority unit basic requirements are as specified (PUT, PUP, PMT, PDE, PRE, PRI, PDR, PUI, PSE, PSA, PVG)</i>	
<i>Check Priority Extension times are as specified (PVE)</i>	
<i>Check Priority Maximum times are as specified (PVM)</i>	
<i>Check Inhibit times are as specified (PVI)</i>	
<i>Check Phase Compensation times are as specified (PCn)</i>	
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.

Telent = HCD

Siemens = DHC

6.4 Check hold period.

Telent = HCH

Siemens = HHC

6.5 Check prevent period.

Telent = 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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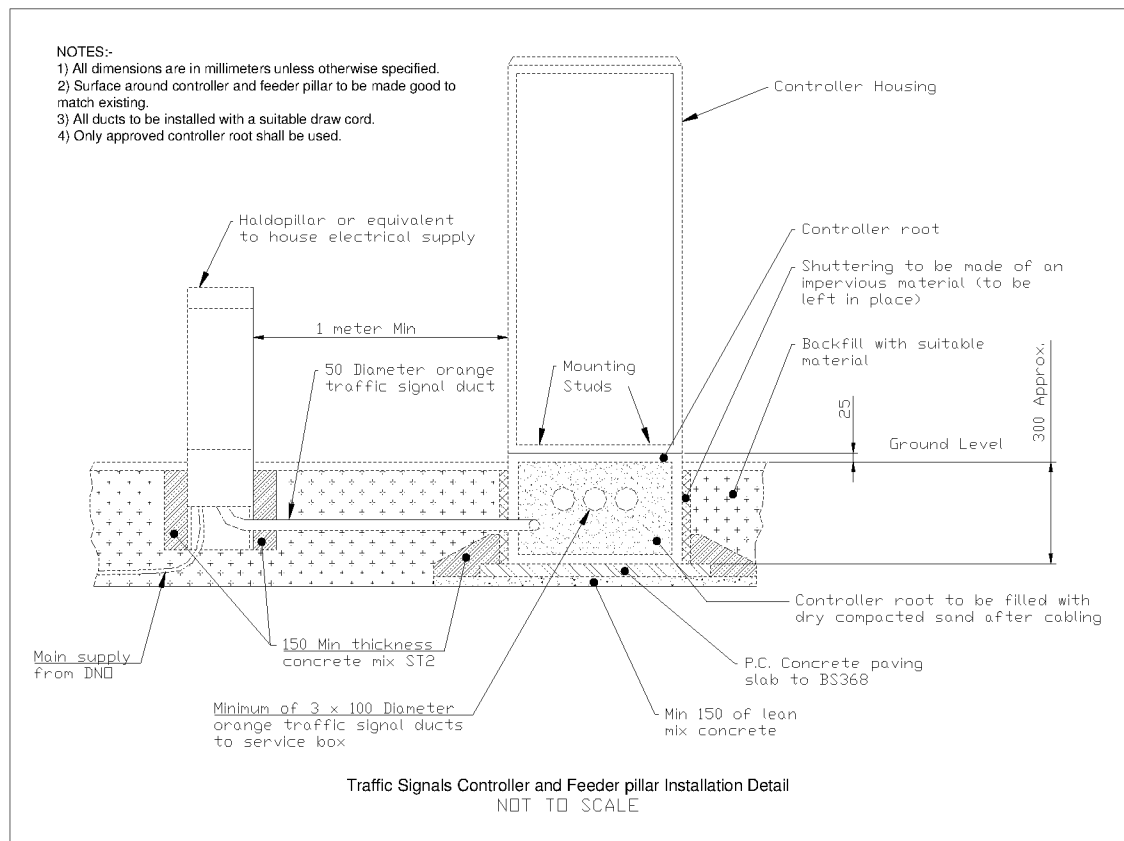
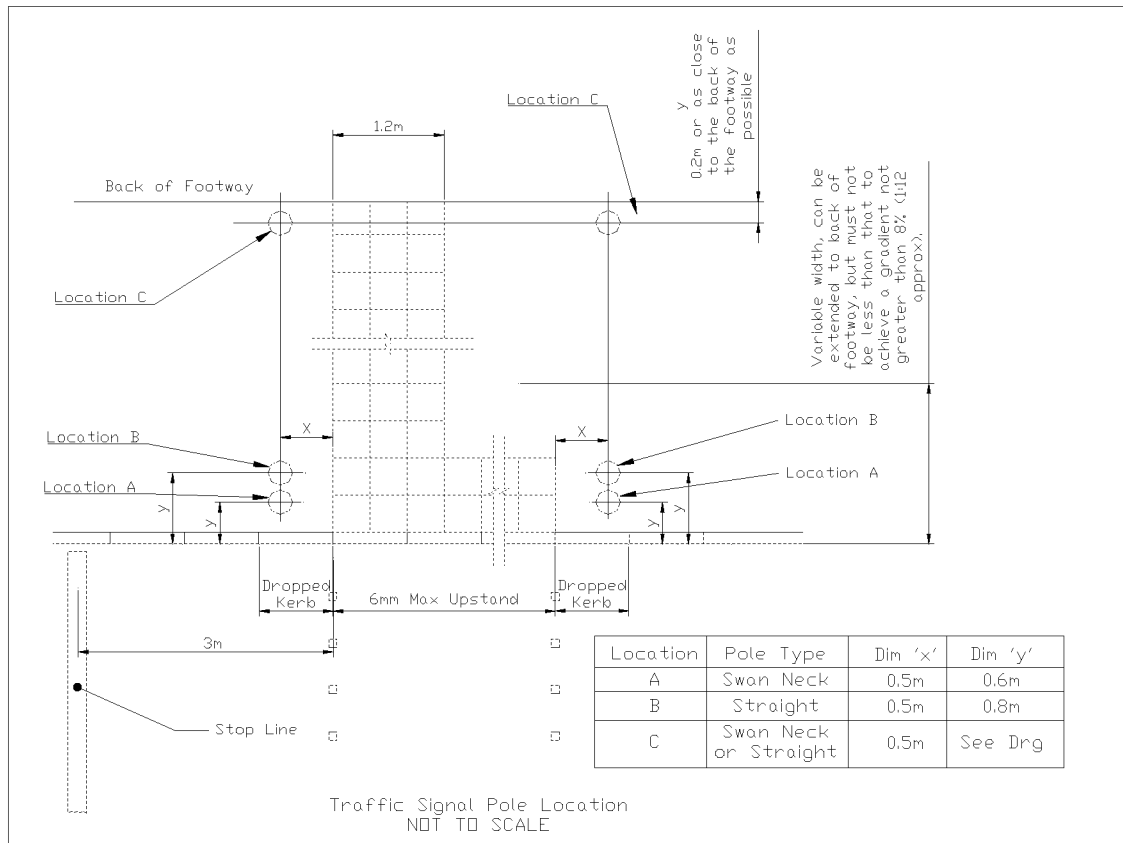
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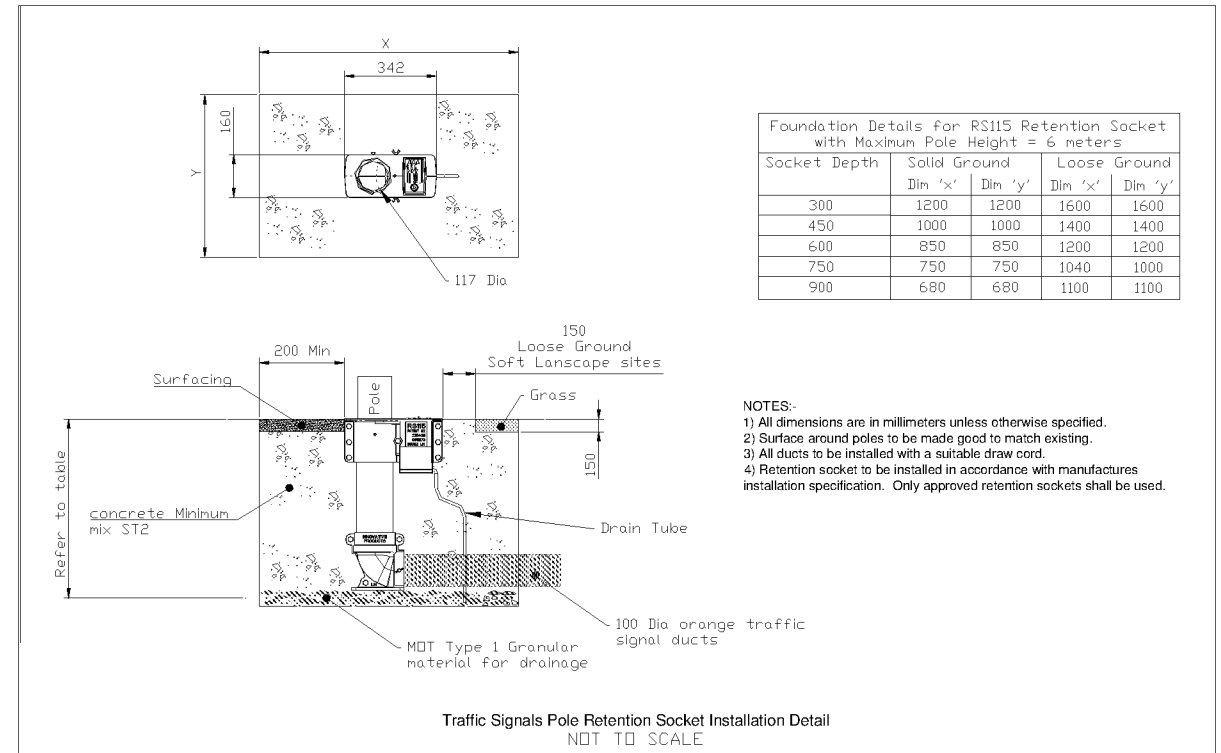
WSCC Traffic Signal Engineer

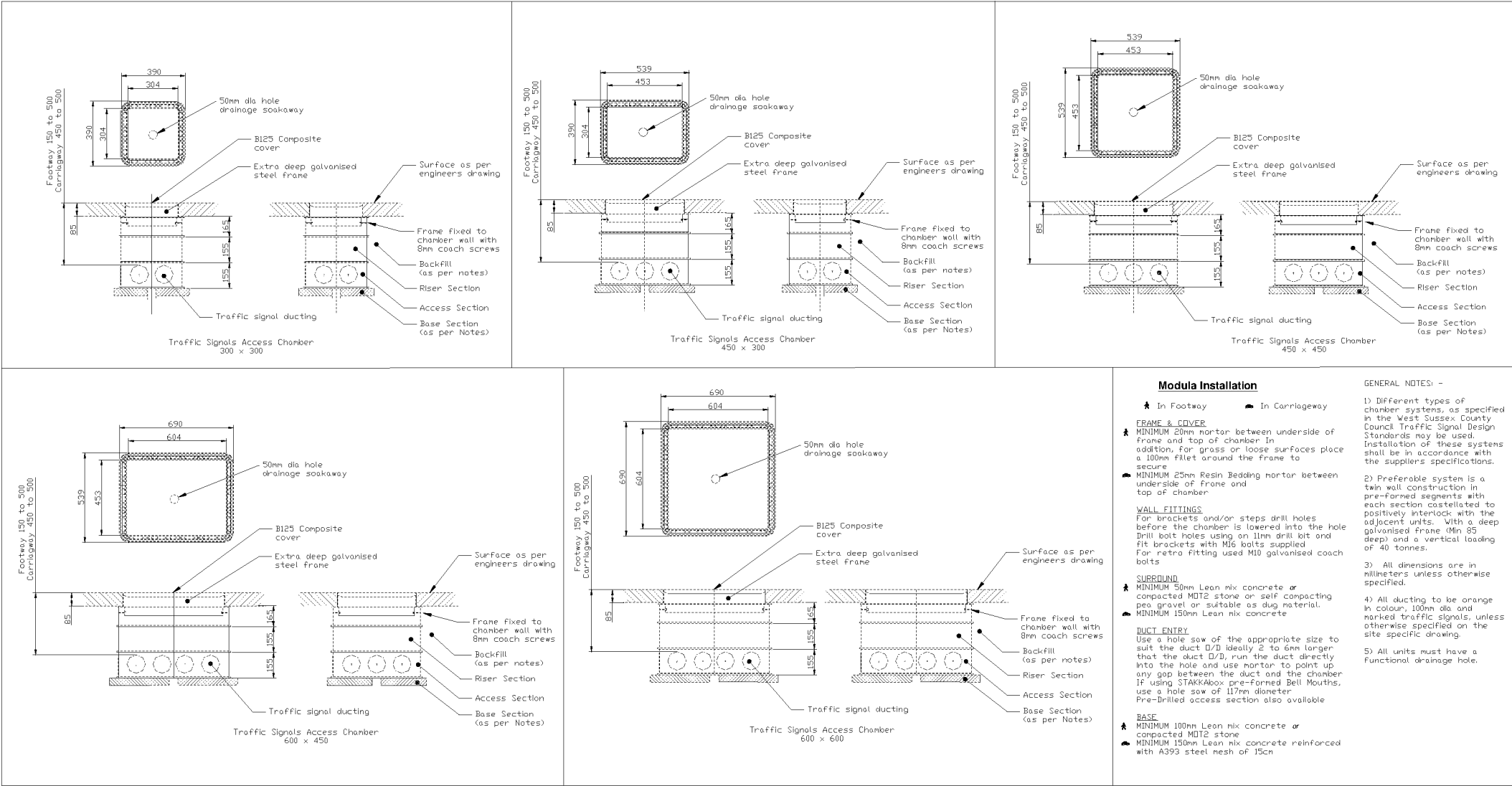
Name..... Signature.....

