Specification

Prince of Wales Cable Stayed Bridge Resurfacing

617317

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P01

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ameyconsulting

Document Control Sheet

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CONTRACT DATA

Part One –Additional Data provided by *Employer* for this Task Order

The Employer is:	National Highways Brunel House, 930 Hempton Court, Aztec West, Bristol, BS32 4SR
The Principal Contractor is:	Amey Transport and Infrastructure, Prince of Wales Bridge Maintenance Unit, Severn Beach, Redwick, Bristol, BS35 4NG
The Principal Designer is:	Amey Consulting, Prince of Wales Bridge Maintenance Unit, Severn Beach, Redwick, Bristol, BS35 4NG

PREAMBLE TO THE SPECIFICATION

1. The Specification referred to in the Tender shall be the 'Specification for Highway Works', published by the Stationery Office (formerly HMSO) as Volume 1 of the Manual of Contract Documents for Highway Works, as modified and extended by the following:

    (i) Appendix 0/1: Contract-specific Additional, Substitute and Cancelled Clauses, Tables and Figures;

    (ii) Appendix 0/2: Contract-specific minor alterations to existing Clauses, Tables and Figures;

    (iii) The Numbered Appendices listed in Appendix 0/3;

    (iv) Appendix 0/5: Special national alterations of the *Client* of Scotland, Wales or Northern Ireland.

    (v) Appendix 0/4 contains a list of the Drawings.

2. Appendix 0/1: Contract-specific Additional, Substitute and Cancelled Clauses, Tables and Figures;
3. Appendix 0/2: Contract-specific minor alterations to existing Clauses, Tables and Figures;
4. The Numbered Appendices listed in Appendix 0/3;
5. Appendix 0/5: Special national alterations of the Overseeing Organisation of Scotland, Wales or Northern Ireland.
6. Appendix 0/4 contains a list of the Drawings.
7. The relevant publication date of each page of the Specification for Highway Works is given in the Schedule of Pages and Relevant Publication Dates.
8. 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.
9. 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.
10. 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.
11. Insofar as any of the contract specific Numbered Appendices may conflict or be inconsistent with any provision of the Specification for Highway Works the Numbered Appendices shall always prevail. Additionally, Numbered Appendices 0/1 and 0/2 shall take precedence over Numbered Appendix 0/5.
12. 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.
13. 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.
14. 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.

15. Any Appendix referred to in the Specification that is not used shall be deemed not to apply.

16. 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 Organisation.

17. Other than where references to the Overseeing Organisation are made in the context of the Overseeing Organisation granting statutory or type approvals, roles and functions of the Overseeing Organisation shall be undertaken by the Project Manager.

18. Where the Specification requires the provision of documentation to the Overseeing Organisation for statutory or type approval such documentation shall be provided to the Project Manager.

19. If the Specification is used in conjunction with a Contract under which the Contractor is responsible for the design of any part of the Permanent Works, the delegation of the roles and functions of the Overseeing Organisation as stated in paragraph 12 above shall be further amended as follows:

20. If any agreement, consent or approval required to be obtained from the Overseeing Organisation impacts on the health and safety of the general public, the environment or any property or equipment not owned or operated by the Contractor, such agreement, consent, approval shall be obtained from the Employers Representative.

21. Where the Specification provides for the Overseeing Organisation to require a test, waive the requirement for a test or alter testing frequency, the party to whom the Overseeing Organisations roles and functions have been ascribed by paragraph 12 above shall exercise such decisions in accordance with the Secretary of State's requirements stated in the Contract.

22. Where a duty on the Contractor is referred to in this Specification the duty is deemed to fall upon the appointed Specialist for that element of the Works as outlined in the scope of works contained in Volume 1 Scope of Works, Contract Data, Special Requirements and Site Information.

SPECIFICATION FOR HIGHWAY WORKS

SCHEDULE OF PAGES AND RELEVANT PUBLICATION DATES (10/22)

Series/Appendix	Page Number	Publication Date
000	1 to 3	May 2014
000	6 to 7F	February 2016
000	4 to 5	October 2022
100	2, W1F, N2 to N11F	May 2014
100	N1	December 2014
100	1, 3 to 30F	April 2022
200	1 to 3F	February 2016
300	1	May 2001
300	4	November 2002
300	2 to 3, 5 to 6F	May 2008
400	1, 9 to 11, 13, 17 to 20, 21, 23F	May 2017
400	2 to 8, 12, 14 to 16, 22	March 2020
500	1 to 2, 4 to 39F N1 to N2F	February 2020
500	3	March 2020
600	1 to 68, 70 to 77F, S1 to S4F, W1 to W4F, N1 to N5F	February 2016
600	69	February 2017
700	1 to 5, 8 to 36F, N1 to N4	February 2016
700	6 to 7, N5 to N6F	October 2022
800	1 to 42F	November 2021
900	1 to 83F, S1 to S3F, W1 to W2F, N1F	July 2021
1000	3 to 33	January 2020
1000	1 to 2, 34 to 58F	November 2021
1100	1 to 16F	February 2021
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

Series/Appendix	Page Number	Publication Date
1300	2, 11 and N1	May 2006
1400	2, N1F	May 2001
1400	1, 3 to 9F	May 2006
1500	1 to 31F	February 2017
1600	1, 4 to 5, 9, 15, 17 to 18, 24 to 26, 29 to 31, 35, 38, 49F	March 1998
1600	2, 6 to 8, 10 to 14, 16, 19, 27 to 28, 32 to 34, 36 to 37, 39 to 42, 44 to 48	November 2003
1600	3, 20 to 23, 43	November 2005
1700	2, 4, 6 to 7, 19, 24 to 27, 30 to 34	December 2014
1700	1, 3, 5, 8 to 18, 20 to 23, 28 to 29, 35 to 39F	March 2020
1800	1	August 2014
1800	2 to 39F	April 2021
1900	1 to 35F, S1 to S2F	August 2014
2000	2	November 2004
2100	1 to 2F	February 2016
2300	1	March 1998
2300	2 to 3F	May 2001
2400	1, 4, 7F	May 2005
2400	2	May 2006
2400	3, 5 to 6	May 2008
2500	1	May 2001
2500	2, 8, 11F	November 2003
2500	10	November 2004
2500	6 to 7, 9	May 2005
2500	5	May 2006
2500	3 to 4	November 2006
2600	2 to 4	November 2003
2600	5	November 2004
2600	6	May 2005
2600	7	November 2006
2600	1, 8F	March 2020
3000	4 to 7, 10, 12 to 17, 19, 22 to 27F	May 2001
3000	20	November 2004
3000	2 to 3	May 2006
3000	8 to 9, 11, 18, 21	May 2008
5000	1, 4 to 19F, S1F	May 2005

Series/Appendix	Page Number	Publication Date
5000	2 to 3	November 2008
5700	1 to 30F	February 2020
Appendix A	1 to 4F	May 2014
Appendix B	1 to 3F	May 2014
Appendix C	1 to 2F	May 2014
#Appendix D	1F	May 2014
Appendix D (NI)	N1F	May 2014
Appendix E	1F	May 2014
Appendix F	1 to 60F	October 2022
Appendix G	Not Used	
Appendix H	1	May 2004
Appendix H	2	November 2005
Appendix H	3	November 2006
Appendix H	4 to 9F	November 2008

APPENDIX 0/1

CONTRACT-SPECIFIC ADDITIONAL, SUBSTITUTE AND CANCELLED CLAUSES, TABLES AND FIGURES INCLUDED IN THE CONTRACT

PART A: VOLUME 1 SPECIFICATION

List of Additional Clauses, Tables and Figures

Clause No.	Title	Written on Page No. following
None		

List of Substitute Clauses, Tables and Figures

Clause No.	Title	Written on Page No. following
None		

List of Cancelled Clauses, Tables and Figures

Clause No.	Title
None	

Additional Clauses, Tables and Figures

Clause No.	Title and written text
None	

Substitute Clauses, Tables and Figures

Clause No.	Title and written text
None	

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

List of Additional Clauses, Tables and Figures

Clause No.	Title	Written on Page No. following
None		

List of Substitute Clauses, Tables and Figures

Clause No.	Title	Written on Page No. following
None		

List of Cancelled Clauses, Tables and Figures

Clause No.	Title
None	

Additional Clauses, Tables and Figures

Clause No.	Title and written text
None	

Substitute Clauses, Tables and Figures

Clause No.	Title and written text
None	

APPENDIX 0/2

CONTRACT-SPECIFIC MINOR ALTERATIONS TO EXISTING CLAUSES, TABLES AND FIGURES INCLUDED IN THE CONTRACT

PART A: VOLUME 1 SPECIFICATION

Clause No.	Alterations to be made
None	

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

Clause No.	Alterations to be made
None	

APPENDIX 0/3

LIST OF NUMBERED APPENDICES REFERRED TO IN THE SPECIFICATION AND INCLUDED IN THE CONTRACT.

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

List A is a complete list of the specific Numbered Appendices referred to in the Specification for Highway Works with those not adopted marked 'Not Used'. Those identifies by the letters T or C shall be completed by the Tenderer and / or Contractor respectively.

Guide to types of Numbered Appendices – who compiles / completes

Symbol

(Co) Compiler compiles: Identified in the Notes for Guidance examples by the term 'Sample' included in their title.

(Co / C) Compiler partially compiles and Contractor completes and returns to Overseeing Organisation.

(Co / T) Compiler partially compiles and Tenderer completes and returns with Tender.

(C) Contractor completes and returns to Overseeing Organisation.

(P) This indicates the Appendix is a national proforma and format must not be altered.

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

[Note to Compiler: Preferably commence the numbering of these Contract-specific Numbered Appendices at the 70th Appendix of the respective Series (e.g. 1/70) to avoid conflict with future National Numbered Appendices.]

Volume No	Appendix No	Appendix Title

List A: List of the Numbered Appendices referred to in the Specification for Highway Works.

SHW Series No	Completed by	Appendix No	Appendix Title
0			**INTRODUCTION**
	Co	0/1	Contract Specific Additional, Substitute and Cancelled Clauses, Tables and figures Included in the Contract.
	Co	0/2	Contract specific Minor Alterations to Existing Clauses, Tables and Figures Included in the Contract
	Co	0/3	List of contract specific Numbered Appendices Referred to in the Specification and Included in the Contract.
	Co	0/4	List of Drawings included in the Contract.
100			**PRELIMINARIES**
	Co	1/4	Working And Fabrication Drawings.
	Co	1/5	Testing to be carried out by the Contractor.
	Co	1/6	Supply And Delivery Of Samples To The Overseeing Organisation
	Co	1/7	Site Extent and Limitations on Use.
	Co	1/9	Control of Noise and Vibration.
	Co	1/11	Temporary works design
	Co	1/12	Setting Out and Existing Ground Levels.
	Co	1/13	Programme of Works
	(Co)(C)	1/16	Privately and Publicly Owned Services and Supplies.
	Co	1/17	Traffic Safety and Management.
	Co	1/18	Temporary Diversions of Traffic.
	Co	1/19	Routeing of Vehicles.
	Co	1/21	Information Boards.
	Co	1/23	Risks to Health and Safety from Materials or Substances.
	Co	1/24	Quality Management System.
	Co	1/27	Temporary Automatic Speed Camera System (TASCAR)
200			**SITE CLEARANCE**
	Co	2/1	List of Buildings, etc. to be Demolished or Partially Demolished
	Co	2/3	Retention of Material Arising from Site Clearance
	Co	2/5	Hazardous Material
400			**Road Restraint Systems**
	C	4/1	Road Restrain Systems (Vehicle and Pedestrian)
	C	4/2	Information required to demonstrate compliance of transitions and terminals to clause 401
600			**EARTHWORKS**
	Co	6/2	Requirements for Dealing with Class U1B and Class U2 Unacceptable Materials (11/04)
700			**ROAD PAVEMENTS – GENERAL**
	Co	7/1	Permitted Pavement Options (Schedules 1, 2, 3, 4 and 5).
	Co	7/2	Excavation, Trimming and Reinstatement of Existing Surfaces
	Co	7/4	Bond Coats, Tack Coats and other Bituminous Sprays (Sheets 1, 2 and Binder Data Sheet).
	Co	7/9	Cold Milling (Planing) of Bituminous Bound Flexible Pavement.
	Co	7/11	Overband and inlaid crack sealing system
1200			**TRAFFIC SIGNS**

	Co	12/3	Traffic Signs: Road Markings and Studs
1500			**HIGHWAYS COMMUNICATIONS**
	Co	15/1	Highways Communications
1700			**Structural Concrete**
	Co	17/1	Schedule for the Specification of Designed Concrete
	Co	17/3	Concrete Surface Finishing
2000			**Waterproofing for Concrete Structures**
	Co	20/1	Waterproofing For Concrete Structures
2600			**MISCELLANEOUS**
	Co	26/1	Ancillary Concrete
	Co	26/3	Cored Thermoplastic Node Markers
5700			**Concrete Repairs**
	Co	57/1	Repair Product – Requirements
	Co	57/2	Requirements For Reinforcement
	Co	57/3	Execution of Concrete Repairs
	Co	57/5	Concrete Injection
	Co	57/6	Contractor Investigation of Concrete Condition
	Co	57/7	Requirements for Galvanic Anodes

APPENDIX 0/4

LIST OF DRAWINGS INCLUDED IN THE CONTRACT

Contract specific Drawings Supplied.

Drawing No	Revision	Title
SBIM-POW-TO824-DWG-0001	C01	Location Plan including extent of resurfacing works for SBIM Prince of Wales Bridge Cable Stay Section
SBIM-POW-TO824-DWG-0002	C01	Prince of Wales Bridge Cable Stay Bridge – Existing General Arrangement
SBIM-POW-TO824-DWG-0003	C01	Prince of Wales Bridge Miscellaneous Details – Sheet 1 of 2
SBIM-POW-TO824-DWG-0004	C01	Prince of Wales Bridge Miscellaneous Details – Sheet 2 of 2
SBIM-POW-TO824-DWG-0005	C01	Prince of Wales Bridge Proposed Details
SBIM-POW-TO824-DWG-0006	C01	Prince of Wales Bridge Cable Stay Bridge – Proposed Phasing of Traffic Management
SBIM-POW-TO824-DWG-0007	C01	Core and Patch Repair Record
SBIM-POW-TO824-DWG-0008	C01	Overview and Details of Concrete Patch Repair
SBIM-POW-TO824-DWG-0201	C01	Prince of Wales Bridge Cable Stay Bridge – Site Clearance
SBIM-POW-TO824-DWG-0701	C01	Prince of Wales Bridge Cable Stay Bridge – Proposed Surfacing (Sheet 1 of 2)
SBIM-POW-TO824-DWG-0702	C01	Prince of Wales Bridge Cable Stay Bridge – Proposed Surfacing (Sheet 2 of 2)
SBIM-POW-TO824-DWG-1201	C01	Prince of Wales Bridge Cable Stay Bridge - Road markings

Standard Drawings

2(i) Supplied to each Contractor

Drawing No	Title	Volume No
	None	

2(ii) Inspected by Contractor

Drawing No	Title	Volume No

2(iii) Brought into the Contract by Reference

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

Drawing No	Title	Date	Aspect / Alternative(s) required if not whole Drawing

APPENDIX 1/4

WORKING AND FABRICATION DRAWINGS

The following working and fabrication drawings shall be submitted by the Contractor to National Highways for approval.

