

ADDITIONAL CLAUSES, TABLES AND FIGURES185 AK Night Work

Night work will only be permitted as detailed in Appendix 1/85.

186 AK Sectional Completion

The Contractor shall comply with the requirements described in Appendix 1/86.

187 AK Site Safety

In the interests of Site Safety, where there is a foreseeable risk, safety helmets and high visibility warning clothing shall be worn on the Site by all Site personnel at all times. The high visibility warning clothing shall be as described in Clause 117.18.

188 AK Sustainability

The Contractor shall comply with the requirements described in Appendix 1/87.

586 AK Existing Drainage

## Renewal of Filter Drains

1. The Contractor shall locate the ends of the existing filter pipe where it has been built into catchpits or the concrete surround to gully connections. These pipes shall be protected during the excavation of the existing drain and surround. The new filter pipe shall connect positively to the existing pipe using a method approved by the Overseeing Organisation.

## Invert and Pipe Details of Replacement Drainage

2. All replacement pipe sizes and inverts shall be as existing.
3. Following agreement of the temporary bench mark values and before the drainage work is commenced, invert and existing ground levels above drain runs shall be agreed with the Overseeing Organisation.

587 AK Deep Bored Soakaways

1. Deep bored soakaways shall be constructed in the position and to the depths shown in Appendix 5/1.
2. The borehole shall not be greater than 250mm in diameter and temporary casing shall be used over its full length to uphold the sides prior to backfilling.
3. The borehole liner shall have an internal diameter, not less than 150mm. It may be in PVC-U in accordance with BS 4962 or other durable material agreed with the Overseeing Organisation. It must be capable of insertion in the borehole without risk of breakage or damage to the joints.

4. Perforated slotted or screened pipe shall only be used in that section where soakage is intended. The apertures in such a pipe shall be smaller than any aggregate placed between the liner and the borehole wall.
5. After installation of the lining tube, rounded 5mm to 10mm pea gravel shall be placed in the annulus between the borehole wall and the lining tube to a level 1 metre above the perforated pipe as the casing is withdrawn. Care must be taken to ensure that the level of the aggregate is maintained just above the bottom of the casing to prevent collapse of the borehole. In addition, excessive heights of aggregate above the bottom of the casing will jam casing withdrawal and lift the liner to the detriment of the installation.
6. A bentonite seal shall be placed on top of the aggregate to a depth of 2.0 metres. Care must be taken to prevent contamination of the gravel.
7. As the casing is withdrawn the remaining annulus shall be filled with suitable material as directed by the Overseeing Organisation.

588 AK Adjustment of Ironwork

1. Where the adjustment or replacement of existing frames and covers or gratings to service boxes, service valves and the like is required, such adjustment or replacement shall be in accordance with Clause 507.18.

685 AK Stone Pitching

1. The type of stone and locations of Stone Pitching shall be as described in Appendix 6/85.
2. The stone shall not be liable to damage by frost.
3. The individual pieces of stone shall be selected to fit roughly together. They shall then be securely wedged in position by stone spalls and small gaps in the top 50mm shall be filled with broken stone or gravel or dry mortar.
4. Selected heavy stones shall be used to prevent displacement at the top and bottom.

686 AK Geosynthetics

The type of geosynthetic and location shall be as described in Appendix 6/86.

687 AK NOT USED

688 AK NOT USED

689 AK Performance Categorised Capping Layer Material

1. Performance Categorised Capping Layer Material shall satisfy the requirements of Clause 613 except as amended below.
2. For the purpose of this clause 'cement' includes Portland cement CEM I and cementitious (hydraulic) binders including PFA and ground granulated blast

furnace slag. Selected granular materials include recycled aggregates, for example: crushed concrete, demolition waste and asphalt, incinerator ash and asphalt planings but excluding unburnt colliery spoil.

#### Type Approval

- 3 Material shall achieve a minimum CBR of 30% when tested in the laboratory in accordance with BS 1377-4 Cl. 7 when compacted to 95% of the maximum achieved by BS 1377 Test 14 and at saturation moisture content using 3 annular surcharge rings. Alternatively, the material shall satisfy an in-situ Stiffness Modulus measured by Portable Dynamic Plate, of 60MPa when tested in the Laboratory for approval purposes in accordance with Clause 890AK using the Portable Dynamic Plate
- 4 At least 2 weeks before the laying of material is to commence, details shall be submitted to the Overseeing Organisation of the sources of material and the methods intended to be used.

#### Main Works

- 5 Chalk shall have a saturation moisture content not exceeding 20% and shall be compacted in homogeneous layers not exceeding 225mm to achieve a maximum air voids of 5%
- 6 Capping layer materials shall be compacted with vibrating rollers so that when tested they achieve an in-situ Stiffness Modulus measured by Portable Dynamic Plate of 40MPa maintained until carriageway construction is complete. Tests shall be carried out every 10m of carriageway which may be reduced in frequency if there is no result less than 80MPa after 5 tests 10m apart.
- 7 Unless otherwise stated in Appendix 7/1, when used in the carriageway the materials shall not be frost susceptible if used within 450mm of the designed final surface when tested in accordance with Clause 801.8.

#### 888 AK Performance Categorised Unbound Mixture for Subbase

1. Performance Categorised Unbound Mixture for Subbase shall be selected granular materials complying with this clause including materials complying with the 800 series of the Specification and other recycled and secondary aggregates for example: crushed concrete, demolition waste, asphalt planings, furnace bottom, fuel and incinerator ash, slag but excluding unburnt colliery spoil.
2. The material shall have a Los Angeles coefficient of LA<sub>55</sub> when tested in accordance with BS EN 1097-2, Determination of resistance to fragmentation by the Los Angeles test.
3. The material shall contain no gypsum plaster, putrescent or soluble material and not more than a total of 2% by mass, timber, plastic, steel or other degradable material. The maximum dimension of any such material shall not exceed 25mm.

4. The material at time of compaction shall be at an appropriate moisture content between +1% and –2% of the optimum moisture content as determined by BS 1377-4 or a recognised field identification test.
5. The material shall satisfy the requirements of Table 8/88 below when tested in the Laboratory for approval purposes using the Portable Dynamic Plate in accordance with Clause 890 AK.
6. In addition after installation the material should have sufficient mechanical interlock not to rut under construction traffic. If necessary this should be demonstrated by a field trial. The material shall not exhibit a rut depth exceeding 20mm after 100 passes of an 8 tonne axle.
7. When tested in-situ it shall achieve a Stiffness Modulus measured by Portable Dynamic Plate described in Clause 889 AK, as given by Table 8/88 measured at a rate of 1 test per 50 linear metres of carriageway
8. Unless otherwise stated in Appendix 7/1, when used in the carriageway the materials shall not be frost susceptible if used within 450mm of the designed final surface when tested in accordance with Clause 801.8.

Table 8/88 Stiffness of granular materials

<b>Stiffness at top of layer</b>	<b>In-situ</b>	<b>Laboratory</b>
Category A material	100 MPa	150 MPa
Category B material	70 MPa	105 MPa
Category C material	50 MPa	75 MPa

9. Materials shall be compacted with vibrating rollers without drying out or segregation so that when tested they achieve 95% of the density when compacted in accordance with BS 1377-4 Method 3.7. This shall be measured in-situ using a calibrated nuclear density meter at a rate of 1 test per 50 linear metres of carriageway.
10. Prior to laying the bituminous material the surface of the subbase shall satisfy the surface tolerance requirements of clause 702.
11. At least 2 weeks before laying of material is to commence, details shall be submitted to the Overseeing Organisation of the sources of material and the methods intended to be used.

889 AK Portable Dynamic Plate Test

1. The Portable Dynamic Plate Test shall be carried out using equipment which has been properly calibrated to the manufacturer's specification and subject to a validation check prior to use.
2. The equipment shall be capable of delivering a total load pulse of peak magnitude 6-8kN, of total duration 15-40 milliseconds, to a rigid circular plate

of 300mm diameter. Both the applied load and the transient deflection shall be measured.

3. The dynamic modulus shall be determined at each point tested using the following formula:-

$$\text{Dynamic Modulus, } E_{vd} \text{ (MPa)} = \frac{P(1-v^2)}{0.3y}$$

Where P is the peak applied load (kN)

y is the peak deflection (mm)

v is the Poissons Ratio; a value of 0.35 shall be used in the absence of any other data

4. The stiffness modulus shall be obtained using the following formula:-

$$\text{Stiffness Modulus, } G \text{ (MPa)} = E_{vd} / 0.6.$$

5. The full technical specification of the Portable Dynamic Plate Test apparatus is published by the German Federal Ministry of Transport, Road Construction Department in TP BF-StB Part B 8.3, 1992 (in German).

#### 890 AK Materials approval using Portable Dynamic Plate Test

1. The material shall be compacted into a box dimensions: 610mm x 610mm x 420mm deep, with a 75Kg Vibrating Plate Compactor in 3 layers with 6 passes on each layer.
2. The moisture content shall satisfy the requirements for the particular material being approved.
3. The density shall be checked with a calibrated nuclear density gauge in direct transmission mode to ensure a minimum compaction of 95% of wet density achieved in BS 1377-4 Method 3.7.
4. The materials shall be tested using the Portable Dynamic Plate Test in accordance with Clause 889 AK.
5. The mean Stiffness modulus shall satisfy the requirements of the relevant Clause for the material.

#### 989 AK Geotextile Surface Dressing

The Geotextile Fabric

1. The membrane shall be a non-woven, 100% polypropylene fabric with the following characteristics:
 

(a) Tensile strength	BS EN 10319	9.0kN/m minimum
(b) Elongation at Break (md)	BS EN 10319	55% minimum
(c) Melting point	ASTM D.276	150°C minimum

(d) Asphalt retention                      Task Force 25 Method 8                      1.0 kg/m<sup>2</sup>

- 2                      The fabric shall not be exposed to direct sunlight for a cumulative period exceeding 2 weeks prior to its being overlaid and shall be stored in accordance with the manufacturer's instructions.

#### Surface Preparation

- 3                      The surface of any existing pavement to be overlaid, whether directly with the membrane, or with a regulating course onto which the membrane will subsequently be laid, shall receive the following treatment:
- (a)                      All cracks of width greater than 5mm shall be blown clean and dry with hot compressed air and filled with 70 - 100 pen grade filled bitumen incorporating 70 - 75% Limestone filler, using a screed box not exceeding 50mm wide.
  - (b)                      All potholes, or fretted areas shall be filled with regulating material of aggregate size appropriate for the depth of material laid.
  - (c)                      The minimum surface temperature shall be 5°C, and the surface shall be dry and swept free from dirt, oil, vegetation and other debris, by mechanical broom.