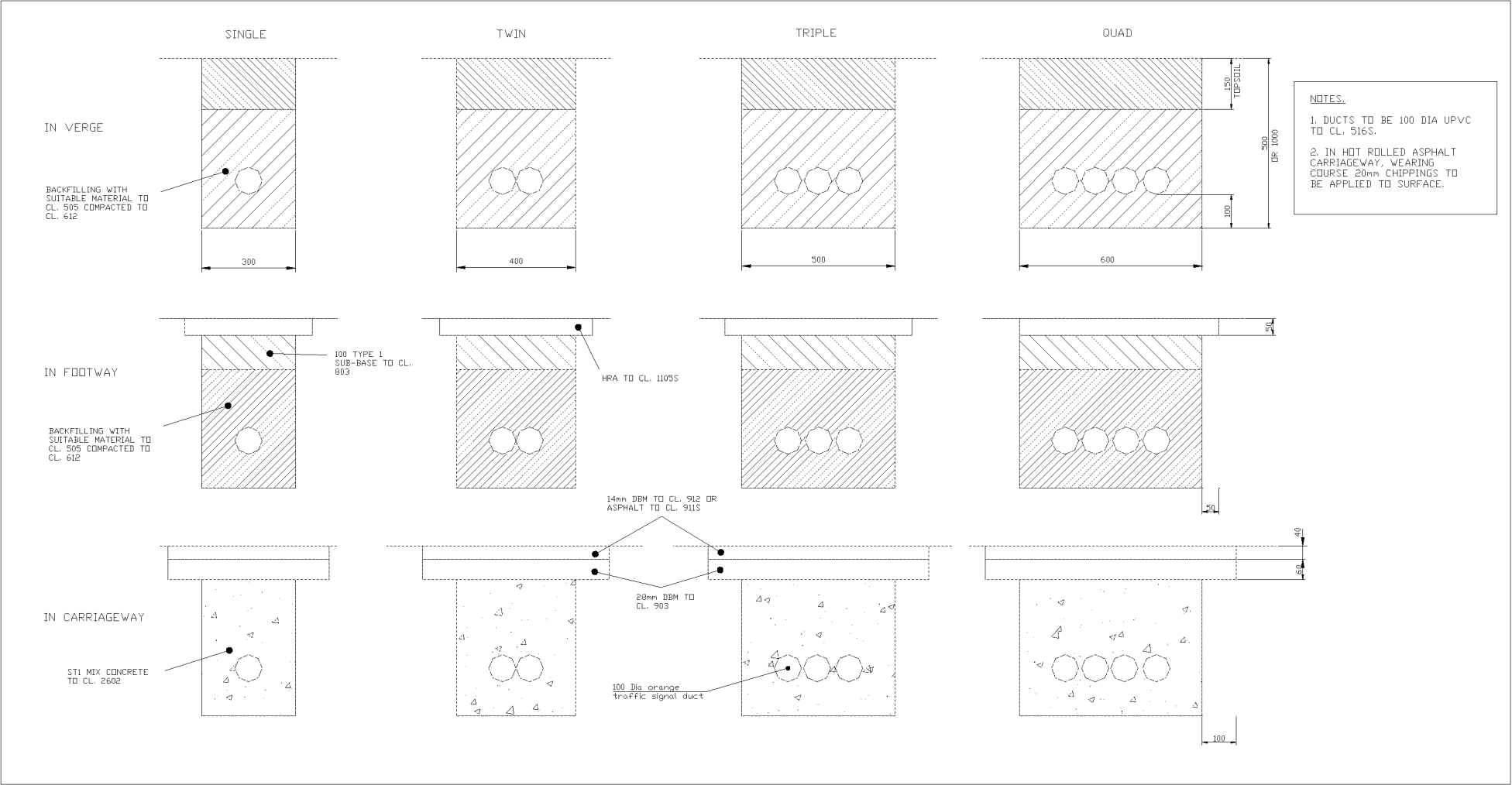
Client Representative

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

Index

- 1. Introduction**
- 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.

-
- (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



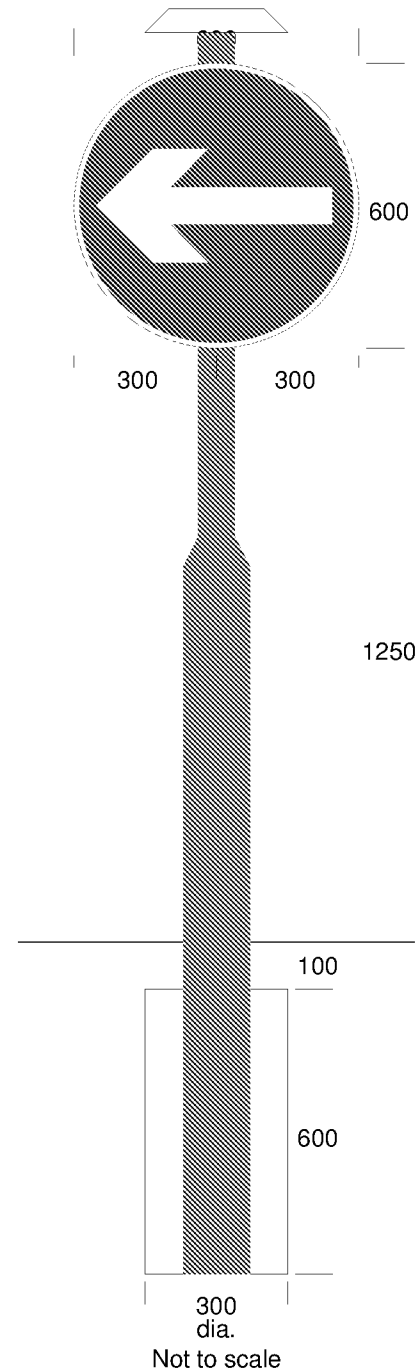
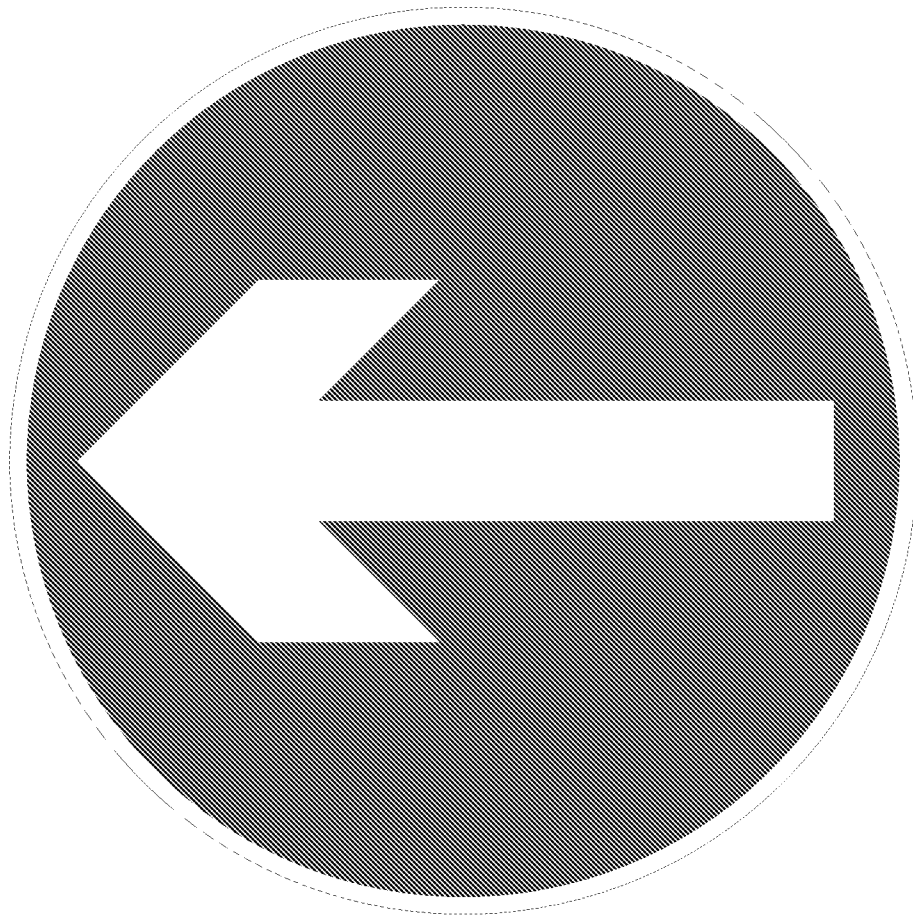
Telent Ltd
Unit N Acorn Industrial park
Crayford Road
Crayford
Kent
DA1 4AL

Controller Configuration

TCT Consultancy Ltd
11 Noon Gardens
Verwood
Dorset
BH31 7WQ



Schedule B - Sign Face Details



Job Ref: A/PHFITZ.2

Sign Ref: TS01

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

Colours:

Mounting height: 1.25m

Material: BS EN 12899-1:2007

Class: R3B (microprismatic)

BS EN 12899-1:2007 classes:

WL9, TDB4, PL3, PAF1

1600 N/m²

Structure Details:

1 no. SPS wide base post:

139.7x3.6 & 76.1x3.0

Support length: 2650 mm

Planted foundation to BD 94/07:

Soil type: poor or unknown

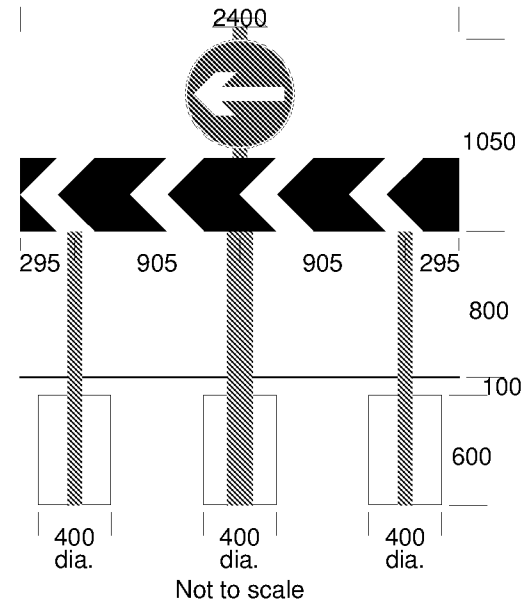
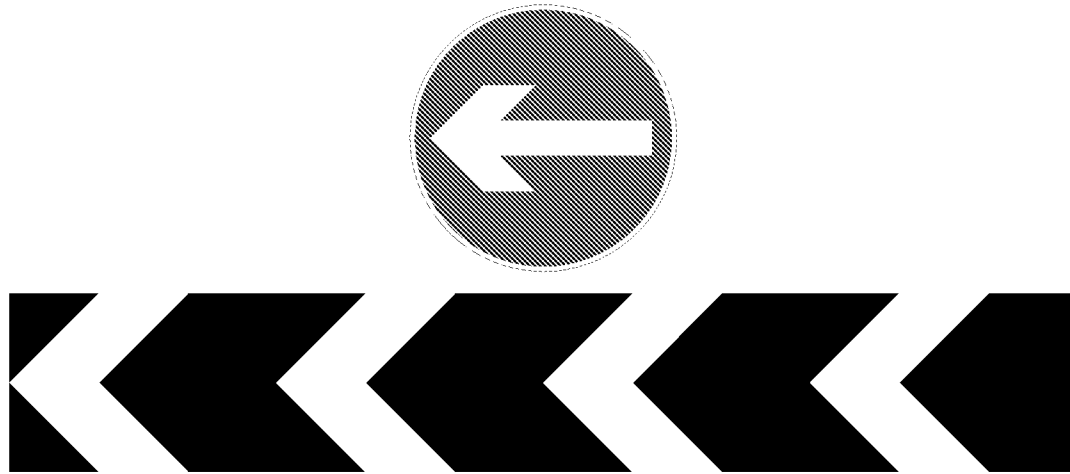
Depth of soft fill: 100 mm