Series	Description of Works	Minimum Period for Submission of Drawings
100	Temporary Traffic Management Layouts, including masts and foundations for cameras	14 Days
100	Diversion Route Signing	14 Days
All	The Contractor provides and maintains a set of marked up as-built record drawings as the work proceeds. These are handed over on completion	On completion

Notes:

1 Two copies of detailed working and fabrication drawings, prepared by or prepared on behalf of the Contractor, shall be submitted for the Overseeing Organisation's approval by the time period given above.

2 At least 1 week prior to the installation of the works the Overseeing Organisation shall either give acceptance in writing to the submitted drawings or give reasons for not accepting the submitted drawings.

3 Plans are to be drawn at a suitable scale and show all salient details of the works. Including:

(i) Proposed equipment to be used.

(ii) Access and entry locations.

(iii) Significant health and safety hazards.

(iv) Traffic management, including pedestrian and cyclist diversions.

4 The *Client* will provide acceptance, or otherwise require alterations to be made, to pre-construction drawings. The *Contractor* will not undertake any works referred to in the drawing until such approval has been given.

APPENDIX 1/5

TESTING TO BE CARRIED OUT BY THE CONTRACTOR

1 In the following schedules are details of testing to be carried out by the Contractor and test certificates to be supplied by the Contractor.

(i) Unless stated below, all sampling and testing in the Appendix shall be by the Contractor;

(ii) 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);

(iii) (N) indicates that a UKAS or equivalent accredited laboratory sampling and test report or certificate is required;

(iv) Unless otherwise shown in this Appendix tests for work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works;

(v) 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.

2 The Contractor shall compile a **Schedule of Proposed Inspections and Tests** that will be required for the Works, based on the testing requirements highlighted in Table 1/5 in the following pages. This schedule shall be submitted to the Overseeing Organisation for acceptance in accordance with the requirements of Appendix 1/24.

3 Testing regime should be submitted to the *Project Manager* on a weekly basis by no later than 12:00 on Friday prior to the week of testing to ensure plans can be put in place and the *Supervisor* can attend.

4 The Contractor shall also include in his method statements activity specific Inspections and Tests, extracted from the Schedule of Proposed Inspections and Tests that will be carried out for each activity.

5 As part of the provision of samples and testing undertaken by the Contractor, the Contractor shall keep a daily record of samples of goods and materials taken by or on behalf of the Contractor for testing. Records shall be in sufficient detail to record the nature and the source of goods and materials, and shall identify the locations and means of selection and sampling. The Contractor on the same working day shall provide a copy of the daily record for retention and use by the Overseeing Organisation.

6 Test reports and certificates shall bear suitable identification compatible with the Contractor's registration of the samples tested, and shall indicate the edition dates of specifications used for compliance evaluation.

7 If the Contractor fails to carry out any testing to the required frequency, or to supply the results thereof in a correct and timely manner, the Overseeing Organisation may carry out such tests as he considers necessary to determine the acceptability of the works/materials employed and shall recover the costs thereof from the Contractor.

8 All tests must be witnessed by the Overseeing Organisation or his Representatives.

TABLE 1/5-1 TESTING DETAILS

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 700					
710	Constituent materials in recycled aggregate and recycled concrete aggregate	Quality control	As required by the 'Quality Protocol for the production of aggregates from inert waste'	Required	[See NG710.1 and 710.2]
711	Overbanding and inlaid crack sealing systems			Required	BBA certification (or equivalent) applies
Series 900					
901, 925, 937, 938, 943	Aggregates for bituminous materials			Required	National quality management sector schemes apply
	Resistance to fragmentation (Hardness)	Resistance to fragmentation (N)	Monthly		
	Resistance to freezing and thawing (Durability)	Soundness (N)	1 per source		
		Water Absorption (N)	As required		
	Cleanness	Sieve test (mass passing 0.063mm sieve) (N)	Monthly		Washing and sieving method to be used
	Shape	Flakiness index (N)	Monthly		
	Blast furnace slag	Soundness (N)	Once every 4 months		
		Bulk density (N)	1 per 500 tonnes		
		Dicalcium silicate disintegration (N)	1 per 500 tonnes		
		Iron disintegration (N)			
	Steel slag	Bulk density (N)	1 per 500 tonnes		
		Volume stability (N)	1 per source		
	Coarse aggregate for surface courses	Resistance to polishing PSV (N)	1 per source		
		Resistance to surface abrasion AAV (N)	1 per source		
	Binder for bituminous materials	Penetration (N)	1 per 750 tonnes		National quality management sector schemes apply. Modified binders should have a BBA HAPAS Roads and Bridges Certificate. In the event that no such Certificates have been issued, then in the interim, only modified binders undergoing BBA assessment should be considered for approval by the Overseeing Organisation
		Softening point (N)	1 per 750 tonnes		
		Other BS tests			

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
903 to 907, 909 to 912, 914, 916, 925, 926, 929, 930, 937, 938, 941, 943, 946 to 948	Bituminous mixtures	Grading (N)	For Audit Test only		National Highway Sector Schemes apply.
		Binder content (N)			
908	Warm Mix Asphalts	General properties		Required	Product Acceptance Scheme or equivalent applies (Clause 942 mixtures).
929	Base and Binder Course Asphalt Concrete (Design Mixtures)	Permanent Works - In situ air void content (N)	1 per product source	Required	
		Permanent Works - Refusal air void content (N)			
		Permanent Works – Deformation resistance			
		Deformation Resistance (design)	1 per product source	Required	The test certificate is the CE Mark for the mixture
		Stiffness (design)			
930	EME 2	Permanent Works - In situ air void content (N)	1 per product source	Required	
		Richness Modulus (design)	1 per product source	Required	The test certificate is the CE Mark for the mixture
		Duriez (design)			
		Deformation Resistance (design)			
		Stiffness (design)			
911	Hot Rolled Asphalt Surface Course	Stability value (N)	1 per product source	Required	The test certificate is the CE Mark for the mixture
		Flow value (N)			
		Density (N)			
915	Coated chippings for application to Hot Rolled Asphalt Surfacing	Grading (N)	For Audit Test only		National Highway Sector Schemes apply.
		Binder content (N)			
		Flakiness index (N)	1 per source	Required	Less than 6 months prior to work
		Resistance to polishing (PSV) (N)	Source approval	Required	Less than 6 months prior to work
		Resistance to surface abrasion (AAV) (N)	Source approval	Required	Less than 6 months prior to work
		Hot sand test	1 per product source		National Highway Sector Schemes apply
		Rate of spread (N)			

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
921	Surface Macro texture	Volumetric Patch (N) in accordance with BS EN 13036-1	All surface courses specified in Appendix 7/1	Required	
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 sub-Clause 924.6		
	Aggregate	Resistance to polishing (PSV) (N)	1 per source and as required for coated chippings in Clause 915.2	Required	
937	Stone mastic asphalt (SMA) binder course and regulating course	Permanent Works – In situ air void content (N)	1 per product source	Required	
		Permanent Works – Deformation resistance			
		Binder drainage test (design)	1 per product source	Required	The test certificate is the CE Mark for the mixture
		Deformation resistance (design)			
942	Thin surface course systems	General properties		Required	The test certificate is in the form of a BBA HAPAS certificate
	Surface Macro texture	Volumetric Patch (N) in accordance with BS EN 13036-1	All surface courses specified in Appendix 7/1	Required	
943	Hot Rolled Asphalt surface course and binder course (performance – related design mixtures)	Permanent Works – In situ air void content (N)	1 per product source	Required	
		Permanent Works – Deformation resistance			
		Deformation resistance (design	1 per product source	Required	The test certificate is the CE Mark for the mixture

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
918	Slurry surfacing incorporating microsurfacing					
		Binder				Modified binders should have a BBA HAPAS Roads and Bridges Certificate. In the event that no such Certificates have been issued, then in the interim, only modified binders undergoing BBA assessment should be considered for approval by the Overseeing Organisation.
			Product Identification	Per product per source	Required	Tests are expected to be repeated every two years
			Vialit cohesion	Per product per source	Required	Tests are expected to be repeated every two years
			Rate of spread	For each machine	Required	Not more than 6 weeks prior to start of work
			Penetration at 25°C and 5°C (N)	Every manufactured batch		Manufacturer's QA test results may be submitted.
		Aggregates	Flakiness index (N)	1 per source	Required	Less than 6 months prior to work
			Resistance to polishing (AAV) (N)	Source approval	Required	Less than 6 months prior to work
			Resistance to surface abrasion (AAV) (N)	Source approval	Required	Less than 6 months prior to work
			Grading (N)	1 per 200 tonnes	Required	
		System	TAIT or BBA/HAPAS		Required	
920	Bond coats, tack coats and other bituminous sprays					
		Binder	Product identification	1 per product source	Required	Tests are expected to be repeated every two years
			Vialit cohesion	1 per product source	Required	Tests are expected to be repeated every two years
			Accuracy of spread	1 for each binder and sprayer per month	Required	Not more than 6 weeks prior to start of work and one per month
			Rate of spread	1 per week		
			Penetration at 25°C and 5°C (N)	Every manufactured batch		Manufacturer's QA test results may be submitted
Series 1100						
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			

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200					
1202	Permanent traffic signs			Required	Quality management scheme applies. Certification that the traffic sign is capable of passing the tests in BS 837: Part 1 is required
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	As specified in BS EN 1824	In accordance with BS EN 1824	Required	
1218	Detector loops				
	Cable			Required	Certification that completed cables comply with specification TR 2029 is required
	Epoxy resin			Required [where considered appropriate]	Certification that the epoxy resin complies with specification MCH 1540 is required
	Feeder cable			Required	Certification that completed cables comply with specification TR 2031 is required
	Joints	Pull test (4kgf)	Each crimp		
	Installation	Series resistance	Each loop	Required	Certification that completed cables comply with specification MCH 1540 is required
		Insulation resistance			
		Inductance			
Series 1700					
1707	Hardened concrete – Identity testing	Cube strength (N) – as described in contract specific Appendix 17/4	Prestressed concrete-two cubes from 12 m^3 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 24 m^3 or 4 batches whichever represents the lesser volume		

			Mass concrete-two cubes from 50 m^3 or 50 batches whichever represents the lesser volume	Required	Contractor to cast and test sufficient additional cubes to demonstrate cube strength before transfer
			Additional cubes for special purposes		
		Density			
	Fresh concrete – Identity Testing	Consistence (slump or flow) (N)	Each batch	Required	
		Air content	Each batch		
		Density	As required		
		Water/cement ratio			
1712	Reinforcement				
	Steel bars			Required (BS 4449)	Product certification scheme or equivalent applies
	Steel wire			Required (BS 4482)	
	Steel fabric			Required (BS 4483)	
	Stainless steel			Required (BS 6744)	
1713	Fabricated reinforcement			Required (BS 8666)	Certification that fabricated reinforcement complies with the routine inspection/testing requirements of BS8666 is required if the fabrication is not covered by a product certification scheme or equivalent.
1716	Reinforcement jointing systems	Permanent elongation characteristic Strength (Manufacturer's tests)		Required for each type of connection	Product acceptance Scheme or equivalent applies
1717	Reinforcement – Welding	Welding procedure approval (BS EN ISO 17660)	As required in BS EN ISO 17660		Tests should be carried out by an independent testing body
		Welder approval (BS EN ISO 17660)			
1726	Stainless steel bar			Required (BS 6744)	Product certification scheme or equivalent applies
Series 5700					
5708 5714	Substrate and ambient weather conditions	Temperature of substrate (observation)	Throughout application		Contractor to take measurements and keep records.

		Ambient temperature (observation)	Throughout application		
		Ambient humidity (observation)	Throughout application		
		Precipitation (observation)	Daily		
		Wind strength (observation)	Before use		
		Dew point (observation)	Throughout application		
5708	Repair concrete or mortar	Compressive strength (N)	3 cubes daily	Required	Contractor to make samples and arrange laboratory testing. Certification required. Laboratory to be accredited by UKAS or equivalent.
5709	Pre-breakout survey	Hammer sounding	All delaminated areas		Site control test.
5710	Substrate conditions	Roughness	During preparation		Site control test.
		Delamination	Before application		
		Cleanliness of substrate	Before application		
		Pre-soaking of substrate	Before application		
5711	Substrate conditions	Cleanliness of existing reinforcement	Before application		
	Replacement and additional reinforcing bars (steel bars)			Required (BS 4449)	Product certification scheme or equivalent applies
	Reinforcement couplers		Each type or size of coupler	Required	Product acceptance scheme or equivalent applies, Clause 1716. Should comply with testing schedule TA1-A.
5712	Galvanic anodes for control of incipient anode effect	Electrical continuity of reinforcement	All reinforcement intersections within patch repair		Site control test.
		Electrical connection to reinforcement	All galvanic anode units or reference electrodes		
		Electrical potential survey (N)	Before connection of galvanic anodes and after curing of repair patch	Required	Site control test. Contractor to arrange testing by laboratory accredited by UKAS or equivalent to carry out the survey work.
5720, 5721	Completed repair	Hammer sounding of repair	All repairs		Site control test
		Core/bore – Integrity of repair	[As required] See Clause 5721	Required	Site control test Results of observations on samples to be reported
		Core – Adhesion to substrate (N)	[As required] See Clause 5721	Required	Site control test Contractor to take samples and arrange laboratory testing. Laboratory to be accredited by UKAS or equivalent.
		Core – Compressive strength (N)	[As required] See Clause 5721		
		Core – penetration of crack with injection filler	[As required] See Clause 5721		Site control test Contractor to take samples. Results of observations on samples to be reported
		Core – Compressive strength of injected concrete (N)	[As required] See Clause 5721	Required	Site control test Contractor to take samples and arrange laboratory testing. Laboratory to be accredited by UKAS or equivalent.

APPENDIX 1/6

SUPPLY AND DELIVERY OF SAMPLES TO THE OVERSEEING ORGANISATION

Clause	Sample Description	Frequency of Sampling	Delivery Location	Comments
915	Pre-coated chippings (N)	One per day per source	Delivery area	If required by the Overseeing Organisation
929	Percentage Refusal Density Test (N)	One pair of 150 mm dia. cores every 500 lane metres	Site laboratory store	Core cutting by Contractor if required by the Overseeing Organisation

Notes:

1) Samples 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).
2) Unless otherwise shown in this Appendix, samples of work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.
3) (N) indicates UKAS or equivalent laboratory accreditation required for sampling.

APPENDIX 1/7

SITE EXTENT AND LIMITATIONS ON USE

1 Extent of the Site

1.1 The extent of the Site is defined on the scheme specific contract drawings as listed in Appendix 0/4.

1.2 At the approval of the Overseeing Organisation, the extent of the Site shall be temporarily extended to cover any traffic lane, hardstrip, hard shoulder, hard standing, verge and central reserve solely for the following:

(a) For the erection, maintenance and removal of temporary traffic signs necessitated by the Contractors traffic management proposals in carrying out the works, and for advance warning of the works. Such signs should be removed as the works progresses when they become no longer applicable to the works;

(b) For the installation of temporary and permanent road markings in advance of the works area.

2 Limitations on the Use of the Site

2.1 The Contractors use of any area of the Site will be limited by the requirements of Clause 117 Traffic Safety and Management and the following conditions:

(a) All parts of the Site outside the limit of the Works that are used or occupied by the Contractors shall be restored to their original condition on completion of the Works. Such restoration shall include any necessary reinstatement, re-soiling, seeding or planting;

(b) No principal offices, messes or stores shall be sited within the trunk road or other highway boundaries without the prior approval of the Overseeing Organisation;

(c) No equipment, plant, materials or other items will be permitted to remain on areas which are not part of the site as defined in this Appendix with the exceptions of items needed to control traffic which are only to be placed in positions agreed with the Overseeing Organisation;

(d) The Contractor is not permitted to use the verge for any reason unless prior authorisation is gained from the Project Manager or Environmental Co-ordinator in writing, this is due to the verge not having an Ecological or Environmental Assessment.