#### Bond Coat

4.                      The binder shall be either 160-220 pen bitumen maintained in a tanker/spray at 160°C ± 5°C or 70-100 pen maintained at 180°C ± 5°C and sprayed at a rate of 0.9 l/m<sup>2</sup> ± 0.1 l/m<sup>2</sup> or cut back bitumen, sprayed at a rate of 1.0 l/m<sup>2</sup> ± 0.1 l/m<sup>2</sup>. If the surface is porous/pervious the rate shall be increased, with the agreement of the Overseeing Organisation, to allow for the binder lost into the surface. The binder shall be sprayed uniformly over the whole area on which the fabric is to be laid, plus 150mm at each side using pressure jets specifically designed and calibrated for the purpose.

#### Fabric Laying

5.                      The fabric shall be laid out mechanically immediately after spraying whilst maintained under sufficient light tension to ensure no wrinkling. Should wrinkling in excess of 25mm occur inadvertently, the fold shall be slit and laid flat, permitting only a double thickness of material. Transverse and longitudinal joints shall be butted, joints shall not coincide with longitudinal or transverse cracks. All fabric must be bonded to the substrate with bitumen, and the Overseeing Organisation may permit additional bitumen to be placed manually to ensure this.
6.                      The fabric shall be brushed with a stiff broom over its whole surface to ensure it is in contact with the bitumen film. If hot binder is used this shall take place before the binder has cooled to a non-tacky state
7.                      The surface of the fabric shall be rolled with at least one pass of a rubber coated drum roller or pneumatic tyred roller immediately after laying the fabric to press the fabric into the bond coat

8. The fabric shall be overlaid immediately with the surface dressing if cut back or penetration grade binder is used for the bond coat or as soon as is practicable if bitumen emulsion is used.
9. Construction and emergency traffic may run on the fabric immediately after laying. However, it must be ensured that damage is not caused to the membrane by vehicles turning, braking etc. and it must also be ensured that the membrane is kept clean of mud or other detritus. If damage occurs the affected area shall be patched with bond coat and fabric. If the surface of the fabric becomes tacky with bitumen during construction, this may be blotted if necessary with sand to prevent spreading and pick-up of the fabric. Excess sand shall be removed by sweeping before overlaying

#### Surface Dressing

10. Surface Dressing overlay shall be carried out using polymer modified cut back or polymer modified binder in accordance with Clause 919 treating the site as 'hard' and except for the following:
  - a) an additional 0.3 l/m<sup>2</sup> bitumen shall be used.
  - b) if a single dressing is used for the main works, any bends, junctions or entrances to premises shall have smaller chippings added to form a racked in system
  - c) compaction shall be carried out using both a vibrating roller with rubber coated drum and a pneumatic tyred roller to ensure the whole surface is fully compacted to produce a stable dressing
11. Unrestricted traffic, turning or braking traffic, shall not use the dressed surface until the binder has gained enough strength and the layer has stabilised to form a mosaic

#### 990 AK Geotextile Reflective Crack Control Membrane

##### The Geotextile Fabric

1. The membrane shall be a non-woven, 100% polypropylene fabric with the following characteristics:
 

(a)	Tensile strength	ISO 10319/1	8.0kN/m minimum
(b)	Elongation at maximum load%	ISO 10319/1	55% minimum
(c)	Melting point	ASTM D.276	150°C minimum
(d)	Asphalt retention	ASTM D 6140-97	1.1 kg/m <sup>2</sup>
2. The fabric shall not be exposed to direct sunlight for a cumulative period exceeding 2 weeks prior to its being overlaid and shall be stored in accordance with the manufacturer's instructions.

##### Surface Preparation

- 3 The surface of any existing pavement to be overlaid, whether directly with the membrane, or with a regulating course onto which the membrane will subsequently be laid, shall receive the following treatment:
- (a) All cracks of width greater than 5mm shall be blown clean and dry with hot compressed air and filled with 60 - 80 pen grade filled bitumen incorporating 70 - 75% Limestone filler, using a screed box not exceeding 50mm wide.
  - (b) All potholes, or fretted areas shall be filled with regulating material of aggregate size appropriate for the depth of material laid.
  - (c) The minimum surface temperature shall be 15°C, and the surface shall be dry and swept free from dirt, oil, vegetation and other debris, by mechanical broom.

#### Bond Coat

4. The binder shall be either 200 pen bitumen maintained in a tanker/spray at 160°C  $\pm$  5°C or 100 pen maintained at 180°C  $\pm$  5°C and sprayed at a rate of 0.9 l/m<sup>2</sup>  $\pm$  0.1 l/m<sup>2</sup> or cut back bitumen, sprayed at a rate of 1.0 l/m<sup>2</sup>  $\pm$  0.1 l/m<sup>2</sup>. If the surface is porous/pervious the rate shall be increased, with the agreement of the Overseeing Organisation, to allow for the binder lost into the surface. The binder shall be sprayed uniformly over the whole area on which the fabric is to be laid, plus 150mm at each side using pressure jets specifically designed and calibrated for the purpose.



### Fabric Laying

5. The fabric shall be laid out mechanically immediately after spraying whilst maintained under sufficient light tension to ensure no wrinkling. Should wrinkling in excess of 25mm occur inadvertently, the fold shall be slit and laid flat, permitting only a double thickness of material. Transverse and longitudinal joints shall be butted, joints shall not coincide with longitudinal or transverse cracks. All fabric must be bonded to the substrate with bitumen, and the Engineer may permit additional bitumen to be placed manually to ensure this.
6. The fabric shall be brushed with a stiff broom over its whole surface to ensure it is in contact with the bitumen film. If hot binder is used this shall take place before the binder has cooled to a non-tacky state.
7. The surface of the fabric shall be rolled with at least one pass of a rubber coated drum roller or pneumatic tyred roller immediately after laying the fabric to press the fabric into the bond coat.
8. Construction and emergency traffic may run on the fabric immediately after laying. However, it must be ensured that damage is not caused to the membrane by vehicles turning, braking etc. and it must also be ensured that the membrane is kept clean of mud or other detritus. If damage occurs the affected area shall be patched with bond coat and fabric. If the surface of the fabric becomes tacky with bitumen during construction, this may be blotted if necessary with sand to prevent spreading and pick-up of the fabric. Excess sand shall be removed by sweeping before overlaying

### 991AK Cold Recycled Bitumen Bound Material structural grade off site mix

1. Scope
  - a) Cold recycled bitumen bound material shall be designed and produced to form the foundation or main structural layer of the road pavement. The primary aggregate source shall be asphalt milling, pulverised pavement material, processed demolition waste, crushed glass, natural or artificial aggregates, mixed remotely and taken to site. The primary binder (stabilising agent) shall be a foamed penetration grade bitumen or bitumen emulsion, with pfa, cement or lime as an adhesion agent. The aggregate grading may be adjusted by the addition of a filler.
  - b) Prior to commencing the works, the Contractor shall demonstrate, to the satisfaction of the Overseeing Organisation using the results of mix design procedures described in sub-Clauses 32 to 48 of this Clause, that the materials are capable of producing a material that can meet the specified requirements.

### Aggregates and Fillers

2. The aggregate components comprising asphalt milling, pulverised pavement material, processed demolition waste, crushed glass, natural or artificial aggregates and filler (if used) shall be granular material with not less than 5% and not more than 20% passing the 0.063mm sieve (Zone A graded material). Approval for use of granular material containing up to 35% passing the 0.063mm sieve (Zone B graded material) shall require confirmation by the Overseeing

Organisation subject to the results of the mixture design procedures described in sub-Clauses 62 to 71 of this Clause.

3. The aggregate components shall contain not more than 2% of organic matter as determined in accordance with BS 1377-3: Clause 3.
4. Using water, the optimum liquid content for the aggregate components shall be obtained in accordance with BS 1377-4 Clause 3.7. If aggregate contains bitumen residues the material shall be dried at a temperature not exceeding 40 °C to constant weight.
5. The particle (or “lump”) size distribution for the aggregate components shall be determined in accordance with BS EN 933-1 (or by an amended method to obtain an early assessment of grading, provided correlation with the standard test method can be demonstrated).

#### Bitumen Binder

6. The primary binder shall be foamed bitumen or bitumen emulsion. The base bitumen shall comply with BS EN 12591 and shall normally be penetration grade 100 - 150. Subject to the results of the mixture design procedures described in sub-Clauses 62 to 71 of this Clause and approval of the Overseeing Organisation, the base bitumen may be a penetration grade in the range 50 to 190.
7. Other than foaming agent(s), bitumen modifiers shall not be used unless approved by the Overseeing Organisation for special purposes or conditions.
8. The binder shall be transported to the plant in tankers capable of maintaining the required temperature and a homogeneous binder consistency and transferred to the plant in a controlled and uniform manner.
9. In the case of foamed bitumen the foaming process shall be carried out within the system of the mixing plant and immediately mixed with the aggregate, at which point the foamed bitumen shall have a volume of not less than 10 times the volume of the base penetration grade bitumen.

#### Cement, Filler and Lime

10. The constituents and required quality standards of hydraulic cement, filler and lime delivered to site shall be certified by the supplier, whose manufacturing and delivery processes shall be implemented using quality management systems in accordance with the BS EN ISO 9001 and certified by an accredited body.
11. Hydraulic cement as a filler or adhesion agent shall be Portland cement CEM I, Portland blast furnace slag cement PBC or Portland pfa cement CEM II/B-V, in accordance with sub-Clause 1001.3.
12. PFA, used as a filler, shall be in accordance with BS 3892: Part 1.
13. Lime shall be either quicklime or hydrated lime, complying with sub-Clause 615.3.

### Water

14. Water for moisture content control shall normally be obtained from a water company supply and used without testing.

### Processing aggregate components

15. The Contractor shall satisfy the Overseeing Organisation that the plant used for processing the aggregate prior to use is capable of consistently manufacturing material to the proposed grading and removing unacceptable material.
16. Process control of the aggregate components shall be carried out as required by sub-Clauses 53 to 56.
17. If the moisture content of the aggregate components fails to meet the required moisture content range, corrective action shall be taken either by aeration to reduce the moisture content or by controlled addition of water to increase the moisture content.
18. Any increase in moisture content of the affected material shall be achieved by the addition of water through an adjustable spraybar system and a conveyor belt or other device to achieve a uniform distribution of the water throughout. The material shall not be used until subsequent moisture content tests show that the material has reached the required moisture content range.
19. Material stockpiles shall be protected from moisture change as a result of hot sun or rainfall. Frozen material shall not be used.

