APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	SERIES 900 – ROAD PAVEMENTS – BITUMINOUS BOUND MATERIALS
	Bituminous Pavement Materials
	General
901SR	Bituminous pavement courses shall be made using the materials described in Table 9/23 and shall be laid in compliance with the Sector Scheme Document for the Laying of Asphalt Mixes, Sector Scheme 16, described in appendix A.
901.1SR	Prior to commencement of the Works the contractor shall inform the Project Manager of the sources of the constituent materials used in bituminous mixes and of any changes of material source during the Works. The Operating Compliance Level (OCL) A, B, or C, as per EN 13108-21:2016 shall be declared weekly followed by the maximum number of non compliant samples in any running 32 up to the time of declaration. The Contractor shall only use material supplied by coating plants that have a current OCL (as defined in the National Sector Scheme 14 for the Production of Asphalt Mixes) equating to no worse than 4 non-complying samples out of 32 provided that the plant has maintained a compliance level of 3 or less non complying samples in two of the previous four weeks. Not withstanding the above where non compliance with the Mean Deviation from Target, as defined in EN 13108-21:2016 occurs, the type, i.e. grading, filler content or binder content, of the Mean Deviation non compliance along with the Product Group(s) in which it has occurred shall be declared along with the OCL level as defined above. Where the non compliance with the Mean Deviation from the target occurs with regard to the Soluble Binder Content for the Group(s) <16mm this will count as the equivalent of 2 non-complying samples. Where it occurs on the Group(s) ≥ 16mm, it will count as 1 non-complying sample. For filler or grading Mean Deviation non-compliance, for any Group, will count as one non-complying sample.
	Aggregates for Bituminous Materials
901.2SR	Natural, recovered unbound and artificial aggregates shall be clean, hard and durable and shall comply with BS EN 13043. Where recycled coarse aggregate or recycled concrete aggregate is used in this Series, it shall have been tested in accordance with Clause 710 and the content of all foreign materials (including wood, plastic and metal) shall not exceed 1% by volume or by mass whichever is the greater. The use of limestone shall not be permitted in bituminous materials to be used as a surface course. If the aggregate for surface courses is obtained from more

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	than one source or consists of crushed rock of more than one type, then the minimum PSV for the aggregate from each source and of each type shall be as described in Table 9/23. Blending of aggregates to achieve the PSV level or the Effective PSV (ePSV) in asphalt surface courses or temporary running surfaces may be permitted with the approval of the Project Manager. Details shall be submitted for approval prior to use. **Resistance to Fragmentation (Hardness)** Irrespective of source, coarse aggregates for bituminous materials shall be considered suitable, unless otherwise stated in the Instruction, if: (i) the resistance to fragmentation of the coarse aggregate in accordance with clause 4.2.2 of BS EN 13043 has an LA_{30} or less for natural crushed and uncrushed aggregates and not more than LA_{50} for blast furnace slag; or (ii) crushed rock aggregate has a Los Angeles Value greater than 30 but less than 35, where evidence can be presented to the Project Manager of previous satisfactory use of the source in asphalt; (iii) recovered, unbound aggregates shall be natural and artificial aggregates recovered from a previous use in an unbound form and which meet the requirements of this Clause. **Resistance to Freezing and Thawing (Durability)** The resistance to freezing and thawing (soundness) of the coarse aggregate shall comply with BS EN 13043, clause 4.2.9.2, and shall have a value not greater than MS_{25}, or such higher value as may be required in the Instruction. Thereafter, except for blast furnace slag aggregate, the water absorption value of the coarse aggregate shall be determined in accordance with BS EN 13043, clause 4.2.9.1. If the water absorption value of the coarse aggregate is greater than $WA_{24}2$, the soundness test shall be carried out on the material delivered to site. **Cleanness** The fraction of material passing 0.063mm, for coarse and fine aggregates for bituminous materials, shall not exceed the limits stated in BSI PD 6691 Annex B, Annex C and Annex D, when tested in accordance with the washing and sieving method of BS EN 933-1. **Chemical Requirements** **Dicalcium Silicate Disintegration** Air-cooled blast furnace slag aggregates shall be free from iron dicalcium silicate disintegration when tested in accordance with BS EN 13043, clause 4.3.4.1. **Iron Disintegration** Air-cooled blast furnace slag aggregates shall be free from iron disintegration when tested in accordance with BS EN 13043, clause 4.4.4.2.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
	Volume Stability The volume expansion of steel slag shall not exceed V_{10} when tested in accordance with BS EN 13043, clause 4.3.4.3.
901.3SR	**Transporting** Hot bituminous materials shall be transported in clean fully insulated vehicles, unless otherwise agreed by the Project Manager, and shall be covered while in transit or awaiting tipping by double sheeting or "Easy Sheet"-type system. To facilitate discharge of the mixed materials, dust, coated dust, water or the minimum of liquid soap, vegetable oil, or other non-solvent solutions may be used on the interior of the vehicles. When a fluid coating is used then, prior to loading, the body shall be tipped to its fullest extent with the tailboard open to ensure drainage of any excess. The floor of the vehicle shall be free from adherent bituminous materials or other contaminants. Under no circumstances shall diesel or other bitumen solvent be used. Delivery vehicles shall not deposit any residual material (e.g. tailboard scrapings) on site, except in approved, clearly marked areas. Material for machine lay works shall be fully used within 4 hours of mixing at the coating plant. Material for hand lay works that is not likely to be fully used within two hours of mixing at the coating plant shall be transported in and used directly from a "hot box" type system. Notwithstanding this the temperature limits stated in BS 594987 shall be adhered to. The maximum time the material shall be allowed to stay in a "hot box" is 12 hours after which it shall be discarded. Prior to loading the "hot box" all unused material from previous loading shall be removed. On dual box systems care shall be taken to prevent cross contamination or intermixing of different materials. Thermostats on "hot box" type systems shall be fitted, set and maintained so as to ensure that the temperature shall not exceed 160°C.
901.4SR	**Laying** On each day, and at each location where hot bituminous material is laid, at least 100 tonnes from a plant approved by the Project Manager shall be placed before material from another approved plant is used. If the Contractor demonstrates that the materials from different plants are of equivalent quality, performance potential and possess equivalent laying and compaction characteristics and the colour differences are not significant this requirement can be waived.
901.5SR	Wherever practicable, bituminous materials shall be spread, levelled and tamped by a self-propelled paving machine, which may be equipped with an averaging beam. As soon as possible after arrival at site the materials shall be supplied continuously to the paver and laid without delay. The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously and it shall be so operated whenever practicable.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
901.6SR	The travel rate of the paver, and its method of operation, shall be adjusted to ensure an even and uniform flow of bituminous material across the screed, so that the material is free from dragging, tearing and segregation of the material.
901.7SR	Hot bituminous materials shall be laid in accordance with the requirements and recommendations for laying in BS 594987. Where there is no British or European standard for the particular material it shall be laid in accordance with the requirements and recommendations of BS 594987, subject also to the requirements of sub-Clauses 8 to 31 of this Clause. The minimum thickness of material laid in each paver pass shall be in accordance with BS 594987 or the full course thickness, where this is less than the specified minimum in BS 594987.
901.8SR	When laying binder course or surface course the paver shall be taken out of use when approaching an expansion joint of a structure. In laying the remainder of the pavement up to the joint, and the corresponding area beyond it by hand, the joint or joint cavity shall be kept clear of surfacing material.
901.9SR	With the exception of sand asphalt carpet, bituminous materials with a temperature greater than 125°C shall not be deposited on a bridge deck waterproofing system unless adequate precautions are taken to avoid heat damage in accordance with a good industry practice. A maximum temperature of 145°C is permitted for sand asphalt carpet.
901.10SR	Hand placing of bituminous materials shall only be permitted in the following circumstances: (i) For laying regulating courses or irregular shape and varying thickness. (ii) In confined spaces where it is impracticable for a paver to operate. (iii) For footways. (iv) At the approaches to expansion joints at bridges, viaducts or other structures. (v) For laying mastic asphalt in accordance with BS 594987 (vi) In individual areas not exceeding 30 square metres in area and not exceeding 1 metre in width, or with the approval of the Project Manager in individual areas not exceeding 50 square metres in area and not exceeding 2 metres in width.
901.11SR	Hand-raking of surface course material or the addition of such material by hand-spreading to the paved area, for adjustment of level, shall only be permitted in the following circumstances. (i) At the edges of the layers of material and at gullies, manholes and other ironwork. (ii) At the approaches to expansion joints at bridges, viaducts or other structures.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
901.12SR	Hand laid work shall conform with the requirements of this Clause except those relating to pavers. All work will be carried out so as to minimise segregation and cooling of the material
	Compaction
901.13SR	Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface level, regularity requirements and compaction to be achieved.
901.14SR	Compaction of bituminous materials shall commence as soon as the uncompacted material will near the effects of the rollers without undue displacement or surface cracking. Compaction should be substantially completed before the temperature falls below the minimum rolling temperatures stated in BS 594987. Rolling shall continue until all roller marks have been removed from the surface.
901.15SR	Compaction should be carried out using 8-10 tonnes deadweight smooth wheeled rollers having a width of roll not less than 450mm, or by multi-wheeled pneumatic-tyred rollers of equivalent mass. Surface course and binder course material shall be surface finished with a smooth-wheeled roller which may be a deadweight roller or a vibratory roller in non-vibrating mode.
901.16SR	Rollers are to be capable of achieving at least the standard of compaction of an 8-tonnes deadweight roller. Where compaction is to be determined in accordance with Clause 929, the requirements to prove the performance of rollers shall not apply. In such case the Contractor may use any plant to achieve the specified level of compaction and finish at temperatures above the minimum specified rolling temperature.
901.17SR	Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least half the width of the rear roll or, in the case of a pneumatic-tyred roller, at least the nominal width of one tyre.
901.18SR	Rollers shall not be permitted to park or stand on warm compacted materials.
901.19SR	Unless stated otherwise in the Instruction, the adequacy of compaction of bituminous materials shall be determined from the attained air void content of the laid material in accordance with Clause 970. Where specified in the Instruction, the design and compliance requirements for base and binder course asphalt concretes shall be in accordance with Clause 929. Vibratory rollers shall not be used. For works carried out at night or in other noise-sensitive situations the use of

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	oscillating rollers or those with similar low noise characteristics shall be used. The maximum noise level emitted by the equipment shall be no more than 85dba.
	Chippings
901.20SR	The application of coated chippings to areas of surface course shall be by a mechanical spreader capable of distributing chippings to an even rate of spread. Addition of chippings by hand operation shall only be permitted in the following circumstances: (i) In confined spaces, where it is impracticable for a chipping spreader to operate. (ii) As a temporary expedient, when adjustments have to be made to the spreader distribution mechanism. (iii) When hand laying of the surface course is permitted. (iv) To correct uneven distribution of chippings.
901.21SR	Chippings shall be applied uniformly and rolled into the surface so they are effectively held and provide the specified macrotexture depth.
	Joints
901.22SR	Except where otherwise specified in this Series, where longitudinal joints are made in surface courses, the material shall be fully compacted and the joint made flush in one of the following ways; only method (ii) shall be used for tranverse joints: (i) By using two or more pavers operating in echelon, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling. (ii) By cutting back the exposed joint, for a distance equal to at least the specified layer thickness, to a vertical face, free of segregated material. All loosened material shall be fully removed and discarded. The exposed vertical face shall be completely and evenly coated with a suitable hot bitumen, or cold-applied polymer modified intermediate or premium grade bitumen emulsion, or polymer modified adhesive bitumen strip with a minimum thickness of 2mm, before the adjacent width is laid. Only method (ii) is permitted on materials exhibiting segregation at the extremeties of the width laid.
901.23SR	All joints shall be offset at least 300mm from parallel joints in the layer beneath. Joints in the surface course or porous asphalt shall coincide with either the lane edge or the lane marking, whichever is appropriate. No joints shall be formed between a hardstrip and the edge of the carriageway, nor within a hardstrip. Longitudinal joints in materials subject to density testing procedures, e.g. air voids, shall not be situated in wheel-track zones.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
	General
901.24SR	All surfaces shall be treated with either a tack coat or a bond coat prior to overlay in accordance with Clause 920.
901.25SR	Bituminous material shall be kept clean and uncontaminated. Unless otherwise provided in sub-Clause 901.28 or otherwise agreed with the Project Manager the only traffic permitted to run on bituminous material to be overlaid shall be that engaged in laying and compacting the next course or, where a binder course is to be blinded or surface dressed, that engaged on such surface treatment. If the binder film on a bituminous surface onto which a bituminous course is to be laid becomes visibly worn or impregnated with dust as a result of additional trafficking, then the rate of application of tack or bond coat spray complying with Clause 920 shall be adjusted accordingly. Should any bituminous material become contaminated the Contractor shall make it good by cleaning it and, if this proves impracticable, by rectification in compliance with Clause 702.
901.26SR	Upper base material, in pavements without binder course, and binder course material shall not remain uncovered by either the surface course or surface treatment, whichever is specified in the Contract, for more than three consecutive days after being laid. With prior agreement with the Project Manager this period may be extended by the minimum amount of time necessary to allow for adverse weather conditions or for other reasons.
	Regulating Course
901.27SR	Regulating course material shall be made and laid in accordance with the requirements of Clause 907.
	Use of Surfaces by Traffic and Construction Plant
901.28SR	Where a bituminous layer, other than the surface course, is to be opened to highway traffic as a temporary running surface it shall either: (i) be surface dressed in accordance with Clause 919 using chippings being of category of not less than PSV_{50}, unless otherwise specified in the Instruction, or (ii) contain a coarse aggregate being of category of not less than PSV_{50} unless otherwise specified in the Instruction. In all cases “Slippery Road” warning signs shall also be used. Where an instruction is given by the Project Manager to traffic a bituminous layer, other than the surface course, due to the Contractor’s failure to perform then the Contractor will not be reimbursed any additional costs.
901.29SR	All temporary running surfaces shall be thoroughly cleaned and a tack or bond coat applied immediately prior to laying the succeeding course.
901.30SR	Tack coat or bond coat in accordance with Clause 920 shall be bitumen emulsion and shall be applied at a uniform rate of spread. The bitumen emulsion shall not be permitted to collect in any hollows and shall be allowed to