(e) The Contractor shall take all due care to avoid damage to the grass verges and drainage system and shall provide railway sleeper or other substantial protection whenever he requires plant or vehicles to cross these features. Any damaged areas of verge shall be reinstated with topsoil and seeded in accordance with the specification;

(f) The Contractors, their agents, servants or workmen shall not erect nor allow his sub-Contractors their agents, servants or workmen to erect within the Site any

advertisement without the prior written approval of the Overseeing Organisation. Should any advertisement be erected without such approval the Overseeing Organisation shall have power to order in writing the Contractors to remove it forthwith;

(g) The Contractor shall afford all reasonable access to authorised authorities or Statutory Bodies who may be employed in the execution of works on or near the site including working areas, or any contract which the Employer may enter into in connection with or ancillary to the Works;

(h) No area of the carriageway shall be utilised for parking of vehicles used by or on behalf of the Contractors. The Contractors shall not obstruct any lane, road junction vehicular or pedestrian access that has not been closed to traffic;

(i) Any vehicle stationary in the area of the traffic management taper must be fitted with a crash cushion or protected by a vehicle fitted with a crash cushion;

(j) Temporary storage of materials for temporary or permanent works beneath canopies of trees is not permitted.

(k) No material shall be disposed of by burning in the area of the works;

(l) The Contractor shall take measures to prevent spillage of oil, fuel, herbicide and other substances detrimental to trees shrubs and other vegetation;

(m) Reference should be made to Appendix 1/23 where substances and materials are to be stored within the extent of the site.

(n) Should the Contractor wish to extend the Site boundaries, he must obtain written approval from the Overseeing Organisation.

(o) The Contractor shall take all necessary steps to avoid creating a dust nuisance. If the Contractor is not dealing adequately with the control of dust, the Contractor may be instructed to halt their Works or carry out such additional measures as the Overseeing Organisation considers necessary, at the Contractor's expense.

(p) The Contractor may be required to suspend operations at any time to allow the passage of emergency vehicles through the works and shall maintain a 3.0m minimum width through the work zone at all times for emergency vehicle access.

(q) The Contractor may be required to suspend operations at any time to allow the passage of wide or high load vehicles through the works.

(r) The Contractor shall at all times keep the area of the Works in a safe, clean and passable state. The Contractor shall clear away all waste or surplus material on the site as the works proceed.

(s) Particular care shall be taken to ensure that existing street furniture to remain is not damaged during the Works. Any such items damaged by the Contractor shall be replaced at the Contractor's expense to the satisfaction of the Overseeing Organisation.

APPENDIX 1/9

CONTROL OF NOISE AND VIBRATION

1 Noise

The Local Authority having responsibility for the area is:
South Gloucestershire Council
Council Offices,
Badminton Rd, Yate,
Bristol
BS37 5AFTel: 01454 868009
Email: customerservices@gloucestershire.gov.uk

1.1 The Contractor shall make available at the request of the Overseeing Organisation noise-monitoring equipment fit for measuring the noise levels identified in this appendix, using the methods set out in Annex E of BS 5228–1:2009. Maximum sound level is the highest value indicated on a sound level meter which meets the requirements of BS EN 61672-1:2003 Class 1 or 2 set to SLOW response and frequency weighting A.

1.2 The Contractor shall liaise with the Local Authority whose area the Works are in and decide whether to seek formal consent to his proposed method of working and to the steps he proposes to minimise noise.

1.3 Without in any way limiting the liabilities and obligations imposed upon the Contractor elsewhere in the Contract, the Contractor shall carry out the Works in such a manner so as to minimise at all times the levels of site-generated noise.

1.4 The Contractor may be given permission by the Overseeing Organisation to carry out works which exceed the noise levels in the Schedule, provided that 7 days' notice of the date and timing of these works is given to the Overseeing Organisation and the Contractor demonstrates that he intends to take all reasonable measures to mitigate the noise nuisance. After consultations with the Local Authority and any other interested bodies a decision will be given within 7 days of receipt of the notice.

1.5 The Best Practicable Means, as described in Section 79(9) of the Environmental Protection Act 1990, to reduce noise to a minimum shall be employed at all times. Procedures for noise control and the assessment of site noise shall be in accordance with BS 5228, Part 1:2009. Without prejudice to the generality of the Contractor's obligation under Conditions of Contract the Contractor shall comply in particular with the following requirements:

(a) Control of noise at source by suitable selection of plant, use of enclosures etc. 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. All compressors shall be 'sound reduced' models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers;

(b) The Contractor shall remove from the works any item of plant which in the opinion of the Overseeing Organisation is ineffectively silenced.

(i) Careful siting/orientation of plant;

(ii) Minimising reversing (and therefore the sounding of audible reversing alarms) at all times;

(iii) Vehicles and plant shall be shut down or throttled down to a minimum in the intervening periods between work;

(iv) Ensuring that all staff and operatives are briefed on the requirement to minimise nuisance from site activities.

(v) The Contractor shall furnish such information as may be required by the Overseeing Organisation in relation to noise levels emitted by plant or equipment used or installed on the site or which the Contractor intends to use or install on the site.

(vi) The Contractor shall afford all reasonable facilities and access to enable the Overseeing Organisation or any person authorised by him to carry out such site noise monitoring as may be required.

(vii) The name and address of any persons other than the Contractor who it is intended will carry out works on the Site shall be notified to the Supervisor before the commencement of any works.

(viii) Compliance with these conditions will not constitute protection from proceedings instituted under Sections 80 and 82 of the Environmental Protection Act, 1990, (whereby a Local Authority or any occupier of premises may institute summary proceedings).

(ix) Where practical noisy operations shall be considered for their affect upon the public and measures taken to programme these into the earlier part of the works reducing the overall noise in the later part of the works.

(x) Static machines shall be sited as far away as practicable from inhabited buildings.

(xi) The following types of plant shall not be permitted to be used on Site:

(a) Vibrating rollers with a mass/metre width in excess of 2900 kg;

(b) Dropping weight compactors; and,

(c) Impulsive piling.

2 Vibration

2.1 The Contractor shall employ the best practical means to minimise intermittent/transient and continuous vibration produced by his operations and shall have regard to the recommendations of BS 5228 Part 2 and BS 6472.

2.2 No structure outside the site boundary shall experience vibrational amplitudes and resultant peak particle velocities arising from site operations greater than the limits. Maximum amplitude (mm) = 0.025. Maximum resultant peak particle velocity (mm/sec) = 5.0 (continuous), 10.0 (intermittent).

APPENDIX 1/11

TEMPORARY WORKS DESIGN

1 General

1.1 All temporary works shall be designed by the Principal Contractor including Traffic Management, temporary VRS and temporary lighting.

1.2 Where design and check certificates are required, the Contractor shall submit two copies of the completed countersigned design and check certificates and drawings for each structure listed to the Overseeing Organisation for approval, at least 6 weeks prior to carrying out the works.

1.3 Where an Approval in Principle is required, the Contractor shall submit two copies of the countersigned Approval in Principle to the Overseeing Organisation for approval at least 12 weeks prior to carrying out the works.

1.4 When accepted, countersigned copy will be returned to the Contractor for their record.

1.5 The periods above are the minimum the Contractor shall allow for in the programme. Revisions and resubmissions may be necessary during the process.

1.6 All submissions shall be made to the Overseeing Organisation

APPENDIX 1/12

SETTING OUT AND EXISTING GROUND LEVELS

1 General

1.1 For setting out details refer to the scheme specific contract drawings as listed in Appendix 0/4.

1.2 The Contractor shall establish a suitable method of level control which must be approved by the Overseeing Organisation prior to work starting. This method of level control must be suitable to determine the thickness of all planed areas, and all new laid materials.

2 Setting Out

2.1 Setting out information supplied to the Contractor comprises:

2.2 Specific requirements for setting out:

(i) The Contractor shall establish and maintain the chainage system, in accordance with the Contract Drawings, throughout the whole length of the works at 10m intervals for the duration of the works;

(ii) The chainage marks shall act as block-up points for level control to match new surfacing to existing levels on adjacent lanes in accordance with the general requirements defined in Schedule 2 of Appendix 7/1;

(iii) The chainage shall be marked on site so as not to be eradicated by planing. The size and location of markings shall be agreed with the Overseeing Organisation;

(iv) For junctions or roundabouts the Contractor is to submit matt pattern drawings to the Overseeing Organisation 14 days in advance of the works to ensure the existing crown lines are maintained;

(v) Any site and line marking paints that may be used in the works shall be lead-free and shall not use chlorofluorocarbons.

3 Horizontal and Vertical Alignment

3.1 The finished level of the carriageway is to match the existing.

3.2 The proposed horizontal and vertical alignments shall be as existing or as per the scheme specific contract drawings as listed in Appendix 0/4.

4 Road markings and Studs

4.1 For setting out of Road Markings and Studs refer to the scheme specific contract drawings as listed in Appendix 0/4.

4.2 The contractor shall reference prior to planing operations:

(i) Changes in the type of road markings.

(ii) Road stud locations.

4.3 The Road Markings are shown on the scheme specific contract drawings as listed in Appendix 0/4. Details given within Appendix 12/3 are indicative only. The Contractor shall survey the existing layout prior to planing operations.

5 Detector Loops

5.1 For setting out of Detector Loop sites refer to Appendix 15/1, the scheme specific contract drawings as listed in Appendix 0/4 and HCD's.

APPENDIX 1/13

PROGRAMME OF WORKS

1. General

a. The Contractor shall provide the Programme of Works, in accordance with Clause 31.2 of the Conditions of Contract in a form of a bar chart produced as a result of a 'critical path analysis'. It shall show the level of detail appropriate to each stage of the Works and all activities and restraints, each of which shall be given a short title. All events shall be numbered and annotated with earliest and latest event dates.

b. The Contractor shall adhere to the timing and order of activities identified on the programme.

c. The programme is to be supplied on paper, electronically in Adobe Acrobat format and in Microsoft Project format. An alternative to Microsoft Project may be proposed provided if agreed with the Overseeing Organisation.

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

e. The schedule of constraints will be provided within the scheme information

f. The Contractor shall supply to the Overseeing Organisation a copy of the weather forecast applicable to the planned pavement works in accordance with the timescales set out below. The weather forecasts shall confirm the expected precipitation periods and temperature. The Contractor at the same time shall confirm his intention to either proceed with the works or postpone the works if conditions are not deemed suitable in accordance with Cl NG 945.

Evening of the week that the works are to be carried out:	Final notification time to proceed with or cancel the Works to be provided to the Overseeing Organisation by;
Monday	By noon on that day
Tuesday	By noon on that day
Wednesday	By noon on that day
Thursday	By noon on that day
Friday / Saturday / Sunday	By noon on the Friday

2. Schedule of Constraints

a. The following is a list of applicable programming constraints, it is not exhaustive and all work elements should be considered for their programming requirements and constraints:

Appendix	Requirements
1/7	Site Extents and limitations of use.
1/9	Restrictions with respect to avoidance of pollution due to noise and vibration
1/12	Setting out and existing ground levels
1/16	Work to Privately and Publicly owned Services and Supplies
1/17	Traffic Safety and Management including Notice Requirements; restrictions arising from Embargoes and Events. Comply with the requirement of Road Space booking for the works and restrictions on the timing of works arising from the use of working windows
1/19	Routing of Vehicles
1/23	Restrictions arising from particular health and safety requirements
	Environmental constraints including seasonal restrictions and provision of environmental protection prior to the main construction
15/1	Works required for installation of Detector Loops

APPENDIX 1/16

PRIVATELY AND PUBLICLY OWNED SERVICES OR SUPPLIES

1 General

1.1 This Appendix contains details of services and supplies affected by the Works, details of preliminary arrangements that have been made with Statutory Undertakers and others for the alteration of services and supplies affected by the Works, and details of any orders already placed.

1.2 The Contractor shall make arrangements with the Statutory Undertakers and others concerned, for the co-ordination of his work with all work which needs to be done by them or their Contractors concurrently with the Works. Compliance with the periods of notice given in this Appendix does not relieve the Contractor of his obligations.

1.3 Private services to individual properties have not generally been listed or shown on the Drawings. The Contractor shall make arrangements with the Statutory Undertakers and others concerned for the phasing of all necessary disconnections and diversions of private services affected by the Works.

1.4 The Contractor shall remove disconnected apparatus only with the prior consent of the Authority concerned.

2 Specific Site Requirements

2.1 The Contractor shall establish the location, depth and size of all services affected by the Works. Initially the location and line shall be established from the service drawings and confirmed using electronic location equipment. The Contractor shall excavate hand dug trial holes prior to excavations being carried out with excavators or machines of any description. The Contractor shall also use electronic location equipment to sweep areas where excavation is to be carried out on areas that appear to have no services or statutory equipment within them.

3 Overhead Cables

3.1 Work below Overhead cables shall be carried out in accordance with the requirements of GS6.

3.2 If Overhead cables cross the carriageway within the scheme limits, they are indicated on all scheme drawings. The Contractor shall provide method statements indicating safe working practices in these areas.

4 Drawings

4.1 The Statutory Undertakers services information provided to the Contractor is included on the PCI pack.

5 Contacts

5.1 The names, addresses and telephone numbers of the authorities serving the locality will be provided to the Contractor in the PCI pack.

APPENDIX 1/17

TRAFFIC SAFETY AND MANAGEMENT

1. Submission of Traffic Safety and Management Proposals

1.1 All Traffic Management for the Works will be designed, installed, maintained and removed by the Contractor in accordance with the requirements of The Traffic Signs Manual Chapter 8, Construction (Design and Maintenance) Regulations and the Health and Safety at Work Act, and shall be considered to exemplify the Traffic Management required.

1.2 Any changes to the Traffic Management will be carried out by the Contractor. No alterations to the Traffic Management shall be made by anyone except the Contractors Traffic Management Operatives.

1.3 The Contractor's proposed method statement prepared after consultation with any statutory police or other authority concerned, for implementation of traffic management shall be submitted to the Overseeing Organisation a minimum of 7 days before the date on which the traffic management system is to be installed. The installation of the traffic management system shall then proceed only in accordance with the approved sequence.

1.4 Proposals shall include:

(i) Position of traffic signals, traffic signs and road markings

(ii) Width of lanes

(iii) Working areas

(iv) Safety Zones

(v) Temporary works details

(vi) Site access and egress layouts (standards shall be appropriate for traffic flows and speeds)

(vii) De-restriction/speed limit signs at the end of the works as appropriate

1.5 The Contractor shall provide the Overseeing Organisation with a report on the traffic management at the end of each week. The report shall include:

(i) details of all traffic management (including reference to which Chapter 8 layout was in use) in place during that week, including times when it was installed, removed and when changes were made

(ii) a record of traffic management inspections made by the Contractor

(iii) the name of the approved traffic management inspector

(iv) any traffic accidents reported, and details of them

(v) a record of any damage to the traffic management, and when damage was repaired

1.6 All removal of existing road markings must be undertaken in accordance with the requirements of Clause 1212.18. Restrictions on the phasing and timing of works shall be stated in the Scheme Information, including embargo periods and details of events resulting in additional restrictions.