### Mixing

20. The mixing plant shall be capable of uniformly mixing controlled amounts of water with the other ingredients and binder to produce the cold recycled material complying with this clause.
21. The mixing plant shall be equipped with a spraybar system within the mixing chamber capable of producing and uniformly distributing bitumen binder at a monitored and controlled rate. An accessible sampling jet shall also be fitted that produces foamed bitumen, where used, having the same characteristics as that produced by the main spraybar. Flow rate meters for measuring the supply rate of hot bitumen and other liquid additives to the mixture shall be capable of recording the correct rate of flow during all states of pipeline flow (i.e. fully or partially charged). Evidence confirming the capabilities of the plant and the calibration of flow meters, shall be submitted to and approved by the Overseeing Organisation prior to delivery of material.
22. The rate of supply of the binder shall be calculated to achieve the target bitumen content determined in accordance with sub-Clauses 62 to 71, and controlled and monitored as the mixing takes place.
23. The rate of incorporation of hydraulic cement and/or filler shall be calculated to achieve the mixture composition determined in accordance with the mix design

process in sub-Clauses 62 to 71 and controlled and monitored as the mixing takes place.

24. The moisture content of the mixed material shall be monitored by sampling after mixing

Storage, transportation, laying and compaction

25. Material stockpiled after mixing shall be protected from moisture change as a result of hot sun, ground water or rainfall.

26. Material shall only be stockpiled for a period which has been shown not to affect the performance of the material when incorporated in the works. This period shall be notified to the Overseeing Organisation

27. Material shall be transported in sheeted trucks, offloaded and incorporated in the works in such a way as to minimise segregation and moisture change. The maximum aggregate size shall not exceed 0.5 times the laid thickness.

28. The compaction of each layer shall be carried out using compaction plant approved by the Overseeing Organisation, until such time as the in-situ density complies with sub-Clause 59 of this Clause and the completed layer provides a stable and dense surface. Compaction shall be discontinued if any distress to the materials is noticed and the cause investigated.

29. The stability of the layer under compaction shall be deemed adequate if the finished surface does not shove, rut or exhibit transverse cracking under the load of subsequent construction traffic.

30. On completion of compaction the surface shall be sealed using a sprayed membrane of Class K1 - 70 bitumen emulsion complying with Clause 920 or a bond coat in accordance with BS 4987-2. Bitumen emulsion shall be sprayed at the rate of not less than 1.0litres/m<sup>2</sup>. Where the surface is opened to traffic, the sealing membrane shall be blinded with fine aggregate or sand applied at a rate of 5.5 to 7.0 kg/m<sup>2</sup>.

31. Not Used.

Mix Design

32. A mix design and characterisation process shall be carried out as described in sub-Clauses 62 to 71

Field trial

33. Mixed material, manufactured at the proposed target grading and with the required quantity of water, binder and other additives, shall be stockpiled for the maximum time as stated by the manufacturer.

34. The material shall be laid by hand or paver 200mm thick over a hard unyielding foundation in a length of not less than 15m and unless contained with a width of

not less than 5m. It shall be compacted in accordance with this Clause. Ramps shall be provided at each end, if necessary.

35. Sufficient representative material shall be taken to produce three 150 mm cube specimens, made in accordance with BS EN 13286-51. The refusal density for each cube sample shall be determined to the nearest  $10\text{kg/m}^3$ .
36. After final compaction of the trial area, the in-situ bulk density shall be measured, with at least 5 determinations made using a nuclear density gauge in direct transmission mode, to a depth within 25 mm of the layer thickness. The meter readings shall be verified periodically with the gauge calibrated in accordance with BS 1377-9.
37. The in-situ bulk density values obtained shall be compared with the refusal density value obtained from the cube specimens. The average in-situ bulk density of each set of five values shall be at least 95% of the mean cube refusal density, with no individual in-situ density value less than 93% of the refusal density for the cube.
38. Within 24 hours of completion the performance of the installed layer shall be evaluated using a dynamic plate-loading device to determine values of elastic modulus at points on a grid pattern to fully cover the laid area. The mean elastic modulus shall be not less than 100MPa measured by Portable Dynamic Plate in accordance with Clause 889AK.
39. The deformation resistance of a layer in any area shall be assessed after a curing period of at least 24 hours by channelled trafficking using a rigid three-axle tipper truck loaded to a gross mass of 24 tonnes (assumed equivalent to three standard axles). The vertical deformation shall be measured in all wheel-tracks at monitoring points on each of 5 transverse sections set 1 m apart after 5, 15, 30 and 40 passes of the truck. The mean vertical deformations at the above trafficking increments shall be plotted against the respective number of truck passes and the mean vertical deformation corresponding to 100 standard axles shall be interpolated. The layer shall be deemed acceptable if the mean vertical deformation corresponding to 100 standard axles is less than 5 mm if the material is to be overlaid with 100mm or less of surface course or 10mm if greater than 100mm of surface course.
40. Sufficient mixed material for specimen preparation shall be taken from the site of the trial and transferred in sealed bags to the laboratory.
41. 15 No. cylindrical specimens (briquettes) 150 mm dia. by  $(70 \pm 5)$  mm height shall be manufactured by compacting the mixed material at  $(20 \pm 5)^\circ\text{C}$  in a mould to refusal using a vibrating hammer with a circular head. A filter paper shall be placed in the top and bottom of the mould prior to compaction.
42. The briquettes shall be cured at  $(60 \pm 5)^\circ\text{C}$  for  $(72 \pm 4)$  hours in the mould. They shall be demoulded and each briquette specimen shall be conditioned in air for a period of  $(12 \pm 3)$  hours at  $20^\circ\text{C}$ .
43. The air voids content of each briquette shall be determined in accordance with BS 598: Part 104, with substitution of self-adhesive aluminium foil to seal the

specimen during immersion, in place of the wax recommended by the British Standard (BS). The maximum density for the partially coated product, used in the air voids content calculation, shall be standardised using the maximum density determined for a fully coated laboratory prepared specimen. A sample of mixed material shall be dried to constant mass at 50°C. Sufficient hot penetration grade bitumen shall then be added in increments to the material, (heated if necessary) in a mechanical mixer until the mixture is visually fully coated (using up to 4% of added bitumen). The coated specimen shall be tested to determine maximum density as specified in BS EN 12697-5.

44. The air voids of each briquette shall be as given in Table 9/91.1 below
45. 6 No. briquettes shall be tested at 20°C in accordance with DD 213:1993, to determine the Indirect Tensile Stiffness Modulus (ITSM) of the material. After removal from the test apparatus, each briquette shall be immersed in water at 20°C for a minimum period of 24 hours, then re-tested to determine the ITSM of the material in a saturated state.
46. 6 No briquettes shall be tested at 30°C in accordance with DD 226: 1996 to determine the repeated load axial test result for permanent deformation (RLAT).
47. 3 No. briquettes shall be tested at 45°C in accordance with TRL Paper 3287/97 for confined dynamic creep (vRLAT).
48. The values shall comply with Table 9/91.1. Greater stiffness modulus and/or improved deformation resistance may be required if the material is to be subjected to heavy construction traffic.

#### Mix Approval

49. The mix is approved if it complies with the requirements of this Clause or has a HAPAS Certificate as a Permanent Cold Lay Surfacing Material (PCSM) and demonstrates compliance with the requirements of Table 9/91.1
50. The mix design shall form part of an approved Quality Assurance System of the supplier.
51. Mix type approval shall be granted if the mixed material complies with Table 9/91.1. It shall be repeated every 3 years.
52. The laboratory measurement of stiffness, deformation and air voids parameters shall be repeated at every visit of the mixing plant to the aggregate component stockpile or every 5000 tonnes manufactured.

#### Process Control

53. The condition or quality of the mixed material shall be assessed for grading and binder content compared to the approved mix design and agreed tolerances at a rate of one sample per 500tonnes mixed or at least daily.

54. The moisture content of the aggregate components and the mixed material shall be monitored using test specimens extracted from one bulk sample of aggregate components taken from material being fed into the plant and after mixing at least daily.
55. The rate of addition of pfa, cement, filler, lime or quicklime shall be measured at least daily.
56. The rate of supply of bitumen binder and any other fluids to the plant shall be set and continuously monitored using the appropriate flow rate meters on the plant. As a check, at the start and completion of each work period, the rate of supply of bitumen shall be determined from before and after dip measurements of the storage/delivery tanks.

#### Process control on installation

57. In the field, for every 250tonnes of material or at least daily a bulk sample of the mixed material shall be taken. It shall be used to produce a 150 mm cube specimen, made in accordance with BS EN 13286-51. The refusal density for each cube sample shall be determined to the nearest  $10\text{kg/m}^3$ .
58. After final compaction of the layer, the in-situ bulk density shall be measured, at 50 m intervals per lane, or as appropriate, with at least 5 determinations made, using a nuclear density gauge in direct transmission mode to a depth within 25 mm of the layer thickness. The meter readings shall be verified periodically with the gauge calibrated in accordance with BS 1377-9.
59. The in-situ bulk density values obtained shall be compared with the refusal density value obtained from the manufactured cube. The average in-situ bulk density of each set of five values shall be at least 95% of the cube refusal density, with no individual in-situ density value less than 93% of the respective refusal density.
60. Within 24 hours of completion and prior to overlaying the material the performance of the installed layer shall be evaluated using a dynamic plate-loading device to determine values of elastic modulus at points on a nominal grid pattern to fully cover the laid area. The mean elastic modulus shall be not less than 100MPa measured by Portable Dynamic Plate in accordance with Clause 889AK.
61. The specification compliance criteria for the process control tests shall be as described in Table 9/91.1.

#### Mixture Design and Characterisation

62. Mixture design and characterisation of cold recycled bitumen bound material for each plant, including details of filler, binder, and other constituents and their quantities, shall be submitted to the Overseeing Organisation at least one week prior to commencement of the recycling works at the plant.
63. The testing standards used for the mixture design of the recycled bitumen bound mixture shall be those listed in Table 9/91.2.

64. The aggregate used in the design and characterisation process shall be obtained from the stockpiled material and shall be representative in terms of component material proportions of the aggregate components to be used. Any laboratory-manufactured aggregate shall be pulverised or crushed such that it closely replicates the nature and grading of the proposed aggregate components
65. The aggregate components shall be thoroughly mixed in the laboratory with measured proportions of the bitumen binder, filler and adhesion agent(s) to produce at least three trial mixtures with different added bitumen contents. The type and grade of the bitumen and adhesion agent(s) used in the trial mixtures shall be the same as those used in the finished works.
66. The different added bitumen contents of the trial mixtures shall be set at increments of between 0.5% and 1.0% in the range 3.0% to 6.0%, with appropriate allowance made for residual binder in any crushed asphalt component. The minimum added binder content shall be as stated in sub-clause 71 below.
67. From each trial mixture, four 150 mm diameter x 75 mm to 100 mm high, cylinder test specimens (briquette specimens) shall be compacted to refusal by vibratory compaction in a cylindrical metal mould, using the compaction mould assembly and vibratory hammer described in BS 598-104. The bulk density of each cylinder shall be determined.
68. The briquettes shall be cured at  $(60 \pm 5) ^\circ\text{C}$  for  $(72 \pm 4)$  hours in the mould. They shall be demoulded and each briquette specimen shall be conditioned in air for a minimum period of  $(12 \pm 3)$  hours at  $20^\circ\text{C}$ .
69. 6 No. briquettes shall be tested at  $20^\circ\text{C}$  in accordance with DD 213:1993, to determine the Indirect Tensile Stiffness Modulus (ITSM) of the material. After further conditioning of the briquettes, immersed in water at  $20^\circ\text{C}$  for a minimum period of 24 hours, the ITSM tests shall be repeated on each specimen.
70. The characteristics of the mixture to be manufactured in the plant, including any added water, shall be determined using the optimum ITSM (dry) values. If peak conditions are not clearly displayed then plateau characteristics shall be accepted and the lowest added bitumen content for which all the criteria defined in Table 9/91.1 are met, shall be used.
71. The minimum added bitumen content shall be subject to a minimum of 4.0% for mixtures containing only pulverised unbound or cement bound aggregate and 3.5% for mixtures containing only pulverised bitumen bound materials; combinations shall be pro-rata.
72. On the basis of the foregoing test results, and subject to a satisfactory field trial as described in this Clause, the contractor shall declare details of the Job Standard Mixture(s) for the plant, setting out target aggregate grading and type, added water content, adhesion agents and binder content, together with tolerances. This shall not be changed without the approval of the Overseeing Organisation in advance.