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	break before the next layer is placed.
901.31SR	Construction plant and traffic used on pavements under construction shall be suitable in relation to the material, condition and thickness of the courses it traverses so that damage is not caused to the subgrade or the pavement courses already constructed. The wheels or tracks of plant moving over the various pavement courses shall be kept free from deleterious materials.
901.32SR	**Bitumen** For the purpose of this Series, bitumen shall be specified as penetration reference, the target penetration of the grade is shown in Table 9/1.
902SR	**Reclaimed Bituminous Materials**
902.1SR	In the production of bituminous base and binder courses, including regulating courses, at least 10% of reclaimed bituminous materials shall be used. The maximum amount of reclaimed bituminous material permitted in hot mix materials shall be 50% in all layers other than the surface course. Larger quantities can be used in foam mix or emulsion mix materials subject to approval by the Project Manager and design in accordance with Clause 948. Up to 10% of reclaimed materials may be used in surface course mixes provided that the aggregate component is identified as being of equal or greater PSV as required in Table 9/23 and the Instruction. Other materials for recycling in bituminous mixtures shall only be used with the approval of the Project Manager. The mixed material shall comply with the requirements of this Series.
902.2SR	Reclaimed bituminous materials may be used in the production of bituminous surface course, binder course including binder and regulating course, and base. The maximum amount of reclaimed bituminous material permitted shall be 50% in all other layers other than the surface course. Up to 10% of reclaimed materials may be used in surface course mixes provided that the aggregate component is identified as being of equal or greater PSV as required in Table 9/23 and the Instruction. Other materials for recycling in bituminous mixtures shall only be used with the approval of the Project Manager. The mixed material shall comply with the requirements of this Series.
902.3SR	When the amount of reclaimed bituminous material comprises 10% by mass or less of the base or binder course, compliance with this Clause is not required. However, when it exceeds 10% by mass, the Contractor shall carry out trials to demonstrate that the mixed materials comply with the requirements of this Clause.
902.4SR	**Reclaimed Feedstock** All reclaimed material shall be pre-treated before use such that it is homogeneously mixed and the maximum particle size does not exceed 32mm.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
902.5SR	**Properties of Recovered Binder** For hot mix materials the binder shall be recovered from the mixture in accordance with the requirements of BS EN 12697 and tested in accordance with BS EN 1426 and BS EN 1427. The penetration value of the binder recovered from trials shall not be less than the minimum value specified in Table 9/2 nor greater than the upper limit of the specified grade in BS EN 12591 for the product being manufactured. The penetration index of the recovered binder shall be in the range –1.5 to +0.7, as defined in Annex B of BS EN 12591.
902.6SR	**Asphalt concrete Binder Course and Base** Trials shall be carried out in accordance with Clause 929. When the amount of reclaimed material in an asphalt concrete exceeds 25% by mass, the stiffness modulus of cores extracted from the compacted mixture shall not be less than the minimum value specified in Table 9/2.

TABLE 9/2: Minimum Penetration Value of Recovered Binder after Mixing and Minimum Stiffness Modulus of Asphalt concretes

Specified Grade of Binder[1] (Penetration Reference)	**Minimum Penetration Value of Recovered Binder after Mixing (x 0.1mm)**	**Minimum Stiffness Modulus of Asphalt concretes (GPa)**
35	20	3.7
50	25	2.5
85	35	1.5
125	50	0.7
Note 1. The added binder shall not have a penetration value greater than 220 x 0.1mm and shall not be more than 2 grades softer than the target grade.		

902.7SR	**Compliance and Frequency of Testing** Compliance shall be monitored either: (i) by sampling and testing from the permanent works at a frequency approved by the Project Manager or (ii) by periodic trials at a frequency approved by the Project Manager Trial areas in which the mixed material complies with the requirements of this Series may form part of the permanent works.
903SR	**Dense Asphalt concrete Base (Design Mixtures)**
903.1SR	Unless otherwise specified in the Instruction, designed dense asphalt concrete

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	base shall comply with Clause 929. Dense asphalt concrete base shall be produced in plants that are registered to the BS EN ISO 9001 'Sector Scheme for the Production of Asphalt Mixes' (Sector Scheme 14) described in Appendix A. It shall comply with PD 6691 for dense base mixtures, and with sub-Clauses 2 and 3 of this Clause and the requirements of Table 9/23.
903.2SR	**Filler** When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. When the coarse aggregate is gravel, 2% by mass of total aggregate of Portland cement or hydrated lime shall be added. The percentage of fine aggregate shall be reduced accordingly. Cement or lime is not required when limestone gravel is used as the coarse aggregate.
903.3SR	**Binder** Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 'Sector Scheme for the Supply of Paving Grade Binders', described in Appendix A. The penetration reference of the bitumen shall be 125pen or as described in the Instruction.
906SR	**Dense Asphalt Concrete Base and Binder Course with Paving Grade Bitumen (Recipe Mixtures)**
906.1SR	The dense base and binder course asphalt concretes shall be one of the materials given in Table 9/3. They shall comply with PD 6691 for the appropriate material and with this Clause and shall be as specified in Table 9/23.
906.2SR	All materials shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes" (Sector Scheme 14), described in Appendix A.
906.3SR	**Filler** When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. When the coarse aggregate is gravel, 2% by mass of total aggregate of Portland cement or hydrated lime shall be added and the percentage of fine aggregate reduced accordingly. Cement or hydrated lime is not required when limestone gravel is used as the coarse aggregate.
906.4SR	**Binder** Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 "Section Scheme for the Supply of Paving Grade Binders", described in Appendix A. The penetration reference of the bitumen shall be as stated in Table 9/3.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
907SR	**Regulating Course**
907.1SR	Regulating courses shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes" (Sector Scheme 14), described in Appendix A. They shall be in accordance with sub-Clauses 2, 3, 4 and 5 of this Clause and the requirements of Table 9/23.
907.2SR	Regulating courses, which may consist of one or more layers of a bituminous material, shall have their finished surfaces laid to achieve the appropriate tolerances for horizontal alignments, surface levels and surface regularity, for pavement layers, in accordance with Clause 702.

TABLE 9/3: Summary of Recipe Dense Base and Binder Course Asphalt concretes				
Brief Title	**Course**	**Full Name**	**Grading Range (mm)**	**Binder Penetration Reference**
AC 32 dense base 40/60	Base	asphalt concrete 32 dense base 40/60 EN13108-1	32	40/60
AC 32 dense base 70/100	Base	asphalt concrete 32 dense base 70/100 EN13108-1	32	70/100
AC 32 dense base 100/150	Base	asphalt concrete 32 dense base 100/150 EN13108-1	32	100/150
AC 32	Binder	asphalt concrete 32 dense binder course	32	40/60*

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

dense bin 40/60*		40/60 EN13108-1*		
AC 20 dense bin 40/60	Binder	asphalt concrete 20 dense binder course 40/60 EN13108-1	20	40/60
AC 20 dense bin 70/100	Binder	asphalt concrete 20 dense binder course 70/100 EN13108-1	20	70/100
AC 20 dense bin 100/150	Binder	asphalt concrete 20 dense binder course 100/150 EN13108-1	20	100/150
* May also be made with bitumen of penetration grade 70/100 & 100/150 and these large nominal size mixes should only be used on advice from the Materials Laboratory.				

907.3SR	Unless otherwise described in the Instruction, stone mastic asphalt complying with Clause 937, or base or binder course asphalt concrete complying with Clause 929 or hot rolled asphalt complying with Clause 943, shall be used for regulating courses immediately below surface courses. Bituminous materials for regulating courses shall meet the requirements for the appropriate material, as specified above.
907.4SR	Where the total depth of a regulating course exceeds 150mm then the course shall be laid so that each regulating layer has a compacted thickness of between 75mm and 150mm. For thicknesses in excess of 45mm dense bitumen asphalt concrete shall be used. The nominal size shall be chosen so as to meet the recommendations in BS 594987.
907.5SR	**Binder** Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A.
909SR	**Dense Asphalt Concrete Surface Course (6mm) (Recipe Mixtures)**
909.1SR	Dense asphalt concrete surface course shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes" (Sector Scheme 14), described in Appendix A. It shall comply with PD 6691 for dense surface course mixtures, and with this Clause and the requirements of Table 9/23.
909.2SR	The traffic category shall be "A" unless otherwise stated in the Instruction.
909.3SR	**Coarse Aggregate** The resistance to polishing of coarse aggregate shall have the minimum declared PSV category specified in the Instruction in accordance with BS EN 13043, clause 4.2.3. The resistance to abrasion of coarse aggregate shall have

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	maximum AAV specified in Table 9/23 in accordance with BS EN 13043, clause 4.2.4.
	Binder
909.4SR	Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A. The penetration reference of the bitumen shall comply with PD 6691 and shall be as specified in Table 9/23 and the Instruction.
	Filler
909.5SR	When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. When the coarse aggregate is gravel, 2% by mass of total aggregate of Portland cement or hydrated lime shall be added and the percentage of fine aggregate reduced accordingly.
910SR	**Rolled Asphalt Surface Course (Recipe Mixture)**
910.1SR	Rolled asphalt surface course shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes" (Sector Scheme 14), described in Appendix A. It shall comply with PD 6691 for surface course recipe mixtures, and with sub-Clauses 2, 3 and 4 of this Clause, and the requirements of Table 9/23.
	Binder
910.2SR	Bitumen shall comply with the requirements of BS EN 12591, and shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A. The penetration reference of the bitumen shall comply with Table 9/1 and shall be as specified in the Instruction.
	Coarse Aggregate
910.3SR	The resistance to polishing of coarse aggregate shall be category PSV_{45} as defined in BS EN 13043, clause 4.2.3. Coarse aggregate content by mass of the total mix shall be as described in Table 9/23.
	Coated Chippings
910.4SR	Coated chippings size and grading category shall be 14/20mm G_c85/20 or, if so instructed in the Instruction, 8/14mm G_c85/15 size in BS EN 13043 as described in Table 9/23 and shall comply with Clause 915.
911SR	**Rolled Asphalt Surface Course (Design Mixture)**
911.1SR	Rolled asphalt surface course shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes"

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	(Sector Scheme 14), described in Appendix A. It shall be designed in accordance with the procedures of PD 6692 and shall comply with PD 6691-1 for surface course design mixtures, and with sub-Clauses 2 to 8 of this Clause, and the requirements of Table 9/23. The design mixture selected by the Contractor shall be notified to the Project Manager prior to its use in the Works.
	Binder
911.2SR	Bitumen shall comply with the requirements of BS EN 12591 and shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A. The penetration reference of the bitumen shall comply with Table 9/1 and shall be as specified in Table 9/23. The binder data required in Table 9/23 shall be provided to the Project Manager.
	Coarse Aggregate
911.3SR	The resistance to polishing of the coarse aggregate shall be category PSV_{45} as defined in BS EN 13043, clause 4.2.3. Coarse aggregate content by mass of the total mix shall be as described in Table 9/23.
	Marshall Stability and Flow
911.4SR	The Marshall stability and flow for the complete mixture at the target binder content, determined in accordance with the procedures of PD 6692, shall be as described in Table 9/23.
	Verification
911.5SR	Verification of the design proposal shall be carried out using materials obtained from the plant before manufacture of the surface course commences. Stability and flow values shall be determined at the proposed target binder content.
911.6SR	The results of design verification for stability shall fall within 2kN of the design proposal. Additionally, the stability shall be not more than 0.5kN below the lower range value described in Table 9/23. The flow value obtained shall not exceed that stated in PD 6691-1. The target binder content determined on verification shall be not less than the specified minimum value given in PD 6691-1.
	Composition
911.7SR	When determined in accordance with the procedures of PD 6692, the composition of the plant mixture shall comply with the requirements for the surface course design mix. The nature and source of the coarse and fine aggregate may be changed only if the mix is redesigned and agreed by the Project Manager prior to its use in the Works. With the agreement of the Project Manager the source of the filler may be varied provided its characteristics remain essentially the same.
	Coated Chippings
911.8SR	Coated chippings size shall be either 14/20mm G_c85/20 or, if so instructed in the Instruction, 8/14mm G_c85/15 size in BS EN 13043 as described in Table 9/23, the Instruction and shall comply with Clause 915.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
912SR	**Close Graded Asphalt Concrete Surface Course (Recipe Mixture)**
912.1SR	Close graded asphalt concrete surface course shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes" (Sector Scheme 14), described in Appendix A. It shall comply with PD 6691, and the requirements of Table 9/23.
912.2SR	The traffic category shall be "A" unless otherwise stated in the Instruction.
912.3SR	**Coarse Aggregate** The resistance to polishing of the coarse aggregate shall have a minimum declared PSV category specified in Instruction in accordance with BS EN 13043, clause 4.2.3. The resistance to abrasion of coarse aggregate shall have a maximum AAV specified in Table 9/23 in accordance with BS EN 13043, clause 4.2.4.
912.4SR	**Binder** Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A. The penetration reference of the bitumen shall comply with PD 6691 and shall be as specified in Table 9/23 and Instruction.
912.5SR	**Filler** When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. When the coarse aggregate is gravel, 2% by mass of total aggregate of Portland cement or hydrated lime shall be added and the percentage of fine aggregate reduced accordingly.
915SR	**Coated Chippings for Application to Pre-mixed Surfacings**
915.1SR	The chippings and the manner of coating, when used for rolling into the surface of rolled asphalt shall be in accordance with PD 6691-1, except size and grading shall be in accordance with sub-Clause 2 of this Clause.
915.2SR	The size of the chippings shall be 14/20mm G_c85/20, or 8/14mm G_c85/15, or 6.3/10mm G_c85/20 in BS EN 13043. The chipping size selected shall be as described in Table 9/23 and Instruction.
915.3SR	The resistance to polishing of coarse aggregate shall have the minimum declared PSV category specified in Table 9/23 and Instruction in accordance with BS EN 13043, clause 4.2.3. The resistance to abrasion of coarse aggregate shall have maximum AAV specified in Table 9/23 in accordance with BS EN 13043, clause 4.2.4. The shape of the chippings shall comply with category FI_{20} as defined in BS EN 13043, clause 4.1.6.
915.4SR	The aggregate shall be deemed to comply if the mean of the 3 most recent