2. Traffic Safety and Management Requirements and Constraints.

2.1 Site Specific Requirements:

a. Traffic management can only be implemented between the hours specified in working windows.

b. Roadspace should be booked at the earliest opportunity for each location. Once the works programme is agreed each roadspace booking should be confirmed and the NOM reference number issued to the Traffic Management Contractor.

c. It may be necessary to submitted departures from working windows (or other relaxations). All traffic management departures will be confirmed by the Overseeing Organisation prior to the commencement of the works.

d. Traffic Lanes

e. The minimum allowable traffic lane widths shall be as shown on the Traffic Management Schematic drawings.

f. Embargo periods (such as holiday periods, stating additional restrictions for these periods):
Contact NH for SBIM or South West or Wales embargo list

g. The following events take place during the course of the Works:
Contact NH for SBIM or South West or Wales embargo list

h. Emergency Vehicle Routing

i. The Contractor is to ensure that an emergency route through the Works can be provided at all times. This lane shall be a minimum of 3.0m in width.

j. Bus Routes

i. Bus stops shall be temporarily relocated to a suitable site to the approval of the Overseeing Organisation when the contractor's working restricts their use. The Contractor shall erect temporary bus stop signs and notices to bus users, when the temporary bus stops are in operation. Where a bus stop is to be closed, the contractor shall erect the appropriate signs informing bus users of the closure and provide the necessary safe unobstructed diversion route to the next bus stop. The contractor shall notify the Bus Companies listed in the Scheme Information of the dates and details of the bus lay-by closures, the position of the temporary bus stops and of the diversions that are required.

k. Other Requirements:

i. The Contractor's attention is drawn to the need to assess the risks and develop and operate safe working practices when vehicles and plant are reversing on Site. Rule 253 to 273 of The Highway Code 2022 is relevant to motorways but the Contractor's practices and procedures should take account of the different conditions, which pertain to the Site.

ii. At the end of each shift the carriageway levels shall be reinstated so that no steps remain across a carriageway for normal traffic running conditions.

iii. The Contractor must be able to provide a 3.0m (minimum) wide route through the works area to accommodate the passage of emergency services vehicles. The Contractor may be required to suspend operations when this route is in use.

iv. The Contractor will not be required to carry out routine maintenance duties during the period of the Works.

3. Temporary Traffic Regulation Orders and other Statutory Orders

3.1 Temporary Traffic Regulation Orders previously applied for are detailed below;

Route Location	Period (From/ to)	Restrictions
M4 E/B & W/B (Main C/way)	01/07/2024 to 29/11/2024	• Stepped speed limit 70-->50mph, 50-->40mph • Contraflow • Hard Shoulder Running • Main Carriageway(s) Closure • Vehicle Width or Height or Weight Restriction

3.2 Notice Requirements

Notice required by the Overseeing Organisation in order to arrange for:

i) amending or making traffic orders	12 weeks
ii) authorising of non-prescribed signs	4 weeks
iii) authorising temporary traffic signals	4 weeks
iv) authorising a Departure (TM timings)	2 weeks
v) moving signs to be compatible with the state of the Works as described in sub-clause 117.11	Not applicable

3.3 Local Requirements

Provision for Welsh Language Act 1993 and ensure written signage is bi-lingual.

4. Temporary Automatic Speed Camera System (TASCAR)

A Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) shall be provided by the Traffic Management contractor. Refer to Appendix 1/27 for requirements.

APPENDIX 1/18

TEMPORARY DIVERSIONS FOR TRAFFIC

1 Temporary Diversions for Traffic Specified by the Overseeing Organisation

a. Any Temporary Traffic Regulation Orders (TTRO's) required to carry out the Works will be arranged and published by the Overseeing Organisation.

b. The Contractor will be informed by the Overseeing Organisation of the proposed TTRO's and diversion routes.

c. Temporary Traffic Regulation Orders will be made available to the Contractor by the Overseeing Organisation to facilitate the Works.

d. All Traffic Management required to implement the TTRO will be designed, installed, maintained and removed by the Contractor in accordance with the Traffic Signs Manual Chapter 8 and the Traffic Signs Regulations and General Directions 2016.

e. Rotating Reflector delineators must be used wherever possible in accordance with Chapter 8 D3.13.1 and Table A1.3 note 10.

f. Notice requirements are as given in Appendix 1/17

g. Details of any Constraints

   i. The standard and siting of proposed temporary diversions shall be suitable in all respects for the classes of traffic using them.

   ii. The minimum acceptable lane widths for all diversions shall be at least the width from which the traffic is to be diverted.

APPENDIX 1/19

ROUTEING OF VEHICLES

1 Permitted Access Routes to and from the Site

1.1 The Contractor, his sub-contractors and suppliers shall not use routes other than those on A and B roads without the prior consent of the Local Highway Authority. Routes should avoid residential areas if possible.

1.2 Access and egress from the site shall only be from properly signed entrances/ exits in accordance with Chapter 8 of the Traffic Signs Manual.

2 The Use of the Permanent Works by construction traffic

2.1 The Contractor shall ensure that construction plant and traffic does not over-run any areas of new footway following the laying of the surfacing course. Any areas damaged during subsequent construction operations shall be reinstated to the satisfaction of the Service Manager prior to completion of the works.

2.2 The Contractor shall ensure construction traffic does not deposit mud and other debris on the public highway and shall take all necessary measures to prevent this occurring at site entrances and exits.

APPENDIX 1/21

INFORMATION BOARDS

1 General

a. Scheme information boards, where required, are to be designed, installed, maintained and removed by the Contractor.

b. A minimum of 2 weeks prior to the start of work on site the Contractor shall erect signing, on each approach to the site, advising of the Works.

c. These signs shall be to Traffic Signs Regulations and General Directions 2016, diagram 7003.1 or similar as approved by the Overseeing Organisation, amended to read National Highways and include the National Highways logo.

d. The exact location at which the signs are to be erected shall be agreed with the Overseeing Organisation.

APPENDIX 1/23

RISKS TO HEALTH AND SAFETY FROM MATERIALS OR SUBSTANCES

1 Restrictions in Relation to Traffic Management Measures

1.1 The Contractor shall consider the need for extra safety zones in additional to the mandatory safety zones when unloading and loading materials/ or spoil off/onto Lorries, so as to avoid spillages into the mandatory safety zone.

1.2 The Contractor shall consider the need for extra lane closures in addition to the mandatory safety zones during off peak working so as to provide greater segregation between the workforce and the travelling public.

1.3 Risk assessments shall be carried out by the Contractor when considering 1.1 & 1.2 above. The findings of the risk assessments shall be included in the Health and Safety Plan.

2 Restriction of Working Practices.

2.1 The Contractor shall ensure that his operatives and site staff comply with the following with the respect to the restriction of working practices;

(a) Food and Environment Protection Act 1985 (FEPA);

(b) Control of Pesticides Regulations 1986;

(c) Health and Safety at Work etc. Act 1974 (HASAW etc 1974);

(d) Control of Substances Hazardous to Health Act 1999 (COSHH);

(e) Suitable training should be given to operatives and staff in the use of substances hazardous to health during the performance of their duties;

(f) A Certificate of Competence is required in respect of (v), which may be requested by the Overseeing Organisation so as to demonstrate the competency of the operative;

(g) Management of Health and Safety at Work Regulations 1999.

3 Measures to be taken to Protect Members of the Public.

3.1 The general public shall be protected from exposure to the following materials until they have set, cured or are no longer considered harmful;

(a) Bituminous joint sealer;

(b) Solvent based curing agents;

(c) Bituminous pavement materials;

(d) Dust from cutting pipes (concrete or clay);

3.2 Access shall be restricted until materials are cured.

3.3 Consideration shall be given to wind, strength, temperature and traffic speed when assessing the foregoing.

3.4 Care should be given to avoid distracting passing motorists with the glare from work lights, contractors vehicles or welding operations.

4 Existing Watercourses, Drains and Sewers.

4.1 The Contractors attention is drawn to the possible hazard of waterborne diseases, for example Leptospirosis (Weil's disease).

4.2 The Contractor shall ensure the following;

(a) The implementation of the 'Card' system to alert the Health Services that the operative has been exposed to work in watercourses, drains and sewers;

(b) That all operatives and staff have received the appropriate inoculation;

(c) That all operatives and staff on site, whether the Contractor's personnel or those working for other bodies have access to a full and high standard of facility for personal hygiene;

(d) The use of personal protective equipment and proper cleaning and maintenance of the same particularly to avoid exposing the skin to the hazard;

(e) That all operatives and staff have had suitable training and been informed of the substances that they are liable to come into contact with, and risk to health that could result from such contact.

5 Monitoring to be Undertaken by the Contractor

5.1 No specific monitoring will be required but the Contractor shall consider Section 3 above and his general obligation under the COSHH Regulations and take action to eliminate or reduce problems that occur due to their site operations.

5.2 If during operations, the Overseeing Organisation considers that dust or other materials are being allowed to enter live traffic lanes, he shall have the unqualified power to suspend the work until he is satisfied that the Contractor has taken all necessary action to contain the offending dust or other materials.

5.3 The Contractor is required to keep records of all materials taken from the Site and must record the location of tips and the nature of the material deposited in them from the Site. These records shall be available for inspection by the Overseeing Organisation on demand.

APPENDIX 1/24

QUALITY MANAGEMENT SYSTEM

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

The Quality Plan shall cover the following items:

(a) Contractor's organisation and management

(b) Contractor's method statements and construction procedures

(c) Contractor's construction quality control

(d) Supplier's Quality Plans

(for each of the quality management schemes listed at Appendix A)

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

CONTRACTOR'S ORGANISATION AND MANAGEMENT

This section of the Quality Plan shall include:

(a) Definition of the Contract and its documentation.

(b) The organisation of the Contract, including the line of command and communication between parties involved in the Contract.

(c) Names, roles, responsibilities and authority of principals and key personnel.

(d) Control of liaison and meetings with third parties.

(e) Identification of the Contractor's own staff responsible for overseeing each major activity.

(f) Supply Chain Management

(g) The main Contractor's control of sub-contracts.

(h) Document control.

(i) Programme for submission of method statements and Suppliers' Quality Plans.

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

(j) The quality of plans for sub-contractors and suppliers of work, goods and materials which are the subject of quality management schemes.

(k) Procedure for the preparation, review and adjustment of programmes for the effective progression of the Works and the recording of this.

(l) Control and approval of purchases of materials.

(m) Control of off-site activities (where appropriate).

(n) Procedures for the regular review and recording by the Contractor of the quality of the Works.

(o) Control of personnel selection, based on their care, skill and experience.

(p) Management review/audits to monitor and exercise adequate control over the implementation of the quality plan.

(q) Any other relevant item.

CONTRACTOR'S METHOD STATEMENTS AND CONSTRUCTION PROCEDURES

This section of the Quality Plan shall include:

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

The method statements shall identify hold points and invoke:

(a) works instructions

(b) quality control procedures

(c) compliance testing/inspection requirements

(d) and work acceptance procedures

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

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

CONTRACTOR'S CONSTRUCTION QUALITY CONTROL

This section of the Quality Plan shall include:

(a) Statement of the Contractor's organisation for quality control.

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

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

(c) Control of test laboratories.

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

(e) Document control.

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

(g) Procedures for tests and inspections for the purpose of the Contractor certifying that prior to covering up, each part of the Works are complete and conforms to the Contract.

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

(i) Procedure for the collation of quality records as identified in BS EN ISO 9002, and provision or copies when requested by the Overseeing Organisation.

SUPPLIERS' QUALITY PLANS

The Quality Plan shall include:

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

(b) The organisation of the Supplier describing the line of command and stating the name of the senior manager responsible for the contracted Work and the name of the Supplier's on-site management representative. Contact addresses, telephone numbers, etc., shall be provided.

(c) 3.* Identification of the relevant parts of the Supplier's quality system relevant to the product or service being provided. (Copies to be provided to the Overseeing Organisation on request.)

(d) The control of personnel selection (at works and on site), including special requirements for skilled personnel e.g. certification of welders, training of operatives, experience requirements etc.

Specific procedures for the following:

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

(f) Product identification and traceability.

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

(h) Quality records.

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

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

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

APPENDIX 1/27

TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROADWORKS (TASCAR)

1. Speed Enforcement System

1.1 The Contractor shall design, supply, install and maintain a TASCAR system for the enforcement of temporary mandatory speed limits in both the westbound and eastbound directions within the traffic management area.

1.2 The Contractor shall consult and comply with the requirements of the enforcing Authority.

1.3 The Contractor shall ensure that the system is fully operational from the time any such traffic management system comes into use and that it remains in operation for the duration of the Contract and is removed on completion of the works.

1.4 The Contractor shall arrange for the provision of a 240v AC single-phase mains electrical supply of adequate power capacity to all components of the system.

2. Location and Quantities

2.1 The Contractor shall submit his proposals for the number and location of speed cameras to the Project Manager and the enforcing Authority for acceptance prior to installation.

2.2 Only speed measuring devices that have Home Office Type Approval (HOTA) shall be used. This also applies to installation poles and cabinets.

2.3 All lanes of the M4 Motorway shall be monitored within the speed-controlled zone.

3. Enforcement Authority (EA)

3.1 The EA for the westbound M4 enforcement is Gwent Police and eastbound is Avon & Somerset Police. Address as follows:

Gwent Police Headquarters Llantarnam Park Way Llantarnam Cwmbran Torfaen NP44 3FW Tel: 01633 838111	Avon and Somerset Police One Bridewell Street The Bridewell Bridewell St Bristol BS1 2AA Tel: 01278 647471 (speed enforcement unit) Tel: 0117 998 9112

4. Installation Requirements

4.1 The Contractor shall install the poles in the individual speed monitoring locations within the Site or the highway boundary as instructed by the Project Manager and shall carry out reinstatement of the ground as directed by and to the satisfaction of the Project Manager.

4.2 The Contractor shall ensure that suitable access arrangements are in place at each speed monitoring Site including vehicle hard standings, walkways and steps where necessary. The Contractor shall provide suitably located and accessible maintenance bays to allow for general maintenance and servicing of the camera unit.

4.3 The Contractor shall install the housing/poles in the positions specified, connect and commission the remainder of the equipment. The Contractor shall ensure that the camera poles are located in accordance with the road restraint system requirements in CD 377 of the DMRB.

4.4 The Contractor shall ensure that the Site reference number is clearly indicated on both the installation and the road surface within the field of view of the camera. Site reference numbers shall be agreed with the EA.

4.5 Any ducting, loop or piezo installation shall be carried out in accordance with the relevant clauses of Series 500 and 1200 of the Specification.

4.6 Category 1 technical approval (including AIP) will be required for the masts and foundation (to CG 300)

5. Commissioning and Acceptance

5.1 The Contractor shall be responsible for the commissioning of the TASCAR as a whole, including secondary checks. Details of equipment commissioning procedures will be provided to the Contractor from the supplier of the system. The Contractor shall provide a secondary method of confirming the speed calculation which is the approved method for the device used under HOTA. Each HOTA speed measuring device has a different approved secondary check method.

5.2 The commissioning of the TASCAR shall be carried out by the supplier of the system in the presence of, and for the acceptance of, the EA. The Contractor shall give the Project Manager not less than four days notice of his intention to carry out the work, to allow for a designated representative of the EA to attend. Commissioning certificates shall be provided to the Project Manager and shall include one pair of photographs or video images for acceptance by the EA as part of the commissioning and acceptance of the procedure of the system.

