SECTION 306 - CEMENTITIOUS TREATED PAVEMENT SUBBASE

##This section cross-references Sections 173, 175, 815 and 821.
If any of the above sections are relevant, they should be included in the specification.
If any of the above sections are not included in the specification, all references to those sections should be struck out, ensuring that the remaining text is still coherent. DELETE THIS NOTE FROM FINAL DOCUMENT.

:##Include the option to use crushed concrete as a specified alternative to the use of Class 3 or Class 4 pavement materials manufactured from crushed rock. Show on the drawings as necessary. DELETE THIS NOTE FROM FINAL DOCUMENT:

306.01 DESCRIPTION

This section covers the requirements for the delivery, spreading and compaction of plant mixed crushed rock and recycled crushed concrete for the construction of pavement subbase, treated with cementitious binder to produce a modified or bound subbase. This section is to be read in conjunction with the following sections:

- Section 815 - Cementitious Treated Crushed Rock for Pavement Subbase
- Section 821 - Cementitious Treated Crushed Concrete for Pavement Subbase.

306.02 DEFINITIONS

Cementitious Binder

A cementitious material capable of being uniformly mixed into a granular pavement material to bind the particles together to increase its strength. Cementitious binders include Portland cement Type GP or blended cement Type GB, hydrated lime, quicklime, or a blend of ground granulated blast furnace slag (GGBFS), hydrated lime, fly ash, alkali activated slag or other pozzolanic material supplied in accordance with this specification.

Maximum Allowable Working Time

The maximum allowable working time for the cementitious binder as specified or as determined in accordance with the relevant Test Method or Code of Practice.

Pavement Design Modulus

The presumptive modulus used as the basis for the mechanistic design of a bound pavement with a bound cementitious treated crushed rock or crushed concrete subbase.

Working Time

The time required to transport, place, compact and trim the pavement layer after the cementitious binder is added at the mixing plant.

306.03 CONFORMITY WITH DRAWINGS

Pavement subbase shall be finished to a smooth and uniform surface and shall, after compaction, conform within the following limits to the levels, lines, grades, thicknesses and cross sections as specified or shown on the drawings.

(a) Width and Alignment

The width of pavement measured on each side of the centreline or design line shall not deviate by more than 50 mm from the designed offset when measured at a right angle.

(b) Surface Level of Subgrade and Pavement

The surface level of the subgrade and pavement courses shall be measured in accordance with the requirements of Section 173 and every test lot shall meet either Scale A, B or C requirements as specified in Clause 306.12.

The maximum lot size for measurement and assessment of surface level shall be 4000 m2.

(i) Scale A and B Surface Level Requirements

Each level measurement shall be taken at random locations over the area of the lot in accordance with the VicRoads Test Method and the number of measurements taken within each lot shall not be less than the number specified in Table 306.031.

The mean surface level and the variation in surface level for the subgrade, and pavement courses within each lot shall meet the requirements of Table 306.032.

Table 306.031 - Minimum Number of Level Measurements per Lot

Scale of Surface Level Measurement	Minimum Number of Measurements Per Lot
Scale A	80
Scale B	40

Table 306.032 - Average Surface Level Tolerances for the Subgrade and Cementitious Treated Subbase

Scale of Level Measurement	Subgrade		Cementitious Treated Subbase	
	$\bar{x}$ Range (mm)	Max. S (mm)	$\bar{x}$ Range (mm)	Max. S (mm)
Scale A	+5 to –15	12	+4 to -8	8
Scale B	+5 to –25	15	+6 to -12	13

Notes:

1. $\bar{x}$ is the mean value of all level readings taken in the lot
2. S is the standard deviation of all level readings taken in the lot
3. A negative value designates a measured departure below the design level and positive value designates a surface level above the design level.

For Scale A and Scale B level requirements, the Superintendent may accept a lot which does not conform with the limits of Table 306.032 at a reduced payment, in which case payment for the work will be reduced as shown in Table 306.033. The value of the lot of work shall be calculated from the unit rates for pavement construction as specified in Clause 306.12(b).

Table 306.033 - Payment Deduction for Surface Level

Variation	Payment reduction
Mean ($\bar{x}$) exceeding the specified limit up to a maximum of 25%	8% plus 4% reduction for each 1 mm of $\bar{x}$ outside the tabulated limit
Standard Deviation (S) exceeding the specified limit up to a maximum of 35%	8% plus 4% reduction for each 1 mm of S greater than the tabulated limit
Note: If both $\bar{x}$ and S vary by more than the specified limit, the payment reduction shall be the sum of the payment reductions for both $\bar{x}$ and S.	

(ii) Scale C Surface Level and Thickness Requirements

Surface level measurement shall be undertaken in accordance with the procedure specified in Section 173 - Examination and Testing of Materials and Work (Roadworks).

The surface level of the subgrade and subbase shall comply with the requirements of Table 306.034.