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	consecutive results from tests relating to the material to be supplied, carried out within the previous 6 months by testing by an appropriate organisation accredited in accordance with sub-Clauses 105.3 and 105.4 for those tests, within 6 weeks of sampling, complies with the declared categories specified in Table 9/23.
920SR	**Bond Coats, Tack Coats and other Bituminous Sprays**
920.1SR	The bond or tack coats required for thin surfacing systems and their application shall be in accordance with the British Board of Agrément HAPAS Roads and Bridges Certificate for each system. All other bond coats, tack coats and bituminous sprays shall comply with sub-Clauses 2 to 12 of this Clause.
	Bond Coats
920.2SR	Bond coats shall be applied to all surfaces to be overlaid with SMA surface course. The bond coat shall be premium grade and have proven low tack properties, e.g. Nynas' Gripclean, so as to not adhere to the tyres of the paver, delivery vehicles, etc. 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 not be used without the approval of the Project Manager.
	Tack Coats
920.3SR	Tack coats shall be applied between base and binder course layers and between binder course and coated asphalt concrete (asphaltic concrete) surface course and shall be bitumen emulsions complying with BS 434-1. Tack coats for hot rolled asphalt and coated asphalt concrete shall be in accordance with PD 6691-2 and BS 594987:2015 respectively.
	Bituminous Sprays
920.4SR	Bituminous sprays used to facilitate sealing and curing shall consist of either bitumen emulsion to BS 434-1; cutback bitumen to BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A; or modified bituminous products with a British Board of Agrément HAPAS Roads and bridges Certificate. In the event that no such certificates have been issued, modified bituminous products shall not be used without the approval of the Project Manager.
	Manufacture and Product Data
920.5SR	Bond coats, tack coats and bituminous sprays shall be manufactured in plants operating under a system conforming to the requirements of BS EN ISO 9001. The Contractor shall complete the binder data sheet specified in Appendix 9/2 (following this Series) and supply a copy to the Project Manager prior to the first application of the product for each type or whenever the details change.
	Preparation
920.6SR	Any limitations on area availability and timing or other constraints for the work

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	shall be as specified in the Instruction. Before spraying is commenced, the surface shall be clean free of all loose material and standing water. Surface preparation shall be carried out in accordance with PD 6691-2, or BS 594987 as appropriate, or for certified products, in accordance with the BBS/HAPAS Certificate. Unless otherwise instructed in the Instruction, street furniture, ironwork and drop-kerbs shall be masked using self-adhesive masking material before application starts and removed prior to the completion of the works.
920.7SR	**Application** Application shall be by metered mechanical spraying equipment, spray tanker or spraying device integral with the paving machine. The spraying equipment used shall not cause permanent deformation in the surface. Bond coats and tack coats shall be sprayed onto an existing surface prior to overlay in accordance with Clause 901. For small or inaccessible areas, application may be by hand held sprayer with the agreement of the Project Manager. Areas treated with tack or bind coat shall not be opened to traffic without the permission of the Project Manager.
920.8SR	**Rate of Spread** The target rates of spread of bond coats or tack coats below hot rolled asphalt and coated asphalt concrete shall be as recommended in Tables 1 to 5 in PD 6691-2 and BS 594987 respectively, unless otherwise agreed with the Project Manager. For other applications, unmodified bitumen emulsions shall be sprayed at the rate of spread specified in BS 434-2 or as otherwise stated in the Instruction. Proprietary materials shall be sprayed at the rate set out in the British Board of Agrément HAPAS Roads and bridges Certificate for each product.
920.9SR	**Accuracy of Application** Spray application shall be uniform. Before spraying begins, the Contractor shall provide the Project Manager with a test certificate showing the results for rate of spread and accuracy of spread. These tests shall be carried out in accordance with BS EN 12272-1 either by an appropriate organisation, accredited in accordance with sub-Clauses 105.3 and 105.4 for those tests, or by the Contractor where this forms part of his Quality Plan. The certificate shall demonstrate that the spraying device has been tested, using the product to be used in the Contract, not more than six months before commencement of the work. The tolerance on the specified rate of spread shall not exceed ±10% and the coefficient of variation of the transverse distribution shall not exceed 15%. During the works the Contractor shall repeat the tests for rate of spread and accuracy of application at a minimum frequency of 6 monthly or when problems are noted on site or when instructed by the Project Manager. The results shall be reported verbally to the Project Manager within 24 hours of carrying out a test and in writing within 7 days. Where application is by hand held sprayer, the rate of spread shall be measured by calculating the volume applied per square metre and evenness shall be visually assessed.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	Joints
920.10SR	There shall be no bare strips or areas having less than the minimum permitted rate of spread. Transverse joints shall have an overlap not wider than 300mm. Longitudinal joints shall have an overlap to ensure that the minimum permitted rate of spread is achieved across the joint. For quartering (using part of the spray bar) the longitudinal joint overlap width may be extended to a maximum of 300mm. Paver integral sprayers shall provide a wet edge to ensure spray overlap under adjacent overlays such that the minimum permitted rate of spread is achieved across the longitudinal joint. Where the longitudinal spray overlap causes the effective rate of spread to be increased by more than 50% of the specified rate then the width of overlap shall not be greater than 100mm and shall be outside the location of the wheel tracks for the lane.
	Overlaying Bituminous Surfaces
920.11SR	All bituminous surfaces shall be treated with either a tack coat or a bond coat prior to overlay. The use of tack coat or bond coat beneath all bituminous layers shall be as stated in the Instruction.
	Overlaying Concrete Surfaces
920.12SR	The Contractor shall submit evidence of the suitability of the bond or tack coats he intends to use when overlaying concrete surfaces to the Project Manager prior to the commencement of the work.
	Blinding Material
920.13SR	Where required, blinding material shall consist of hard clean crushed fine aggregate or slag, fine aggregate or sand containing not more than 15% retained on a 6.3mm sieve. It shall be broadcast over the sprayed areas and left unrolled. Blinding used on cementitious materials shall be light in colour to minimise solar gain. All loose material on a sprayed surface including non-adhered blinding material shall be removed prior to the application of an overlay.
	Prevention of Binder Pickup
920.14SR	Where required, chippings to prevent bon coat binder pickup on vehicle tyres shall consist of hard clean aggregate 2/4mm or 2/6mm G_C 85/35. The rate of application of aggregate shall be the minimum necessary and shall be distributed by metered mechanical means. Bond coat shall be visible after aggregate application to ensure bond is achieved.
921SR	**Surface Macrotexture of Bituminous Surface Courses on High Speed Roads**
921.1SRS	The average depth of pavement surface macrotexture of bituminous surface course shall be measured using a volumetric patch technique described in BS EN 13036-1.
921.2SR	If a macrotexture depth is required, it shall be requested in the Instruction and the average macrotexture depth of each 1,000 metres section of carriageway lane, or the complete carriageway lane where this is less than 1,000 metres,

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	shall not be less than 1.5mm. The average of each set of 10 individual measurements shall not be less than 1.2mm.
923SR	**Binder Recovery using the Rapid Recovery Test (RRT) and Accelerated Ageing using the Modified Ageing Rolling Thin Film Oven Test (RTFOT)**
923.1SR	This Clause specifies the procedure for obtaining a quantity of "Recovered Binder" from modified or unmodified cutback or emulsion binder (Rapid Recovery Test – RRT) and an extended procedure for obtaining a quantity of "Aged Binder" (Modified Ageing Rolling thin Film Oven Test). "Aged Binder" may be prepared directly from "Recovered Binder" or from other binder samples. Binders used to manufacture hot mix asphalt are first subjected to a "short term ageing test" (RTFOT) to stimulate the effects of manufacture, transport and laying. The Modified Ageing RTFOT is suitable for all bituminous binders and rapidly provides homogeneous samples at different ages so that a plot of a relevant characteristic with ageing may be generated. For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
924SR	**High Friction Surfaces**
924.1SR	High friction surfacing systems shall have current British Board of Agrément HAPAS Roads and Bridges Certificates.
924.2SR	A high friction surfacing system with a current British Board of Agrément HAPAS Roads and Bridges Certificate shall only be installed by a Contractor approved by the BBA and the Certificate Holder as an Approved Installer for that system.
924.3SR	The high friction surfacing system BBA/HAPAS Type Classification required for each location shall be Type 1 comprising a two-component epoxy binder and a graded (1mm to 3mm) calcined bauxite aggregate. If so instructed in the Instruction the binder shall be a two-component bitumen extended epoxy binder.
924.4SR	**Aggregate** Aggregate used in high friction surfacing systems shall have a minimum declared PSV category of 70 in accordance with BS EN 13043, clause 4.2.3. The Contractor shall provide, before work commences, test certificates, issued by an appropriate organisation accredited in accordance with sub-clauses 105.3 and 105.4 for those tests, not more than six months previously, showing conformity with the requirements.
924.5SR	**Installation and Quality Control Procedures** The installation and quality control procedures shall be in accordance with the

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	British Board of Agrément HAPAS Roads and Bridges Certificate for each system and the current method statement agreed by the BBA. The results of all quality control checks carried out on site by the Contractor and quality assurance information compiled in accordance with the requirements of the Certificate, including results from BBA surveillance visits, shall be made available to the Project Manager on request.
924.6SR	**System Coverage** For each location where high friction surfacing is applied, the total quantities of each system component used, the measured area of the surface treated and the calculated coverage rate in kg/m² shall be reported to the Project Manager within three days of completion at that location. For systems in which aggregate is broadcast over a film of binder applied to the surface, the calculated coverage rate shall be that of the binder film and shall not include the mass of the aggregate.
924.7SR	**Guarantee** The Contractor shall guarantee the high friction surfacing materials and workmanship for a period of two years from the date of opening the surfacing to traffic. This guarantee shall exclude defects arising from damage caused by settlement, subsidence or failure of the carriageway on which the surfacing has been applied, but shall cover failure to meet the minimum requirements set out in Table 4 of the BBA/HAPAS "Guidelines Document for the Assessment and Certification of High Friction Surfaces for Highways".
928SR	**Determination of the Complex Shear (Stiffness) Modulus (G*) and Phase Angle (δ) of Bituminous Binders using a Dynamic Shear Rheometer (DSR)**
928.1SR	This Clause describes the test method for the determination of the Complex Shear (Stiffness) Modulus (G*) and Phase Angle (δ) of a bituminous binder over a range of temperatures and frequencies when tested in harmonic, sinusoidal oscillatory shear mode using a dynamic shear rheometer (DSR) with parallel plate test geometry and where both plates are controlled at the same temperature. For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
929SR	**Dense Bitumen Asphalt concrete Base and Binder Course (Design Mixtures)**
929.1SR	The designed dense base and binder course asphalt concretes shall be one of the materials given in Table 9/8. They shall comply with PD 6691 for the appropriate material and with this Clause and shall be as specified in Table 9/23.
929.2SR	All materials shall be produced in plants that are registered to the BS EN ISO 9001 "Sector Scheme for the Production of Asphalt Mixes" (Sector Scheme 14),

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay

	described in Appendix A. Where the contractor can demonstrate that a previous Job Mixture Approval Trial is relevant to the proposed material then details shall be forwarded to the Project Manager at least 7 days prior to the intended use date of the material.

TABLE 9/8: Summary of Design Mix for Dense Base and Binder Course Asphalt concretes

Brief Title	Course	Full Name	Grading Range mm	Binder Penetration Reference
HDM50	Base	Heavy duty asphalt concrete base	0/32	50
DBM50	Base	Dense bitumen asphalt concrete base	0/32	50
HMB35	Base	High modulus base	0/32	35
HDM50	Binder	Heavy duty asphalt concrete binder course	0/20 or 0/32	50
DBM50	Binder	Dense bitumen asphalt concrete binder course	0/20 or 0/32	50
HMb35	Binder	High modulus binder course	0/20 or 0/32	35