Height of footing: 600 mm

Diameter of footing: 300 mm

TS01
PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2
Sign Ref: TS03&04, 05&06

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: .8m

Material: BS EN 12899-1:2007

Class: R3B (microprismatic)

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. 2.6mm thick and

1 no. SPS wide base post: 139.7x3.6
 & 76.1x3.0

Support length (longest): 2650 mm

Planted foundations to BD 94/07:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 600 mm

Diameter of each footing: 400 mm

TS03&4
 PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2
Sign Ref: TS07-12, 14-21 & 26
Scale 1:3
Dimensions (mm):
Width: 300, Height: 300
Area: 0.07 m²

Colours:

Material: BS EN 12899-1:2007
Class: RA2/R2

TS07
PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2

Sign Ref: Various

Scale 1:2

Dimensions (mm):

Width: 150, Height: 150

Area: 0.02 m²

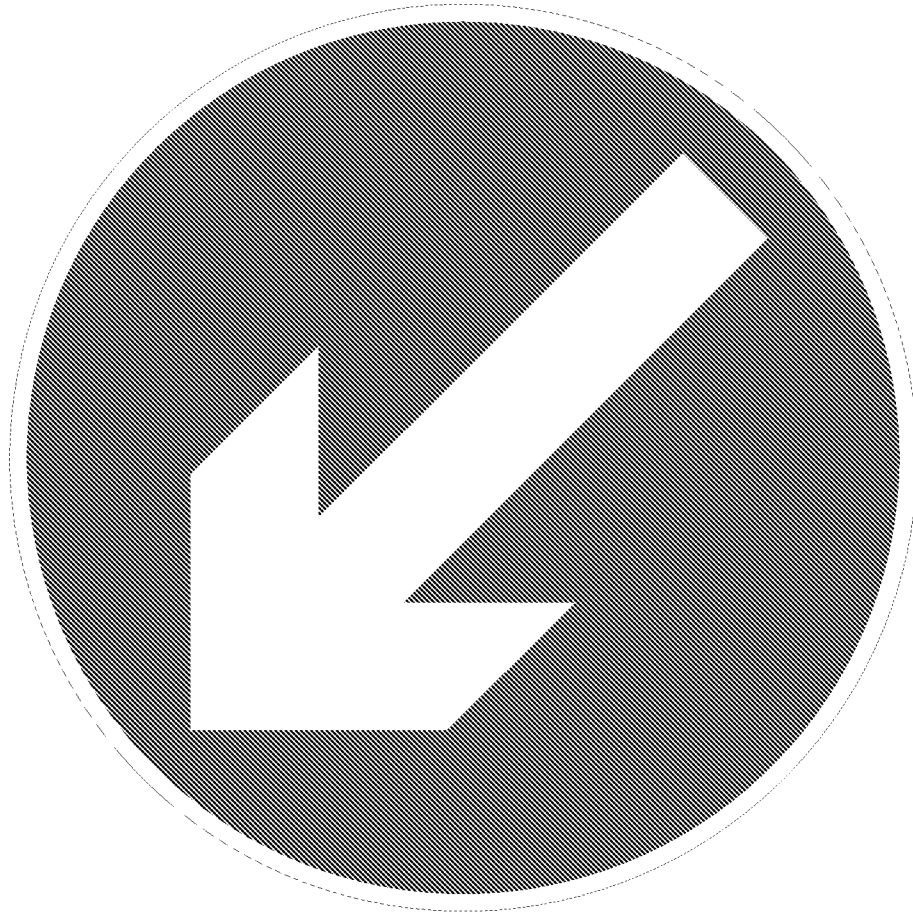
Colours:

Material: BS EN 12899-1:2007

Class: RA2/R2

TS13
PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2

Sign Ref: TS24&25

Scale 1:5

Dimensions (mm):

Width: 600, Height: 600

Area: 0.28 m²

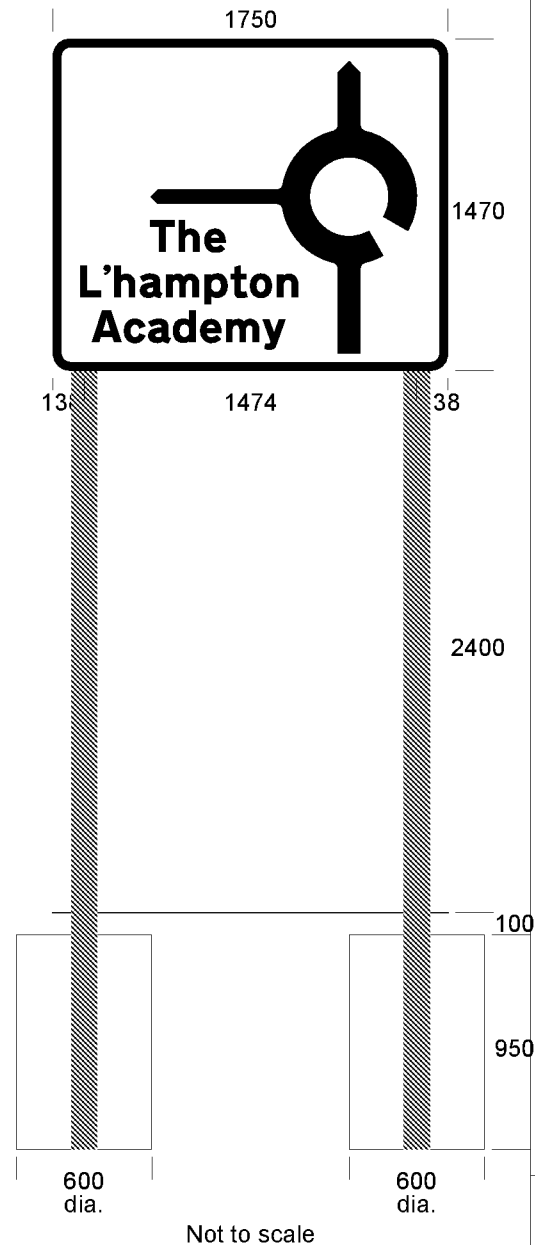
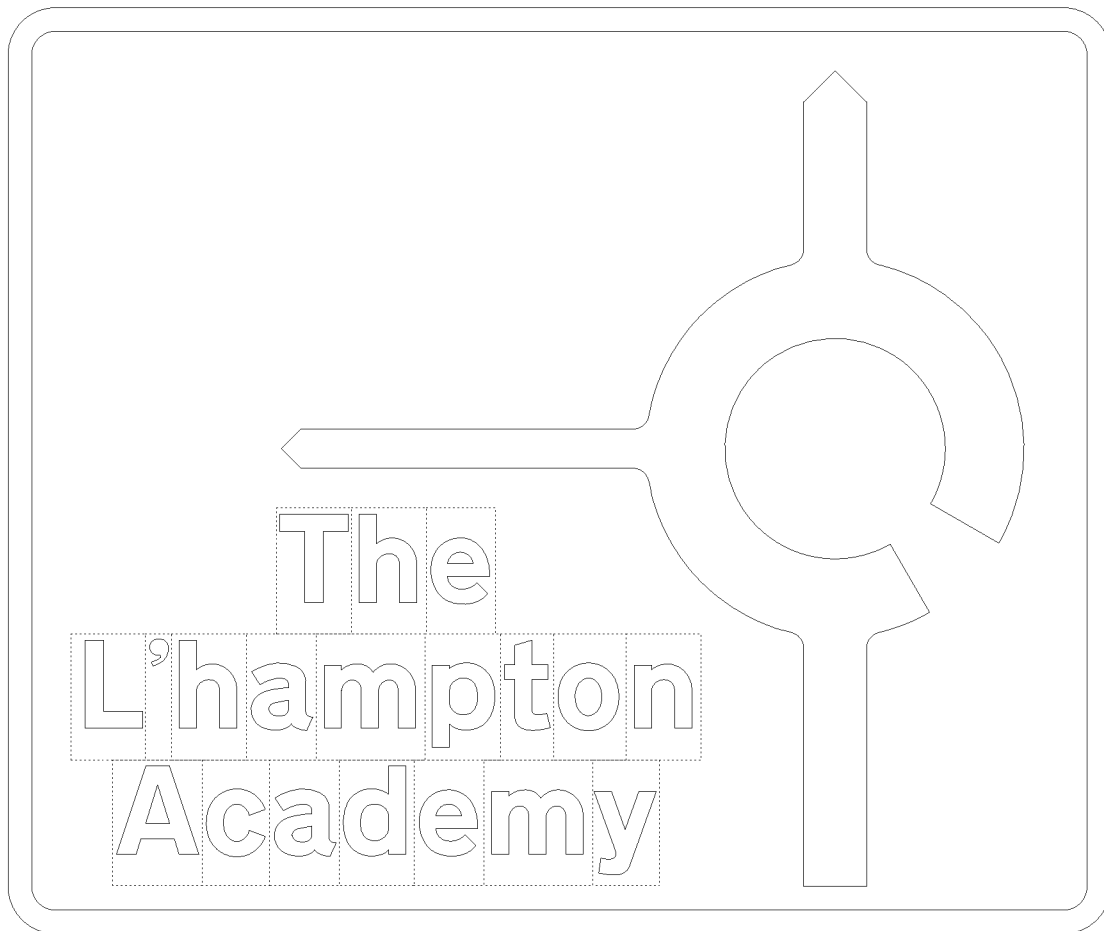
Colours:

Material: BS EN 12899-1:2007

Class: RA2/R2

TS24&25
PHFITZ

SignPlot v3.40



Job Ref: A/PHFITZ.2

Sign Ref: TS27

Scale 1:12

Dimensions (mm):

Width: 1750, Height: 1470

x-Height: 100 Area: 2.57 m²

Colours:

black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

1300 N/m², TDB4, PL3, PAF1

1300 N/m²

Structure Details:

2 no. Steel circular section S275:

114.3mm O.D. 5mm thick

Support length: 4920 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

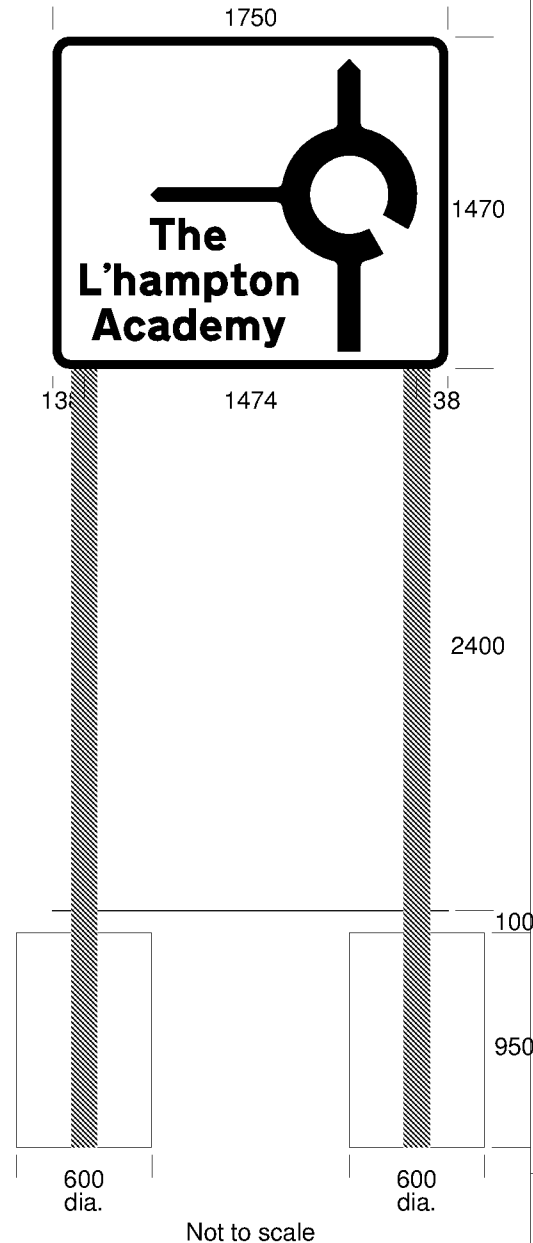
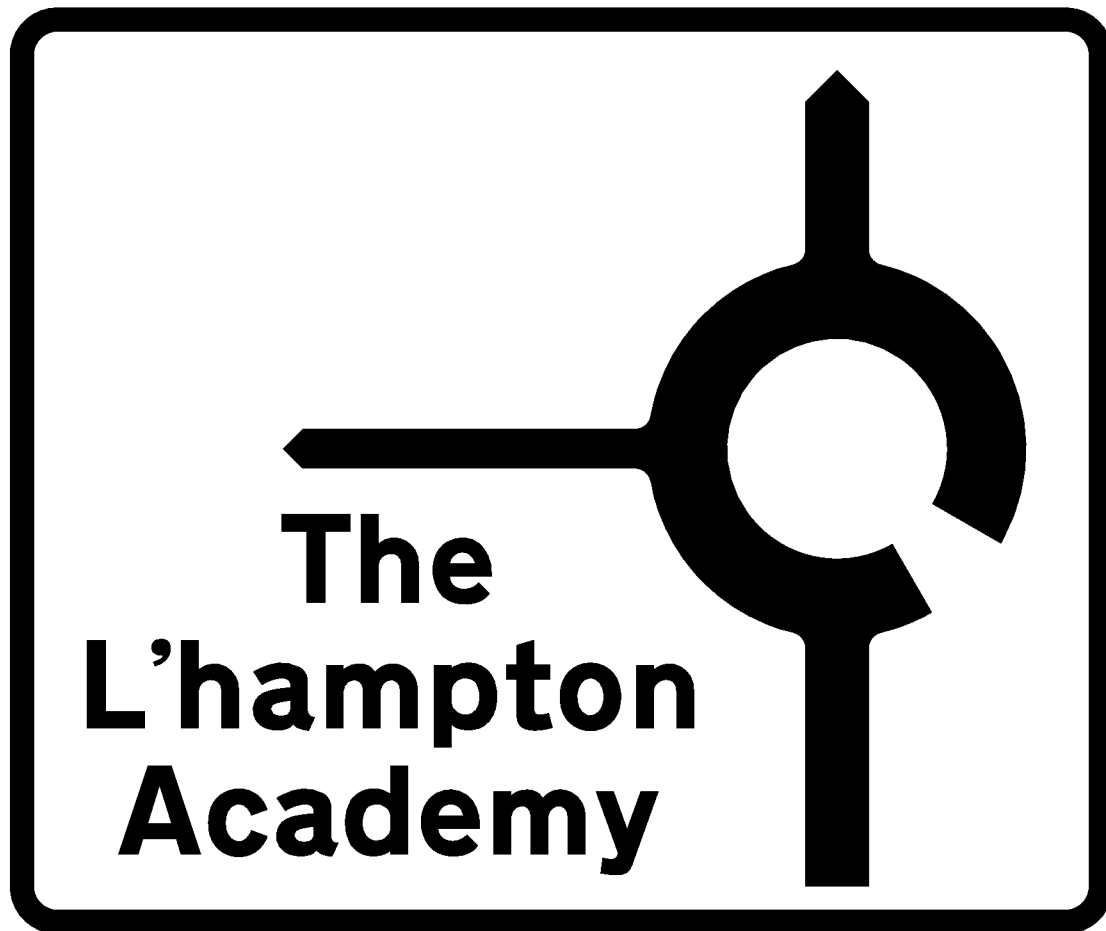
Depth of soft fill: 100 mm

Height of footing: 950 mm

Diameter of each footing: 600 mm

TS27
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS27

Scale 1:12

Dimensions (mm):

Width: 1750, Height: 1470

x-Height: 100 Area: 2.57 m²

Colours:

☐ black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

1300 N/m², TDB4, PL3, PAF1

1300 N/m²

Structure Details:

2 no. Steel circular section S275:

114.3mm O.D. 5mm thick

Support length: 4920 mm

Planted foundations to BD 94/07:

Soil type: poor or unknown

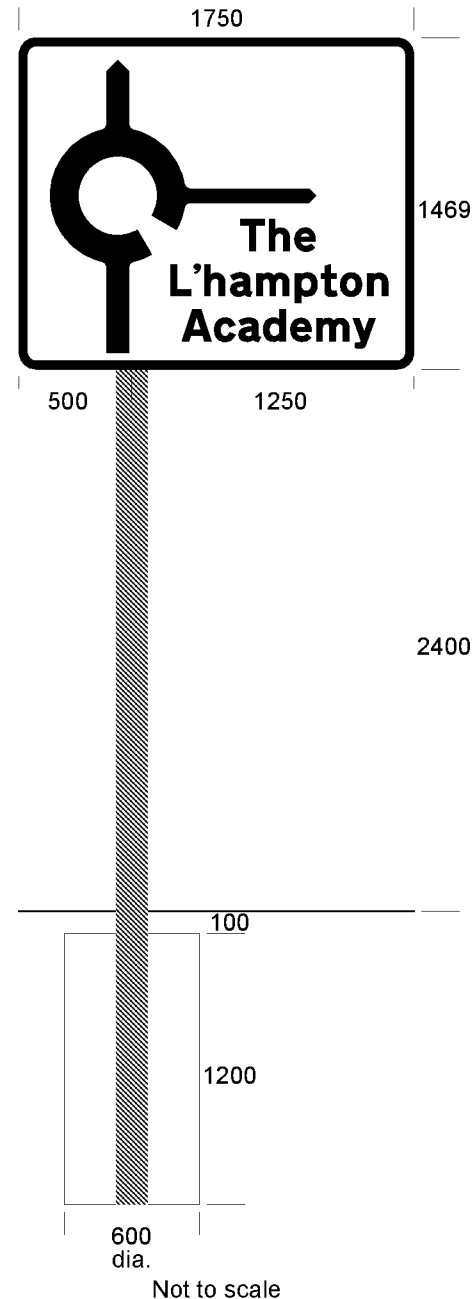
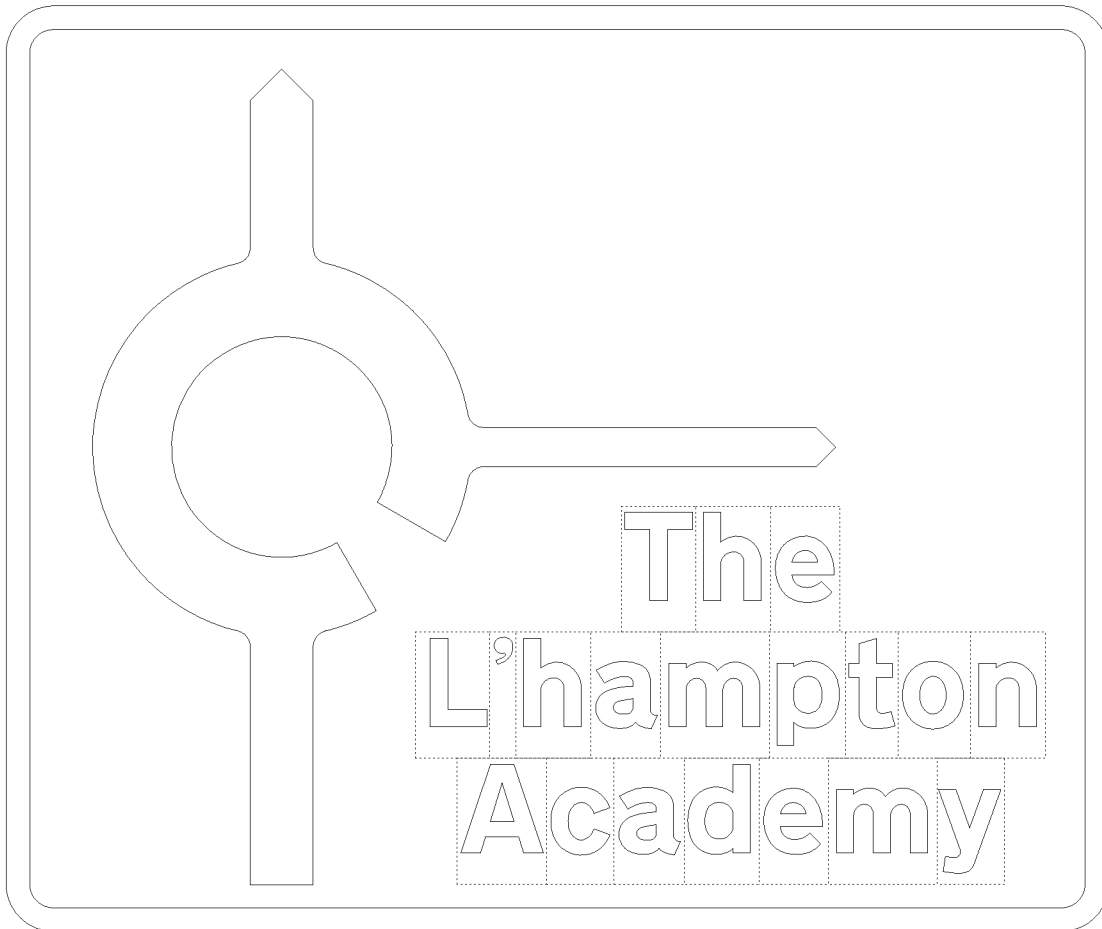
Depth of soft fill: 100 mm

Height of footing: 950 mm

Diameter of each footing: 600 mm

TS27
PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2

Sign Ref: TS28

Scale 1:12

Dimensions (mm):

Width: 1750, Height: 1469

x-Height: 100 Area: 2.57 m²

Colours:

■ black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

1300 N/m², TDB4, PL3, PAF1

1300 N/m²

Structure Details:

1 no. Steel circular section S275:

139.7mm O.D. 6.3mm thick

Support length: 5169 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

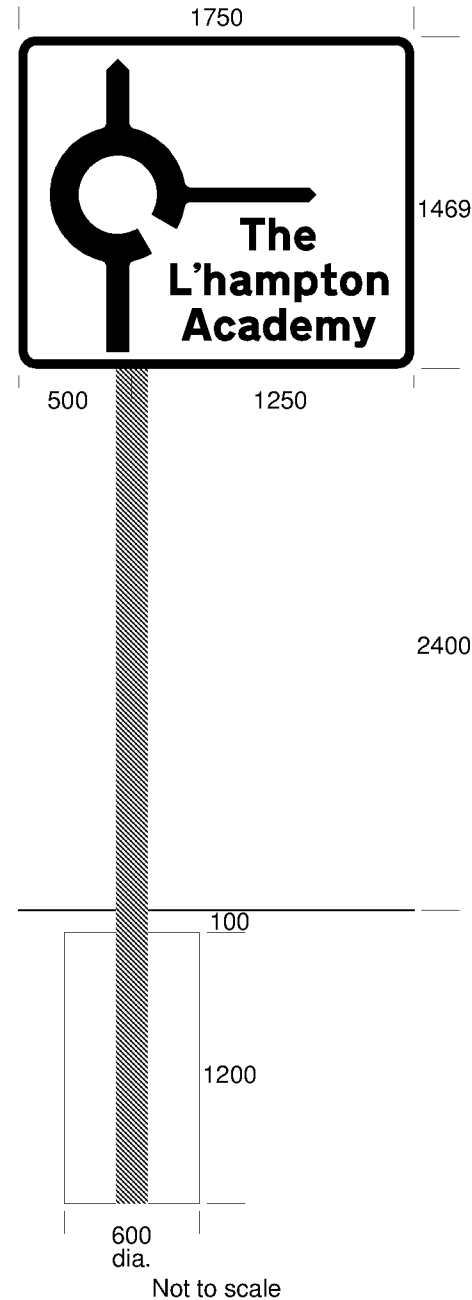
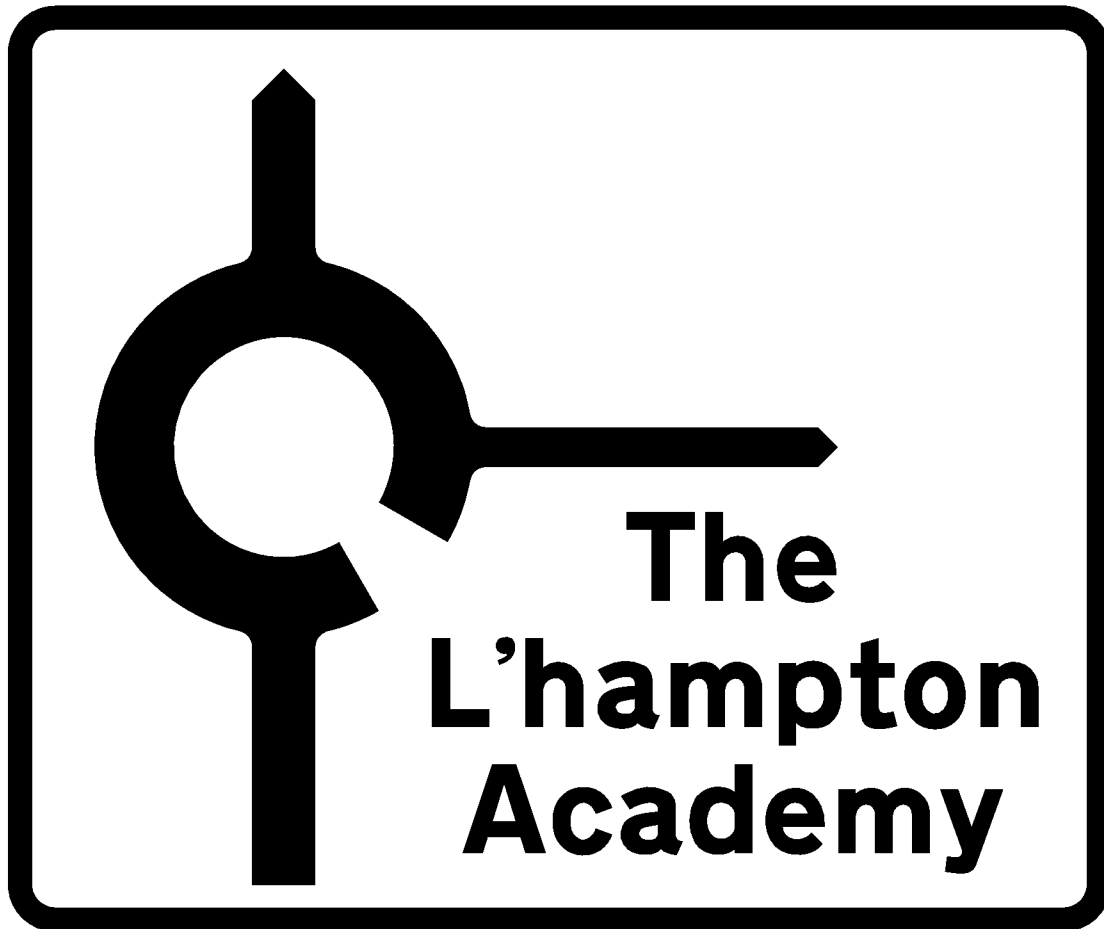
Depth of soft fill: 100 mm