**TABLE 9/91.1: Compliance Criteria for Type Approval and Process Control Tests on mixed material**

Material property or characteristic	Individual results	Mean from test set
Relative in-situ density	93% minimum	95% minimum
Aggregate grading (BS 598-102)	In accordance with the proposed target grading range	
Added bitumen content (BS 598-102)	Target $\pm$ 0.6%	N/A
Moisture content (BS 1377-2)	Optimum $\pm$ 3%	Optimum $\pm$ 2%
Adhesion agents content	Target $\pm$ 2%	Target $\pm$ 1%
Indirect Tensile Stiffness Modulus (ITSM) - dry specimens after curing	2500 MPa minimum	3500 MPa minimum
ITSM - water saturated specimens	2000 MPa minimum	2800 MPa minimum
Deformation resistance (RLAT)		1.6% maximum strain
Deformation Resistance (vRLAT)		1.4% maximum strain
Percentage air voids content of briquettes	9% maximum	7% maximum
Dynamic plate loading		100MPa

**TABLE 9/91.2: Testing Standards for the Design and Characterisation of Recycled Bitumen Bound Material**

Test	Standard
Moisture content	BS 1377-2
Bulk Density	BS 598-104
Air Voids Content	BS 598-104 & sub-Clause 45 of Clause 948
Grading and Binder Content	BS 598-102
Indirect Tensile Stiffness Modulus [ITSM]	DD 213
Deformation resistance	DD 226 and TRL Paper 3287/97

992 AK NOT USED

993 AK NOT USED

994 AK NOT USED

995 AK NOT USED

996 AK Permanent Cold Lay Base (PCLB) Material Storage Grade

General

1. Permanent Cold Lay Base Material (PCLB) shall comply with the grading requirements and tolerances given by the manufacturer for the relevant maximum size of aggregate and this Clause

#### Aggregate

2. The maximum aggregate size shall not exceed 0.5 times the laid thickness, defined in the contract. For the purposes of this Sub-Clause bitumen bound material (if any) shall be wet sieved.
3. The aggregate components comprising asphalt milling, pulverised pavement material, processed demolition waste, crushed glass, natural or artificial aggregates and filler (if used) shall be granular material with not less than 5% passing the 0.063 mm sieve. For the purposes of Sub-Clause 1 the material shall be sieved using an organic solvent.

#### Binder

4. The binder shall be a bitumen emulsion or a foam bitumen system with penetration of base bitumen of 100-150 pen unless agreed with the Overseeing Organisation.
5. The target bitumen and binder content shall be determined by the performance requirements within the mix design procedure within this clause. The permitted tolerance on target bitumen content shall be  $\pm 0.6$  % by mass. For the purposes of analysis, the bitumen content of any reused asphalt shall be included as binder if the pen of the bitumen therein exceeds 20 pen.

#### Sample Preparation

6. Sufficient material for specimen preparation and optimum moisture (liquid) content determination shall be mixed in the laboratory or in the plant, at the mid point grading. (Approx. 60 kg).
7. Using water, the optimum liquid content for the mixture shall be obtained in accordance with BS 1377-4 Clause 3.7. If aggregate contains bitumen residues the material shall be dried at a temperature not exceeding 40 °C to constant weight.
8. Sufficient material for 15 specimens shall be mixed in the laboratory with the proposed binder, at the mid point grading, the target binder content and at optimum liquid content  $\pm 1\%$ , to achieve a thorough coating of aggregate with binder. The liquid content is the total moisture and binder content but excluding any bitumen residues in reused asphalt used as aggregate.
9. 15 No. cylindrical specimens (briquettes) 150 mm dia. by  $(70 \pm 5)$  mm height shall be manufactured by compacting the cured material at  $(60 \pm 5)$  °C in a mould to refusal using a vibrating hammer with a circular head. A filter paper shall be placed in the top and bottom of the mould prior to compaction.

10. The specimens shall be cured at  $(60 \pm 5)$  °C for  $(72 \pm 4)$  hours in the mould. They shall be demoulded and each briquette specimen shall be conditioned in air for a period of  $(12 \pm 3)$  hours at 20°C.

#### Mix Design

11. The air voids content of each briquette shall be determined in accordance with BS 598: Part 104, with substitution of self-adhesive aluminium foil to seal the specimen during immersion, in place of the wax recommended by the British Standard (BS). The maximum density for the partially coated product, used in the air voids content calculation, shall be standardised using the maximum density determined for a fully coated laboratory prepared specimen. A sample of mixed material shall be dried to constant mass at 50°C. Sufficient hot penetration grade bitumen shall then be added in increments to the material, (heated if necessary) in a mechanical mixer until the mixture is visually fully coated (using up to 4% of added bitumen). The coated specimen shall be tested to determine maximum density as specified in BS EN 12697-5.
12. The air voids shall be in the range 2.0 % to 8.0%.
13. 6 No. briquettes shall be tested at 20°C in accordance with DD 213:1993, to determine the Indirect Tensile Stiffness Modulus (ITSM) of the material. After removal from the test apparatus, each briquette shall be immersed in water at 20°C for a minimum period of 24 hours, then re-tested to determine the ITSM of the material in a saturated state.
14. 6 No briquettes shall be tested at 30°C in accordance with DD 226: 1996 to determine the repeated load axial test result for permanent deformation (RLAT).
15. 3 No. briquettes shall be tested at 45°C in accordance with TRL Paper 3287/97 for confined dynamic creep (vRLAT).
16. The results obtained from each set of specimens tested for ITSM shall be averaged, excluding the highest and lowest result, and the average value of stiffness modulus obtained. The average value of stiffness modulus shall not be less than 900 MPa.
17. The average stiffness modulus of the six specimens after soaking shall be at least 80 % of the average value before soaking.
18. The average value of deformation (Axial strain) for the six specimens tested for RLAT shall not exceed **16,000 microstrain for 1800 load applications**.
19. The average value of deformation (Axial strain) for the three specimens tested for vRLAT shall be reported.

#### Mix Approval

20. The mix is approved if it complies with the requirements of the Mix Design procedure above or has a valid BBA HAPAS Certificate.

21. The mix design shall form part of an approved quality assurance system of the supplier.
22. Mix approval shall be obtained if the aggregate, binder or plant changes and be repeated at approximately 6 monthly intervals.

#### Transportation, Laying and Compaction

23. The material shall be delivered to and stored on site so that the liquid content of the material is maintained within the range specified for compaction and notified by the manufacturer. It shall be protected from rainfall, ground water and direct sun.
24. The material shall be laid and compacted to the design thickness in such a way that segregation is minimised. The layer shall have a dense closed surface on completion, to the thickness, levels and tolerances given in the contract. Compaction shall be discontinued if any distress to the materials is noticed and the cause investigated.
25. The material shall comply with the compositional analysis including tolerance declared by the manufacturer
26. The material shall be compacted at a liquid content in the range +0% to -2% of the optimum determined in accordance with Sub-Clause 7
27. The material shall not be laid at surface/air temperatures below 1 °C.
28. In footways the material shall be compacted as recommended by Table 9/96 below, except that where the plant cannot properly compact the layer because of the presence of obstructions or around ironwork, compaction shall be achieved by compaction to refusal with a vibrating/percussive hammer with a square head maximum size 150 mm, maximum layer thickness 60 mm. In case of doubt the voids shall be assessed using a calibrated nuclear density gauge or cores. The air voids shall be measured in accordance with Sub-clause 11. The air voids shall be in the range **2% to 12%**.
29. In carriageways, for every 250tonnes of material or at least daily a bulk sample of the mixed material shall be taken. It shall be used to produce a 150 mm cube specimen, made in accordance with BS EN 13286-51. The refusal density for each cube sample shall be determined to the nearest 10kg/m<sup>3</sup>.
30. After final compaction of the layer, the in-situ bulk density shall be measured, at 50 m intervals per lane, or as appropriate, with at least 5 determinations made, using a nuclear density gauge in direct transmission mode to a depth within 25 mm of the layer thickness. The meter readings shall be verified periodically with the gauge calibrated in accordance with BS 1377-9.
31. The in-situ bulk density values obtained shall be compared with the refusal density value obtained from the manufactured cube. The average in-situ bulk density of each set of five values shall be at least 95% of the cube refusal density,

with no individual in-situ density value less than 93% of the respective refusal density.

32. The material shall be laid by contractors approved by the manufacturer and agreed with the Overseeing Organisation.

#### Sampling and Testing

33. Materials shall be sampled and tested at the frequency given in Appendix 1/5.

**Table 9/96 Recommended Compaction plant and weight category ( Footways )**

Layers of compacted thickness up to	Compaction passes required		
	40 mm	60 mm	80 mm
<b>Vibrotamper</b> 50 kg minimum	5 <sup>(2)</sup>	-	-
<b>Vibrating roller<sup>(1)</sup></b> 600-1000 kg/m twin drum	5	-	-
1000-2000 kg/m twin drum	4	5	-
Over 2000 kg/m twin drum	3	4	4
2000-3500 kg/m single drum	5	-	-
<b>Vibrating plate</b> Over 1800 kg/sq. m	4	5	-

Note 1 Twin drum requires vibration on both drums.

Note 2 A Vibrotamper shall not be used for the compaction of areas of greater than 500 mm width.

### 1085 AK Concrete Carriageway Repairs

#### General

1. The locations of all repairs of concrete carriageways are detailed in Appendix 10/85.

#### Thin Bonded Repairs

2. Clause 1032 specifies the requirements for Thin Bonded Repairs.

#### Full Depth Repairs and Reinstatements

3. Clause 1033 specifies the requirements for Full Depth Repairs and Reinstatements.

#### Temporary repairs

4. The area of the temporary repair shall be prepared as described in Clause 1033, and reinstated with the materials detailed in Appendix 10/85.