	Filler
929.3SR	When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. When the coarse aggregate is gravel, 2% by mass of total aggregate of Portland cement or hydrated lime shall be added and the percentage of fine aggregate reduced accordingly. Cement or hydrated lime is not required when limestone gravel is used as the coarse aggregate.
	Binder
929.4SR	Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 “Sector Scheme for the Supply of Paving Grade Binders”, described in appendix A. The penetration reference of the bitumen shall be as stated in Table 9/8. The binder data required by Table 9/23 shall be supplied to the Project Manager.
929.5SR	The Contractor shall nominate a target aggregate grading and target binder content for his proposed mixture which shall fall within the limits of the appropriate table within PD 6691, for Group one or for Group two dense mixtures and comply with the appropriate Clause within this Specification. Additionally, for HDM mixtures, the target percentage of aggregate passing the 0.063mm sieve shall not be less than 7.0%. For compliance purposes the binder content and aggregate grading limits shall be those obtained by applying the tolerances stated in Table 9/9 to the target binder content and target aggregate grading. The aggregate grading curve shall be smooth and continuous and shall not vary from the low limit on one size of sieve to the high limit on the adjacent sieve size or vice-versa.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
929.6SR	The compaction of base and binder course asphalt concretes during the approval stage shall be assessed by measurement of: (i) in situ and refusal air void contents of cores subjected to the Percentage Refusal Density (PRD) test procedure carried out in accordance with PD 6692; and (ii) in situ density using a nuclear density gauge. Once a mix is approved compaction compliance shall be assessed by the in-situ air voids test.
929.7SR	**Job Mixture Approval Trial** At least three days before a designed material from each source of asphalt concrete is first laid, the Contractor shall carry out a trial to demonstrate compaction plant and rolling procedures. Subject to the agreement of the Project Manager the trial may be carried out off site. The trial area shall be not less than 30metres nor more than 60metres long and of a width and thickness required in the Contract. If the trial is carried out on site and complies with this specification then it may form part of the Permanent Works. The materials, mixing and laying plant proposed for the Works shall be used for the trial.
929.8SR	During the laying of the trial area, two samples of loose mixture shall be taken at three evenly spaces locations along the trial length, in accordance with BS 598-100, six samples in total. The maximum density of one sample of mixture from each location shall be determined in accordance with BS EN 12697-5. The average value of maximum density ρ_{Max} expressed in MG/m³ shall then be used for subsequent calculation of the air void content of the compacted mixture. The remaining samples shall be analysed to determine their composition in accordance with PD 6692.
929.9SR	At three locations, four nominal 150mm diameter cores shall be taken using a suitable coring machine, in accordance with BS 598-100, twelve cores in total. Two of the locations shall be from the wheel-track zones of the completed traffic lane, the third location shall be agreed by the Project Manager. For the purposes of this Clause the wheel-track zone shall be taken to be between 0.5 metres and 1.1 metres and between 2.55 metres and 3.15 metres from the centre of the nearside lane markings for each traffic lane. Two cores from each location shall be tested using the PRD test procedure in accordance with sub-clause 2 of this Clause.
929.10SR	At or adjacent to the location of the cores, the density of the asphalt concrete shall be measured using a nuclear density gauge and the results correlated with the in situ air void contents determined in accordance with sub-Clause 11 of this Clause.
929.11SR	The air void contents of each core subjected to the PRD test procedure shall be determined, as follows:

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	(i) the in situ air void content shall be calculated using as the bulk density ρ, the initial dried bulk density determined in accordance with PD 6692, and expressed in Mg/m³; (ii) the refusal air void content shall be calculated using as the bulk density ρ, the refusal density determined in accordance with PD 6692, and expressed in MG/m³. The air void contents shall be calculated to ± 0.1 per cent as follows: Air voids content = $(1-\frac{\rho}{\rho_{Max}})\times 100\ \%$ where: ρ is the bulk density in accordance with PD 6692 (Mg/m³); and ρ_{Max} is the maximum density in accordance with BS EN 12697-5 (MG/m³).
929.12SR	The percentage binder volume B_{vol} shall be calculated for each location in accordance with the following expression: $B_{Vol} = B_{Mass} \times (\rho/\rho_b)$ where: B_{Mass} is the target binder content by mass added at the mixer expressed as a percentage of the total mixture. ρ is the average initial dried bulk density of asphalt concrete at each location determined from the pair of cores subjected to the PRD test procedure. ρ_b is the density of the binder at 25°C.
929.13SR	The remaining pair of cores from each location shall be used for the measurement of Stiffness Modulus and Deformation Resistance, as follows: (i) The in situ air void content of each core shall be calculated from the equation given in sub-Clause 929.11, using the dried bulk density ρ determined in accordance with PD 6692 and the maximum density ρ_{Max} determined in accordance with sub-Clause 929.8. (ii) Each core shall be tested for Stiffness Modulus in accordance with DD 213:1993. (iii) Following the determination of Stiffness Modulus, one core from each location shall be tested for Deformation Resistance in accordance with DD 226:1996, and the other core shall be tested similarly except that the DD 226:1996 test procedure shall be modified in accordance with TRL Paper PA 3287/97.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

	Within 28 days copies of the test sheets and results for stiffness modulus and deformation resistance measured for each core shall be supplied to the Project Manager. Additionally if the trial area is on site, the exact location of the cores, their dried bulk densities, in situ air contents, the composition of the mixture determined using the methods specified in PD 6692 and the percentage binder volume determined in accordance with sub-Clause 929.11 shall be reported. No limits are specified for the Stiffness Modulus, except for materials complying with Clause 902, or 944; or for Deformation Resistance.

TABLE 9/9: Tolerances for Aggregate Grading and Binder content to be Applied to the Agreed Grading and Binder Content

Test Sieve (mm)	**Tolerance for aggregate grading in percent by mass of aggregate passing test sieve**	
	32mm base/binder course	**20mm binder course**
63	±0	
10	±0	
31.5	±10*	±0
20	±12	±5
14	±12	±10
10	-	±10
6.3	±8	±8
2	±7	±7
0.25	±6	±6
0.063	±3.5	±3.5
0.063 (HDM)	±2	±2
Binder Content	±0.6	±0.6

Note: Application of the above tolerances to the agreed aggregate grading and binder content may result in limits outside those permitted by the appropriate table in PD 6691. Provided the target grading and target binder content of the mixture proposed for use, and agreed after trials, are within the limits contained in PD 6691, then the limits obtained by applying the above table shall prevail over those implied in PD 6691.

*The upper limit may be less than +5% (or +10%), depending on the agreed aggregate grading.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
929.14SR	The trial area shall be acceptable if the mixture complies with sub-Clause 15 of this Clause. If the trial area fails to comply with the requirements of sub-Clause 15 and was intended to form part of the Permanent works, it shall be removed. In the event that the trial area fails to comply, the Contractor may nominate an alternative target aggregate grading and target binder content and the trial shall be repeated until compliance has been demonstrated. The target aggregate grading and target binder content of the complying mixture shall be used in the Permanent Works.
929.15SR	**Compliance Requirements** (i) The average value of in situ air void content of the pair of core samples from each location to be subjected to the PRD testing procedure shall not exceed 7%; (ii) The average air void content at refusal density of the core samples subjected to the PRD testing procedure shall be not less than 0.5%; and (iii) The minimum binder volume at each location shall be as stated in Table 9/10. When the void content determined in (i) exceeds 6.0% the binder aggregate combination shall be tested in accordance with Clause 953 and the results reported to the Project Manager for information. (iv) The compositional analysis of aggregate grading and binder content carried out in accordance with PD 6692 shall demonstrate compliance with the requirements set out in sub-Clauses 929.1 and 929.5. (v) The horizontal alignments, surface levels and surface regularity of the finished surface shall comply with Clause 702.

TABLE 9/10: Aggregate Size and Minimum Binder Volume	
Mixture Size/Designation Size (mm)	**Minimum Binder Volume (%) of the Total Volume of the Mixture**
0/32	8
0/20	9.4

929.16SR	**Sampling and Testing from the Permanent Works** The compaction of asphalt concretes laid in the Permanent Works shall be assessed by determination of: (i) in situ air void content calculated from in situ density measured using a nuclear density gauge; and (ii) in situ and refusal air void contents of pairs of cores taken every 500 lane metres and subjected to the Percentage Refusal Density (PRD) test

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	procedure carried out in accordance with PD 6692.
929.17SR	The compaction of base and binder course asphalt concretes shall be continuously assessed using the nuclear density gauge with readings taken at 20 metre intervals in alternate wheel-tracks, commencing with readings at a location from which a pair of cores is to be extracted. Additional readings shall be taken 300mm from the edge of the mat adjacent to each core location. The Contractor shall take corrective action as is necessary whilst the material is still above the minimum rolling temperature specified in BS 594987 if low densities are indicated at the time of laying.
929.18SR	Initially the calibrations of the nuclear density gauges established in accordance with sub-clause 10 of this Clause shall be used. When results are available from loose samples and pairs of cores taken every 500 lane metres, each gauge shall be re-calibrated if the density measured by that gauge and the density of the cores show a different bias. Each gauge used shall be individually calibrated.
929.19SR	For material from each mixing plant, a pair of nominal 150mm diameter cores shall be taken every 500 lane metres laid, one core from each wheel-track zone of the completed carriageway as defined in sub-Clause 929.9. Cores shall be extracted using a suitable coring machine, in accordance with BS 598-100. Each core shall be subjected to the PRD test procedure carried out in accordance with PD 6692, and the air void contents shall be determined in accordance with sub-Clause 929.11 using the maximum density ρ_{Max} expressed in Mg/m³ determined in accordance with sub-clause 929.20.
929.20SR	Samples of uncompacted material shall be taken from the paver augers in accordance with BS 598-100, clause 6.3, as near to each location from which cores are to be taken as is practicable and: (i) The maximum density of a sample of the mixture shall be measured in accordance with BS EN 12697-5. The value of maximum density so determined, ρ_{Max} expressed in Mg/m³, shall be used for the subsequent calculation of the air void contents of the compacted mixture at that location. (ii) The compositional analysis of a sample shall be carried out to determine the aggregate grading and binder content in accordance with PD 6692.
929.21SR	Each core extracted shall be examined for evidence of excessive voids below the depth to which the nuclear density gauge penetrates. If excessive voids are observed, further cores shall be taken to determine its extent.
929.22SR	Each layer of asphalt concrete shall be sampled and tested separately. Where Separate coring of each layer would unreasonably delay placing a second layer, subject to the approval of the Project Manager, both layers may be cored together and the resulting core split prior to testing.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
929.23SR	Cores shall be extracted without the use of excessive force. Cores shall not be taken until the material has cooled to a temperature of 40°C or less at mid-depth of the course to be cored. The walls and base of all holes from which core samples have been cut shall be dried and painted with hot bituminous binder or cold applied polymer modified intermediate or premium grade bitumen emulsion immediately prior to making good. Core holes shall be backfilled with dense bitumen asphalt concrete in accordance with PD 6691, or with approved cold-lay dense bitumen asphalt concrete. Dense bitumen asphalt concrete incorporating fluxed binder shall not be used. The backfill material shall be compacted to refusal in layers not exceeding 75mm. Where cores have been cut through the surface course, the last layer of backfill material shall comply with the specification for the surface course unless otherwise agreed with the Project Manager.
929.24SR	Two copies of the final nuclear density test results obtained and their correlation with in situ air void contents shall be passed to the Project Manager within 24 hours.
	Compliance Requirements for the Permanent Works
929.25SR	For material from each mixing plant: (i) The average in situ air void content calculated from any six consecutive nuclear density readings shall not exceed 7%. If the in situ air void content exceeds the limit specified, then a pair of cores shall be taken at that location and the in situ air void contents determined. If the average in situ air void content of the pair of cores also exceeds 7%, then the defective length shall be removed and replaced such that compliance is re-established. Lengths of not less than 15 linear metres shall be removed and replaced, unless otherwise agreed by the Project Manager. (ii) The average in situ air void content of each pair of cores taken every 500 lane-metres shall not exceed 7% in binder course or base. If the average in situ air void content of a pair of cores exceeds the limit specified, then density readings with the nuclear gauge and if necessary further cores, shall be taken to determine the extent of the defective area to be removed. Lengths of not less than 15 linear metres shall be removed and replaced unless otherwise agreed by the Project Manager. (iii) The average values of air void content at refusal density of pairs of cores taken every 500 lane-metres and subjected to the PRD testing procedure shall be reported. If the average air void content at refusal of any three consecutive pairs of cores falls below 0.5% the Contractor shall cease laying. The Contractor shall nominated an alternative target aggregate grading and target binder content and a further Job Mixture Approval trial shall be carried out in accordance with this Clause. Laying shall not recommence in the Permanent Works until compliance has been demonstrated.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
	(iv) The compositional analyses of aggregate grading and binder content carried out in accordance with PD 6692 shall demonstrate compliance with the requirements set out in sub-Clauses 929.1 and 929.5. (v) The horizontal alignments, surface levels and surface regularity of the finished surface shall comply with Clause 702. When the void content determined in (i) and (ii) exceeds 6.0% the binder aggregate combination shall be tested in accordance with Clause 953 and the result reported to the Project Manager for information.
929.26SR	**Binder Course Asphalt concretes Below Porous Asphalt Surface Course** Binder course asphalt concretes below porous asphalt shall comply with sub-Clauses 1 to 25 of this Clause except that every third pair of cores from the Permanent Works shall be taken across a longitudinal or transverse joint as agreed by the Project Manager.
931SR	**Heavy Duty Asphalt concrete Base and Binder Course Asphalt concretes with Paving Grade Bitumen (Recipe Mixtures)**
931.1SR	The heavy duty asphalt concrete base and binder course asphalt concretes shall be one of the materials given in Table 9/11. They shall comply with PD 6691 for the appropriate material and with this Clause and shall be as specified in the Instruction.
931.2SR	All materials shall be produced in plants that are registered to the BS EN ISO 9001 “Sector Scheme for the Production of Asphalt Mixes” (Sector Scheme 14), described in Appendix A.