6. Operation and Maintenance

6.1 The TASCAR Operator will be the EA. Once the TASCAR has been commissioned, the repositioning of the speed monitoring equipment between the housings, or switching of detection equipment between zones and servicing, will be the responsibility of the EA. The Contractor shall furnish whatever assistance is requested by the Operator through the Project Manager to carry out these tasks.

6.2 All evidential media from speed monitoring Sites will remain the property of the EA.

6.3 The Contractor shall provide the EA, through the Project Manager, with a two hourly log showing the locations of all the speed limit and speed limit repeater signs relative to existing marker posts. It is accepted that under certain conditions, i.e. a collision in the works, this task may not be able to be completed in the timescales given and where this occurs a record should be made on the log. A repeater sign shall be positioned such that one is visible in each photograph (Refer to Chapter 8 – Traffic Signs Manual). Where there is a 24-hour CCTV system installed that is monitoring ALL speed limit and repeater signs this log can be compiled remotely.

APPENDIX 2/1

LIST OF BUILDINGS ETC. TO BE DEMOLISHED OR PARTIALLY DEMOLISHED

1 General

1.1 Site clearance requirements are shown on the scheme specific contact drawings as listed in Appendix 0/4 and the schedules below.

1.2 If previously unidentified hazardous materials are suspected to be present work is to be stopped immediately and the National Highways Environment Manager contacted.

1.3 Existing lane widths and cross-section detail shall be recorded prior to any planing of the pavement.

2 Site Clearance Schedules

2.1 Carriageway Site Clearance

Carriageway

Location	Requirements
See Appendix 0/4 for scheme drawings	Material to be disposed of at a licensed off-site facility for recycling. See Appendices 6/2, 7/2 and 7/9.

2.2 Road Markings Site Clearance

All existing road markings shall be removed in accordance with MCHW clause 1212.18

Road Markings

Location	Requirements
See Appendix 0/4 for scheme drawings	Material to be disposed of at a licensed off-site facility for recycling*. See Appendices 12/3.

Road Studs Site Clearance

All existing road studs shall be removed in accordance with the scheme drawings in Appendix 0/4.

Road Studs

Dwg. No.	Type	Requirements
See Appendix 0/4 for scheme drawings	Depressible/Non-depressible /301/290/Halifax	To be disposed of at a licensed off-site facility for recycling

Cold-Milling Site Clearance

Dwg. No.	Type	Requirements
See Appendix 0/4 for scheme drawings	Existing pavement to be cold milled.	To be disposed of at a licensed off-site facility for recycling

APPENDIX 2/3

RETENTION OF MATERIAL ARISING FROM SITE CLEARANCE

For location of material to be retained from site clearance see scheme specific contract drawings as listed in Appendix 0/4

Description	Location	Delivered to	Requirements
Vegetation	Throughout the Scheme	Suitably licensed recycling facility	Green waste recycling.
Bituminous materials	Throughout the Scheme	Suitably licensed recycling facility	
Road Studs etc	Throughout the Scheme	Suitably licensed recycling facility	

APPENDIX 2/5

HAZARDOUS MATERIALS

1 General

1.1 It is not anticipated that hazardous materials will be present on the site. However, if hazardous materials are encountered the Contractor shall immediately cease work and cordon the area off to protect his employees, the site staff and the general public from any further possible contact.

1.2 Hazardous material shall be considered in all risk assessments and method statements.

1.3 No provisions have been included for hazardous waste, if hazardous material is identified within the Scheme extent this will require disposal at a suitably licenced facility.

1.4 Once the area where the hazardous material has been located is made safe, the Contractor shall submit his proposals to the Overseeing Organisation for the safe disposal of the material.

1.5 The Overseeing Organisation will only give their approval when they are satisfied that the Contractors proposals provide a safe method of working for the removal and disposal of the hazardous material.

1.6 Any information given within the contract documentation is for guidance only and does not relieve the Contractor of his responsibilities to check for the presence of any such materials and take appropriate precautions.

1.7 Asbestos may be present in materials on and around bridges and will need to be taken into consideration for the proposed works. If hazardous materials are encountered the Contractor shall immediately cease work and cordon the area off to protect his employees, the site staff and the general public from any further possible contact.

1.8 The Contractors attention is also drawn to the possibility of waterborne diseases being transmitted to a member of his workforce, or any other person on the site, via the waters of the onsite drainage systems.

2 Known or Assumed Hazardous Materials

2.1 The Contractor shall prior to commencement of the Works, provide the Overseeing Organisation with COSHH assessments.

2.2 The Contractor should have a Waste Management Plan in place to improve the environmental performance, meet regulatory controls and reduce rising costs of disposing of waste.

3 Tar Bound Materials

Core logs have confirmed that Tar Bound Materials will be not be present therefore any arisings from the planning operation to be removed to a licensed recycling centre.

APPENDIX 4/1

ROAD RESTRAINT SYSTEMS

1 General

1.1 A temporary N2 restraint system is required, positioned in various separate phases to protect the workforce and provide the necessary barrier protection for contraflow. This shall be provided in accordance with the indicative traffic management drawings and the contractor shall compile appendices 4/1 and 4/2.

APPENDIX 6/2

REQUIREMENTS FOR DEALING WITH CLASS U2 UNACCEPTABLE MATERIAL

1 Known Class U1 and U2 Materials

1.1 Class U1 material expected to be encountered within the Works is expected to be the bituminous surfacing materials, all bituminous and cement bound materials shall be classified as hard material.

1.2 It is not anticipated that Class U2 materials will be encountered during the Works.

1.3 All bituminous material that is excavated during the removal of the pavement deemed as unacceptable and surplus materials (other than those classified as Class U2 materials as defined in Clause 601.3 of the Specification) to be removed from site shall be classified as controlled waste and the Contractor will be required to dispose of such materials in accordance with the Environmental Protection Act 1990. The duty of care imposed by the Act shall apply to the Contractor as producer of the waste. This shall also apply to any subcontractor employed by the Contractor.

1.4 All waste material haulage must be undertaken by a carrier registered to transport controlled waste and each load must be accompanied by a transfer note and transported in sheeted wagons.

1.5 All waste must be deposited at an approved or licensed site capable of taking the waste in question. The contractor should contact the Overseeing Organisation to check the availability and location of appropriate waste disposal facilities.

1.6 It is not anticipated that liquid wastes, leachates or significant groundwater will be encountered during the Works. If such wastes are encountered, then the Overseeing Organisation shall be notified immediately. A suitable regime of chemical contamination testing will then be established by the Overseeing Organisation to enable the liquids to be classified and disposed of in an appropriate manner.

APPENDIX 7/1

PERMITTED PAVEMENT OPTIONS

1 Permitted Pavement Options – Schedule 1

Schedule 1: Permitted Pavement Options						
Drawing Ref	Area				General requirements	Permitted Pavement Option
	Description	Chainage		Lane		
		From	To			
SBIM-POW-TO0824-0701	M4 Prince of Wales Bridge Cable Stay Section	0	948	EB and WB Lane 1	Schedule 2	A1
	M4 Prince of Wales Bridge Cable Stay Section	0	948	EB and WB Lane 2		A2
	M4 Prince of Wales Bridge Cable Stay Section	0	948	EB and WB Lane 3 and Hard Shoulder		A3
	M4 Prince of Wales Bridge Cable Stay Section	0	948	Hard Shoulder		A4

2 General Requirements – Schedule 2

Schedule 2: General Requirements		
Grid for checking surface levels of pavement courses [702.4]	Longitudinal dimension:	10m
	Transverse dimension	2.0m
Surface regularity [702.5, table 7/2]	Category of Road	A
Interval for measurement of longitudinal regularity [702.7]		Continuous in any line or lines parallel to the edge of pavement
Interval for measurement of transverse regularity [702.8]		10m

Measurement of surface texture is required. (921.2)	Yes
Measurement of surface macrotexture is required (921 & Table 9/3) Average Maximum Minimum	Yes 1.2 2.0 1.5
Full documentation of the manufacturer's design shall be supplied to the Principal Contractor for his written consent before the commencement of laying of any material designed in accordance with MCHW.	

3 Permitted Construction Materials – Schedule 3

All pavement works to be full lane width in accordance with the scheme specific drawings in Appendix 0/4.

	Pavement Option (A1)		Pavement Option (A2)		Pavement Option (A3)	
Pavement Layer	**Material Ref.**	**Thickness (mm)**	**Material Ref.**	**Thickness (mm)**	**Material Ref.**	**Thickness (mm)**
Surface Course	**SCA1**	**45**	**SCA2**	**45**	**SCA3**	**45**
Regulating Course	**RCA1**	**20 – 68 mm (As Required)**	**RCA1**	**20 – 68 mm (As Required)**	**RCA1**	**20 – 68 mm (As Required)**
Waterproofing	**TBC**	**3**	**TBC**	**3**	**TBC**	**3**
Total Thickness		**68 - 116**		**68 - 116**		**68 - 116**

	Pavement Option (A4)	
Pavement Layer	**Material Ref.**	**Thickness (mm)**
Surface Course	**SCA4**	**45**
Regulating Course	**RCA1**	**0**
Waterproofing	**-**	**0**
Total Thickness		**45**

4 General Requirements for Construction Materials – Schedule 4

Schedule 4: General Requirements for Construction Materials	
Clause	Requirement
900 Series	All mixtures supplied in accordance with British Standard EN 13108-1:2016 Bituminous mixtures. Material specifications. Asphalt Concrete shall be CE marked and the Contractor shall submit the declaration of performance to the Principal Contractor, which shall demonstrate that the mixture provides the performance required by the specification. The Principal Contractor shall maintain up to date copies of the CE mark and Declaration of Performance.
901	In addition to the requirements of Clause 901 the coarse aggregate in all base and binder course materials shall be crushed rock. Blast furnace slag and steel slag are not permitted as coarse aggregate.
901.9 and 903.27	In addition to the requirements of Cl 901.9 and 903.27, temporary running surfaces shall have a minimum PSV of 50.
903.25	Sealant shall be applied to any freestanding edge of the finished pavement.
901.6	The requirements for resistance to fragmentation (hardness) shall be as stated in Clause 901.6.
901.7	The requirements for resistance to freezing and thawing (durability) shall be as stated in Clause 901.7.
901.8	The requirements for cleanness shall be as stated in Clause 901.8.
901.13	Requirements for resistance to fragmentation (hardness) shall be as stated in Clause 901.13.
901.16	Requirements for resistance to freezing and thawing (durability) shall be as stated in Clause 901.16.
902.2	The requirements for reclaimed asphalt shall be as stated in Clause 902.2.
903.27	PSV of temporary running surface shall be as stated in Clause 903.27.
903.35	Requirements for positioning of longitudinal joints shall be as stated in Clause 903.35.
903.36	Requirements for treating the faces of cold upstanding edges shall be as stated in Clause 903.36
903.38	Requirements for assessment of compaction at joints in binder courses and bases shall be as stated in Clause 903.38

5 Requirements for Construction Materials – Schedule 5

Schedule 5: Requirements for Construction Materials			
Material Ref:	Clause	Description	Requirement
SCA1, SCA2, SCA3 & SCA4	943	Hot Rolled Asphalt Surface Course and Binder Course (Performance-Related Design Mixtures)	**HRA 35/14F Surf PMB 40/60** Nominal thickness: **45mm-50mm** Resistance to permanent deformation classification [943.6 and PD 6691 Table C.4]: **Class 2** Is resistance to permanent deformation to be monitored in the permanent works [943.10]: **Yes** Coated chippings size, when required [910.3]: **14/20mm** Required declared PSV category for chippings [915.2]: SCA1 (PO A1) = **65** SCA2 (PO A2) = **60** SCA3 (PO A3) = **50** SCA4 (PO A4) **= 50** Required Maximum AAV category [915.2]: SCA1 (PO A1) = **10** SCA2 (PO A2) = **10** SCA3 (PO A3) = **14** SCA4 (PO A4) **= 14** Whether surface macrotexture measurement is required [921.1]: **Yes** Interval and frequency of macrotexture measurements, if not 10 per 250m [921.2]: **As per 921.2** Initial texture depth, if not in accordance with Table 9/3 [921.2]: **As per 921.2** Monitoring of resistance to permanent deformation required [943.10]: **Yes** Bond Coat shall be applied in accordance with SHW Causes 920 & BS 594987.
RCA1	943, 907	Hot Rolled Asphalt Regulating Course (Design Mix)	HRA 50/10 PMB Reg/Bin Nominal thickness: **25-50 mm** Thickness varies Contractor to determine as required. Resistance to permanent deformation classification [937.4, Table NG 9/26 and PD 6691 Table D7]: **2**

			Is resistance to permanent deformation to be monitored in the permanent works [943.10]: **Yes** Design air-void no less than 4% in accordance with CD358. The voids at the base of the asphalt layer shall be prevented from interconnecting.

6 Thin Surface Course Systems: Information to be Provided by the Contractor

6.1 Not Required

7 Mixture Data Requirements – Schedule 8

The following data shall be provided to the Overseeing Organisation for modified binders as required in sub-Clauses 937.3 and 943.4. The data should not be more than 12 months old. A table in which the binder data may be recorded is given at the end of this section

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

I. Binder Samples

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

II. Penetration

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

III. Product Identification Test and Rheological Properties

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

IV. Storage Stability Test

All binders shall be stored strictly in accordance with the manufacturer's instructions. Polymer modified binders claimed to remain homogeneous in storage without agitation shall be tested for storage stability in accordance with BS EN 13399. The

mean of the differences in softening point between the top and bottom samples, of not less than five pairs of such samples shall not exceed 5°C. Manufacturers of pre-blended modified binders shall state what precautions are necessary to ensure that adequate homogeneity is maintained during storage.

V. Photomicrograph

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

VI. Cohesion

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

VII. FRAASS Brittle Point

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

Summary of binder data

Manufacturer of Binder:			
Product name:			
Batch ref:			
Binder type:			
Binder source:			
Softening point difference in storage stability test			
Test	Supplied binder	After RTFOT	After RTFOT and PAV85
Penetration at 25°C 0,1 mm (100g and 5 secs)			
Penetration at 5°C 0,1 mm (200g and 60 secs)			
Vialit pendulum cohesion see Clause 939 maximum peak value J/cm^2	#	#	#
Product identification test	#	#	#
Complex shear (stiffness) modulus (G*) and phase angle (δ) data.			
Fraass brittle point			
Other properties the Contractor considers useful			

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

APPENDIX 7/2

EXCAVATION, TRIMMING AND REINSTATEMENT OF EXISTING SURFACES

1. Locations of pavements that require trimming prior to surfacing are referenced in the scheme specific contract drawings as listed in Appendix 0/4.

2. Locations of any trenches, pits, etc, which require to be excavated in existing paved surfaces in order to carry out the Works are shown on the scheme specific contract drawings as listed in Appendix 0/4 and detailed in Appendices 7/1 and 7/9

3. Locations and estimated areas of existing paved areas which require to be trimmed, regulated and reinstated to match levels where new and existing pavements abut or where new construction overlays existing pavement are shown on the scheme specific contract drawings as listed in Appendix 0/4 and detailed in Appendices 7/1 and 7/9.

4. Where planing / cold milling has taken place and residual surfacing remains, which, in the opinion of the National Highways Supervisor, is either in poor condition or has formed lenses that will affect the performance of the overlying material, the residual surfacing shall be removed, as directed by the National Highways Supervisor.