#### Re-sealing joint grooves and sealing cracks

5. All existing sealant and caulking material shall be removed. A sealing groove shall be sawn or chased out along the line of the crack to the required dimensions. If required the sealing groove is to be widened or deepened by sawing. The sides of the groove shall be cleaned by abrasive blasting.
6. The groove shall be sealed in accordance with Clause 1016.

#### Stitched crack repairs

7. Slots are to be chased out and holes drilled at each end as described in the contract.
8. The slots are to be cleaned out and dried using oil-free compressed air prior to priming. Primer shall be applied to the cleaned dry surface in accordance with the manufacturers instructions and allowed to dry. The staple tie bars shall be clean, dry and oil free and shall be placed into a bed of resin mortar and covered to a minimum depth of 30mm with the same material.
9. The sides of the slot shall be prepared for the filling material as described in the contract by abrasive blasting followed by priming with resin primer or neat cement grout as appropriate. The resin or cementitious mortar shall be compacted into the prepared slot and finished flush with the surface.
10. Curing shall be as described in Clause 1027 and continued for the period set out in Appendix 10/85 until the concrete has achieved adequate strength which will depend upon surface temperature.
11. A groove shall be sawn along the line of the crack to the required width and depth and prepared and sealed in accordance with Clause 1016. The groove shall not be deeper than it is wide.

#### Slab lifting

12. The bay to be treated shall be separated from the adjacent slabs by a full depth saw cut along the longitudinal joint or joints.

The slabs shall be slowly raised and held at the required level by an approved means and the void beneath the slab shall be filled with grout by either pressure or vacuum grouting.

#### Pressure and Vacuum Grouting

13. The method to be employed is to be approved by the Overseeing Organisation before work commences.

#### Surface texturing

14. Surface texturing shall be only by grooving in accordance with Clause 1029. Surface dressing shall be in accordance with Clause 919. Before surface dressing is carried out transverse joint grooves shall be resealed if necessary and masked.

#### Bump cutting

15. Bump cutting is to be carried out by approved means over the area and to the depths detailed by the Overseeing Organisation. Cutting shall be in a longitudinal direction and the depth of cut shall be regularly checked with a straight edge and wedge to ensure that the irregularity is being removed as described.

1485 AK Switch and Fuse Gear

Switch and fuse gear shall be totally enclosed in metal casings, with back drilled holes for mounting vertically and shall be provided with hinged lids or covers secured when closed with captive, knurled thumb screws, drilled for sealing wires. Hinge pins are to be solid and incapable of removal except with tools, split pins shall not be used for this purpose. The lids shall be rebated or channelled all round to hold a sealing strip to ensure the exclusion of all moisture.

1585 AK Existing Motorway Communication System

The Contractor shall comply with the requirements contained within Appendix 15/85.

1885 AK Requirements for Bridge Number Plates

Dimensions and Materials

1. Bridge number plates shall be 300mm x 175mm cast aluminium oval shaped, with raised figures, letters and border 12mm thick overall.

Surface Preparation and Protective System

2. a) Surface Preparation

Method : Blast Clean

- b) Protective System

Zinc chromate primer with synthetic enamel stoved on by infra-red process. Figures, letters and border to be coloured black on red background.

Position and Bridge Number

3. Bridge number plates shall be located in positions to be agreed with the Railtrack Area Civil Engineer on Site.
4. The bridge number will be supplied by Railtrack.

2085 AK Waterproofing Systems on Existing Bridge Decks

## a) Separate Waterproofing and Surfacing Systems

## i) Waterproofing

Where waterproofing is provided separately from the surfacing, the waterproofing system shall comply with the requirements of Clauses 2001 to 2003 and 2005 except that the minimum depth of surfacing shall be 25 mm.

## ii) Surfacing

Surfacing shall comply with the requirements of Clause 1105. Where it is proposed to use Mastic Asphalt as both waterproofing and surfacing, the material shall be laid in two separate layers.

## b) Combined Waterproofing and Surfacing Systems

i) Where a combined waterproofing and surfacing system is to be used the system shall comply with the requirements of Clauses 2001 to 2003 and 2005. The system shall be agreed by the Overseeing Organisation.

ii) The performance of the combined waterproofing and surfacing system shall be not less than that achieved by separate systems in all respects including slip resistance of the surfacing component specified in Appendix 11/1 and the following:-

- a) resistance to water penetration;
- b) resistance to indentation;
- c) resistance to chloride ions or sunlight;
- d) tensile bond with the concrete substrate;

iii) In addition to the requirements stated elsewhere, the Contractor shall furnish the Overseeing Organisation with evidence of the performance of proposed combined waterproofing and surfacing system. This evidence shall be in the form of test results and/or service history.

iv) Where the proposed combined waterproofing and surfacing system has an overall thickness less than the existing, any features such as tuck grooves exposed by the removal of the existing waterproofing shall be filled to the approval of the Overseeing Organisation. The repair material used for filling shall comply with the requirements of Appendix 20/1 except that the surface finish shall match the finish of the adjacent concrete.

2485 AK Knapped Flint Facing

1. Flints shall be naturally occurring material knapped to reveal a cleft face between 100 and 150mm nominal diameter.



2. Knapped flints are to be clean and laid uncoursed with the cleft face outwards. They shall be bedded in mortar designation (iii) as Table 24/1, but the sand for the mortar shall comply with BS EN 13139. Anchor ties are to be bedded in the mortar at centres described in Appendix 24/1. The appearance of the finished face shall conform in all respects with that of a trial panel described in Appendix 24/1.

2486 AK Reconstruction of Existing Walls in Ashlar

1. All stones in ashlar which are to be removed shall be numbered on their external face using a waterproof crayon. No two stones shall have the same number.
2. After numbering, all stones shall be measured and then photographed in their original position. The photograph shall show the two adjacent stones and the first one below.
3. All stones on a particular course shall be removed before the Contractor starts to remove stones from a lower course.
4. When cutting out old stone, due care must be taken to ensure that the surviving stones adjacent are not damaged. Cutting of perimeter joints shall be carried out with a masonry saw or a diamond cutting disc mounted on a power tool. If the old stone is to be retained the cut shall first be made by diamond disc or with a quirk or plugging chisel, in the case of a wide joint. In the case of a fine joint and hard mortar, a purpose-made fine saw must be used.
5. After all mortar and extraneous material has been removed the Overseeing Organisation or his representative will inspect the stones in a particular course prior to their removal.
6. The Overseeing Organisation or his representative will agree with the Contractor the condition of each stone and will categorise them as follows:-
 

Class 'A' stones that can be replaced in their original positions without remedial works;

Class 'B' stones that can be replaced in their original positions after joining or remedial works;

Class 'C' stones that cannot be replaced in their original positions. The sizes of these stones will be agreed by the Contractor and the Overseeing Organisation and a note made if part of a stone can be re-used in another part of the Works.
7. All loose mortar and other materials shall be removed from the voids left by stones which have been removed. Stones around the void shall be cleaned on their inside faces with a stiff wire brush. Where necessary, mortar keys shall be cut into stones surrounding the voids.
8. Bedding mortar shall be in compliance with BS 8221-2 and the mortar designation in Appendix 24/85.

9. Class 'A' and Class 'B' stones shall be wire brushed to remove all mortar and loose fragments of masonry on all faces. They shall be placed in their original position and orientation.
10. Wherever possible at least one tie stone shall extend between adjacent layers of masonry. Unless agreed otherwise by the Overseeing Organisation, all new stones in ashlar shall be tie stones.
11. Where the face of the stonework is flaking (foliating) this shall be brushed down using a stiff bristle brush to remove all loose material. Where flaking stone is specified to be dressed back to sound material this shall be done using a scutch or chisel or boasted back to sound stone. The work shall be carried out using the minimum of force and care shall be taken not to disturb the adjoining stonework.
12. New stones in ashlar shall be the same material as adjacent stones unless otherwise stated elsewhere in the Contract. All stones shall be dressed into accurate plains on the beds and joints and they shall be tooled to produce a pecked finish on the face, to match adjacent stonework. All stones shall be of good hard durable quality, uniform in texture and free from iron band, spots, sand holes, flaws, shakes and other imperfections. Samples of the stone intended for use in the Works shall be submitted for the Overseeing Organisation's prior approval.
13. Areas identified as in need of surface repair involving the removal of existing stonework either whole or in part shall be repaired using natural stone and in general compliance with BS 8221-2.
14. Confirmation of the acceptability of the intended replacement stone will be required.
15. The Contractor will be required to produce a method statement to cover the repair of specific areas of stonework involving stone replacement.

2487 AK Reconstruction of Existing Block-in-Course Walls

1. Stones in block-in-course need not be numbered or photographed except as given below:-
  - (a) Corner stones in block-in-course on parapets, or similar walls, shall be treated as stones in ashlar;
  - (b) Stones in bases of parapets walls shall be treated as stones in ashlar;
  - (c) Stones in small parts of the parapet walls which are in ashlar shall be treated as stones in ashlar.
2. The Contractor may remove stones in block-in-course at his own discretion except as given below:-
  - (a) Stones which are not of the stone specified in Appendix 24/85 shall not be re-used. Their size and orientation shall be noted and agreed with the

Overseeing Organisation or his representative and these stones shall be discarded;

- (b) Stones which the Contractor deems are not suitable for re-use in any part of the structure shall be noted as in (a) above. These stones shall be stored in a place separate from other stones and at the end of the Contract disposed of as the Overseeing Organisation directs.

3. When rebuilding in block-in-course, beds and joints shall be squared and dressed for a distance of at least 225mm from the exposed face. Bond stones shall form not less than one sixth of the exposed area and shall extend the full width of the wall. All stones shall be battled on the exposed face unless the exposed face has been previously worked to an acceptable finish. The use of phosphor bronze or stainless steel ties is permitted.

Stainless steel dog cramps may be used as detailed below:-

- (a) Cramps shall be made of stainless steel from 3mm thick strip, 20mm wide and 225mm long. Stainless steel shall be designation 1.4301 and comply with Clause 2411;
- (b) 4 Cramps shall be placed in every square metre of masonry.

4. Bedding mortar shall be as defined in Appendix 24/85 and shall completely fill all joints. Joints shall be sufficiently thick to prevent stone to stone contact.
5. Pointing shall be as described in Appendix 24/85. Stones need not be placed in their original positions. All new stones shall be of the stone specified in Appendix 24/85.