TABLE 9/11: Summary of Recipe Heavy Duty Asphalt concrete Base and Binder Course Asphalt concretes

Brief Title	**Course**	**Full Name**	**Grading Range mm**	**Binder Penetration Reference**
HDM50	Base	Heavy duty asphalt concrete base	0/32	50
HDM50	Binder	Heavy duty asphalt concrete binder course	0/20 or 0/32	50

931.3SR	**Filler** When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. When the coarse aggregate is gravel, 2% by mass of total aggregate of Portland cement or hydrated lime shall be added and the percentage of fine aggregate reduced accordingly. Cement or hydrated lime is not required when limestone gravel is used as the coarse aggregate.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	Binder
931.4SR	Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A. The penetration reference of the bitumen shall be as stated in Table 9/11.
937SR	**Stone Mastic Asphalt (SMA) Binder Course and Regulation Course**
	General
937.1SR	Stone mastic asphalt shall comply with the general requirements of BS EN 13108-5:2016, Series 700 and 900 and the specific requirements of sub-Clauses 2 to 44 of this Clause and Table 9/23.
937.2SR	Stone mastic asphalt shall be produced in plants that are registered to the BS EN ISO 9001 "Sector scheme for the Production of Asphalt Mixes" (Sector Scheme 14), described in Appendix A.
	Aggregates
937.3SR	Coarse aggregate shall be crushed rock or crushed slag complying with Clause 901. The shape of the coarse aggregate shall comply with a maximum flakiness index of Category FI_{25} as defined in BS EN 13043, clause 4.1.6.
937.4SR	Fine aggregate shall comply with Clause 901 and shall comprise crushed fine aggregate derived from rock, slag or gravel. With the prior approval of the Project Manager the fine aggregate may be blended with not more than 50% of natural sand.
	Filler
937.6SR	When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.0% of hydrated lime shall be added. The optimum amount shall be determined by trials. Added filler aggregate shall be hydrated lime, crushed limestone or Portland Cement, in accordance with the requirements of PD 6691-1 and shall be not less than 2% by mass of total aggregate.
	Binder
937.7SR	Bitumen shall comply with BS EN 12591 and shall be produced in plants that are registered to BS EN ISO 9001 "Sector Scheme for the Supply of Paving Grade Binders", described in Appendix A. The binder shall not be harder than penetration reference 50 (paving grade 40/60). If the deformation resistance requirement in sub-Clause 38 of this Clause is not required, then the binder penetration shall be 70/100 pen or as specified in Table 9/23 and the Instruction.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
937.8SR	**Binder Modifiers** Binder modifiers pre-blended with bitumen or binder modifiers, including natural or man-made fibres, which are added or blended with base bitumen complying with BS EN 12591 of the stated penetration range at the mixing plant shall have a British Board of Agrément HAPAS Roads and Bridges Certificate. In the event that no such Certificates have been issued, binder modifiers, pre-blended modified binders or additives shall not be used without the approval of the Project Manager.
937.9SR	In the event that no British Board of Agrément HAPAS Roads and Bridges Certificates have been issued, the Contractor shall provide with his design a data sheet giving details of the properties of the modified binders or additives proposed including those specified in Table 9/23. The Contractor shall provide the rheological product identification data for pre-blended modified binders in accordance with Clause 928 and cohesion in accordance with Clause 939.
	Mixture
937.10SR	The target aggregate grading and target binder content proposed by the Contractor shall fall within the envelope formed by the limits given in Table 9/12.
937.11SR	When slag aggregates are used, adjustments will be required to the binder content ranges in Table 9/12 to account for the varying density of the slag aggregates.
937.12SR	The binder drainage of the loose mixture at the target composition at a temperature of 175°C in accordance with BS 594987 shall not be more than 0.3% by total mass of mixture.
937.13SR	The agreed aggregate grading for the mixture shall be that obtained by applying the tolerances given in Table 9/13 to the target aggregate grading. The grading curve of the aggregates shall be broadly parallel to the limits of the envelope and shall not vary from the low limit on one size of sieve to the high limit on the adjacent size of sieve or vice-versa.
937.14SR	The agreed binder content for the mixture shall be the target binder content ±0.6%.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/12: Target Aggregate Grading and Target Binder Content				
Sieve Size (mm)	**Per cent by mass of total aggregate passing**			
	Maximum Nominal Size			
	20mm	**14mm**	**10mm**	**6mm**
31.5	100			
20	90 – 100	100		
14	30 – 60	90 – 100	100	
10	24 – 40	35 – 60	90 – 100	100
6.3	21 – 32	23 – 35	30 – 50	90 – 100
4	-	-	-	25 – 42
2	15 – 26	17 – 29	21 – 31	21 – 33
0.063	7 - 12	8 - 13	8 - 13	8 - 15
Binder % by mass	5.2 – 6.2	5.5 – 6.5	5.7 – 6.7	6.3 – 7.3

TABLE 9/13: Tolerances around Target Aggregate Grading				
Test Sieve (mm)	**Tolerances for aggregate grading in per cent by mass of aggregate passing the test sieve**			
	Nominal Size			
	20mm	**14mm**	**10mm**	**6mm**
20	±5			
14	±10	±5		
10	±8	±10	±5	
6.3	±8	±8	±10	±5
4	-	-	-	±10
2	±7	±7	±7	±8
0.063	±2	±2	±2	±2.5
Note: Application of the above tolerances to the target grading may result in limits outside those permitted by the appropriate envelope in the Table 9/12. This is acceptable.				

937.15SR	**Job Mixture Approval** Details of the proposed mixture design from each asphalt mixing plant shall be submitted to the Project Manager. The information may be obtained from either a job mixture trial or from the use of the mixture on a previous contract carried out in accordance with this Clause, and shall include all the following particulars: (i) bitumen penetration reference; (ii) quantities of binder and aggregate; (iii) aggregate source and grading; (iv) proprietary name and generic type of binder modifier; (v) quantity of any binder modifier, including natural or man-made fibres added at the mixer; (vi) modified binder and mixture data requirements specified in Table 9/23.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
937.16SR	If a modified binder, including any proportion of the modifier, is not fully recovered on analysis for determination of binder content, details of alterations to the test method and/or the correction necessary to the results together with supporting data shall be submitted to the Project Manager with the proposed mixture design for the approval to implement them.
937.17SRS	The mixture shall be approved by the Project Manager as the Job Standard Mixture provided that: (i) the mixture design proposed complies with sub-Clause 1 of this Clause; (ii) information has been submitted in accordance with sub-Clauses 9 and 10 of this Clause; (iii) information submitted in accordance with sub-Clause 16 of this Clause has been approved by the Project Manager; (iv) test results submitted establish the correlation between the air voids content, as measured from cores in accordance with sub-Clause 33 of this Clause, and nuclear density gauges (v) test results submitted demonstrate compliance with sub-Clauses 37, 38 and 39 of this Clause.
937.18SR	If the mix design or constituent materials of a Job Standard Mixture are changed, details of the revised mixture shall be submitted for approval in accordance with sub-Clause 17 of this Clause. Job Mixture trials may be carried out on or off site, however material laid for a Job Mixture trial on site which complies with this specification may form part of the appropriate course in the Permanent Works. If carried out off site trials may be arranged independently or in conjunction with other Works.
	Mixing
937.19SR	Unless otherwise specified by the supplier of the modified binder, stone mastic asphalt shall be mixed at a temperature in accordance with the requirements of PD 6691 for the penetration reference of the bitumen. This shall be done in such a manner that a homogeneous mixture of aggregate, filler, bitumen and additive is produced. At the time of mixing, the coarse aggregate shall be in a surface dry condition.
	Transportation
937.20SR	The transportation of stone mastic asphalt shall be in accordance with sub-Clause 901.3.
	Permanent Works
937.21SR	Sampling and testing shall be carried out to establish compliance of material laid in the Permanent Works.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	Sampling from the Laid Material
937.22SR	Samples of uncompacted material shall be taken from the paver as near to where the cores are to be taken as is practicable, in accordance with BS 598-100, clause 6.3.
937.23SR	Six 200mm diameter cores shall be cut, where practical from the centre of the lane, out of material from each mixing plant; (i) from material laid specially in a Job Mixture Approval Trial; (ii) from the first 1km length of stone mastic asphalt from a mixing plant laid in the Permanent Works; or (iii) within 3 days of laying stone mastic asphalt from a mixing plant in the Permanent Works, where less than 1km length has been laid, whichever occurs first.
937.24SR	The 200mm diameter cores shall be cut within 3 days of laying the material unless they have been cut under the requirements of sub-Clause 35 of this Clause. The cores shall be transported as soon as possible to the laboratory. If the storage period is less than 4 days, the storage temperature shall be within the range 0°C to 5°C. Cores shall be stored on a flat face on a horizontal surface, and shall not be stacked. Site storage of cores where unavoidable, and conditions of transportation shall be as close as it practicable to the laboratory conditions. The storage temperature and times, including whilst cores are on site, shall be recorded.
937.25SR	Three pairs of 150mm diameter cores shall be cut at the same chainages as the 200mm diameter core. One core of each pair shall be taken from the centre of the lane, adjacent to the 200mm diameter core and one whose centre is between 500mm and 1000mm from the edge of the mat.
937.26SR	Cores shall be taken after the stone mastic asphalt has cooled to ambient temperature and not less than 12 hours after laying, and before trafficking, unless otherwise specified in the Instruction. The walls and base of all holes from which core samples have been cut shall be painted with hot bitumen or cold applied polymer modified intermediate or premium grade bitumen emulsion containing normally 60% binder immediately prior to making good. Core holes shall be backfilled with materials compacted to refusal with a circular headed vibrating hammer in layers not exceeding 75mm thick. Hot base material shall be similar to existing pavement.
937.27SR	In the Permanent Works, after the first 6 cores and where the required thickness of the material exceeds 25mm, for material from each mixing plant, not less than one pair of 200mm diameter cores shall be cut from the centre of the lane every 1 lane-kilometre laid in a day's production or if less than 1 lane-kilometre is laid.

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	Tests and Calculations
937.28SR	Where possible, density readings using the nuclear density gauge calibrated as described in sub-Clause 17 of this Clause shall be taken at not more than 50 metre centres along each lane, including areas immediately adjacent to where each core is taken.
937.29SR	Initially, the calibration of the nuclear density gauge for the mixture being laid which has been submitted in accordance with sub-Clause 17 of this Clause shall be used. Once results are available, the gauge shall be re-calibrated using the results for bulk density and air voids content from the first six pairs of cores. Thereafter, the gauge shall be re-calibrated if the density from the nuclear density gauge and from cores show any significant bias.
937.30SR	For each uncompacted sample, the compositional analysis shall be carried out in accordance with PD 6692, corrected by any correction factor approved under sub-Clause 16 of this Clause.
937.31SR	Each six consecutive 200mm diameter cores of material from the same mixing plant shall form a set of cores on a running basis. For each set, the wheel-tracking rate and rut depth shall be determined in accordance with the procedure in BS 598-110 at the test temperature of 60°C.
937.32SR	For each 150mm diameter core, the bulk density shall be determined in accordance with the procedure in PD 6692, clause 4. The bulk density at a chainage shall be the mean from the two cores taken at a chainage. Subsequent to determining the bulk density, the maximum density shall be determined from the pair of the cores in accordance with BS EN 12697-5.
937.33SR	The air void content of each pair of 150mm diameter cores shall be calculated to ±0.1% as follows: Air voids content = $\left(1-\frac{\rho}{\rho_{Max}}\right)\times 100\ \%$ where: ρ is the bulk density in accordance with PD 6692 (Mg/m³); and ρ_{Max} is the maximum density in accordance with BS EN 12697-5 (MG/m³).
937.34SR	Where the thickness of material will exceed 40mm, prior to testing for air voids, the indirect tensile stiffness modulus (ITSM) of the 150mm diameter cores taken during the Job Mixture Approval Trial shall be measured in accordance with DD 213 : 1993.
	Additional Sampling and Testing
937.35SR	If the density readings taken with the nuclear density gauge indicate that the air voids content may be less than 2% when using the calibration relationship derived from sub-Clause 29 of this Clause, one 200mm diameter core shall be cut at that chainage and the wheel-tracking rate and rut depth determined in accordance with sub-clause 31 of this Clause.

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
937.36SR	If the density readings taken with the nuclear density gauge indicate that the air voids content may not comply with the requirements for a pair of cores set out in sub-Clause 39 of this Clause when using the calibration relationship derived from sub-Clause 29 of this Clause, two 150mm diameter cores shall be cut at the chainage and the air voids content determined in accordance with sub-Clauses 32 and 33 of this Clause.
	Compliance Requirements
937.37SR	When determined in accordance with PD 6692, the compositional analysis shall demonstrate compliance with following: (i) the binder content on analysis shall not differ from the target binder content declared by the Contractor by more than ± 0.6%; and (ii) the target aggregate grading declared by the Contractor shall not differ from that given in Table 9/12 and Table 9/13.
937.38SR	Deformation resistance shall be determined in accordance with the requirements of Clause 952 and the deformation values specified in Table 9/23.
937.39SR	The air voids content shall be not more than 6% for a pair of cores at a chainage and shall be not more than 4% for the mean of any six consecutive determinations from pairs of cores from material from the same mixing plant. When the SMA is being used as a regulating course at thicknesses below 30mm, the appropriate limiting void contents shall be 8% and 6% respectively.
	Reporting Results
937.40SR	For Job Mixture Approval Trials the Contractor is responsible for testing, the individual determinations, including location of samples, and results from all tests shall be given to the Project Manager in writing within two weeks of the material being laid.
	Surface Preparation
937.41SR	Existing surfaces shall be prepared in accordance with the requirements of BS 594987 and Series 700 Clauses. Bond coats shall be in accordance with Clause 920, except that where the thickness of the stone mastic asphalt is less than 20mm, only premium polymer modified bond coats shall be used.
	Laying
937.42SR	Unless required otherwise in the Instruction, stone mastic asphalt shall be laid and compacted in accordance with the requirements of Clause 901, to the thickness stated in the Instruction.
	Weather Conditions
937.45SR	The weather conditions specified in Clause 945 shall not apply to stone mastic asphalt laid as a binder course in accordance with this Clause. The manufacturer's recommendations for the use of modified binders in various weather conditions for laying, and compaction temperatures of the modified stone mastic asphalt shall be submitted to the Project Manager with details of

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	the modified binder required under sub-Clause 9 of this Clause and shall include information on early trafficking, particularly in hot weather.
937.46SR	**Temporary Trafficking** The Contractor shall ensure the pavement material has adequately cooled and hardened before it it subjected to temporary traffic. Unless otherwise agreed by the Project Manager, the material shall not be trafficked if its surface temperature exceeds 25˚C unless the maximum temperature within the mat has fallen below 35˚C.
938SR	**Porous Asphalt Surface Course**
938.1SR	For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
939SR	**Determination of Cohesion of Bitumen and Bituminous Binders**
939.1SR	**Scope** This Clause specified the Vialit Pendulum Test method for the measurement of the cohesion of bitumen and bituminous binders at temperatures in the range -10˚C to +80˚C, and determines the relationship between cohesion and temperature. For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
941SR	**Modified Binder Storage Stability Test**
941.1SR	**Scope** This test determines the susceptibility of a pre-blended modified binder to separation or instability during prolonged storage at high temperature. For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
943SR	**Hot Rolled Asphalt Surface Course and Binder Course (Performance-Related Design Mix)**
943.1SR	For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