Height of footing: 1200 mm

Diameter of footing: 600 mm

TS28
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS28

Scale 1:12

Dimensions (mm):

Width: 1750, Height: 1469

x-Height: 100 Area: 2.57 m²

Colours:

☐ black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

1300 N/m², TDB4, PL3, PAF1

1300 N/m²

Structure Details:

1 no. Steel circular section S275:

139.7mm O.D. 6.3mm thick

Support length: 5169 mm

Planted foundation to BD 94/07:

Soil type: poor or unknown

Depth of soft fill: 100 mm

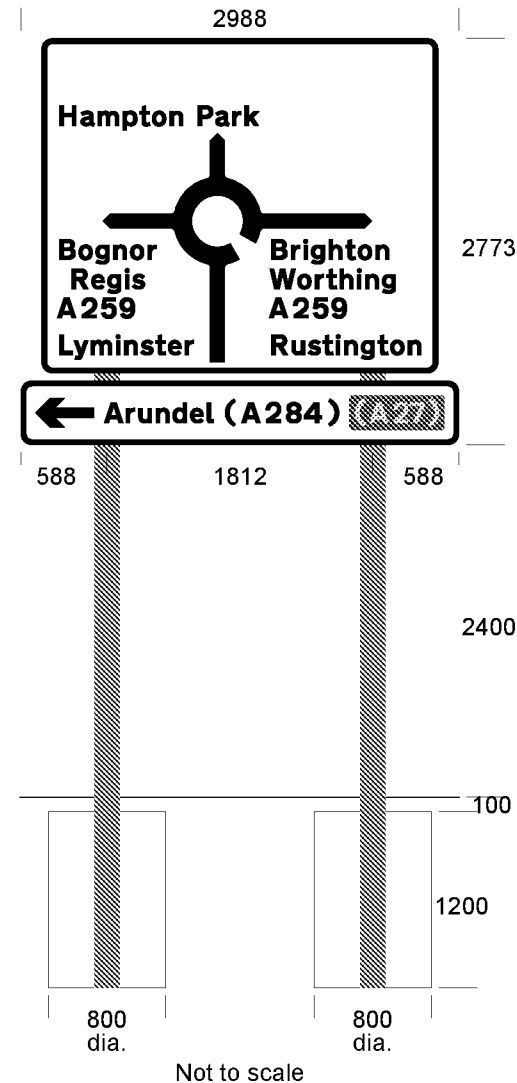
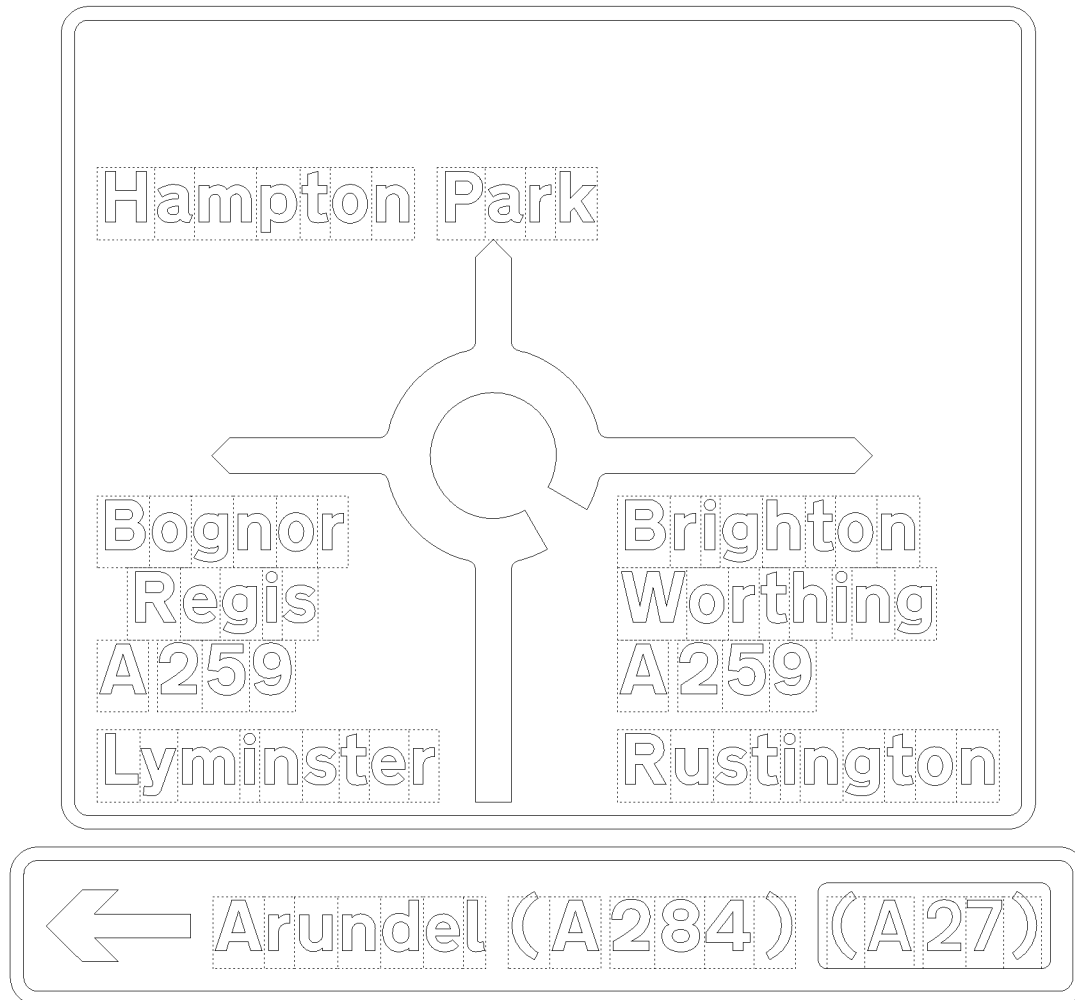
Height of footing: 1200 mm

Diameter of footing: 600 mm

TS28

PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2

Sign Ref: TS29A&B

Scale 1:21

Dimensions (mm & m²):

Width: 2706, Height: 2285, Area: 6.18

Width: 2988, Height: 438, Area: 1.31

x-Height: 100 Total area: 7.49 m²

Colours:

1 black on white

2 yellow on dark green

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

WL5, TDB4, PL3, PAF1

1000 N/m²

Structure Details:

2 no. Steel circular section S275:

168.3mm O.D. 5mm thick

Support length: 6473 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

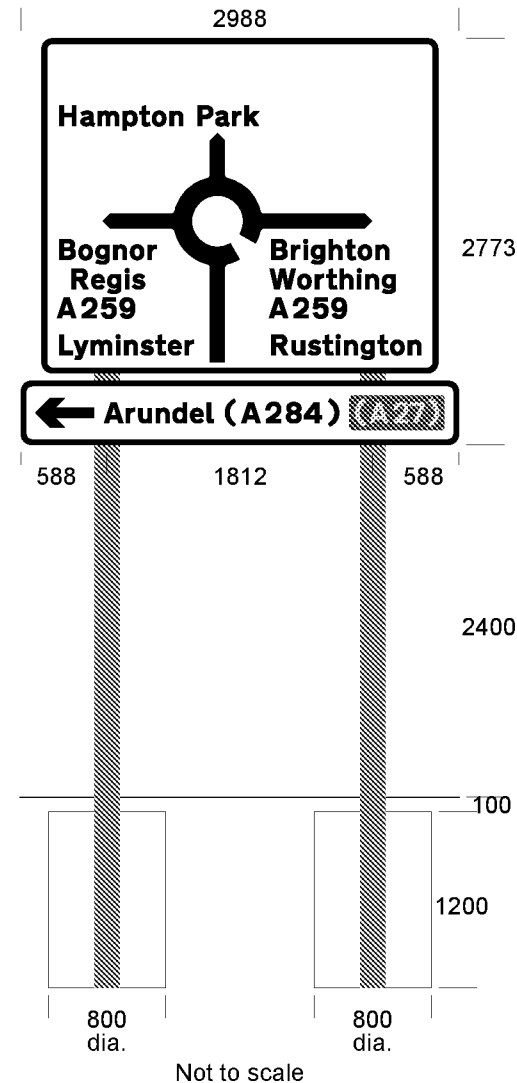
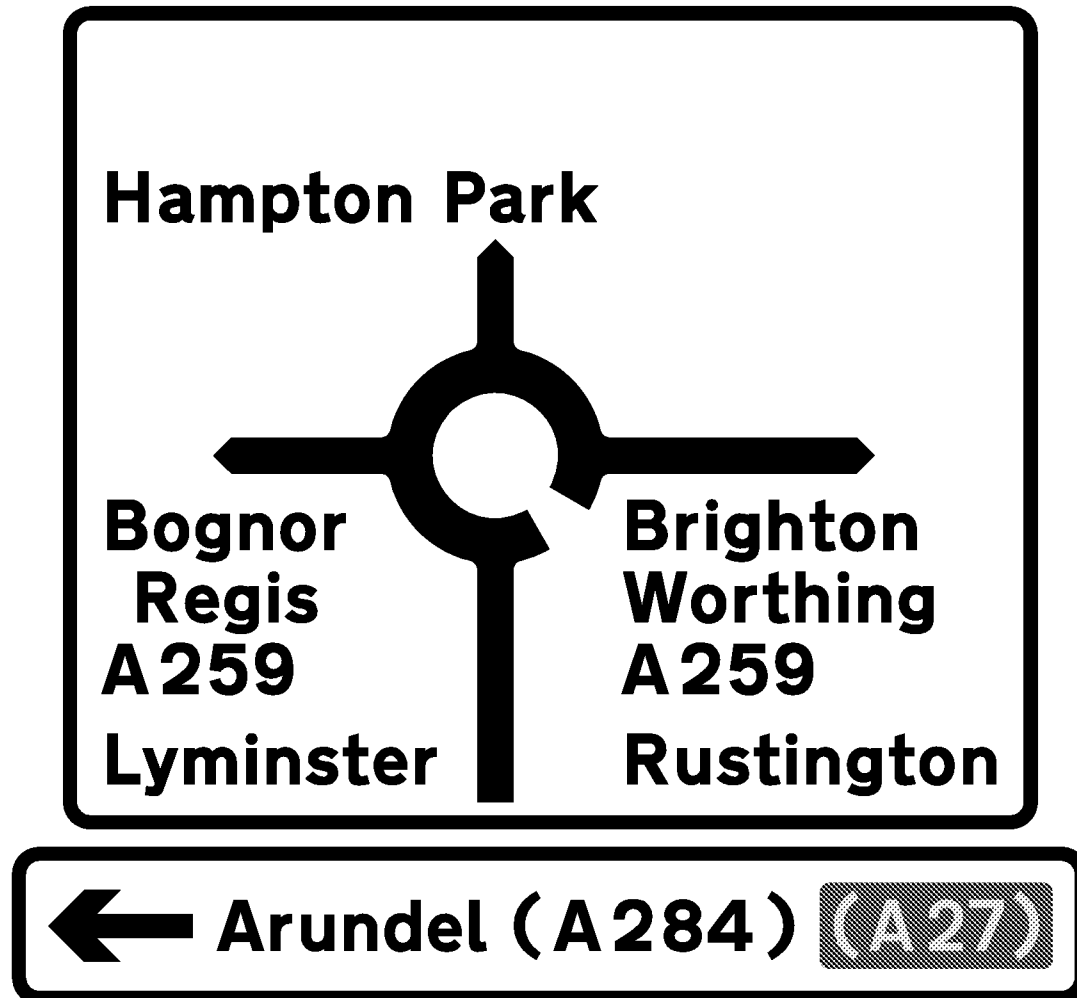
Depth of soft fill: 100 mm