#### 2488 AK Reconstruction of Existing Walls in Squared Random Rubble

1. Stones in squared Rubble - coursed or broken coursed need not be numbered or photographed except as given below:-
  - (a) Corner stones in squared rubble on parapets, or similar walls, shall be treated as stones in ashlar;
  - (b) Stones in bases of parapets walls shall be treated as stones in ashlar;
  - (c) Stones in small parts of the parapet walls which are in ashlar shall be treated as stones in ashlar.
2. The Contractor may remove stones in squared rubble at his own discretion except as given below:-
  - (a) Stones which are not of the stone specified in Appendix 24/85 shall not be re-used. Their size and orientation shall be noted and agreed with the Overseeing Organisation or his representative and these stones shall be discarded;

- (b) Stones which the Contractor deems are not suitable for re-use in any part of the structure shall be noted as in (a) above. These stones shall be stored in a place separate from other stones and at the end of the Contract disposed of as the Overseeing Organisation directs.
3. When rebuilding in squared rubble, coursed or broken coursed, beds and joints shall be squared and dressed for a distance of at least 125mm from the exposed face. Bond stones shall be provided at the rate of one to every 0.85 sq.m of exposed face and shall measure not less than 150 mm x 150 mm on the face and not less than 450 mm in length or the full thickness of the wall if the latter is less than 450 mm. Sneck stones shall not be less than 75 mm in any dimension. Vertical joints shall not include more than three stones, and the horizontal lapping of the stones shall not be less than 100mm.
4. The use of Phosphor bronze or stainless steel ties is permitted. Stainless steel dog cramps may be used as detailed below:-
- (a) Cramps shall be made of stainless steel from 3mm thick strip, 20mm wide and 225mm long. Stainless steel shall be designation 1.4301 and comply with Clause 2411;
- (b) 4 Cramps shall be placed in every square metre of masonry.
5. Bedding mortar shall be as defined in Appendix 24/85 and shall completely fill all joints. Joints shall be sufficiently thick to prevent stone to stone contact.
6. Pointing shall be as described in Appendix 24/85. Stones need not be placed in their original positions. All new stones shall be of the stone specified in the Contract.

2489 AK Reconstruction of Existing Walls in Random Rubble

1. Stones in Random rubble, coursed or uncoursed need not be numbered or photographed except as given below:-
- (a) Corner stones in block-in-course or ashlar shall be treated as stones in ashlar;
- (b) Stones in small parts of the parapet walls which are in block-in-course or ashlar shall be treated as stones in ashlar.

2489 AK Reconstruction of Existing Walls in Random Rubble (continued)

2. The Contractor may remove stones in random rubble at his own discretion except as given below:-
- (a) Stones which are not of the stone specified in Appendix 24/85 shall not be re-used. Their size and orientation shall be noted and agreed with the Overseeing Organisation or his representative and these stones shall be discarded;

- (b) Stones which the Contractor deems are not suitable for re-use in any part of the structure shall be noted as in (a) above. These stones shall be stored in a place separate from other stones and at the end of the Contract, disposed of as the Overseeing Organisation directs.
3. When rebuilding in random rubble all stones shall be carefully set with a bond stone provided at the rate of one to every 0.85 sq.m of exposed face. Bond stones shall measure not less than 150 mm x 150 mm on the exposed face, and not less than 450 mm in length or the full thickness of the wall if the latter is less than 450 mm unless otherwise described in Appendix 24/85.
4. The use of phosphor bronze or stainless steel ties is permitted. Stainless steel dog cramps may be used as detailed below:-
- (a) Cramps shall be made of stainless steel from 3mm thick strip, 20mm wide and 225mm long. Stainless steel shall be designation 1.4301 and comply with Clause 2411;
- (b) 4 Cramps shall be placed in every square metre of masonry.
5. Bedding mortar shall be as defined in Appendix 24/85 and shall completely fill all joints. Joints shall be sufficiently thick to prevent stone to stone contact.
6. Pointing shall be as described in Appendix 24/85. Stones need not be placed in their original positions. All new stones shall be of the stone specified in Appendix 24/85.

2490 AK Storage of Stones for Reconstruction Work

The Contractor shall provide land adjacent to the Works, where at his own discretion the Contractor may construct a safe and secure storage place for stones removed from the structure. Alternatively the Contractor may remove the stones from the Site to a storage place of his own choosing. In either case the Contractor must seek the Overseeing Organisation's approval for the details of the security of his storage place. If the Contractor should choose a storage place remote from the site, then he must seek the approval of the Overseeing Organisation for the location of his site and must provide the Overseeing Organisation with the name and address of the owner of the site.

2491 AK Repointing of Brickwork or Stonework

1. In general, workmanship shall comply with the contents of Clause 7.3 of BS 8221-2.
2. During the repointing operations in respect of arches, some bricks or stones may become loose in which case strutting may be required. If a large area becomes unstable then centring may be necessary to avoid progressive instability.
3. Any voids discovered behind vertical face of stonework shall be packed with bedding mortar except where this would require the removal of large stones in

ashlar or block-in-course or special stones such as quoins, copings, plinths, voussoirs etc. Where these stones are stable they shall be repointed incorporating grout tubes into the void and then pressure grouted to fill the voids with non-shrink grout.

4. If it becomes evident on an arch, that voids exist in or above the arch ring which cannot be packed, then a grid of grouting tubes shall be left in the joints at 500 mm centres to enable pressure grouting to take place upon completion of repointing. These tubes shall project into the voided area.
5. The mortar to be used for repointing shall be in compliance with BS 8221-2 and the mortar designation in Appendix 24/85. The proportions shall be subject to the Overseeing Organisation's approval following the preparation of a trial area as specified in sub-clause 7 below.
6. For repointing and bedding below water level a suitable mortar additive may be used to inhibit constituent loss or wetting. Alternatively, a proprietary cementitious material for use underwater may be used. The Overseeing Organisation must be given the opportunity to approve the chosen material prior to its use.
7. When repointing commences a trial area of at least 10 square metres shall be prepared in a location on the structure to be agreed by the Overseeing Organisation so that a standard of pointing can be agreed between the Overseeing Organisation and the Contractor. As repointing progresses convenient areas will be inspected by the Overseeing Organisation or his representative and, if the standard of pointing is comparable to the accepted trial panel, scaffolding or falsework associated with that area can then be dismantled.
8. The hydrated lime shall comply with the requirements of BS EN 459-1.
9. The lime and sand shall be mixed at least sixteen hours before use and when required shall be mixed in proportion with washed stone dust of the stone to be fixed.
10. The sand shall be well-graded, crushed natural stone to comply to BS EN 13139, the size of the coarse particles being as large as possible in relation to the width of the joints.

2491 AK Repointing of Brickwork or Stonework (continued)

11. All mortars shall be thoroughly mixed in an approved manner and in small quantities as required and used within half an hour of mixing, clean water being used at all times.
12. Before repointing, joints must be thoroughly cleaned and dampened to receive the new mortar.
13. The mortar must be placed firmly against the back of a joint with the appropriate tools, tamped firmly and receive the agreed surface treatment.

14. The finished face of the mortar shall be recessed such that it is behind the weathered arrises of the stonework, the resulting joint width thus being no greater than when the wall was originally constructed. Ribbon pointing is not acceptable.
15. The finished pointing to be lightly rubbed off with sacking or stippled with a stiff brush as directed on Site by the Overseeing Organisation. Care shall be taken to keep the face of the masonry free from mortar staining.

2492 AK Grouting of Voids in or Between Brickwork, Stonework and Concrete

1. Voids behind vertical faces shall be filled by gravity grouting.
2. Voids behind brickwork, stonework or concrete in horizontal faces or arches shall be filled by pressure grouting. Minimal pressure must be used to place the grout. The pressure gauge must be monitored closely to detect surges in pressure caused by blockages or filling of the void. When these surges occur the grout flow shall be stopped and continued at a different grout tube (usually higher than the first tube).
3. Before filling any void with grout it shall be thoroughly washed out to remove any loose particles.
4. Any grout which may run down the stonework face shall be immediately washed off with clean water.
5. After completion of the grouting at each location the grout tubes shall be sealed and left to set. When the grout in the tubes has hardened it shall be cut off flush with the stone facing.

2493 AK Grout for Grouting Voids behind Brickwork, Stonework or Concrete

1. Mortar mixes for grouting shall consist of one of the following
  - (a) 2 parts French hydrated lime to 3 parts 3/10 graded sharp sand with the addition of High Thermal Insulation (H.T.I.) powder in accordance with the manufacturer's recommendations or
  - (b) A proprietary pre-bagged grout mix designed by a specialist grout supplier and incorporating a pozzolanic additive such as Reactive PFA (pulverised fuel ash).

It shall have a compressive strength at 28 days of 10-15 N/mm<sup>2</sup> and be capable of pump placement via a tube of diameter 12 mm without segregation.

Mixes comprising ordinary Portland Cement and water only are not acceptable.

2494 AK Masonry Cleaning

1. The methods of masonry cleaning shall be carried out by the following systems:-

- a) washing-limestone, and dense brick;
  - b) mechanical-sandstone;
  - c) chemical-sandstone, and brickwork.
2. Approval of a test area of cleaning will be required before the main works are commenced.
  3. All cleaning shall comply with the requirements of BS 8221-1.
  4. No washing should take place during months which are liable to frost.
  5. Washing may take place using intermittent or pulse washing. Flexible bars may be used to position the nozzles.
  6. Brushes which may be used shall be made from a tight formation of phosphor bronze crinkle wire. Small blocks of sandstone, 'rubbing' or abrasive stones may be used to remove staining and encrustation from flat surfaces.
  7. Cold water may normally be used for cleaning the facades of structures. Hot water may be used where detergents or 'de-greasing' chemicals are needed.
  8. Mechanical cleaning will be performed using a compressed air and abrasive system. The abrasive to be used will be angular type abrasive consisting of either blasting grits, quartz sand or flint grit.
  9. Operatives engaged in dry abrasive cleaning should wear full face and head protection.
  10. Chemical cleaning will be performed using a proprietary, pre-diluted form of hydrofluoric acid ( 4 to 15 per cent concentration). Phosphoric acid may be added. The concentration of the acid shall be displayed on the side of the container.
  11. Operatives engaged in chemical cleaning must be equipped with full face and head protection, heavy-duty gauntlets, waterproof boots and waterproof clothes.
  12. General precautions for protecting the structure must be taken. Particular care must be taken to protect contract personnel and the public from spillages or drift.
  13. First-aid boxes containing sodium gluconate gel must be kept on Site at all times.
  14. At least half an hour should elapse between subsequent applications of the acid solution.

2495 AK Protection of Permanent Works

The Contractor shall design, manufacture, erect and maintain Temporary Works to protect the Permanent Works from all harmful effects whilst the stonework is removed.

2496 AK Scaffolding, Working Shelters, Staging and Ladders



The Contractor shall ensure that at no time shall any of his Temporary Works, or plant whether for his own use or for the use of a Sub-Contractor, damage, deface or alter the masonry work of the structure, either during the Contract period or at any time thereafter; as required under the Ancient Monuments Act 1931 and all subsequent amendments.