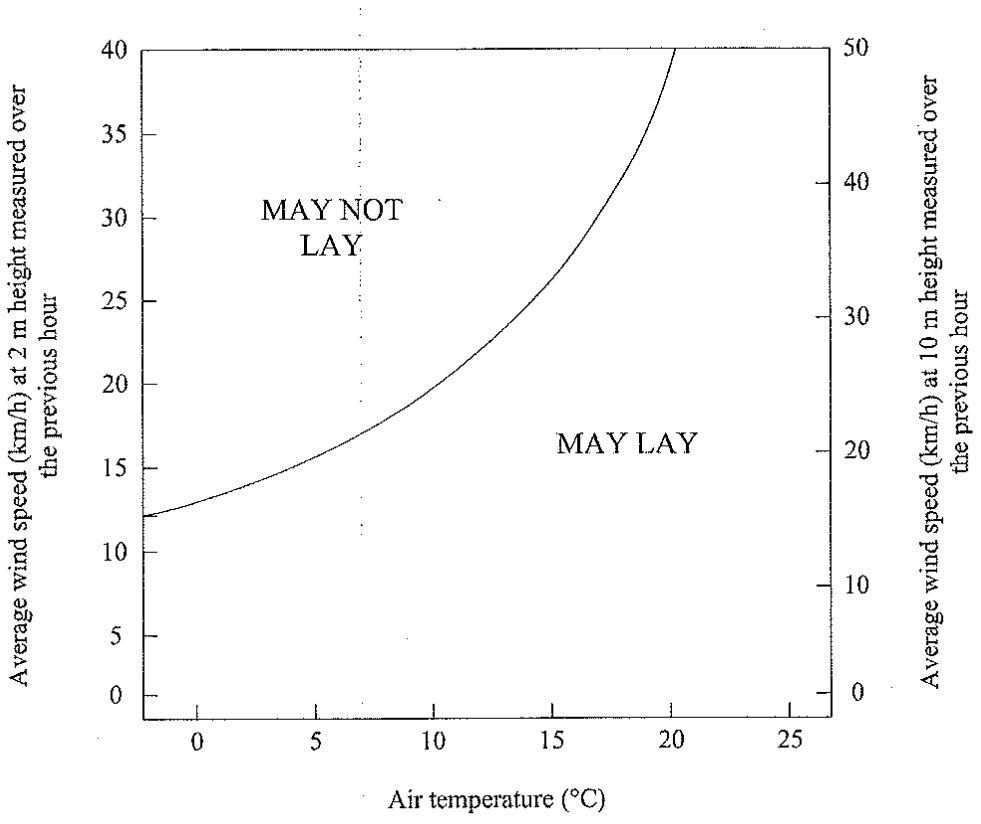
List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
944SR	**Design, Testing and Compliance of Performance-Specified Base and Binder Course**
944.1SR	For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency Binder.
945SR	**Weather Conditions for Laying of Bituminous Materials**
945.1SR	Laying of road pavement materials containing bitumen binders may proceed during light precipitation provided that both the surface to be covered and the air temperature are above 0°C, except where otherwise specified in this Clause. Responsibility for working methods shall remain with the Contractor including all necessary adjustments to suit changes in weather conditions.
945.2SR	Laying of road pavement materials containing bitumen binders may proceed provided that the temperature of the surface to be covered if 0°C or more, the air temperature is at or above -1°C and rising and the surface to be covered is dry, unfrozen and free from ice, snow, salt and grit, except where otherwise specified in this Clause.
945.3SR	**Hot Rolled Asphalt** Unless otherwise specified in the Instruction, hot rolled asphalt surface course materials incorporating 30% coarse aggregate shall have a minimum delivery temperature of 155°C and shall be laid 45mm thick, within the constraints of wind speed and temperature given in Figure 9/7. When an anemometer is not available hot rolled asphalt surface course materials incorporating 30% coarse aggregate shall have a minimum delivery temperature of 165°C and shall be laid 45mm thick. It shall not be laid when the air temperature falls below 5°C unless the temperature of the surface to be covered is 3°C or more.
945.4SR	Alternatively, unless otherwise specified in the Instruction, hot rolled asphalt surface course materials incorporating 35% coarse aggregate shall be laid 50mm thick, within the following constraints of delivery temperature, wind speed and air temperature. Air temperature (minimum): 0°C Wind speed (maximum at any air temperature): 40km/hr (at 2 metres height) or 50km/hr (at 10 metres height) Minimum delivery temperature of materials: 155°C
945.5SR	Unless otherwise specified in the Instruction, hot rolled asphalt binder course and base materials shall be laid in accordance with the requirements of sub-Clause 4 above, except the minimum delivery temperature shall be 135°C.
945.6SR	**Dense and Heavy Duty Asphalt concretes** Unless otherwise specified in the Instruction, and excluding end performance specified materials, dense and heavy duty asphalt concretes shall be laid in

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	accordance with the requirements of sub-Clauses 1 and 2 above, and shall be at least 50mm thick.
945.7SR	Dense asphalt concrete surface course and dense or heavy duty binder course layers shall be laid and compacted within the constriants of wind speed and temperature given in Figure 9/8, and the requirements of sub-Clauses 1 and 2 above, unless their compaction is assessed in accordance with Clause 929.
945.8SR	**Wind Speed** Wind speed shall be measured by anemometer positioned near the laying site to accurately reflect conditions at the laying site. The anemometer shall be fitted with a digital accumulative device.

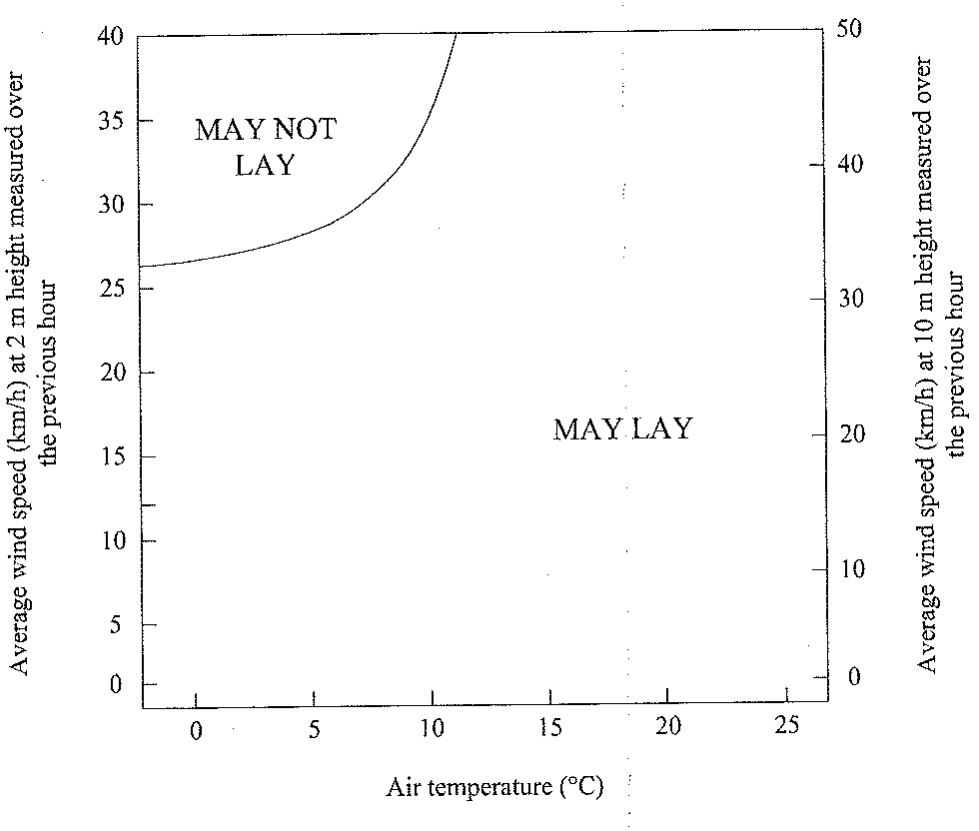
Figure 9/7: Wind Speed and Air Temperature Laying Restrictions for 45mm Thickness Rolled Asphalt Surface Course

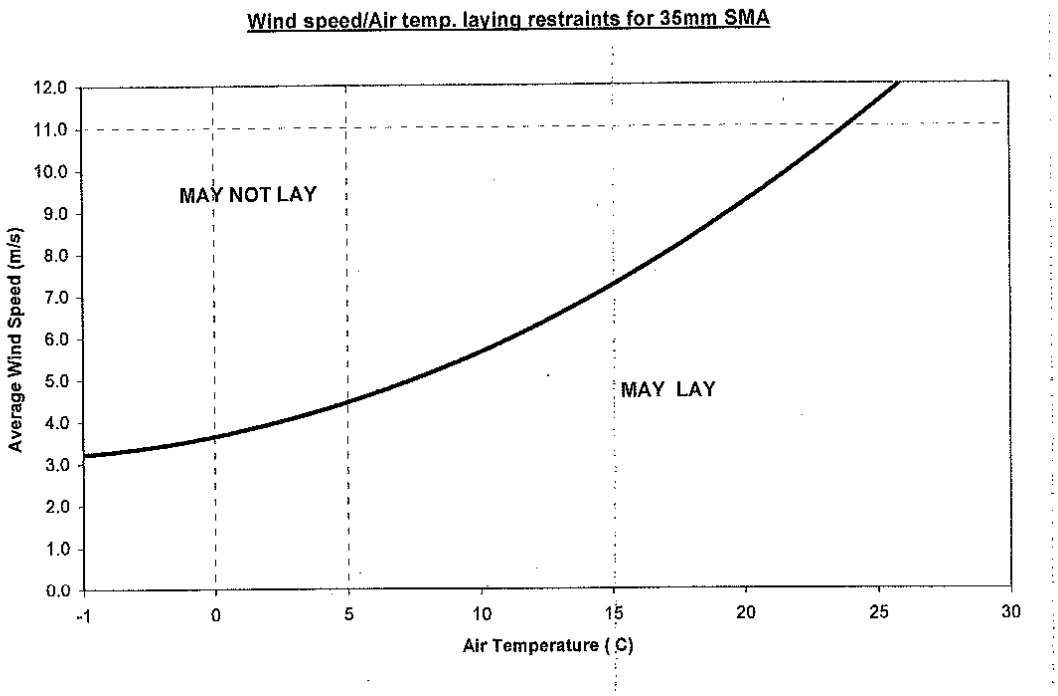


List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay

FIGURE 9/8: Wind Speed and Air Temperature Laying Restrictions for Dense Bitumen Asphalt concrete Surface Course or Binder Course, or Heavy Duty Asphalt concrete, or High Modulus Base Binder Course Layers





APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
946SR	**China Clay Sand Asphalt Base**
946.1SR	For details of the requirements of this Clause, refernce must be made to the corresponding Clause in the Manaul of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
947SR	**Slate Asphalt concrete Base**
947.1SR	For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
948SR	**Cold Recycled Bitumen Bound Material**
	Scope
948.1SR	Cold recycled bitumen bound material shall be designed and produced in accordance with the guidelines set out in TRL Report TRL611.
948.2SR	Prior to commencing the pulverisation and stabilisation works, the Contractor shall demonstrate, to the satisfaction of the Project Manager, that the existing pavement materials in the sections of the works defined in the Instruction are capable of being recycled by pulverisation to form the primary aggregate component of a cold recycled bitumen bound material which can meet the appropriate end-product performance requirements.
949SR	**Repairs to Potholes**
949.1SR	A pothole is defined as an area in a carriageway requiring repair and not exceeding 0.25 square metres. Repairs shall either be temporary or permanent, as described in the following sub-Clauses.
949.2SR	Temporary repairs to potholes shall be carried out using a proprietary deferred set bituminous material approved by the Project Manager (6mm or 10mm "Bitucrete" or similar). It shall be laid in accordance with the manufacturer's instructions in layer not exceeding 40mm thick. Each layer shall be compacted using a mechanical rammer or approved hand rammer.
949.3SR	Permanent repair to potholes shall be carried out in accordance with the following and to the requirements specified in the Instruction:- (i) Where a temporary repair has been previously made to the pothole, the Contractor shall remove all the temporary material and dispose of to the Contractor's tip off site in accordance with Clause 605. (ii) The pothole will be stabilised by cutting back the edges to sound material to form a regular shape with vertical sides.

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	(iii) The surface course shall be cut to a minimum depth of 35mm using a disc cutter. (iv) Remaining course may be cut back using a pneumatic or electric road breaker. (v) All loose material shall be removed from the pothole and disposed of to the Contractor's tip off site in accordance with Clause 605. (vi) The bottom and sides of the pothole shall be coated completely with: (a) for roads with a Maintenance Category of 3 to 6 an approved cold applied thixotropic bitumen emulsion ("Bitukold" or similar) (b) for roads with a Maintenance Category of 7 to 12 spray applied K1-40 bitumen emulsion applied at the rate of 0.5 litres per square metre. (vii) Filling shall be carried out using the 6mm SMA pothole mix with a PSV of 60 for roads with a Maintenance Category of 3 to 6 and a PSV o 55 for roads with a Maintenance Category of 7 to 12, and meeting the requirements of Table 9/23 unless otherwise specified in the Instruction. It shall be laid by hand in layers not exceeding 40mm thick in accordance with the appropriate Clauses. (viii) Where any dimension of the pothole is greater than 300mm then the surface shall be gritted in accordance with sub-Clause 937.43 (ix) The repair shall be finished level with the adjacent pavement surface and when completed the filled area and adjacent pavement shall be swept and cleared of all detritus and loose material.
949.4SR	Alternatively patching may be carried out using proprietary in-situ recycling repair systems incorporating indirect infra red heating having an appropriate British Board of Agrément HAPAS Roads and Bridges Certificate.
952SR	**Deformation Resistance for Binder Course and Base**
952.1SR	For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
953SR	**Durability of Bituminous Materials – Saturation Ageing Tensile Stiffness (SATS) Test**
953.1SR	**Scope** This Clause specifies a test method to assess the durability of dense bituminous materials using the Saturation Ageing Tensile Stiffness (SATS) test.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
	For details of the requirements of this Clause, reference must be made to the corresponding Clause in the Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works as published by the Highways Agency.
970SR	**Adequacy of Compaction – Attained Air Voids**
970.1SR	The adequacy of compaction of bituminous materials shall be determined from the attained air void content of the laid material using the method specified in BS 598 : Part 104, and as provided in this Clause.
970.2SR	The Project Manager shall take samples in accordance with the following principles:- (i) Three 100mm core pairs shall be taken when the new material has attained ambient temperature. (ii) For sites exceeding 1,000 square metres in area three core pairs for every 1,000 square metres. (iii) For sites of less than 1,000 square metres in area, three core pairs for every 1,000 square metres of the aggregated area of the multiple sites completed each day or successive days thereafter. (iv) When the newly laid mat is either half or full carriageway width, at least two of the core pairs shall be taken from the wheel track zones as determined by the Project Manager. Where the laid width is less than half the carriageway width, the core pairs shall be taken where chose by the Project Manager.