5. The Contractor shall identify and precisely record the location of any detector loops, node markers, police speed check markers, road markings and studs prior to any excavation, planing or overlaying of existing carriageway in order that they can be reinstalled in accordance with Specification Appendix 15/72 and 26/3 after surfacing works have been carried out.

6. Principal Contractor to employ suitable methods to avoid planing of the concrete deck. Trial pits to be carried out prior to removal of any asphalt layers to identify accurate depth of planing.

7. Trafficking of the planed surface will not be permitted other than by construction traffic.

8. All trimmed joints are to be to the full depth of the planing and shall be vertical for their full length.

9. The existing surface shall be thoroughly swept using a mechanical brush and all surplus material shall be removed and all surplus material and debris shall be dealt with in accordance with the SHW 900.

10. A bond coat of bituminous spray in accordance with Appendix 7/4 shall be applied to all surfaces prior to the overlay being placed.

11. The Contractor shall carry out all permanent reinstatements of excavations opened by Statutory Undertakers in the course of carrying out their diversion works in areas of carriageway or paved areas which are to be subsequently overlaid.

    Cross-section diagrams of typical trench reinstatements in flexible and flexible composite pavements giving the permitted alternative materials are shown in HCD K4.

    Also refer to the 'Manual of Contract Documents for Highway Works Volume 2' Series 700 clause 706 and Series 1000 clause 1033, where appropriate.

APPENDIX 7/4

BOND COATS AND OTHER BITUMINOUS SPRAYS

Sheet 1: Information to be provided by the Compiler.

1 Location

1.1 Locations and estimates of existing paved areas which are to be bond coated/tack coated are shown on the scheme specific contract drawings as listed in Appendix 0/4.

2 Performance Characteristics

2.1 Declaration of Performance to be provided to demonstrate that the requirements of the specification are met.

3 Site Specific Limitations

3.1 Contractor to ensure that winds do not affect spray coats and spray coats are contained within the site.

4 Type of treatment required and details of the existing surface and overlay material (920.1, 903.4 and 942)

4.1 A bond coat, tack coat or other bituminous spray in accordance with clauses 920 and / or 942 (see below) shall be applied in accordance with manufactures recommendations between all planed surfaces and existing bituminous / cement bound layers.

Bond coat

A bond coat forming part of the HAPAS approved thin surfacing system shall be applied between the proposed binder course and proposed thin surface course in accordance with the Installation Method Statement, clause 920, 942 and BS 594987.

Bond coats shall have a British Board of Agrément HAPAS Roads and Bridges Certificate. In the event that no such certificates have been issued, they shall have the approval of the Overseeing Organisation. The bond coats shall be CE marked and the Contractor shall submit the declaration of performance to the Overseeing Organisation prior to their application. The declaration of performance shall demonstrate that the bond coat meets the requirements of the specification.

5 Surface preparations required

5.1 All surfaces shall be clean, dry and free from dust and detritus prior to the application of the Bond Coat; the bond-coat shall not be applied to any surface more than 4 hours in advance.

5.2 If new pavement layers have been trafficked prior to overlaying, the surface shall be cleaned and sprayed at the Contractors expense.

5.3 Care must be taken to avoid trafficking of the bond/tack coat. The site should be planned to avoid asphalt delivery wagons on the planed surface where possible.

5.4 If there are any loose loop tails evident in the planed surface after planing they are to be cut and removed and any remaining slot in the planed area filled a hot bituminous binder.

5.5 Immediately before bituminous layers are reinstated, the vertical edges of the existing material (kerbs/ironwork etc) shall be cleaned of all loose material and be coated with an appropriate hot bituminous binder.

6 Masking of street furniture, drop-kerbs, etc.

6.1 All street furniture, ironwork and drop-kerbs shall be masked using self-adhesive masking material before application starts and removed on completion of the works.

7 Rate of spread required

7.1 The bond-coat / tack coat rate of spread shall be applied in accordance with the Installation Method Statement and / or clause 920, 942 and BS 594987.

8 Type of blinding material to be used

8.1 If blinding material is to be used it shall be in accordance with Clause 920.13.

SHEET 2: Information to be Provided by the Contractor

(i) The product or products he proposes to use together with their declaration(s) of performance, as specified. [920.2, 920.3, 920.4, 920.5]

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

(iii) The spraying equipment proposed, and a test certificate. [920.7, 920.9]

(iv) The source or sources of blinding material proposed. [920.12]

(v) Contingency plans in the event of any breakdown

Binder Data Sheet – Appendix 7/4	**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 25ºC 0,1 mm (100g and 5 secs)			
Penetration at 5ºC 0,1 mm (200g and 60 secs)			
Vialit pendulum cohesion see Clause 957 maximum peak value J/cm^2		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 7/9

COLD MILLING (PLANING) OF BITUMINOUS BOUND FLEXIBLE PAVEMENT

1. Cold-milling requirements:

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

1.2. All areas are to be 'swept' immediately prior to cold milling with appropriate equipment to locate any buried ironworks. Any buried ironworks should be reported to the Supervisor and clearly marked on site by the Contractor.

1.3. It is anticipated that the existing pavement construction varies. This shall be monitored during planing works, and adjustments made if required to ensure that thin slithers of loose material do not remain.

1.4. The Contractor shall ensure that where new surfacing abuts existing surfacing, existing surfacing is saw cut and sealed with hot bituminous binder in accordance with Clause 901.

1.5. Existing ironwork shall not be disturbed by the milling action. Where necessary, surfacing in the vicinity of ironwork and in small or irregular areas shall be cut out by pneumatic tools or other suitable methods and removed.

1.6. Following planing, the exposed surface shall be mechanically swept prior to bond coating.

Start New Chainage (m)	End New Chainage (m)	Lane	Direction	Depth in mm	Comments
Refer to scheme specific contract drawings listed in Appendix 0/4 for areas and depths of planing				TBC	Mainline including hard-strip / hardshoulder

APPENDIX 7/11

OVERBAND AND INLAID CRACK SEALING SYSTEM

1. Crack sealing system is to comply with Clause 711 and are categorised as one of the following and for the purposes of this contract shall be deemed to be applied to the surface where there are cracks seen on the pavement;

    a. Fill and Overbanding Systems for repairing crack widths up to 40mm
    b. Grade H Inlaid Sealing Systems for repairing crack widths in excess of 40mm.

2. Overbanding and inlaid crack sealing systems shall have current HAPAS Roads and Bridges Certificates.

3. A crack sealing system with a current HAPAS or equivalent certificate shall only be installed by a contractor approved by the Certificate Holder as an Approved Installer for that system.

4. For any of the crack sealing systems above, the Contractor shall supply details of the materials to be used to the Overseeing Organisation for approval before commencement of the works.

5. Locations of the proposed crack and joint repair system are shown on the contract drawings.

6. The minimum polished stone value of the source aggregate for chippings applied to the surface of overbanding and inlaid crack sealing systems, determined in accordance with BS EN 1097-8, shall be minimum 65 PSV unless otherwise stated on the contract drawing.

APPENDIX 12/3

TRAFFIC SIGNS: ROAD MARKINGS AND STUDS

1 General

1.1 The locations of proposed road markings and road studs shall be as specified in TSRGD 2016, and the scheme specific contract drawings as listed in Appendix 0/4. Permanent road markings are to match existing, exact marking locations shall be in accordance with the Traffic Signs Manual (Chapter 5) and agreed with the Supervisor prior to installation on site.

1.2 All new markings must be located to tie in correctly with existing carriageway markings.

1.3 Any permanent or temporary road markings that conflict with the designed permanent road markings should be removed in accordance with Clause 1212.18.

2 Permanent Road Markings

2.1 All permanent road markings shall be of thermoplastic material in accordance with BS EN 1871 and BS EN 1436. All road markings shall be white and shall be reflectorised in accordance with Clause 1212. All road markings shall contain reflectorised solid glass beads incorporated into the thermoplastic mixture in accordance with Clause 1212.

2.2 The skid resistance level for all road markings should be greater than 45 (Class S1) at all locations, as defined in Table 8 of BS EN 1436.

2.3 All material types, colours and dimensions shall be in accordance with Traffic Signs Regulations and General Directions (TSRGD) 2016 diagram numbers.

2.4 All markings shall be white or yellow unless otherwise detailed on the drawings.

2.5 Where markings are to be provided at sites of High Friction Surfaces, those markings shall not be applied until after the installation of the treatment.

2.6 Transverse raised rib detailed in diagram 1012.3 shall be spaced at 500mm intervals.

2.7 The road markings should have a coefficient of retroreflected luminance (RL) of R3.

2.8 Unless otherwise stated thermoplastic material markings on flexible carriageways shall be reflectorised to the requirements of Clause 1212: white colour; Class B2 luminance factor.

2.9 For concrete carriageways the Luminance Factor (β) should be specified as B3.

2.10 Prior to the application of the thermoplastic material a tack coat compatible with the concrete road surface and the marking material shall be applied in accordance with the manufacturer's instructions.

3 Temporary Road Markings

3.1 Temporary road markings shall comply with Clause 1212.13, or if required to be removable, be constructed only from a proprietary preformed road marking material complying with BS EN 1790:2013.

3.2 Temporary lines and other road markings, when laid on permanent carriageways, shall be of an approved material, capable of removal without resultant damage or defacement of the surface of the carriageway.

3.3 Preformed temporary road marking materials shall be limited to emergency use as temporary road marking repairs.

4 Permanent Road Studs

4.1 Permanent Road Studs shall be installed at locations indicated on the scheme specific contract drawings as listed in Appendix 0/4 and shall comply with Clause 1213 and the Traffic Signs Manual Chapter 5.

4.2 Reflecting road studs anywhere else than the central reserve shall be as follows:

Embedded road studs with Non-Depressible Corner Cube reflectors for all Greens, Reds, Whites road studs. Reflecting road studs adjacent to the central reserve shall be Amber/Red Bi-Directional Non-Depressible Corner Cube reflectors and on the offside of a slip road shall be Amber Non-Depressible Corner Cube reflectors, which are to be mounted applied directly onto the surface using approved hot melt bitumen adhesive.

4.3 Studs to be used shall be from list of approved studs given in - "List of Approved / Registered Products – SA /1/05" published by HMSO.

4.4 All road studs shall be installed to the manufacturer's recommendations. Studs to be BS EN 1463-2 approved.

4.5 Temporary reflecting road studs using hot melt adhesive shall only be used on surfaces which will be subsequently resurfaced as part of the works. On all other surfaces self-adhesive road studs shall be used.

APPENDIX 15/1

INSTALLATION AND COMMISSIONING OF LOOPS AND COMMISSIONING OF OUTSTATION

1. CWF Contractor shall install new detector loops, to MCH 1540, as shown on scheme specific contract drawings as listed in Appendix 0/4 in the positions described in the Loop Schedule detailed below.
2. Prior to start of works the CWF Contractor to confirm position of all new detector loop with National Highways.
3. CWF Contractor shall install new loops at sites (Loop Schedule detailed in section);

   No loops identified within the scheme extents.

   by replacing the existing loops (which are marked on SITE) and should be sited next to the redundant loops and as close as possible. CWF Contractor shall raise prior to start of works with Highway England Service Manager, any discrepancies between drawings identifying locations and loops marked on site
4. CWF Contractor shall ensure the new loop tails are clearly identified for which lanes and left within chamber with sufficient lengths for RTMC Connection.
5. For MIDAS loops CWF Contractor shall leave sufficient length of 1.5m (Min) to 2m (Max) of loop tails shall be left within the loop chamber. For NTIS loops CWF Contractor shall leave sufficient length of 0.5m to 1m (Max) of loop tails shall be left within the cabinet.
6. CWF Contractor shall send test certifications of the new Loops to RTMC (MCENWFaults@balfourbeatty.com) and National Highways (karen.critchley@nationalhighways.co.uk) and the relevant National Highways Construction Lead on completion of works.
7. Where TM is required for RTMC commissioning activities, the CWF will coordinate and organise TM for RTMC works.
8. RTMC shall connect the new loops tails to the existing feeder cables by disconnecting the redundant loop tails from the redundant loops located in the existing loop joint chambers for MIDAS and within cabinets for NTIS loop.
9. RTMC shall commission all the sites and outstations affected. The testing and commissioning of the loops are to be carried out to MCH 1755.
10. The existing motorway infrastructure shall be protected from damage during the works. Any part of the existing infrastructure damaged during the works shall be re-instated by the contractor at the contractor's expense.
11. For NTIS Loops, the CWF Contractor will need to install the loops into cabinets; if they don't have keys to access the cabinets then CWF Contractor shall speak to RTMC to organise access.

All the above refers to MIDAS loops. If other loops are present (signal, weather station, weigh on motion, TDC loops etc) then a specific Appendix 15/1 should be provided by the technology scheme.

APPENDIX 17/1

SCHEDULE FOR THE SPECIFICATION OF DESIGNED CONCRETE

Requirement	Schedule	
Designed Concrete Ref / Location of the Works	**Large Concrete Repairs**	**Central Reservation Repairs**
Intended Working Life of Structure	50 years in accordance with CS 462 7.28	120 years
Nominal Cover to Reinforcement	25 mm	60 mm. If this cannot be achieved it shall be equalised above and below the mesh.
Applicable Exposure Classes (Excluding DC-class)	XD1	XD3 / XF4 / XS1
DC-class (where appropriate)	-	-
Compressive Strength Class of Concrete	C60/75	C40/50
Minimum Cement Content (kg/m³)	360 kg/m^3	360 kg/m^3
Maximum Free Water/Cement Ratio	0.45	0.45
Required Group or Type and Class of Cement or Combination (where a DC-class has not been specified)	IIIA IIIB IIIC	BS8500-1 2023 Combined Performance Category: A1, B1, C1, D1, G1
Maximum Aggregate Size	10 mm	20mm
Chloride Content Class	Cl 0,30	If G1 cement is selected Cl 0,20. Otherwise Cl 0,30.
For Lightweight Concrete, the Density Class or Target Density	Not applicable	Not applicable
For Heavyweight Concrete, the Target Density	Not applicable	Not applicable
Consistence Class	To be selected by contractor	To be selected by contractor
Special Type or Class of Cement or Combination	Not applicable	Not applicable
Required Source/Special Type of Aggregate	-	Freeze-thaw resisting aggregates.
Maximum Cement Content (kg/m³)	550 kg/m^3	550 kg/m^3
Required Admixture	-	-
Air Entrainment Required [YES/NO]	No	No
Minimum or Maximum Temperature of Fresh Concrete °C	Minimum, 5ºC Maximum, 35ºC	Minimum, 5ºC Maximum 35ºC, or 30ºC if CEM I or IIA cements are used.
Sampling and Testing	In accordance with DMRB SHW 1/5	In accordance with DMRB SHW 1/5
Requirements to Control Early Thermal Cracking or Other Requirements	-	-

APPENDIX 17/3

CONCRETE - SURFACE FINISHES

1 Requirements for contract specific surface finishes

1.1 Large Concrete Repairs; U4
1.2 Central Reservation Repairs; U2

APPENDIX 17/3

CONCRETE – GENERAL

1.1 Concrete shall be in accordance with BS8500-1:2015 unless noted otherwise concrete grades are:

(a) Cable Stayed Bridge Deck Repairs: C60/75

(b) Central reservation: C40/50

1.2 It is the duty of the Principal Contractor to source suitable formwork in accordance with the scheme drawings and agree with the Principal Designer prior to construction.