SUBSTITUTE CLAUSES, TABLES AND FIGURES918 SK Slurry Surfacing including Microasphalt

- 1 Slurry Surfacing for use in Footways, including vehicle crossover sections, shall comply with the requirements of this Clause. Slurry surfacing and Microasphalt for use in Carriageways shall comply with Clause 942
- 2 The slurry surfacing shall have a British Board of Agrément Certificate demonstrating that it is suitable for use in footways.
- 3 The Contractor shall provide a copy of the British Board of Agrément HAPAS Roads and Bridges Certificate for the system, a Quality Plan containing the product information, installation method statement and other information required by this Clause. The slurry surfacing system shall be manufactured, transported and laid in accordance with these documents.
- 4 The contractor shall guarantee the design, materials and workmanship against defects and against failure to meet the other requirements of this clause for a period of two years from the date of completion of the works.

Materials

- 5 When required for audit purposes the component materials (including, where relevant, their nominal sizes) and their relative proportions and/or spread rates for use in the Permanent Works shall be notified to the Overseeing Organisation. The component materials listed shall include, as appropriate, coarse aggregates, fine aggregates, filler, additives (including fibres), binder, modifier and bond coat.
- 6 Coarse aggregate shall be crushed rock or steel slag complying with Clause 901 when tested in accordance with the procedures of BS EN 13043. The coarse aggregate shall additionally have the following properties.
  - a) Polished Stone Value (PSV) – not less than 50
  - b) Aggregate Abrasion Value (AAV) – not more than 14.
  - c) Flakiness Index (FI<sub>F</sub>) - not more than 20 per cent.
  - d) Any special colour of chipping for the site.

The Contractor shall supply the Overseeing Organisation with test certificates stating the properties of the aggregate to be used.

Health and Safety

- 7 Health and Safety information and safe handling guidance shall be provided.

Layer Thickness

- 8 When required the minimum and/or maximum thickness of the Slurry Surfacing shall be as specified in Appendix 7/7.

#### Preparation

- 9 Where necessary, existing surfaces shall be regulated in advance of laying surfacing material to this Clause. The material described in this Clause may be used up to 20mm thick otherwise the material shall be agreed with the Overseeing Organisation
- 10 Any necessary remedial works to the existing surface and structure shall be completed either prior to or as part of the Contract and agreed as acceptable by the Overseeing Organisation and the Contractor before Slurry Surfacing commences.
- 11 Street furniture, ironwork and kerbs, shall be masked using self-adhesive masking material or other material firmly secured against the passage of the spreader box or the tools used for hand laying. Any packed mud or other deposits on the existing surface shall be removed, all organic growth shall be removed by suitable means and if necessary an approved weedkiller applied, and the surface shall be swept free of all loose material.

#### Traffic Safety and Management

- 12 Traffic management shall be carried out as agreed with the Overseeing Organisation to ensure pedestrian and workforce safety, including the provision of safety zones, during installation and curing, and any site specific additional requirements specified in Appendix 1/17.

#### Mixing

- 13 The Slurry Surfacing shall either be mixed in a suitable mixing machine and discharged directly into the spreader box or if delivered in drums the mixture fully agitated to ensure a homogeneous material is discharged. The Quality Plan will detail the precautions to be taken to achieve a homogenous mixture.

#### Application

- 14 Application shall be in accordance with the method statement provided to ensure compliance with the BBA HAPAS Certificate and to achieve the requirements of this Clause.
- 15 The Slurry Surfacing Machine, when used, or hand methods shall be capable of uniform application and the provision of a continuous completed surface
- 16 Application restrictions to be observed in the event of adverse weather shall be as specified in the Contractor's Method Statement and any additional requirements specified in Appendix 7/7.
- 17 Transverse and longitudinal joints shall be formed such that there shall be no ridges or bare strips.

- 18 Handwork around street furniture and other ironwork shall meet the same performance requirements and form a homogeneous surface with the rest of the treated surface.
- 19 All voids, cracks and surface irregularities shall be completely filled. Spreading shall not be undertaken when the temperature falls below 4°C or when standing water is present on the surface. In warm dry weather, the surface immediately ahead of the spreading, shall be slightly damped by mist water spray applied mechanically, by a pressure sprayer, unless otherwise agreed by the Overseeing Organisation.
- 20 The surface shall be finished by dragging a dampened broom transversely over the footway under its own weight or other method producing a similar macrotexture
- 21 The finished Slurry Surfacing shall have a uniform surface macrotexture throughout the work, without blow holes, surface irregularities or damage by rain or frost.
- 22 Slurry Surfacing which does not comply with this Clause or is non-uniform in surface macrotexture or colour 24 hours after laying shall be rectified by removal and replacement, or superimposed if this is impractical, with fresh material in compliance with this Clause.
- 23 The Contractor shall record the amount of Slurry Surfacing used and the area covered for each run or section completed.
- 24 The Contractor shall facilitate duplicate or joint testing by the Overseeing Organisation if required.

#### Aftercare

- 25 Masking shall be removed after the Slurry Surfacing has been applied, without damage to the edge of the surfacing, and before opening the footway to traffic.
- 26 The Contractor shall remove surplus aggregate from the treated areas using a method agreed in the Quality Plan. The Contractor shall monitor the Slurry Surfacing closely for a minimum period of 2 hours. The monitoring shall continue until the Slurry Surfacing has reached sufficient stability to carry unrestricted pedestrian or vehicle crossover traffic.
- 27 Further operations to remove subsequently loosened aggregate shall be carried out over the next 48 hours. The areas treated and adjacent side roads, footways and paved areas shall be kept substantially free of loose aggregate for a period of 30 days after completion of the work.

As Built Manual

- 28 Not more than 30 days after completion of the works the Contractor shall provide a record of the progress of the work in the form of an As Built Manual incorporating all relevant information, including all test results, volumes of Slurry Surfacing used and areas covered with calculated thickness, record of traffic control carried out, weather information, unforeseen problems, a list of complaints, if any, from the general public or road users and any other information that the Overseeing Organisation may reasonably require to be included.

Performance Standards for Slurry Surfacing During the Guarantee PeriodSurface Macrotexture

- 29 The Contractor is responsible for maintaining the surface macrotexture requirements throughout the guarantee period. The Overseeing Organisation will monitor the surface macrotexture.
- 30 In case of doubt the surface macrotexture shall be measured by the Contractor by the patch test in accordance with BS EN 13036-1. The mean of 10 readings shall be not less than 0.5mm. Alternatively a walking speed laser texture meter may be used to provide the patch equivalent value.

Defects

- 31 The extent of area and linear defects will be monitored by the Overseeing Organisation using visual assessment before the end of the guarantee period and notified to the contractor.
- 32 In case of doubt the extent of defects shall be measured by the Contractor in accordance with BS EN 12274-8 and shall have less than the permitted maximum level of defects as follows:
- a) Delamination, bleeding or fatting up, loss of aggregate, corrugations, bumps and ridges 8%.
  - b) Groups of small defects or repetitive defects - 20 in not more than 20 rectangles
- 33 Coloured materials shall retain their colour with no perceptible fading
- 34 The extent of remedial works and appropriate remedial action shall be agreed with the Overseeing Organisation

921 SK Surface Macrotexture of Bituminous Surface Courses

1. Bituminous surface courses include Thin surfacing, Asphalt and Macadam hot mix materials , surface dressing , microasphalt and slurry surfacing
2. The requirements of this clause supersede the requirements of BS 594 Part 2
3. The measurement of surface macrotexture shall be carried out in one of the following ways
  - a) SCANNER survey vehicle – [SMTD] in accordance with the operators instructions
  - b) Walking speed laser texture meter to EN ISO 14473-1 in accordance with the operators instructions
  - c) Patch test to BS EN13036-1 or BS 598-105 with at least one set of 10 individual measurements taken per 100m of carriageway.
  - d) Mini Texture Meter [MTM] in accordance with the Operating Maintenance Manual (1986).
4. The requirements for macrotexture are classified High, Medium or Low in accordance with Table 921 SK.

**Table 921 SK Classification of Initial and Retained Texture Depth**

		Average not less than			Average not less than		
		per carriageway lane length	Per 10 readings	Per 50m length	Per 10 readings		
	Thin Surfacing Level	MTM*	SCANNER/ laser t m	Patch	MTM*	SCANNER/ laser t m	Patch
<b>Initial</b>							
High	3	1.03	1.50	1.50	0.90	1.20	1.20
Medium	2	0.85	1.20	1.20	0.65	1.20	1.00
Low	1	0.65	0.90	0.90	0.50	0.90	0.70
<b>Retained after 12mths in Wheel Track</b>							
High	3	0.90	1.30	1.30	0.70	1.05	1.05
Medium	2	0.70	1.05	1.05	0.55	0.80	0.80
Low	1	0.55	0.80	0.80	0.45	0.65	0.65
<b>Retained after 24mths in Wheel Track</b>							
High	3	0.70	1.00	1.00	0.60	0.90	0.90
Medium	2	0.60	0.80	0.80	0.50	0.70	0.70
Low	1	0.50	0.70	0.70	0.40	0.60	0.60

Note 1 Texture Depth measurements shall be taken on a dry surface. Typically this requires 3 to 4 dry days after laying/rainfall.

Note 2\* MTM measurements apply to HRA and Surface dressing only. The MTM may be used on thin surfacing only if calibrated for the particular surfacing.

4. The surface macrotexture of new surfaces should where required be measured not more than 7 days after the surfacing has been laid and where practicable before the surfacing has been opened to traffic
5. Measurements shall be made and the macrotexture determined as follows
  - a) Over sections of each carriageway 1000m in length or the complete carriageway lane where this is less than 1000m
  - b) On lane/surface lengths not exceeding 50m in length regularly spaced along the section and covering not less than one third of the section
  - c) When using the patch test method 10 individual measurements shall be taken within the 50m section.
6. Measurements shall be taken along the nearside wheelpath of the left hand lane (lane 1) unless otherwise instructed
7. Where the determination of average texture depth for a section of the carriageway lane, based on measurement taken over part of the section is less than shown in the contract, measurements shall be extended to cover the complete length of the section and the average macrotexture depth recalculated.

922SK Surface Dressing: Performance Specification

- 1 The Contractor shall be responsible for the design of the Surface Dressing, choice of materials, techniques and processes based on site and traffic data provided by the Overseeing Organisation and the schedule of constraints on site availability in Appendix 1/13 so that the works satisfy the requirements of this Clause. The supply and application of Surface Dressing to road surfaces shall comply with the National Sector Scheme for Surface Dressing 13A described in Appendix A and as detailed in this Clause.
- 2 The Contractor shall:
  - (i) Provide a Design Proposal for each site ( and if necessary each sub-section within a site) to achieve the performance requirements in terms of macrotexture and maximum levels of defects as set out in this Clause and in Appendix 7/3, ensuring that the Surface Dressing has an initial stability such that it is capable of withstanding the normal traffic subject to the speed limit specified for the site in Appendix 7/3 when opened in accordance with this clause.
  - (ii) Provide a Quality Plan that shall contain at least the information required by the National Sector Scheme described in Appendix A
  - (iii) Carry out the Surface Dressing in accordance with the Design Proposal
  - (iv) Guarantee the design, materials and workmanship against defects and against failure to meet the end product performance requirements for a period of 2 years from the date of completion of the surface dressing

programme. The Overseeing Organisation will monitor the performance levels of the surface dressing during the guarantee period, and bring any defects to the attention of the Contractor.