TABLE 9/20: Limits for Air Void Content for Surfacing and Major Reconstruction Works

	Mean of 6 Cores		Mean of any Pair	
Material	Minimum %	Maximum %	Minimum %	Maximum %
Dense asphalt concrete base	2	7	1.5	8
Dense asphalt concrete binder course	2	6	1.5	7
All hot rolled asphalt materials i.e. base, binder course and surface course	2	6	1.5	7
Dense asphalt concrete and close graded asphalt concrete surface courses	2	9	1.5	10
Stone mastic asphalt surface course 14mm nominal size aggregate	2	6	1.5	7
Stone mastic asphalt surface course 10mm nominal size aggregate	2	8	1.5	9
Stone mastic asphalt surface course 6mm nominal size aggregate	2	10	1.5	11
NOTES:				

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

1. Air voids results will be rounded to the nearest whole number for the purpose of assessing compliance over a core pair and to the nearest 0.5% for single core pair compliance.
2. The measured mix density will be used in the calculation. This figure is based on data from laboratory analysis of the mix density in accordance with ASTM D2041. The figure used will be:
   (a) for sites of 1000m² or greater, based on a sample of the material used on that site.
   (b) for sites of less than 1000m² the most recent mix density measured for the same material type from the supplying quarry.
   (c) For referee purposes a 200mm diameter core may be extracted for subsequent analysis of mix density.
3. An additional 1% tolerance on the maximum voidage shall be applied for hand laid material where permitted by the Project Manager.
4. For footpath works an additional 1% tolerance on the maximum voidage shall be applied as for hand laid material.

970.3SR	The Project Manager will ensure that each sample is marked with information that denotes the location from where and at what time and date the sample was taken and that it is delivered to the Devon County Council Laboratory, Exeter where it will be tested in accordance with the following principles:- (i) The air void content shall be determined for each layer of material and calculated to the nearest 0.1%. (ii) When the material contains surface applied chippings the air void content shall be calculated for the asphalt material only. The mass and volume of chippings shall be subtracted from the mass and volume of the core. The mass of the chippings shall be calculated assuming that the mean rate of spread of chippings specified or agreed upon has been achieved. The volume shall then be determined using the relative density of the chippings as delivered including binder.
970.4SR	(i) The air void content of each layer shall not exceed the limits given in Table 9/20 and Table 9/21. (ii) The results will be rounded to the nearest whole number for the purpose of assessing compliance with the mean of 6 cores and to the nearest 0.5% for the purpose of assessing compliance with the mean of any pair of cores.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/21: Limits for Air Void Content for Patching and Minor Reinstatements which are Hand Laid

Material	Mean of 6 Cores		Mean of any Pair	
	Minimum %	Maximum %	Minimum %	Maximum %
Dense asphalt concrete base (excluding Clause 929 mixes)	2	9	1.5	10
Dense asphalt concrete binder course (excluding Clause 929 mixes)	2	8	1.5	9
All hot rolled asphalt materials i.e. base, binder course and surface course	2	8	1.5	9
Dense asphalt concrete and close graded asphalt concrete surface courses	2	10	1.5	12
Stone mastic asphalt surface course 14mm nominal size aggregate	2	8	1.5	9
Stone mastic asphalt surface course 10mm nominal size aggregate	2	10	1.5	10
Stone mastic asphalt surface course 6mm nominal size aggregate	2	11	1.5	12

NOTES:

1. Air voids results will be rounded to the nearest whole number for the purpose of assessing compliance over a core pair and to the nearest 0.5% for single core pair compliance.

2. The measured mix density will be used in the calculation. This figure is based on data from laboratory analysis of the mix density in accordance with ASTM D2041. The figure used will be the most recent mix density measured for the same material type from the supplying quarry (for referee purposes a 200mm diameter core may be extracted for subsequent analysis of mix density).

970.5SR	The Project Manager shall make good the core holes in accordance with the following and undertake all necessary traffic safety and management required for that operation: (i) The walls and base of holes from which core samples have been cut shall be dried, painted with thixotropic bitumen emulsion edge sealant pr hot bituminous binder, and filled to the underside of the surface course with an approved cold mix dense asphalt concrete or the same material used in the ongoing works, and be well rammed in layers not exceeding 50mm. (ii) Where cores have been cut through the surface course, the last layer of fill material shall comply with the specification for the surface course unless otherwise agreed with the Project Manager.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

970.6SR	Where the requirement for air void content is not met the Contractor shall determine the full extent of the area of the defective material to the satisfaction of the Project Manager. For failure to meet the required maximum air voids payment reduction will be applied in accordance with the following table:

Voidage in excess of the specified maximum (%)	Reduction in payment (%) – Base, Binder & Regulating courses*	Reduction in payment (%) – Surface courses*	Other action
≤0.5	5	5	
≤1.0	10	10	
≤1.5	25	25	
≤2.0	33	50	
>2.0	50	-	Replace
>2.5	-	-	Replace

Notes:
* Where the excess voidage is restricted to one or more core pairs the reduction (R) shall be calculated from:

$R = r \times (n / 3)$

n = number of core pairs per 1000m² or per section (where less than 1000m²) where voidage exceeds maximum tolerance for a single core pair.

R = percentage reduction from table for the layer.

971SR	**Stone Mastic Asphalt Surface Course**
	General
971.1SR	Stone amstic asphalt shall comply with the general requirements of BS EN 13108-5:2016 and the following clauses.
	Materials – Aggregates and Filler
971.2SR	Coarse aggregate shall comply with Clause 901 and shall be as specified in Table 9/13.
971.3SR	When tested in accordance with the procedures of BS 812, the coarse aggregate shall additionally have the following properties: (i) Polished Stone Value – as specified in the Works Order; (ii) Ten Percent Fines Value – not less than 180kN when tested in a dry condition, or as spcified in the Works Order (iii) Maximum Aggregate Abrasion Value as specified in Table 9/13; (iv) Maximum Flakiness Index – for the coarse aggregate only, 30 percent, or

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	as specified in the Works Order.
971.4SR	Fine aggregate shall comply with Clause 901 and shall be as specified in Table 9/13.
971.5SR	Added filler shall be as specified in Table 9/13 and in accordance with the requirements of PD 6691: part 1 and shall be at least 2 percent by mass of total aggregate. When either the coarse or fine aggregate is quartzite or other aggregate requiring anti-strip measures at least 1.2% of hydrated lime shall be added. The optimum amount shall be determined by trials.
	Binder
971.6SR	Unless specified otherwise in the Works Order, either a modified binder or bitumen with stabilising additive shall be used, at the choice of the Contractor. Modifiers are deemed to include any material added to or blended with the base bitumen.
971.7SR	The binder shall comply with BS EN 12591. The bitumen shall be grade 70/100 (referred to as 70/100 pen) unless instructed otherwise on the Works Order when it shall be either grade 40/60 (referred to as 40/60 pen) or, for handlay works specifically approved by the Project Manager 100/150 (referred to as 125 pen).
971.8SR	If a modified binder is used the base bitumen, before modification, shall comply with BS EN 12591 and shall have a nominal grade of 70/100 (70/100 pen), unless specified otherwise in the Works Order when grade 40/60 (40/60 pen) shall be used.
971.9SR	The choice of type or modified binder shall be notified to the Project Manager before the commencement of work.
	Stabilising Additive or Modified Binders
971.10SR	When bitumen complying with BS EN 12591 is used as the binder, at least 0.3% by mass of total mixture of stabilising additive shall be used to ensure binder drainage does not occur during transport and handling. Stabilising additives shall be as specified in the Works Order.
971.11SR	Proposals to use a bitumen and stabilising additive or a modified binder shall be submitted to the Project Manager, complete with all details including binder drainage test results, manufacturer's recommendations for addition or means of incorporating any stabilising additives or modifiers homogeneously, without sgregation, into the mix.
971.12SR	Before agreeing the use of additive or modified bitumen, the Project Manager shall be satisfied that it has proved satisfactory in use elsewhere under

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay

	circumstances similar to the Contract, or that it has undergone appropriate performance trials. For the purpose of this sub-Clause, documented evidence of use and trials of the additive or modifier, in any member state of the European Economic Area, will be acceptable.
971.13SR	Where information on use or trials is inadequate or lacking, in the opinion of the Project Manager, trials by the Contractor may be required to be undertaken before any agreement by the Project Manager to the use of the additive or modifier.
	Mixture
971.14SR	The target aggregate grading and target bind content proposed by the Contractor shall fall within the envelope formed by the limits given in Table 9/2, unless agreed otherwise by the Project Manager before the commencement of work.
971.15SR	Adjustments may be required to the binder content ranges in Table 9/2 to account for the varying density of slag aggregates should these be used.

TABLE 9/22: Aggregate Grading and Binder Content

Percentage by mass of total aggregate passing BS test sieve:	Nominal size of aggregate		
	14mm	10mm	6mm
20mm	100	100	Mix approved by the Project Manager
14mm	90 to 100	100	
10mm	35 to 60	90 to 100	
6.3mm	23 to 35	30 to 50	
2.36mm	18 to 30	22 to 32	
63μm	8 to 13	8 to 13	
Binder content (%)	6.5 to 7.5	6.5 to 7	

971.16SR	The Contractor shall demonstrate the properties of the proposed mixture at the target composition by preparing loose mixture and compacted specimens in accordance with the general requirements of BS EN 13108. The loose mixture and compacted specimens shall comply with the requirements of sub-Clauses 971.17 and 971.19 below.
971.17SR	When tested at the target composition, the loose mixture shall demonstrate no more than 0.3% binder drainage, by total mass of mixture, at a temperature of 175°C. The test shall be carried out using the apparatus and general principles stated in BS DD 232. The drainage shall be calculated as: Binder drainage = [(W2 – W1)/(1100 + B)] x 100% where B us the initial mass of binder in the mixture, W1 and W2 are respectively the mass of tray and foil before testing and the mass of tray and foil and drained

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay
	binder after testing, and the mass of combined aggregate before addition of binder was 1100 grammes, al as stated in BS DD 232.
971.18SR	Three compacted specimens shall be manufactured at the target composition and the air void contents of these shall be measured by the procedure described in ASTM D 3203 (or DD XYZ – Methods for determination of maximum density of bituminous mixtures), using: (i) the maximum density of the mixture, obtained using the theoretical maximum specific gravity of the loose mixture, determined in accordance with ASTM D 2041 and converted to relative density using the appropriate correction factor. (ii) The bulk desnity of the speciment, determineed in accordance with BS 594987, as the bulk density required by ASTM D 3203, except the specimen shall not be coated in wax.
971.19SR	At the target composition, the air void content of the mixture shall be within the range 2 – 4% for 14mm aggregate and as agreed with the Project Manager for 10mm and 6mm aggregate.
	Mixing
971.20SR	Stone mastic asphalt shall be mixed in accordance with the requirements of BS EN 13108-5:2016, such that an homogenous mixture of aggregate, filler, bitumen and additive (when used) is produced at a temperature of between 150°C and 185°C for 70/100 pen bitumen and between 150°C and 195°C for 40/60 pen bitumen. At the time of mixing, the coarse aggregate shall be in a surface dry condition.
	Transportation
971.21SR	Stone mastic asphalt shall be transported to site in double sheeted or tented and sealed ridge sheeted insulated vehicles (e.g. – "Easysheet" type system).
971.22SR	To facilitate discharge of stone mastic asphalt, a small amount of water may be used. When so used then, prior to loading, the body shall be tipped to its fullest extent, with the tailboard open, to ensure drainage of any excess. The floor of the vehicle shall be free froma dherent bituminous materials or other contaminents.
	Compaction
971.27SR	Stone mastic asphalt shall be compacted immediately to practical refusal, using at least two steel wheeled rollers with minimum mass of 8 tonnes per roller. One roller shall be a tandem drum roller.
971.28SR	The tandem drum roller shall operate directly behind the paver while the other roller shall be used for completion of rolling and the removal of all roller marks.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**
971.29SR	**Surface Texture** When stated in the Works Order, the texture depth of the surfacing shall be in accordance with the requirements of Clause 921 after compaction.
971.30SR	**Surface Treatment** Clean, dry, crushed, angular quartzite aggregate (grit) to the grading shown in Table 9/14 or an approved alternative shall be applied evenly to the surface during the initial rolloing, i.e., after 5 passes of the primary roller. The rate of application shall be 700g per square metre for 14mm, 10mm and 6mm SMA. After the final rolling care shall be taken to ensure that any surplus aggregate is removed prior to the application of roadmarkings and before the road is opened to traffic.