Height of footing: 1200 mm

Diameter of each footing: 800 mm

TS29TMP
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS29A&B

Scale 1:21

Dimensions (mm & m²):

Width: 2706, Height: 2285, Area: 6.18

Width: 2988, Height: 438, Area: 1.31

x-Height: 100 Total area: 7.49 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:

WL5, TDB4, PL3, PAF1

1000 N/m²

Structure Details:

2 no. Steel circular section S275:

168.3mm O.D. 5mm thick

Support length: 6473 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

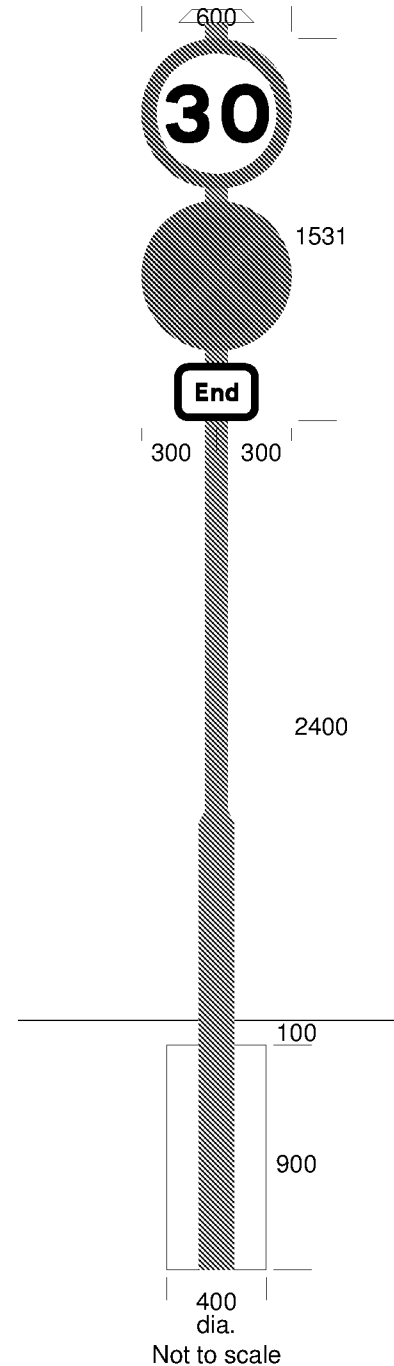
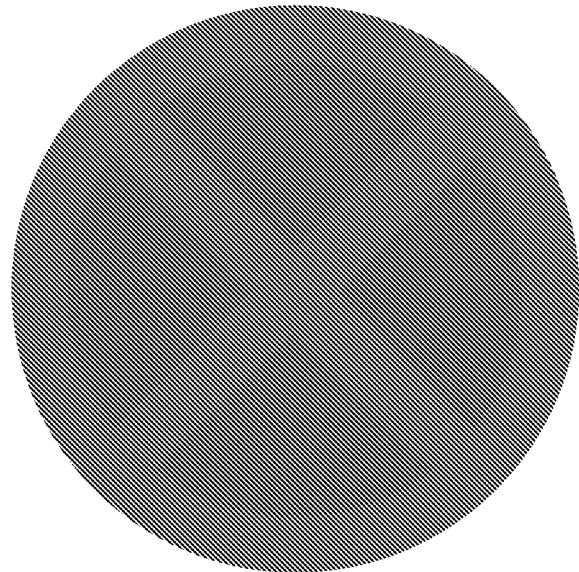
Depth of soft fill: 100 mm

Height of footing: 1200 mm

Diameter of each footing: 800 mm

TS29TMP
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS30, 89 & 90, 32, 92 & 93

Scale 1:8

Dimensions (mm & m²):

Width: 600, Height: 600, Area: 0.28

Width: 600, Height: 600, Area: 0.28

Width: 337, Height: 231, Area: 0.08

x-Height: (75), 50 Total area: 0.64 m²

Colours:

☐ black on white

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 & 88.9x3.0

Support length: 5031 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

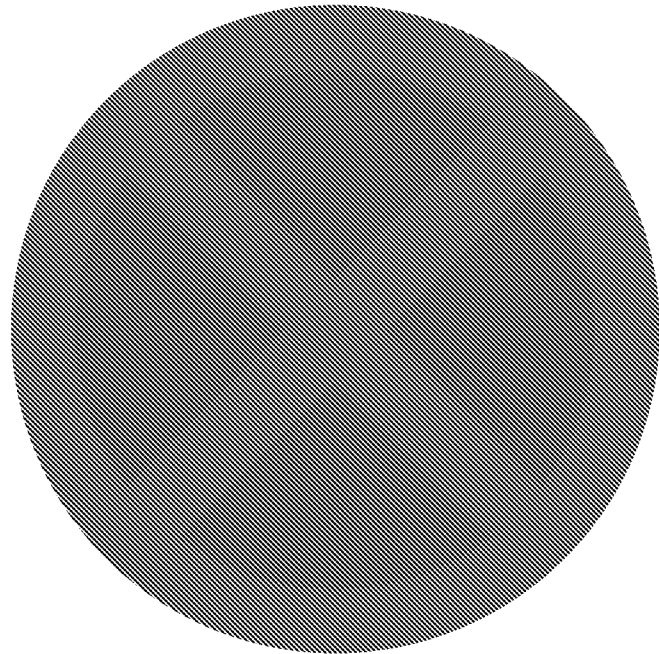
Height of footing: 900 mm

Diameter of footing: 400 mm

TS308990

PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2
Sign Ref: TS31&91, 33&94

Scale 1:7

Dimensions (mm & m²):

Width: 600, Height: 600, Area: 0.28

Width: 600, Height: 600, Area: 0.28

x-Height: (100) Total area: 0.57 m²

Colours:

Material: BS EN 12899-1:2007

Class: RA2/R2

TS31&91
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS34&35

Scale 1:3

Dimensions (mm):

Width: 300, Height: 300

Area: 0.07 m²

Colours:

Material: BS EN 12899-1:2007

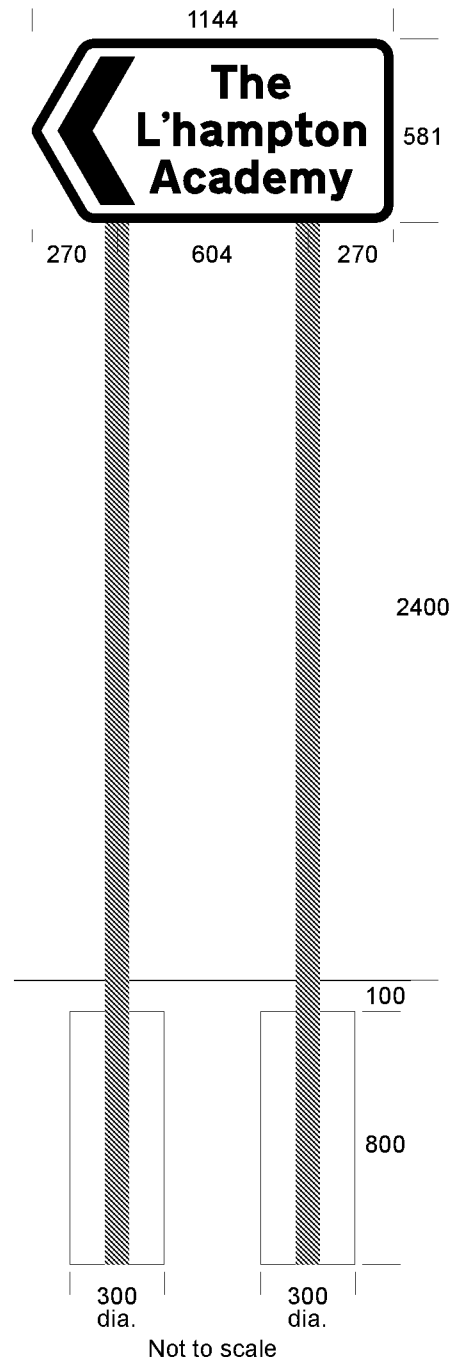
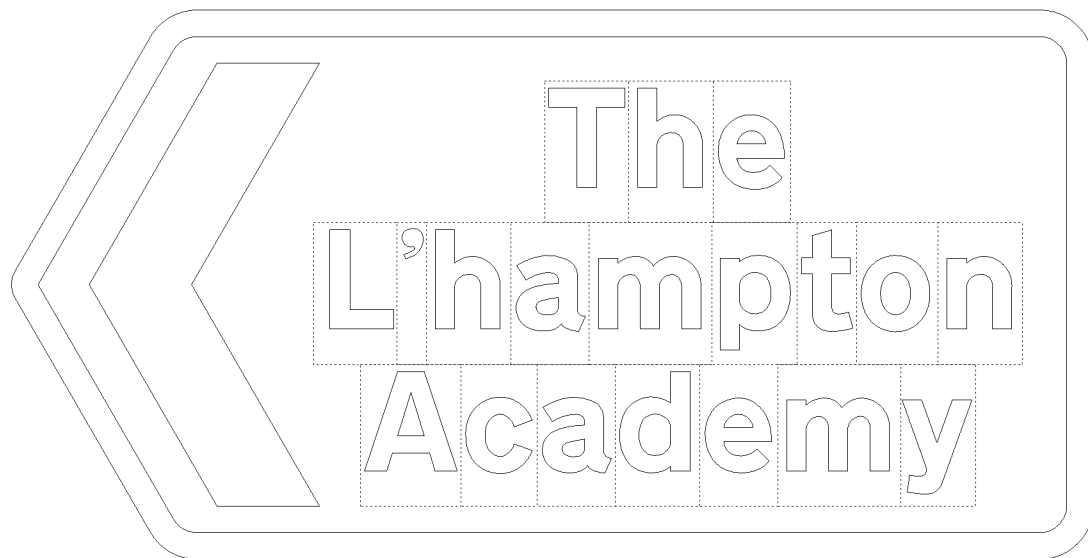
Class: RA2/R2

Mounted on LC7

TS34&35

PHFITZ

SignPlot v3.40



Job Ref: A/PHFITZ.2

Sign Ref: TS38

Scale 1:8

Dimensions (mm):

Width: 1144, Height: 581

x-Height: 75 Area: 0.66 m²

Colours:

black on white

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:

2 no. Steel circular section S275:

76.1mm O.D. 3mm thick

Support length: 3881 mm

Planted foundations to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

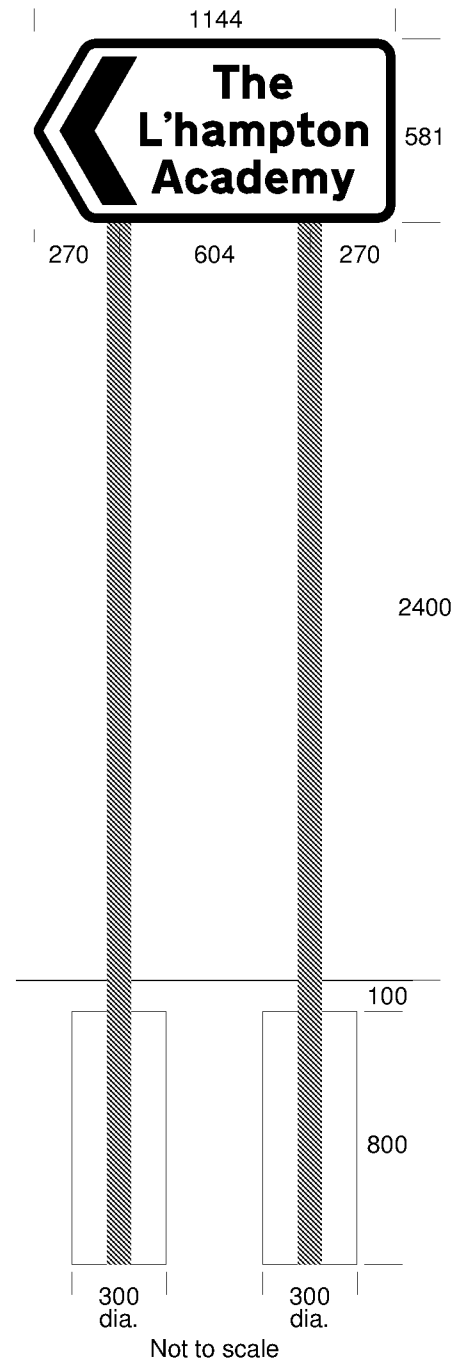
Height of footing: 800 mm

Diameter of each footing: 300 mm

Passively safe to BS EN 12767:2007

TS38
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS38

Scale 1:8

Dimensions (mm):