#### The System

- 3 Details of the proposed Surface Dressing shall be submitted to the Overseeing Organisation at least 2 months prior to the programme of Surface Dressing commencing. Where a choice of aggregate size for the site could be made, the minimum aggregate size compatible with achieving the retained texture depth requirements in this clause shall be used in order to minimize the tyre/road surface noise. When required to limit tyre/road noise, the Contractor shall design the Surface Dressing to limit the maximum macrotexture after four weeks trafficking to that specified in Appendix 7/3
- 4 The design details shall include any variations made to the works to take account of conditions along the site. The Contractor shall provide, with his Design Proposal, a Data Sheet giving details of each system proposed, including the data specified in this Clause and in Appendix 7/3.

#### Materials and Equipment - The Binder

5. Conventional binders shall be cutback bitumen complying with BS 3690-1, or bitumen emulsion complying with BS 434-1 Type K1-70. Modified binders shall have a British Board of Agrément HAPAS Roads and Bridges Certificate.
6. The Contractor shall provide, with his Design Proposal, a Binder Data Sheet giving details of the properties of each binder proposed, including those specified in Appendix 7/3. The recovery of the binder shall be carried out in accordance with Clause 923. The test to determine Vialit Pendulum Cohesion shall be carried out in accordance with Clause 939. The Contractor shall provide rheological product identification data for modified binders in accordance with Clause 928. Data provided for unmodified binder shall be not more than 6 months old and sampled from binder being manufactured and supplied using the same source and processes as the proposed binder. For modified binder the information provided in the HAPAS Certificate shall demonstrate compliance with this Clause. Health and Safety information and a safe handling guide from the manufacturer shall be provided together with details of any weather restrictions placed upon use of the binder.
7. Before spraying begins, the Contractor shall provide the Overseeing Organisation with a test certificate showing test results for rate of spread and accuracy of spread of binder carried out in accordance with the test methods in BS EN 12272-1 and issued by an appropriate organisation, accredited in accordance with sub-Clauses 105.3 and 105.4 for those tests, or tests carried out under his own Quality Assurance Scheme, demonstrating that the binder sprayer has been tested, using the binder to be used in the Contract, not more than six weeks before the commencement of the work.

#### Materials and Equipment - The Chippings

8. The chippings shall be crushed rock, slag, gravel or calcined bauxite complying with the general requirements of BS EN 13043. The shape of the chippings shall not exceed  $FI_{20}$ , tested at the frequency specified in Appendix 1/5. The binder aggregate compatibility shall be demonstrated in accordance with EN 13624 -2. Resistance to



abrasion in accordance with BS EN 13043, clause 4.2.4. shall be a maximum of 10.

9. For each site the following additional requirements are specified in Appendix 7/3:

Resistance to polishing in accordance with BS EN 13043, clause 4.2.3.

Any special colour of chipping for the site. The contractor shall supply a sample to the Overseeing Organisation prior to use.

10. In the Design Proposal the Contractor shall state the source, the characteristics of chippings to be used as described above and the coating, if any. The Contractor shall provide, before work commences, a test certificate, issued by an appropriate organisation, accredited in accordance with sub-Clauses 105.3 and 105.4 for the tests in sub-clauses 8 and 9 not more than six months previously, showing conformity with these requirements.
11. Chipping spreaders shall have controlled metering and be capable of variable or fixed width application to match the binder sprayer. Before a spreader is used, the Contractor shall provide the Overseeing Organisation with a test certificate showing test results for rate of spread and accuracy of spread of chippings carried out in accordance with the test methods in BS EN 12272-1, and issued by an appropriate organisation, accredited in accordance with sub-Clauses 105.3 and 105.4 for those tests, or tests carried out under his own Quality Assurance Scheme, demonstrating that the chipping spreader has been tested, using chippings similar to those to be used in the Contract, not more than six weeks before the commencement of the work.

#### Preparation

12. Any necessary remedial works to the road surface and structure shall be completed prior to or as part of the contract and agreed as acceptable by the Overseeing Organisation and the Contractor before Surface Dressing commences
13. Before binder is applied, street ironwork, road studs, bridge joints, detector loops and road markings, shall be masked using self-adhesive masking material. Masking material shall not overlap the edge of the object by more than 10mm. Any packed mud or other deposits on the road surface shall be removed, and the road surface shall be swept free of all loose material.
14. 'Give Way' lines and where stated in Appendix 7/3 other road markings shall be masked as above or removed prior to surface dressing.

#### Traffic Safety and Management

15. Traffic Safety and Management shall be in accordance with the requirements of Appendix 1/17 and the Code of Practice for Traffic Safety and Control of Surface Dressing Operations.(Joint CSS/RSDA Publication)
16. 'Give Way' lines and other lines essential for safe traffic management and which have been lost or removed shall be reinstated the same day as surface dressing takes

place.

### Application

17. The contractor shall decide when weather conditions are, or will be such as to jeopardize the quality of the works.
18. Transverse joints shall be formed with spraying starting and finishing on a protective strip not less than 1 metre wide at each end of the lane length being treated. Transverse joints shall be of binder overlap only and not wider than 100 mm. There shall be no ridges or bare strips.
19. Longitudinal joints shall coincide with lane markings. Longitudinal joints shall be of binder overlap only, while ensuring that the proposed rate of spread is achieved across the joint. For quartering (using a part of the spraybar) the overlap may be extended to a maximum of 300 mm. There shall be no ridges or bare strips.
20. The Contractor shall carry out the tests for rates of spread and accuracy of application of binder and chippings in accordance with the test methods in BS EN 12272-1 at the frequency specified in Appendix 1/5. The Contractor shall facilitate duplicate testing by the Overseeing Organisation if required.
21. Rolling of the dressing shall be carried out with sufficient rubber coated vibratory steel drum rollers or pneumatic tyred rollers to ensure that the dressing is stabilized sufficiently for opening to traffic in accordance with this Clause.
22. Where any road marking is obscured or lost by the application of surface dressing, "No Road Markings" signs to Diagram 7012 shall be provided in each direction of traffic at centres not exceeding 400 metres. These signs shall be maintained in position and kept clean and legible until the road markings have been reinstated.

### Aftercare

23. Masking shall be removed after the Surface Dressing has been applied and before opening the road to unrestricted traffic. The time period before unrestricted traffic may use the Surface Dressing shall not exceed 3½ hours or a lesser time specified in Appendix 7/3. The Contractor shall remove surplus chippings from the road by suction sweeping before it is opened to unrestricted traffic.
24. The Contractor shall monitor the Surface Dressing closely for a minimum period of 3½ hours, or as specified in Appendix 7/3, after the road is opened to traffic. The Contractor shall reinstate traffic safety and management procedures or other remedial action where necessary, such as dusting, if there are signs of distress, such as turning of the chippings, in order to prevent further damage to the Surface Dressing.
25. The road itself and adjacent side roads, footways and other paved areas onto which chippings have migrated, shall be kept substantially free of loose chippings by sweeping for a period of 30 days after completion of the work. Where a sweeping operation is obstructed by parked vehicles, etc., a suction hose or similar shall be used to remove loose or surplus chippings.

26. Aftercare involving the application of rock fines shall be the Contractor's responsibility for a period of 96 hours after the completion of the surface dressing. Additionally the Contractor shall, from the Date for Commencement of the Works until 3 months after the completion of the surface dressing programme, maintain the ability to supply and apply clean rock fines passing a 3.35 mm BS sieve. Where excess binder becomes visible and the dressing may be at risk, the Contractor shall, the same day, apply the rock fines by mechanical spreader to either any areas of surface dressing laid during the Contract Period, or any areas of the Highway.
27. All reasonable precautions, including use of Contractors vehicles if necessary, shall be taken to control the speed and movement of traffic in order to avoid damage to new dressings and to obviate danger to road users "Loose Chippings" signs to Diagram 7009 together with a supplementary plate stating "Max Speed 20 mph" to Diagram 513.2 shall be provided in each direction of traffic at centres not exceeding 400 metres alongside roads that have been surface dressed. The "Max Speed 20mph" plates shall be maintained in position until the loose and surplus chippings have been removed but must be removed before the traffic can be considered unrestricted. The "Loose Chippings" signs shall be kept in position for 48 hours and then removed.

#### As Built Manual

28. Not more than 30 days after completion of the Works the Contractor shall provide a complete record of the work carried out in the form of an As Built Manual incorporating all relevant information, including: all test results; variations to the Design Proposal and those necessitated by localised site conditions; a record of traffic control carried out; weather information; unforeseen problems; a list of complaints, if any, from the general public or road users; and any other information that the Overseeing Organisation may reasonably require to be included.

#### Performance Standards During the Guarantee Period

##### Surface Macrotexture

29. The Contractor is responsible for maintaining the surface macrotexture requirements set out in Appendix 7/3 throughout the guarantee period. These shall be High, Medium or Low as described in Clause 921 SK.
30. The Overseeing Organisation will use the SCANNER survey vehicle to determine the Sensor Measured Texture Depth (SMTD) for Category 1 [Major Strategic] Category 2 [Strategic] and Category 3 [Locally Important] roads and will notify the contractor of the result within 1 month of testing. Measurements of SMTD will be made in the nearside wheel-track of the left hand lane (Lane 1).
31. For other roads, the texture depth shall be measured by the Contractor using Mini Texture Meter or a walking speed laser texture meter complying with EN ISO 14473-1 in the nearside wheel-track of the left hand lane (Lane 1).
32. The macrotexture depth shall be maintained above the values in Appendix 7/3 for the macrotexture class required for the site for the duration of the guarantee period. The macrotexture shall be measured after 20 months and before the end of the guarantee period at 24 months, or in case of doubt. Where stated in Appendix 7/3

for noise reducing purposes the maximum macrotexture shall not exceed 3mm measured by Patch Test or equivalent not more than 4 weeks after installation.

Defects

33. The extent of chipping loss or other defects will be monitored by the Overseeing Organisation using a visual method of assessment. In case of dispute if there is a section deemed to have failed, the Contractor shall measure the site in accordance with BS EN 12272-2. The performance standard is that any section of the Works shall be deemed as having failed if the areas of defects do not comply with the classes specified in Appendix 7/3.
34. Remedial works shall be proposed by the Contractor and agreed with the Overseeing Organisation.