TABLE 9/14: Fine Aggregate Grading	
Sieve (mm):	**Cumulative % passing**
6.30	100
4.00	80 – 95
2.80	38 – 68
2.00	10 – 35
1.00	0 – 12
0.50	0 – 5
0.063	0 – 1
To be quartzite aggregate or similar approved aggregate. Particle shape to be predominantly angular.	

971.31SR	The aggregate is to be applied by a calibrated roller-mounted spreader. The full calibration procedure is to be carried out at least 3 monthly and when there is a change in the source of the aggregate. The calibration procedure is in accordance with BS EN 12272-1:2002. A grid marked onto the test surface is a suibale alternative to the picking grid provided that the dimensions are the same and that care is taken in collecting the aggregate for weighing. Records of the calibration shall be available on site. The calibration record shall confirm the effective width of spread and that the spreader is capable of applying the grit evenly across the full width of its spread subject to a tolerance of -100/+100 grammes and over the range of 0.5 – 1.5 kilogrammes per square metre. Daily checks on the evenness and rate of spread shall be carried out using a carpet tile test or any other method approved by the Project Manager. A record of all such checks shall be maintained.

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials

Designation	**Spec. Clause**	**Material**	**Grade of Binder**	**Thickness**	**Special Requirements**
<u>Base (Recipe Mixture)</u> Dense bitumen asphalt concrete base with 32mm aggregate and 100/150 pen binder: AC 32 HDM base 100/150 EN13108-1	906	Dense bitumen asphalt concrete	100/150 pen bitumen See Note A	70mm to 150mm	Aggregate Type – Crushed rock
Heavy duty asphalt concrete base with 32mm aggregate and 40/60 pen binder: AC 32 HDM base 40/60 EN13108-1	931	Heavy duty asphalt concrete	40/60 pen	70mm to 150mm	Aggregate Type – Crushed rock
<u>Base (Design Mixture)</u> Dense bitumen asphalt concrete base with 20mm aggregate and 40/60 pen binder: AC 20 HDM base 40/60 des EN13108-1	929	Dense bitumen asphalt concrete	40/60 pen	50mm to 100mm	None
Heavy duty asphalt concrete base with 32mm aggregate and 40/60 pen binder: AC 32 HDM base 40/60 des EN13108-1	919	Heavy duty asphalt concrete	40/60 pen	70mm to 150mm	None
<u>Binder course (Recipe Mixture)</u> Dense bitumen asphalt concrete with 20mm aggregate and 100/150 pen binder: AC 20 HDM bin	906	Dense bitumen asphalt concrete	100/150 pen bitumen See Note A	50mm to 100mm	Aggregate Type – Crushed rock

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials					
100/150 EN13108-1					
Note A: Where instructed in the Instruction the Contractor shall use 40/60 pen or 70/100 pen bitumen.					
<u>Binder course (Recipe Mixture) continued</u> Dense bitumen asphalt concrete with 32mm aggregate and 100/150 pen binder AC 32 HDM bin 100/150 EN13108-1	906	Dense bitumen asphalt concrete	100/150 pen bitumen See Note A	70mm to 150mm	Aggregate Type – Crushed rock
Heavy duty asphalt concrete with 20mm aggregate and 40/60 pen binder:	931	Heavy duty asphalt concrete	40/60 pen bitumen	50mm to 100mm	Aggregate Type – Crushed rock
Heavy duty asphalt concrete with 32mm aggregate and 40/60 pen binder: AC 32 HDM bin 40/60 EN13108-1	931	Heavy duty asphalt concrete	40/60 pen	70mm to 150mm	Aggregate Type – Crushed rock
<u>Binder course (Design Mixture)</u> Dense bitumen asphalt concrete design mix binder course with 20mm aggregate and 40/60 pen binder: AC 20 dense bin 40/60 des EN13108-1	929	Dense bitumen asphalt concrete	40/60 pen	50mm to 100mm	None
Dense bitumen asphalt concrete binder course with 32mm aggregate and 40/60 pen binder:	929	Dense bitumen asphalt concrete	40/60 pen	70mm to 150mm	None

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials					
AC 32 dense bin 40/60 EN13108-1					
Note A: Where instructed in the Instruction the Contractor shall use 40/60 pen or 70/100 pen bitumen.					
Heavy duty asphalt concrete design mix binder course with 20mm aggregate and 40/60 pen binder Ac 20 HDM bin 40/60 des EN13108-1	929	Heavy duty asphalt concrete	40/60 pen	50mm to 100mm	None
Heavy duty asphalt concrete design mix binder course with 32mm aggregate and 40/60 pen binder: AC 32 HDM bin 40/60 des EN13108-1	929	Heavy duty asphalt concrete	40/60 pen	70mm to 150mm	None
<u>Binder course (SMA)</u> Stone mastic asphalt binder course with 14mm aggregate and 70/100 pen binder: SMA 14 bin 70/100 BS EN 13108-5	937	Stone mastic asphalt	70/100 pen bitumen See Note B	35mm to 75mm	None
Stone mastic asphalt binder course with 20mm aggregate and 70/100 pen binder: SMA 20 bin 70/100 BS EN 13108-5	937	Stone mastic asphalt	70/100 pen bitumen See Note B	50mm to 100mm	None
<u>Surface course (Recipe Mixture)</u>					

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials					
Dense asphalt concrete with 6mm aggregate and 100/150 pen binder:	909	Dense asphalt concrete	100/150 pen bitumen See Note C	20mm to 30mm	Aggregate Type – Crushed rock Minimum PSV: See Note D Maximum AAV: 12
Note B: Where instructed in the Instruction the Contractor shall use 40/60 pen or 100/150 pen bitumen.					
<u>Surface course (Recipe Mixture)</u> continued					
Close graded asphalt concrete with 10mm aggregate and 100/150 pen binder:	912	Close graded asphalt concrete	100/150 pen bitumen See Note C	30mm to 40mm	Aggregate Type – Crushed rock Minimum PSV: See Note D Maximum AAV: 12
Close graded asphalt concrete with 14mm aggregate and 100/150 pen binder: AC 14 close surf 100/150 EN13108-1	912	Close graded asphalt concrete	100/150 pen bitumen See Note C	40mm to 55mm	Aggregate Type – Crushed rock Minimum PSV: See Note D Maximum AAV: 12
Rolled asphalt recipe Type F designation 30% with 14mm aggregate, 40/60 pen binder and 14/20mm coated chippings: HRA 30/14F surf 40/60 EN13108-4	910	Rolled asphalt	40/60 pen See Note C	40mm	Aggregate Type – Crushed rock Minimum PSV: See Note D Maximum AAV: 12
Rolled asphalt recipe Type F designation 35% with 14mm aggregate, 40/60 pen binder and 14/20mm coated chippings.	910	Rolled asphalt	40/60 pen See Note C	45mm or 50mm	Aggregate Type – Crushed rock Minimum PSV: See Note D Maximum AAV: 12

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials					
HRA 35/14F surf 40/60 EN13108-4					
Note B: Where instructed by the Instruction the Contractor shall use 40/60 pen or 100/150 pen bitumen. Note C: Where instructed by the Instruction the Contractor shall use 70/100 pen bitumen. Note D: Minimum PSV to be 53, 57, 60, 65 or 68 as instructed on the Instruction.					
<u>Surface course (Design Mixture)</u>					
Rolled asphalt design Type F designation 55/10 with 10mm aggregate and 40/60 pen binder: HRA 55/10F surf 40/60 des EN13108-4	911	Rolled asphalt	40/60 pen See Note C	40mm	Aggregate Type – Crushed rock Minimum PSV:- Coarse aggregate: See Note D Maximum AAV:- 12 Marshall Stability Range:- 6kN to 8kN Marshall Flow: 5mm max.
Rolled asphalt design Type F designation 55/14 with 14mm aggregate and 40/60 pen binder: HRA 55/14F surf 40/60 des EN13108-4	911	Rolled asphalt	40/60 pen See Note C	45mm	Aggregate Type – Crushed rock Minimum PSV:- Coarse aggregate: See Note D Maximum AAV:- 12 Marshall Stability Range:- 6kN to 8kN Marshall Flow: 5mm max.
Rolled Asphalt design Type C designation 55/10 with 10mm aggregate and 40/60 pen binder: HRA 55/10C surf 40/60 des EN13108-4	911	Rolled asphalt	40/60 pen See Note C	40mm	Aggregate Type – Crushed rock Minimum PSV:- Coarse aggregate: See Note D Maximum AAV:- 12 Marshall Stability Range:- 6kN to 8kN Marshall Flow: 5mm max.
Rolled Asphalt design Type C designation	911	Rolled asphalt	40/60 pen See	45mm	Aggregate Type – Crushed rock

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials					
55/14 with 14mm aggregate and 40/60 pen binder: HRA 55/14C surf 40/60 des EN13108-4			Note C		Minimum PSV:- Coarse aggregate: See Note D Maximum AAV:- 12 Marshall Stability Range:- 6kN to 8kN Marshall Flow: 5mm max.
Note C: Where instructed by the Instruction the Contractor shall use 70/100 pen bitumen. Note D: Minimum PSV to be 53, 57, 60, 65 or 68 as instructed on the Instruction.					
<u>Surface Course (SMA)</u>					
Stone mastic asphalt with 6mm aggregate and 70/100 pen binder: SMA 6 surf 70/100 BS EN 13108-5	937	Stone mastic asphalt	70/100 pen bitumen See Notes E and F	20mm to 30mm	Minimum PSV:- Coarse aggregate: See Note D Fine aggregate: See Note D Fibres: Cellulose (from an approved source) Maximum Void Content: 6%
Stone mastic asphalt with 10mm aggregate and 70/100 pen binder: SMA 10 surf 70/100 BS EN 13108-5	937	Stone mastic asphalt	70/100 pen bitumen See Note E	25mm to 35mm	Minimum PSV:- Coarse aggregate: See Note D Fine aggregate: See Note D Maximum AAV: 12 Fibres: Cellulose (from an approved source) Maximum Void Content: 6%
Stone mastic asphalt with 14mm aggregate and 40/60 pen binder: SMA 14 surf 40/60 BS EN 13108-5	937	Stone mastic asphalt	40/60 pen bitumen See Note C	35mm to 45mm	Minimum PSV:- Coarse aggregate: See Note D Fine aggregate: See Note D Maximum AAV: 12

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

TABLE 9/2329/23: Bituminous Pavement Course Materials					
					Fibres: Cellulose (from an approved source) Maximum Void Content: 6%
Note C: Where instructed by the Instruction the Contractor shall use 70/100 pen bitumen. Note D: Minimum PSV to be 53, 57, 60, 65 or 68 as instructed on the Instruction Note E: Where instructed by the Instruction the Contractor shall use 40/60 pen bitumen. Note F: For footways and potholes the Contractor shall use 125 pen. .					

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

APPENDIX 9/1 – Surface Dressing – Information Required from the Contractor.

The Contractor shall be required to complete the following Schedules in accordance with Clause 912.26

SCHEDULE 9/1: Binder Schedule				
Binder – the Contractor shall state there the sources they propose to use				
Material	**Name of Supplier**	**Source**	**Viscosity**	**Minimum Residue at 163˚C**
Bitumen Emulsion Polymer Enriched Bitumen Emulsion Proprietary Binder (Premium 80 or similar)				

SCHEDULE 9/2: Chipping Schedule					
Chippings – the Contractor shall state here the sources they proposed to use					
Clean chipping	**Name of Supplier**	**Source**	**Aggregate Type**	**Actual PSV**	**Specific Gravity**
8/14mm 6/10mm 3/6mm 0/3mm					

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

SCHEDULE 9/3: Plant Schedule				
Plant – the Contractor shall state here details of the plant they propose to use				
Item	**Team No 1**	**Team No 2**	**Team No 3**	**Team No 4**
Binder Distributor Vehicle Registration No. Make of Spraybar Spraybar Type (fixed/extensible/expandable) Minimum Spraying Width (metres) Capacity of Binder Tank (litres) Capacity of Pumping System (litres/minute)				
Sweepers For Preparatory Work – Type For Surplus Chippings – Type				
Rollers Type Weight (tonnes) Tyre Pressure (bar)				
Chipping Spreaders Maintenance Category 2-6 Highway Maintenance Category 7-12 Highway				

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay

SCHEDULE 9/4: Schedule of Allowances for Laps			
The Contractor is to insert the allowance for longitudinal joints used, as sub-Clause 912.4(ii)(e)			
	Increase in Site width for Joint Types		
Distributor	Lap to Lap mm	Lap to Butt mm	Butt to Butt mm

APPENDIX 0/1: Contract-Specific Additional, substitute and Cancelled Clauses, Tables and figures included in the Contract

List of Additional and Substitute Clauses, Tables and Figures

Clause or Table No. (etc.)	**3661 Contract of Resurfacing and Ancillary Works to Edginswell Railway Bridge, Torquay**

APPENDIX 9/2 – Bond Coats, Tack Coats and other Bituminous sprays – Information Required from the Contractor.

The Contractor shall be required to complete the following Schedules in accordance with Clause 920.5

Appendix 9/2: Data Sheet for Bond Coats, Tack Coats and other Bituminous Sprays																			
Manufacturer of Binder:																Product name:			
Binder																Batch No:			
Binder Grade (tick 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 923	Aged in accordance with Clause 923
Penetration at 25°C 0.1mm (100g and 5 secs)		
Penetration at 25°C 0.1mm (200g and 60 secs)		
Vialit pendulum cohesion see Clause 939 maximum peak value J/cm²	The contractor shall attach a Report and graphical output to this schedule as specified in Clause 939.	The contractor shall attach a report and graphical output to this Schedule as specified in Clause 939.
Product Identification test. **The provision of data for identification and ageing is optional for unmodified bitumen 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 928	The Contractor shall attach a Report and graphical output to this schedule as specified in Clause 928.	The contractor shall attach a Report and graphical output to this schedule as specified in Clause 928.
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 manufacture; road or air temperature; humidity; wind chill adjustment; tolerance of surface dampness; etc. Temperature max: Temperature min: Torque bind: Other:		