Width: 1144, Height: 581

x-Height: 75 Area: 0.66 m²

Colours:

☐ black on white

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:

2 no. Steel circular section S275:

76.1mm O.D. 3mm thick

Support length: 3881 mm

Planted foundations to BD 94/07:

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

TS38

PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2
Sign Ref: TS41 & TS42

Scale 1:2

Dimensions (mm):

Width: 291, Height: 222

x-Height: 20 Area: 0.06 m²

Colours:

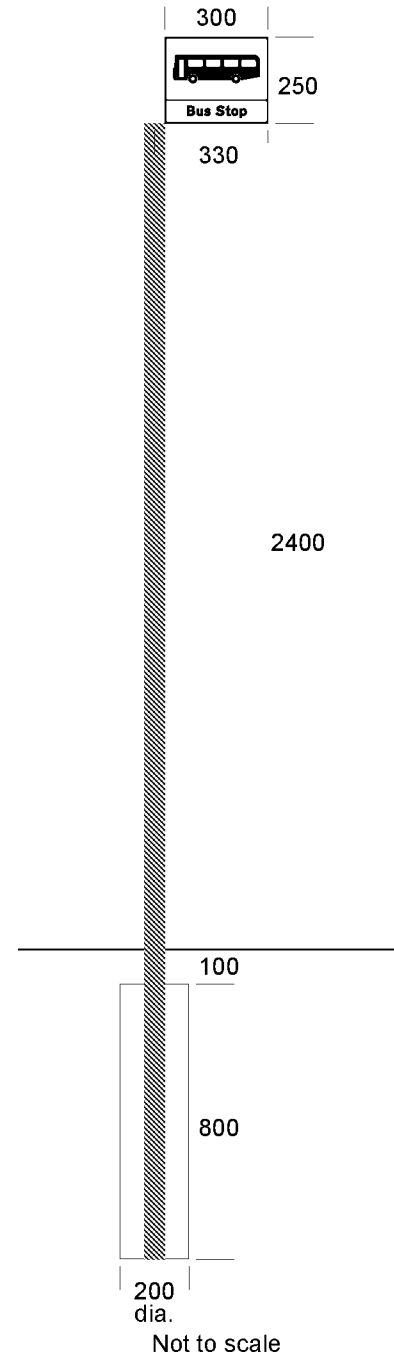
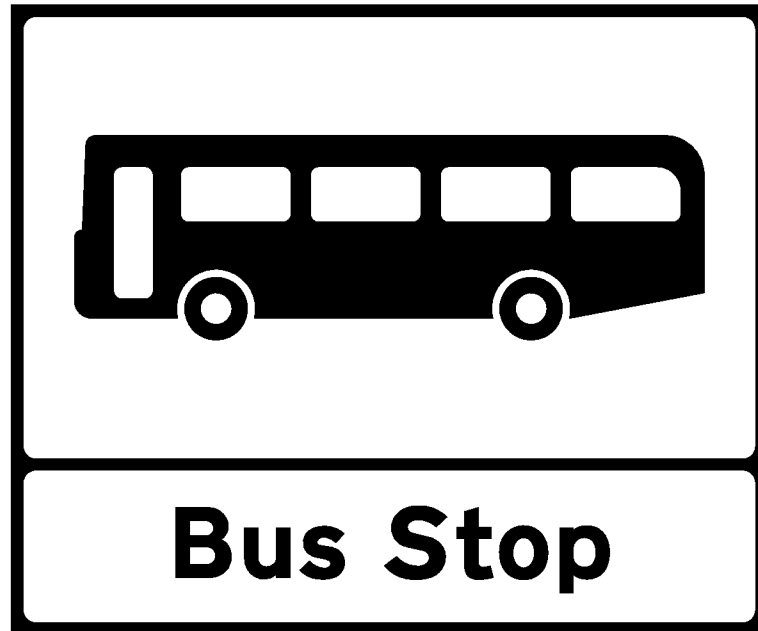
 black on yellow

Material: BS EN 12899-1:2007

Class: RA2/R2

TS41&42
PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2
Sign Ref: TS41A & 42A

Scale 1:3

Dimensions (mm):

Width: 300, Height: 250

Area: 0.08 m²

Colours:

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: RA2/R2

BS EN 12899-1:2007 classes:

1300 N/m², TDB5, PL3, PAF1

1300 N/m²

Structure Details:

1 no. Steel circular section S275:

60.3mm O.D. 2.6mm thick

Support length: 3550 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

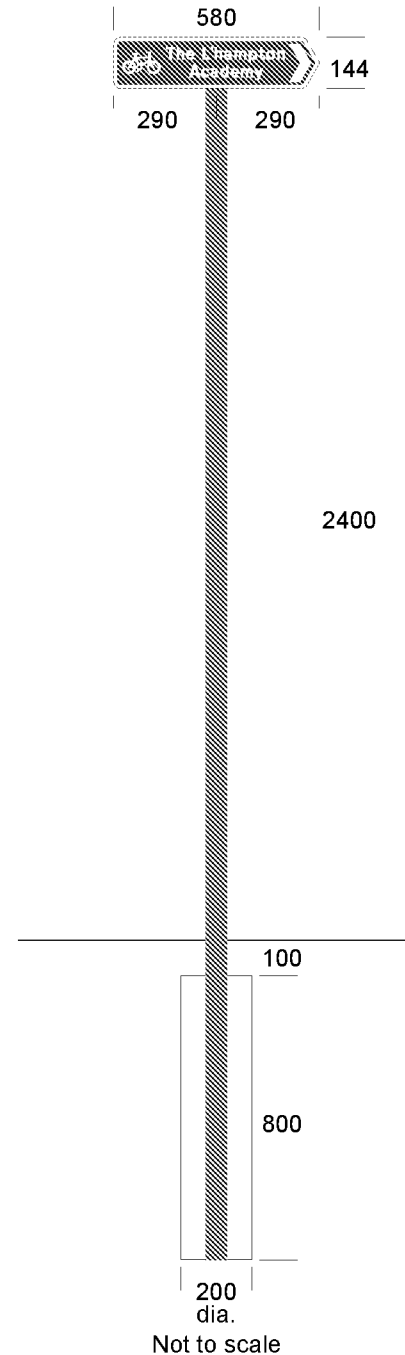
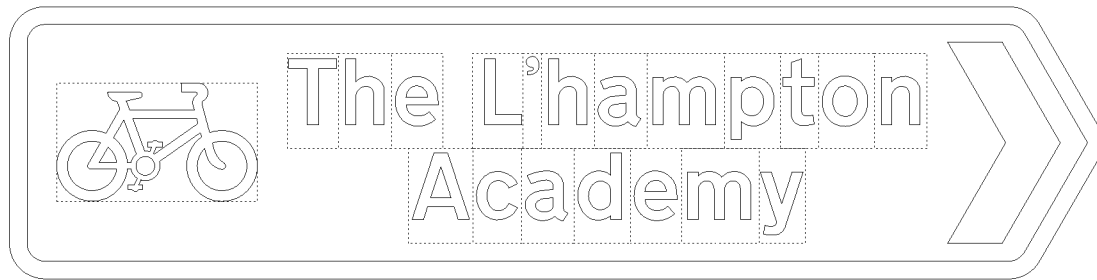
Height of footing: 800 mm

Diameter of footing: 200 mm

Passively safe to BS EN 12767:2007

TS41A
PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS43

Scale 1:4

Dimensions (mm):

Width: 580, Height: 144

x-Height: 25 Area: 0.08 m²

Colours:

1 white on blue

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. Steel circular section S275:

60.3mm O.D. 2.6mm thick

Support length: 3444 mm

Planted foundation to BD 94/17:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

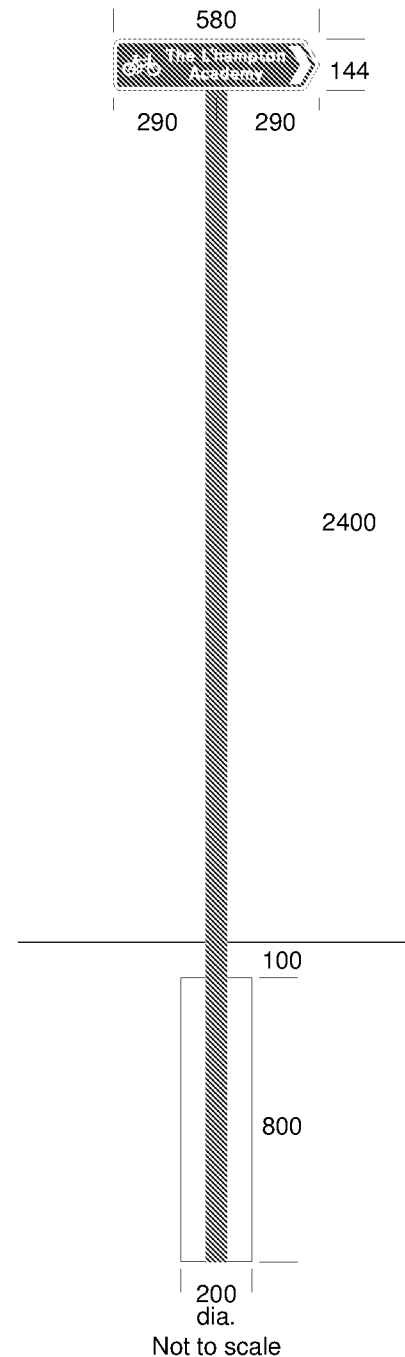
Diameter of footing: 200 mm

Passively safe to BS EN 12767:2007

TS43

PHFITZ

SignPlot v3.50



Job Ref: A/PHFITZ.2

Sign Ref: TS43

Scale 1:4

Dimensions (mm):

Width: 580, Height: 144

x-Height: 25 Area: 0.08 m²

Colours:

white on blue

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. Steel circular section S275:

60.3mm O.D. 2.6mm thick

Support length: 3444 mm

Planted foundation to BD 94/07:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

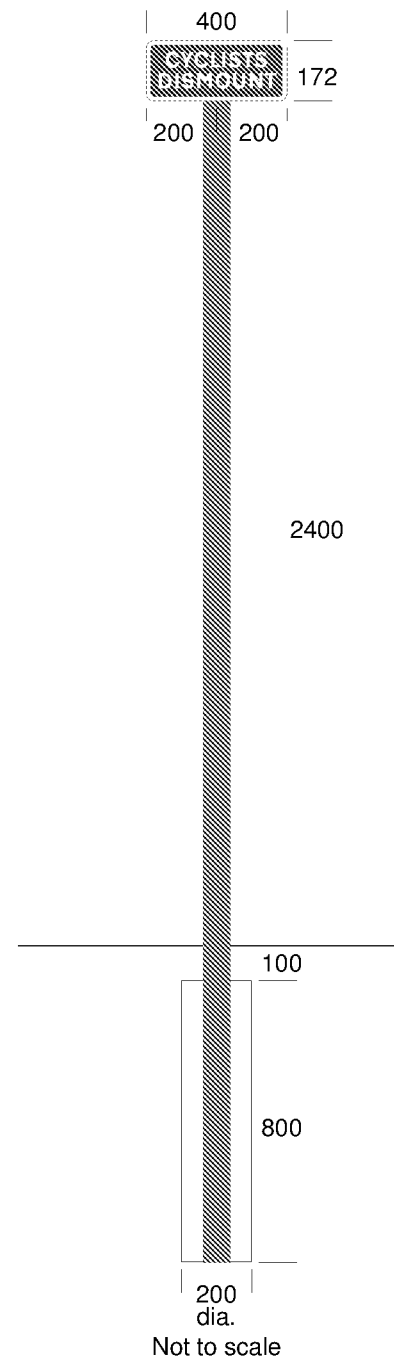
Diameter of footing: 200 mm

Passively safe to BS EN 12767:2007

TS43

PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2

Sign Ref: TS46 & 47

Scale 1:3

Dimensions (mm):