1.3 All concrete testing to be in accordance with Appendix 1/5 of this specification and 1707.1.

1.4 The use of retarding agents is not foreseen.

1.5 Cement types permitted shall conform with the requirements in Specification Clause 1702.1 with limitations in Appendix 17/1. No other cement types shall be permitted.

1.6 All hot rolled and cold worked carbon steel bars shall conform to BS EN 10080 and BS4449 (Grade B500B) and shall be cut and bent in accordance with BS8666. The bars shall be obtained from a company holding a valid CARES (or fully equivalent scheme) certificate of approval, a copy of which shall be provided to the Overseeing Organisation.

1.7 Welding of reinforcement shall not be permitted, unless directed otherwise by the Overseeing Organisation. Welding for fixing in position may be considered where performed by fabricators holding relevant valid CARES (or equivalent scheme) certificate of approval. Guidance for the welding of bars can be found in BS EN ISO 17660 (part 1 and 2) and the relevant UK National Annexes, which contain additional guidance and reference to relevant Standards applicable in UK.

1.8 Cover to reinforcement shall be in accordance with the contract specific drawings.

1.9 All protruding reinforcement shall be guarded / protected to eliminate the hazard of impalement.

APPENDIX 20/1

WATERPROOFING FOR CONCRETE STRUCTURES

1.1 Prince of Wales Bridge Cable-Stayed spans (Shoots Bridge - Structure Number. 26624) was waterproofed during construction in 1996. The existing waterproofing on the Prince of Wales Bridge is a spray applied system – consisting of Pitchmastic PmB primer, membrane, aggregated binder, and tack coat.

1.2 Waterproofing is to be replaced as shown on drawings:

- SBIM-POW-TO824-DWG-007
- SBIM-POW-TO824-DWG-008

2 General requirements

2.1 After the waterproofing membrane has been applied, there should be no hollows or depressions of maximum dimension 150mm in plan and depth greater than 2mm in trafficked areas of the deck that are not drained naturally by the longitudinal gradient or cross fall, or by the provision of subsurface drainage.

2.2 The thickness of spray applied waterproofing membranes should a minimum of 2mm overall, including peaks and arises in the concrete deck, but should not be greater than 3mm. The thickness of areas at laps shall not exceed 4.5mm.

2.3 The asphalt layer directly overlaying the waterproofing system shall have a design air void content of no more than 4%.

2.4 The waterproofing systems specified for installation on concrete bridge decks and buried top slabs constructed, improved, or maintained in accordance with MCHW Series 2000 shall be a permitted waterproofing system (PWS) in accordance with:

- BS EN 14695 for sheet applied systems
- ETAG 033 for liquid applied systems
- PAS in MCHW Series 0100

2.5 The waterproofing systems specified for use on concrete bridge decks and buried top slabs shall have an minimum working life of 25 years.

2.6 Systems that require an APL are disallowed.

2.7 Sheet membrane systems are disallowed.

3 Lapping onto existing systems

3.1 Pull off tests shall be carried out on any existing waterproofing system onto which a lap is required. The adhesion achieved shall be recorded.

3.2 If the adhesion is of similar magnitude to the proposed waterproofing system then prepare joint and overlap with new waterproofing system, in accordance with the Certificate holder's method statement agreed with the certification body and in accordance with CD358 Appendix D1.

3.3 Where the adhesion is significantly different (greater than 20%) the procedure below should be used.

- Seek agreement from the Overseeing Organisation.
- Treat in accordance with CD358 Appendix D2.

- Record the structure in IAMIS as 'At Risk' to failure of the waterproofing system.

4 Installing bridge deck waterproofing onto concrete less than 28 days cured

4.1 Bridge deck waterproofing shall not be installed on concrete, including repair concrete, which has had less than 7 days curing time.

4.2 If a bridge deck waterproofing system is to be installed on concrete aged between 7 and 27 days then the following instructions shall be followed:

- The concrete shall be thoroughly flame dried until measurements show that the moisture content is below 6% (4% if using a hand held moisture meters).
- Should the application be carried out during the winter months, a system to protect the waterproofing layers while they are curing, such as tarps or large covers should be implemented where possible. Alternatively, an allowance of time could be allocated to wait for the weather to be ideal for application with a fast-curing system.

5 Destructive Testing of the Waterproofing System

5.1 The Supply chain partner shall measure the adhesion of the fully cured membrane to the deck using an Elcometer pull-off rig applied to a core of 12 to 15mm diameter. Two tests will be required per 50m2 of sprayed membrane. The Supply chain partner shall provide test values and locations of the tests.

5.2 The Supply chain partner shall measure the adhesion of the fully cured membrane to the deck using an Elcometer pull-off rig applied to a core of 12 to 15mm diameter. Two tests will be required per 50m2 of sprayed membrane. The Supply chain partner shall provide test values and locations of the tests.

5.3 The Supply chain partner shall reinstate the test areas on completion of the test.

5.4 The pull off tests shall meet the following requirements dependant on the proposed depth of the surfacing at that location of the test. Any test values below the following values will require spraying operations to be suspended while further investigation is undertaken:

- Surfacing depth> 90 mm; Min test value 0.50 N/mm²
- Surfacing depth 90 to 60 mm; Min test value 0.70 N/mm²

5.5 Test results not in compliance with the above are deemed to be unacceptable and the waterproofing in the location shall be removed and re-sprayed to the satisfaction site supervisor.

6 Non-Destructive Integrity Testing of the Waterproofing System

6.1 The finished waterproof membrane shall be "Spark tested" for porosity and pinholes. All imperfections detected shall be rectified to the satisfaction of the site supervisor.

6.2 "Spark testing" is to be carried out using a high voltage direct current pin hole detector. In addition to the manufacturer's instructions for use, the following requirements and conditions apply:

- The holiday detection equipment shall supply a DC voltage to the test head. The voltage to be used shall be determined in accordance with Method B as contained in ASTM G62- 87 subject to a minimum of 13.5kv. The equipment shall also have an audible and visual alarm triggered when a pin hole is detected in the membrane.
- On completion of the testing the earthing probe shall be removed and any resulting void in the concrete repaired in accordance with CS 462. If the partial structural repair is adopted, small diameter stainless steel dowels shall be bonded to the substrate concrete in

accordance with CD 372. The repair material shall be in accordance with Appendix 57/1. Alternatively, a full structural repair in accordance with Appendix 57/3 shall be made.

6.3 Pinhole defects are not permitted.

6.4 The earth lead shall not be more than 10m in length.

- Movement/Expansion joints shall not be crossed when testing.
- Earthing with screws set into substrate or exposed reinforcement shall be used.
- Pin holes shall be indelibly marked with a pen compatible with the waterproofing material.
- The instrument is not to be tested on wet or damp surfaces.
- The "Spark Testing" equipment shall have a current certificate of compliance/calibration.

6.5 In the case of two-coat spray applied membranes both coats shall be tested. Faults found in the first coat shall be rectified before the application of the second coat.

7 Application Records

7.1 The application records detailed below shall be maintained by the contractor and supplied to the site supervisor.

7.2 The contractor shall provide a certificate of compliance.

7.3 The contractor shall continuously monitor the coverage rate of the material applied to the deck and shall provide the site supervisor with records showing the start/finish weights and areas covered for each period of spray operation.

7.4 The contractor shall continuously monitor the wet film thickness every 5m2 using a gauge pin or a standard comb type and provide results for wet film thickness measured and their locations to the site supervisor. The acceptance criteria shall be as per the certificate awarded by the certification authority and this specification appendix.

7.5 The contractor shall continuously monitor and record the air temperature, concrete deck surface temperature and relative humidity to ensure compliance with the certification authorities requirements.

8 Removal of Existing Surfacing and Waterproofing in Areas where New Waterproofing is Specified.

8.1 On horizontal surfaces which slope at not more than 5 degrees to the horizontal mobile recoverable abrasive blast cleaning machines shall be used, "open" blast cleaning will not be permitted.

8.2 On sloping surfaces a closed vacuum dust removal/abrasive collection blast cleaning system shall be used, open blast cleaning will not be permitted.

8.3 If a significant quantity of oil is present on the concrete surface it shall be removed by spraying water soluble paint remover over the contaminated area and then scouring the surface. Debris and dirt shall be rinsed away with clean water after scouring has removed the oil.

8.4 Following complete removal of all debris arising from the foregoing operations, the deck surface will be visibly inspected for defects.

8.5 A series of concrete tests shall be completed in accordance Appendix 57/6.

8.6 Repairs to the concrete substrate shall then be carried out in accordance as directed by the site supervisor. Repairs to receive new waterproofing shall have class U4 finish.

9 Removal of Existing Materials

9.1 The works shall be carried out in a manner that does not damage or disturb any part of the existing structure that is to remain upon completion of the works.

9.2 On completion of removal of the waterproofing the area shall be thoroughly cleaned prior to a joint inspection with the Overseeing Organisation.

9.3 Prior to application of the new waterproofing, the deck concrete shall be examined by the Overseeing Organisation for testing and/or concrete repairs (in accordance with the requirements of Series 1700 and 5700).

10 Deck preparation

10.1 Existing deck concrete shall be grit blasting in preparation to receive the waterproofing, "open" blast cleaning will not be permitted.

10.2 laitance shall be removed from all new concrete.

10.3 Pressure washing shall not be undertaken.

10.4 Concrete curing compounds or surface impregnates must be removed prior to the application.

APPENDIX 26/1

ANCILLARY CONCRETE

Concrete for ancillary purposes shall be as per Table below unless otherwise specified on the drawings or details.

Concrete for Ancillary Purposes Purpose	**Preferred designated concrete**	**Alternative standardised prescribed concrete**
Footings for fence posts and augured foundations for traffic signposts	GEN 2	ST2/ST3
Foundations for environmental barrier posts, and planted lighting columns; foundations for non-proprietary VRS safety barrier posts and end anchorages.	RC20/25	ST5
Blinding concrete, backfill for structural foundations, over dig of post holes and preparation of formation to Clause 616	GEN1	ST1
Bedding and backing to precast concrete kerbs, channels, edgings, and quadrants	GEN1	ST1
Bed to drains Type A #. Foundations, channels and benching to chambers	GEN3	ST4
Bed, haunch and surround to drains other than Type A #. Surround to chambers and gullies	GEN2	ST2

Allowable cement types
Cement types as defined in BS 8500 (see Table A.15 of BS 8500-1 or Table 1 of BS 8500-2) shall comprise one of the following:
CEM I, CEM II/A, CEM II/B-M, CEM II/B-S, CEM II/B-P, CEM II/B-Q, CEM II/B-V, CEM IIIA, CEM IV/B-P, CEM IVB-Q, CEM IV/B-V
For buried concrete, if ground aggressive is unknown the ST mixes must be used.

Aggregates
Aggregates shall comply with BS EN 12620, the maximum size shall be 20 mm.

APPENDIX 26/3

CORED THERMOPLASTIC NODE MARKERS

1 General

1.1 Cored thermoplastic node markers shall be white and installed in pairs in the centreline of Lane 1 at the locations defined in the scheme specific contract drawings as listed in Appendix 0/4 upon completion of the resurfacing works.

1.2 Prior to the removal of a node marker, the record form below shall be completed by the Contractor in accordance with the National Highways Network Management Manual, Part 2, Chapter 2.3, and Paragraph 2.3.5. This record form shall be forwarded to the Overseeing Organisation for inclusion in the Health and Safety File.

2 Node Markers

2.1 The node markers shall be constructed in accordance with sub-Clause 2606.2 (i).

2.2 The node markers shall be constructed as follows:

2.3 100 mm diameter pockets 10 mm ± 5 mm deep shall be cored in the finished road surface at 175 mm ± 5 mm centres within a longitudinal tolerance of ± 0.25 m. The pockets shall be cored using a drill consisting of central pilot bit surrounded by a 100 mm annular bit. The material within the annulus shall be carefully broken out leaving a rough surface to the base of the pocket. The line joining the centres of the markers shall be perpendicular to the centre line of the lane in which the markers are installed.

2.4 The base of the pockets shall be cleaned and dried ensuring that all loose material is removed.

2.5 Thermoplastic road marking material or paint, in accordance with BS EN 1871, shall then be poured into the pockets until the material projects slightly above the level of the road surface, but the material must not be allowed to spread onto the surrounding carriageway surface.

2.6 The completed markers shall be free from raggedness at their edges and free from streaks and be flush (i.e. not more than 2 mm above) with the surface of the adjacent carriageway.

Appendix 57/1: Repair Product – Requirements

(a) **Assumed repair method for each construction activity**

1.1. Superstructure deck slab concrete repair works are to be undertaken following the removal of the surfacing layers including the waterproofing. Concrete repairs are to be carried out in accordance with BS EN 1504-9:2008 – Principal 3: Concrete restoration. Recommended construction methods are recasting with concrete (3.2).

1.2. The concrete shall be a proprietary shrinkage-compensated normal flow concrete made from Portland cement, natural aggregates, additives and potable water, and shall be Class R4 in accordance with BS EN 1504 Part 3.

1.3. Only one type of concrete shall be used throughout the Works. Once accepted for inclusion in the Works, there shall be no changes in the source or type or material, manufacturer, supply, design or method of mixing without the approval of the Overseeing Organisation. Such approval will only be given after compliance with the Specification has been demonstrated by repeat approval testing.

1.4. The repair material shall be fully compatible with the parent concrete and with the materials that will be subsequently applied (e.g. waterproofing system and joint nosing's).

1.5. Proprietary material shall be supplied by a manufacture who holds a current BSI Certificate of Registration as a BSI - Registered Firm of Assessed Capability in accordance with BS EN ISO 9001.

1.6. Repair concrete shall not be used in the Works until it has been approved by the Overseeing Organisation. The Contractor shall provide the Overseeing Organisation with copies of the results of all tests. The tests to be performed are specified below and should be carried out in a UKAS accredited laboratory.

1.7. Maximum Chloride Content

For proprietary concrete the total chloride content of the repair concrete arising from the cement, aggregate and any other source shall not exceed 0.05% of chloride ion by weight of cement when determined in accordance with the method in BS EN 1015-17.

1.8. Storage

The material shall be stored in a controlled environment in accordance with the manufacturers' recommendations and BS EN 1504-10, sub-clause 8.1. It shall not be older than 3 months or such lesser period stated by the manufacturer when incorporated in the Works and shall not be removed from the Site store for use in the Works until immediately before mixing with water on Site.

(b) **Contract specific requirements for performance characteristics of repair products**

Description of structure and/or structural element	BS EN 1504 Part 3 strength class of repair product	Minimum compressive strength of repair product (Mpa)
M4 Prince of Wales Cable Stayed Bridge Deck Slab	R4	70

(c) **Contract specific information provided to assist contractor in choice of repair product.**

Description of structure and/or structural element	Compressive strength of existing concrete being repaired. (MPa)	Galvanic anodes required within repair patches? (Yes/No)	Minimum strength of repair concrete before loading permitted. (MPa)
M4 Prince of Wales Cable Stayed Bridge Deck Slab	70	To be determined following site testing.	See Appendix 57/3

Appendix 57/2: Requirements for Reinforcement

1. Circumstances when a primer or barrier coating is required to be applied to prepared surface of existing or new reinforcement or to structural steelwork.

No used.

2. Definition of the limiting corrosion condition of existing reinforcement (typical average section loss) Greater loss of steel in the cross section would require the affected reinforcement bars should be cut out and replaced, or new bars lapped

2.2 Exposed reinforcement with significant surface contaminates shall be treated by wet grit blast cleaning.

2.3 Where the section loss of the reinforcement is found to be more than 15% of the originally specified bar (based on record drawings), the damaged length of the bar shall be replaced.