Width: 400, Height: 172

x-Height: 30 Area: 0.07 m²

Colours:

white on blue

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. Steel circular section S235:

76.1mm O.D. 3mm thick

Support length: 3472 mm

Planted foundation to BD 94/07:

Soil type: poor or unknown

Depth of soft fill: 100 mm

Height of footing: 800 mm

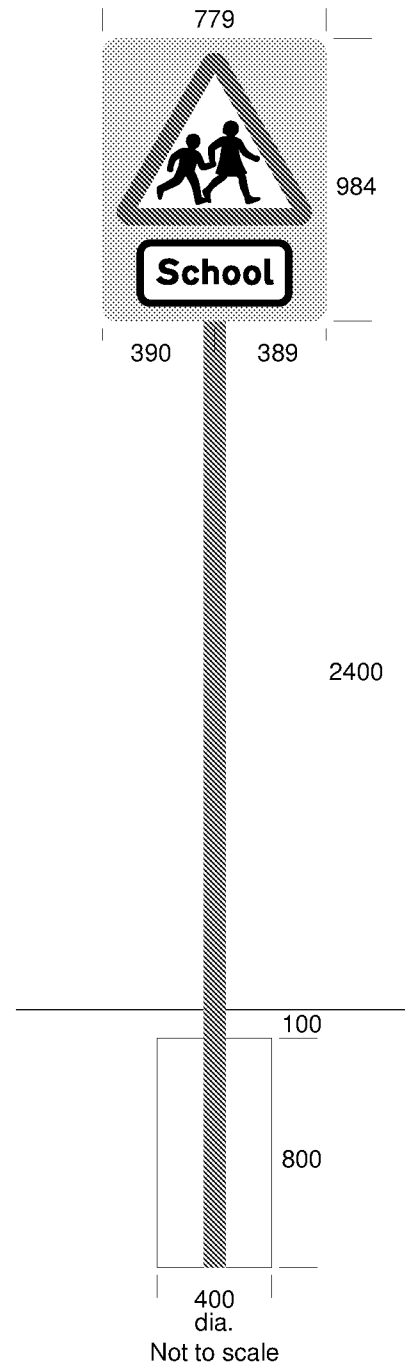
Diameter of footing: 200 mm

Passively safe to BS EN 12767:2007

TS46

PHFITZ

SignPlot v3.45



Job Ref: A/PHFITZ.2
Sign Ref: TS48&49, 50&51

Scale 1:6

Dimensions (mm):

Width: 779, Height: 984

x-Height: 62.5 Area: 0.77 m²

Colours:

 yellow

 black on white

Mounting height: 2.4m

Material: BS EN 12899-1:2007

Class: R3B (microprismatic)

BS EN 12899-1:2007 classes:

WL5, TDB5, PL3, PAF1

1000 N/m²

Structure Details:

1 no. Steel circular section S275:

76.1mm O.D. 5mm thick

Support length: 4284 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

Passively safe to BS EN 12767:2007

TS49&50

PHFITZ

SignPlot v3.45

**Schedule C - 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: Simmonsigns LUA (up to 750mm Sign) LED with low voltage HF electronic ballast (Note on centre islands Extra Low Voltage 24 volt circuit). Above 750mm Simmonsigns 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: Simmonsigns 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: Simmonsigns 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 Simmonsigns 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: Simmonsigns 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

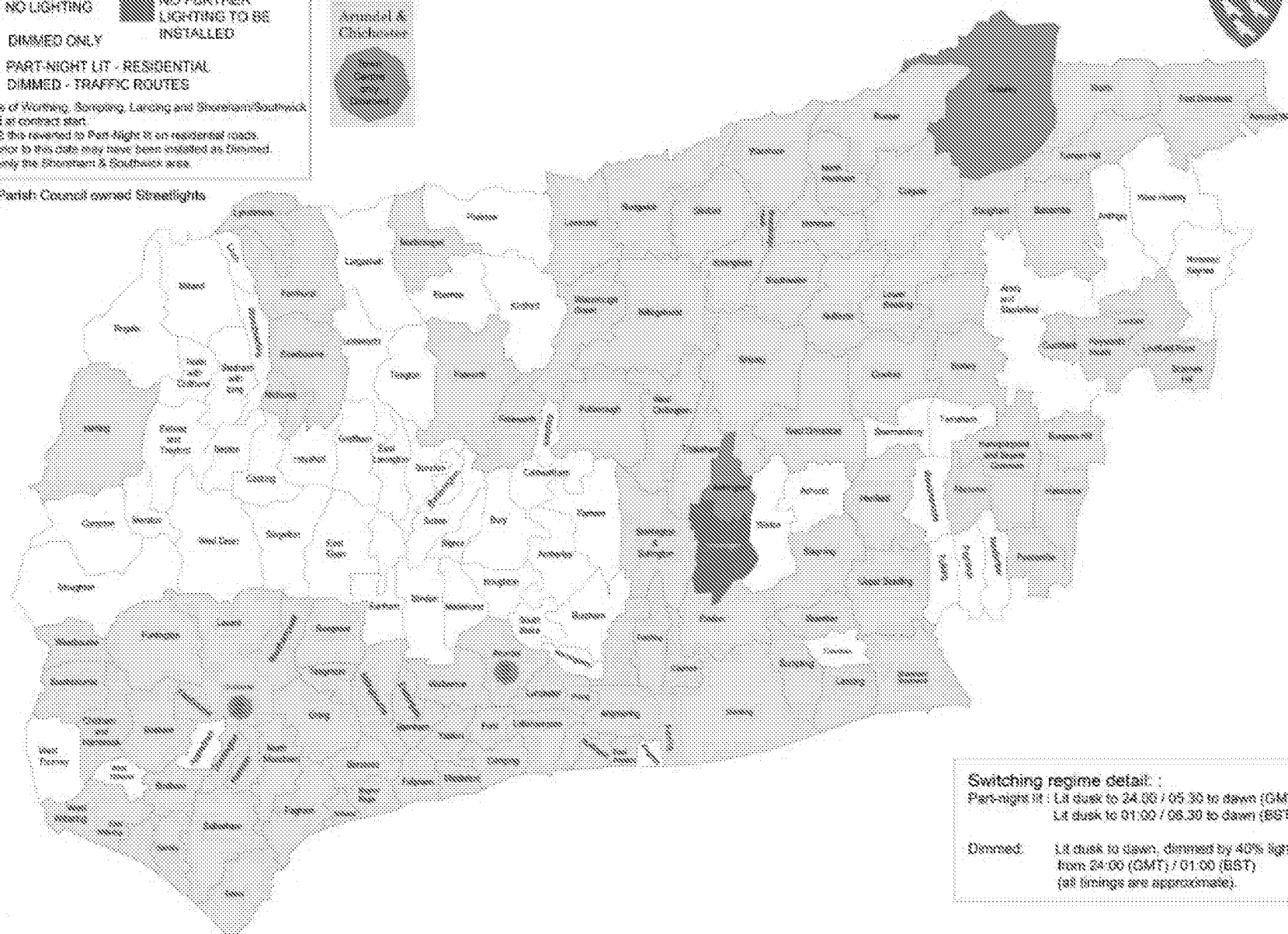
Painted surfaces shall be protected by 5mm thick solid neoprene banding placed between the sign mounting clips and the painted surface.

3. Part Night Lighting Areas Plan

KEY:	NO LIGHTING	NO FURTHER LIGHTING TO BE INSTALLED
	DIMMED ONLY	
	PART-NIGHT LIT - RESIDENTIAL DIMMED - TRAFFIC ROUTES	

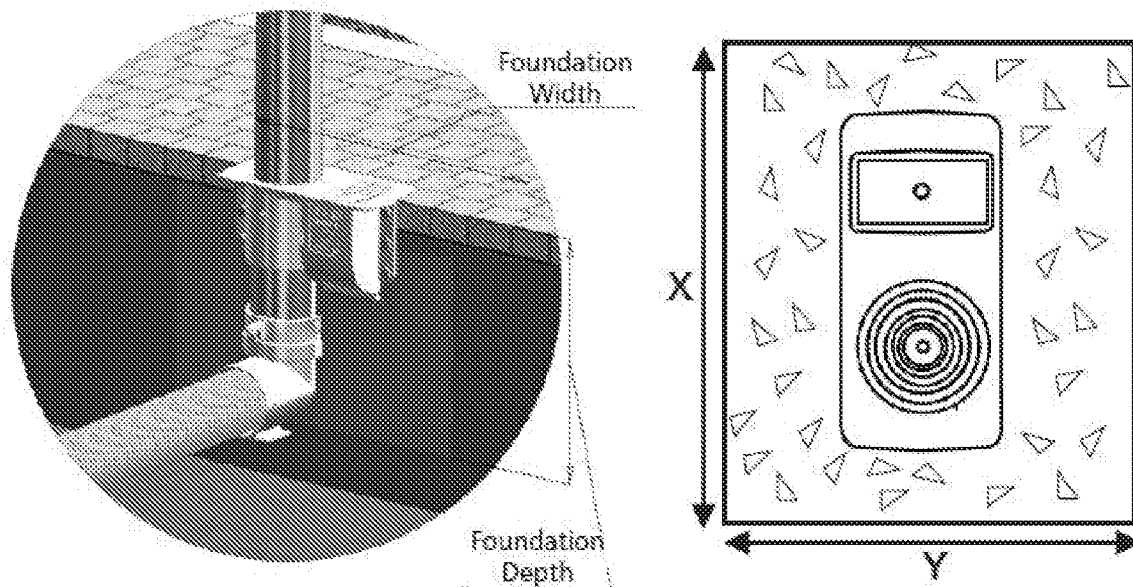
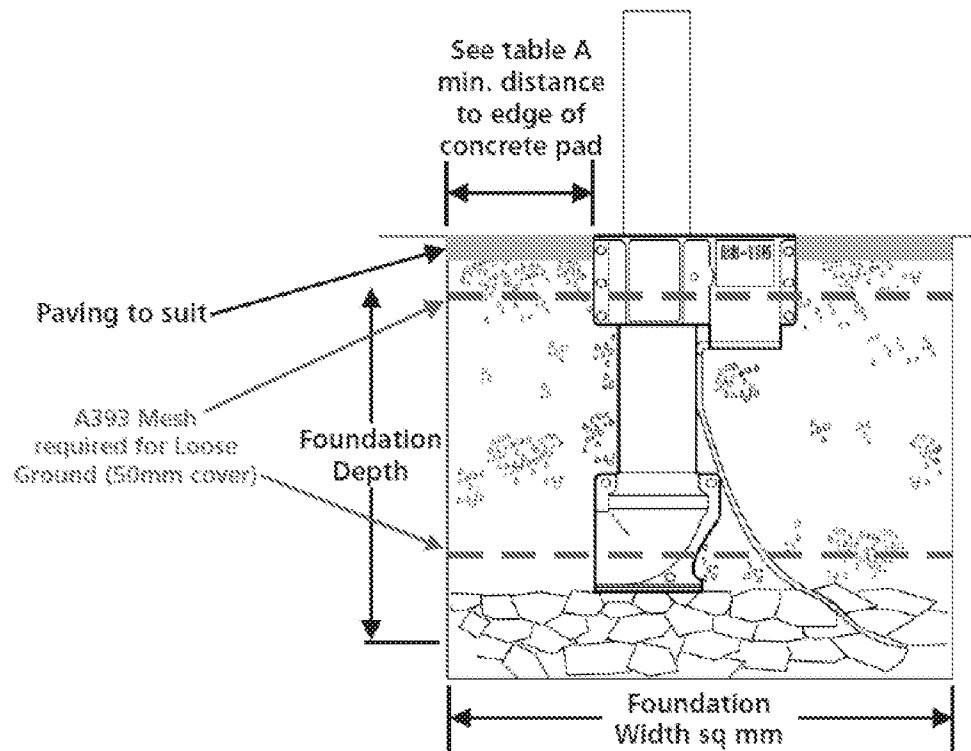
NB: The parishes of Worthing, Bognor, Lancing and Shoreham/Southwick were all Dimmed at contract start. From 02/01/2012 this reverted to Part-Night lit on residential roads. Any CIP works prior to this date may have been installed as Dimmed. This affected mainly the Shoreham & Southwick area.

Not including Parish Council owned Streetlights



Column Height	Dim 'A'
5.0m	800mm
6.0m	1000mm
8.0m	1200mm
10.0m	1500mm
12.0m	1700mm

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.