2.4 Should smaller reinforcement be discovered than is specified on the record drawings then the project engineer shall be notified.

2.5 The record drawings show the longitudinal reinforcement is shown to be nominal 20mm diameter bars within the Prince of Wales Bridge Deck.

2.6 Longitudinal replacement bars should be lapped to the existing reinforcement and shall have:

(i) Nominal cover of 25mm, ΔC = 0mm

(ii) A lap length of 36φ – conditions will be good bond as long as pour depth is less than 250mm.

(Where φ is Nominal diameter of bar)

For example, 20mm nominal diameter bar will require a lap length of 720mm.

2.7 Traverse replacement bars (these are underneath the longitudinal bars) should be lapped to the existing reinforcement and shall have:

(i) A lap length of 36φ – conditions will be good bond as long as pour depth is less than 250mm.

(Where φ is Nominal diameter of bar)

For example, 20mm nominal diameter bar will require a lap length of 720mm.

2.8 Welding of bars shall not be permitted.

3. Schedule of reinforcing bars to be maintained on site or reinforcement bending schedule and lapping requirements

A schedule of all reinforcement procured and installed shall be maintained on site.

4. Requirements for steel reinforcement couplers including type, reinforcement diameter, minimum fatigue class

Not used.

5. Requirements for lapping of new steel reinforcement to existing reinforcement

Not used.

6. Specific requirements for site welding of reinforcement, where it is permitted

Not permitted.

7. Requirements for anchoring of steel reinforcement or dowels including reaction to fire class for any polymer-based reinforcement anchoring product

Not permitted.

Appendix 57/3: Execution of Concrete Repairs

1. Structural Concrete - General Requirements

1.2 All concrete repairs and removal of concrete shall be undertaken on deck areas as indicated on the drawings and as directed on site by the Project Manager following suite of testing undertaken.

1.3 Repairs shall only be undertaken by Contractors who offer satisfactory evidence of experience and expertise.

1.4 All proprietary materials shall be stored in a dry weatherproof lock up store free from extremes of cold or heat in accordance with the Manufacturer's instructions, to ensure that their properties shall not be impaired.

1.5 The materials shall not be removed from the store for use until immediately prior to mixing.

1.6 Repair concrete shall achieve a cover to reinforcement that is not less than existing cover.

1.7 Concrete repairs will be undertaken on areas:

a. Identified through on-site testing (including visual inspection) in accordance with Appendix 57/6.

b. Identified as high risk through historic concrete testing and on drawings.

1.8 Finishes - Deck concrete surface that receives waterproofing shall have U4 finish.

1.9 The area for concrete repair shall be limited to 3.6x3.6m panels, ensuring that no adjacent repair is undertaken within 2m transversely and 7.3m longitudinally until full strength requirement is achieved for the repair panel.

2 Requirements for the Removal of Concrete

2.1 The areas of concrete removal (area and depth) shall be as indicated on the Drawings, as described in Appendix 0/4, as identified through onsite surveys or as confirmed by the Overseeing Organisation prior to commencement of concrete removal. Removal of additional concrete (i.e additional hollow areas) to that described in the Contract Drawings and Documents may be instructed by the Overseeing Organisation if found to be necessary.

2.2 The Contractor shall prepare detailed method statements for concrete removal and shall submit them to the Overseeing Organisation for approval.

2.3 Concrete shall be removed from the areas shown in the Contract Drawings, until sound concrete is reached. Where reinforcement becomes exposed, concrete shall be removed for a minimum distance of 25mm beyond the rear face of the reinforcement. Any laps installed need to be onto undamaged and uncorroded reinforcement. Exposed reinforcement may be encountered either where concrete has already spalled off, or where delaminated concrete is initially knocked off. In both these cases the repair should be taken to behind the reinforcement.

2.4 Before cutting out, the Contractor shall determine the position and depth of the reinforcement with a covermeter. The perimeter of repairs shall be prepared to prevent feather edging or overbreak. The upper concrete surfaces of repair areas shall be inclined to avoid the entrapment of air when the concrete is poured.

2.5 The Contractor shall not damage concrete to be retained adjacent to, above or below repair and replacement areas. Any concrete damaged by the Contractor shall be rectified as directed by the Overseeing Organisation. The Contractor shall not damage the steel reinforcement. Any steel reinforcement damaged by the Contractor shall be rectified as directed by the Overseeing Organisation.

2.6 The Contractor shall take measures necessary to keep the Site, immediate work areas and staging free of concrete debris arising from concrete removal operations.

2.7 Hydro-demolition - Water and debris to be removed and disposed off site – no discharge to watercourse permitted. Recommend use of water silt filtering to ensure water is recycled on site where possible.

3 Preparation of Surfaces of Concrete

3.1 Immediately before mixing and placing the repair product, the existing concrete substrate within the repair area and the existing unbroken concrete immediately surrounding the repair area shall be hammer tested to detect any remaining loose, or hollow sounding concrete which has occurred since the main concrete breakout activities. Any defective concrete shall be removed.

3.2 Before concreting, the surface of the existing concrete shall be free of laitance and cleaned of all dust and grit by a water jet at mains pressure, filtered oil-free air or other equivalent method and loose aggregate shall be removed. The surfaces shall be wetted with potable water for a minimum of four hours and surface water shall be removed on completion of the wetting. Repair concrete shall be placed not more than one hour after completion of wetting.

3.3 If the manufacturer instructions for the repair material recommend use of a bonding primer then a bonding primer shall be applied.

4 Access to Repair Areas for Inspection

4.1 The Contractor shall allow the Overseeing Organisation a minimum period of 2 hours of unhindered access to previously inaccessible areas to allow time to inspect the concrete and identify repair areas in conjunction with the Contractor. The Contractor shall give at least 5 days' notice that access to previously inaccessible areas will be available.

4.2 As repair work proceeds, the Contractor, in conjunction with the Overseeing Organisation, will continue to carry out inspections, and shall undertake further testing as required to establish the limits of the concrete to be removed.

4.3 When the initial removal of concrete for an area is completed, the Overseeing Organisation will require access to the area for inspecting the concrete and reinforcement prior to issuing instructions for further removal or reinforcement repairs if necessary. Such inspection in each area will normally be carried out within a period of 4 hours from the time of receipt of the written request for an inspection. Concreting shall not be carried out without the approval of the Overseeing Organisation.

Appendix 57/5: Concrete Injection

1. Introduction:

1.1 The underlying cause of concrete cracking should be carefully considered, and the conclusions documented before adopting a solution including crack injection.

1.2 Cracking in the existing concrete which is wider than designed or causing concern about long term durability of the structure, may be considered for injection. The structure may predate the publication of crack control codes, and cracking could be extensive if the structural reinforcement was insufficient to prevent cracking in the immature concrete.

1.3 If cracking is caused by reinforcement corrosion, a full concrete repair should be carried out because there is a risk corrosion may have caused general delamination of the concrete. Concrete injection should not be specified in an attempt to stick the delaminated concrete to the parent concrete.

2. Inspection to Identify Cracks for Treatment

2.1 It is Principal Contractor's responsibility to undertake the inspection of cracks prior to starts of concrete repairs works.

2.2 Any cracks >0.3mm to 0.8mm shall be use sealed using concrete crack injection technique as per CS 462 and shall follow the recommendations in Annex A of BS EN 1504-9 [Ref 28.I] and in 'Repair of concrete structures with reference to BS EN 1504' CS TR69 [Ref 31.I]

3. Preparation of Cracks

1.10 BS EN 1504 Part 10, Annex A.8 contains advice about techniques of concrete injection.

1.11 For those methods which require cleaning the following requirements shall be met:

a) The substrate shall be free from dust, loose material, surface contamination and materials which reduce bond or prevent suction or wetting by repair materials.

b) unless cleaning is carried out immediately before application of protection and repair materials the cleaned substrate shall be protected from further contamination.

4. Execution of Concrete Injection

4.1 BS EN 1504 Part 10, Annex A.8 contains advice about techniques of concrete injection. Further information and guidance may be found in Concrete Society publication TR 69, Repair of Concrete Structures with reference to BS EN 1504.

4.2 Concrete injection should be carried out by an appropriate method that ensures complete filling of the crack. If the proposed method includes combined vacuum and pressure, injection pressures will generally be limited to a positive pressure of 1.5 bar combined with a vacuum negative pressure not greater than –0.75 bar.

4.3 Filling cracks can be by injection, soaking or vacuum techniques. Before filling any cracks contamination such as oil or other contaminants must be removed. The tolerable amount of moisture or water in the cracks depends on the properties of the filling material. Cracks may be cleaned and dried by methods including the use of water and solvents and clean air under pressure. If cracks are injected, sealing of the cracks is usually necessary to ensure that injection can be completed without interruption. Parts of nozzles remaining in the structure should be of material which will not cause electrochemical reaction. Care must be taken that the pressure of injection does not produce further cracks or other detrimental effects to the substrate, other components or the environment. The use of thixotropic grouts may give rise to unacceptability high pressures.

4.4 The equipment for soaking must ensure an adequate, uninterrupted flow of the crack-filling material until absorption has ceased.

4.5 If there are significant changes in crack-width during filling and hardening, then the time of injection must be selected where possible to allow re-injection at the moment of maximum crack width and within the workability time of the product.

4.6 Sealing of cracks with bandages may be preferable if cracks are contaminated, too small for filling or if longitudinal and/or shear movements are more than 25 % of the crack width. If no other information is available pre-tests may be necessary to determine the adhesion and tightness of bandages.

Appendix 57/6: Contractor Investigation of Concrete Condition

1. Requirements for testing to determine the location of concrete repairs following the exposure of reinforced concrete deck regions

1.1 The contractor will undertake a defect survey of the deck to identify any areas of exposed reinforcement, low cover, delamination, cracking.

1.2 The contractor will also identify the extents of any areas of hollow sounding concrete which indicate areas of delamination.

1.3 Areas with identified defects will be addressed with a concrete repair as outlined in Appendix 57/3.

2. Extent of Investigation

3.2 Site sampling and laboratory testing is to be undertaken in accordance with the Overseeing Organisation's requirements as specified in the guidelines given in CS 462 Repair and management of deteriorated concrete highway structures.

3.3 A visual and defects survey shall be undertaken on the exposed deck during the deck refurbishment works. See Section 3 below.

3.4 The test panels shall be 2m long and 1m wide. The nodes shall be spaced at 500mm in both directions. Therefore 15 nodes will be tested per panel.

3.5 If this panel size (2m by 1m) does not fit on the part of the structure indicated in section 6 then the panel dimensions shall be adjusted to 2m by 0.5m with nodes at 500mm spacing in both directions.

4 Inspection

4.1 General Information

An inspection of the general condition of the concrete shall be carried out to the whole exposed deck area. Photographic records are to be made which shall include:

- Close-up views of any concrete defects found;
- Photographs of any exposed reinforcement and/or spalled areas.

4.2 Visual Defect Survey

A visual defects survey shall be carried out on the whole deck when exposed. This will include details of crack extent and crack widths, hairline cracks, exposed reinforcement, exposed tie wire, rust spotting/staining, honeycombing, spalling, exposed aggregate, delamination, staining and failed repairs.

4.3 Delamination Survey

A 'tapping survey' shall also be carried out on the whole deck when exposed. Any loose concrete that can be removed by hand will be removed from site by the contractor to an appropriate tip. Any hollow sounding concrete that cannot be removed shall be recorded and documented in the testing reports. Hollow sounding concrete should also be marked for the concrete repairs phase where it will be broken out and repaired.

5 Concrete Testing

5.1 General Information

Concrete tests and investigations listed below prior to the deck refurbishment works. All testing and investigations shall include:

5.1.2 Half Cell Potential Testing

Half Cell Potential is to be measured to ASTM C876-91 but using silver / silver chloride reference electrode. Readings to be taken at 3m intervals across the deck transversely (total number of 5 readings). This shall be repeated at intervals of 10m longitudinally. Readings shall be in grid form (3x10m grid). A more refined grid may be additionally instructed at areas of high corrosion risk.

Reinstatements of breakouts to establish a reinforcement connection may be as partial structural repairs in accordance with CS 462. If the partial structural repair is adopted, small diameter stainless steel dowels shall be bonded to the substrate concrete in accordance with CD 372. The repair material shall be in accordance with Appendix 57/1. Alternatively, a full structural repair in accordance with Appendix 57/3 shall be made.

5.1.3 Depth of Cover to Reinforcement

A cover survey of depth to reinforcement shall be carried out using an electromagnet cover meter in accordance with BS 1881: part 204: 1988. The cover meter readings shall be taken on a 2m x 2m grid.

5.1.4 Resistivity Measurement

Where half-cell potential values are more negative than -250mV then measuring electrical resistivity of concrete shall be in accordance with the procedure given in CS TR60. Where resistivity measurements are required, moisture content measure will also be required.

Portable equipment based on the Wenner four-probe technique may be used or an alternative approach using a square wave AC current to accommodate the effects of a poor surface contact.

5.1.5 Chloride Ion Gradient Testing

The chloride testing shall be carried out following completion of the Half Cell Potential Testing. Test to include 3 number across the deck transversely and repeated at intervals of 25m longitudinally. Readings shall be in grid form.

The drill holes shall be 20mm in diameter with the tests carried out in increments of 25mm to a depth of at least 100mm.

The chloride ion content shall be taken at depths of 5-25mm, 25-50mm and 50-75mm.

All holes shall be infilled with a resin injection mortar suitable for application in non-cracked and cracked concrete with a minimum 50 year working life.

5.1.6 Cement Content Tests

Five cement content tests shall be carried out per carriageway spaced at even intervals. The cement content will be measured as a percentage by mass.

5.1.7 Depth of Carbonation

Measurement of the depth of carbonation of the concrete, using phenolphthalein as an indicator, is to be carried out in accordance with current best practice. Two carbonation test will be carried in each of the known over planed areas, A, B, C and D. Any other unknown over planed areas shall also receive two carbonation tests. In addition to these, three carbonation tests shall be carried out in each carriageway and evenly spaced intervals.

6 Report

6.1 A full factual report for all the findings shall be produced in accordance with the recommendations for testing given in MCHW Vol 1 S.5700. The reports shall include digital photographs including a general view of the bridge and views of any damaged concrete areas found during the inspection. An interpretive summary of the results shall also be included at

the end of each report. A pdf copy of each report shall be issued by the Contractor to the Project Manager.

Appendix 57/7: Requirements for Galvanic Anodes

1. Galvanic anodes shall have a minimum service life of 20 years.
2. Galvanic anodes shall be installed around the periphery of the repair at maximum 400mm centres in accordance with this specification and the manufacturer's recommendations.
3. Reference electrodes and monitoring equipment are not required for the concrete repair areas.
4. The requirement for galvanic anodes shall be instructed following concrete testing should it be required.
5. The galvanic anode system shall comprise of discrete anodes as below:

Galvashield® XPT (Type 1A anode)	Vector Corrosion Technologies 27a Upper High Street Cradley Heath Birmingham, UK B64 5HX T: +44 (0)1384 671 414
PatchGuard™ 175 (Type 1B anode)	1 Palmer Business Court Manor House Road Long Eaton NG10 1LZ T: +44 (0)1159 724 238

Equivalent materials and suppliers may be permitted subject to approval. The Contractor would need to demonstrate equivalent performance.