Table 306.034 - Level Tolerances at the Surface of Subgrade and Subbase

Subgrade (mm)	Subbase (mm)
+ 15 to – 25	+ 10 to - 25

(c) Shape

No point on the prepared surface of the subgrade shall lie more than 12 mm below a 3 metre straight edge placed on the pavement in any direction.

No point on the surface of the cementitious treated subbase layer shall vary by more than 8 mm from a 3 metre straight edge, or 10 mm from a 6 metre straight edge, placed in any direction.

Water shall not pond on the surface of the cementitious treated subbase.

306.04 MATERIALS

The Contractor shall supply all materials required to construct the cementitious treated pavement subbase. The supply of Cementitious Treated Crushed Rock or Cementitious Treated Crushed Concrete shall comply with the requirements of Sections 815 and 821 respectively.

306.05 MOISTURE CONTENT

The moisture content of the material at the time of spreading and compaction, expressed as a percentage by mass, shall be within plus 0.5% and minus 1.0 % from the Modified optimum moisture content.

306.06 WATER

Except for the purpose of curing, no water shall be added to the cementitious treated material.

Water shall be clean and substantially free from detrimental impurities such as oils, salts, acids, alkalis and vegetable substances. Water sources shall be tested for electrical conductivity and pH, in accordance with the current Australian Standards as listed in Section 175 *Referenced Documents for Standard Specifications for Roadworks and Bridgeworks* prior to use. The electrical conductivity shall not be more than 3500 µS/cm and pH within the range of 6 to 10 unless otherwise approved. Water sources classified by the relevant water authority as potable water shall be exempt from this requirement. Water sources shall be tested at a maximum of twelve monthly intervals or when the nature of the water source has changed. The use of reclaimed water will require the approval of the Superintendent and shall conform to the VicRoads guidelines for reclaimed water as listed under other referenced documents in Section 175.

306.07 DELIVERY

(a) Delivery Vehicles

Delivery vehicles shall have bodies fitted with covers of a suitable material to prevent loss of moisture during transport. Vehicles used for delivery of material to the hoppers of pavers shall have bodies or discharge equipment which will enable the load to be discharged direct into the hopper without spillage and in such a way that segregation will be minimised.

(b) Delivery Dockets

Delivery dockets shall show:

(i) name of the supplier, and location of plant;
(ii) docket number;
(iii) name of user;
(iv) project name and location (or contract number);
(v) registered number or fleet number of the vehicle;
(vi) date and time of loading;
(vii) nature and source of material;
(viii) empty and loaded masses of the vehicle (where material is scheduled for measurement by mass);
(ix) loose volume in delivery vehicle.

Where material is scheduled for measurement by loose volume in delivery vehicles or by mass, a delivery docket for each load shall be issued at the point of delivery.

Where material is measured by other means and for Lump Sum Contracts, the Contractor shall make delivery dockets available for inspection on request.

306.08 JOINTING

The layout of joints shall conform to the following requirements unless otherwise approved by the Superintendent:

(a) material shall be spread in such a manner as to minimise the number of joints;

(b) in any layer, transverse joints in adjoining paver runs shall be offset by not less than 2 m;

(c) transverse joints shall be offset from one layer to the next by not less than 2 m;

(d) longitudinal joints shall be offset from one layer to the next by not less than 150 mm;

(e) longitudinal joints shall be located within 300 mm of the planned position of traffic lane lines or within 300 mm of the centre of a traffic lane.

If approval is given to depart from the joint location specified in 306.08(a) to (e), the Contractor shall record of the location of these joints.

The edge of any paver run shall be kept moist until spreading and compaction have been completed in adjacent paver runs.

Longitudinal and transverse joints shall be made where specified, or at the end of each day's work, or where spreading operations have been halted for a period in excess of the maximum allowable working time for the binder as specified in Clause 306.09 and Table 306.091. If the binder is not one of the binders listed in Table 306.091 the allowable working time for the binder shall be determined in accordance with the VicRoads Test Method.

Joints shall be made in a careful manner and shall be prepared immediately prior to the recommencement of spreading operations by cutting back the edge of previously laid material to a clean vertical face in compacted material of the full specified layer thickness. Longitudinal joints shall be constructed parallel to the centre line of the carriageway and transverse joints at right angles to the centre line.

Material cut during the preparation of joints shall be removed from site.

The faces of all joints shall be thoroughly wetted immediately before spreading new material.

The level and shape of the surface at all joints shall be within the limits specified in Clause 306.03.

306.09 COMPACTION PROCEDURE AND REQUIREMENTS FOR TESTING AND ACCEPTANCE

(a) General

The cementitious treated subbase material shall be placed, trimmed to level and fully compacted within the maximum allowable working time specified in Table 306.091 depending on the binder type and the time of year the subbase is being placed.

HP ***If the Contractor proposes to use an alternative cementitous binder to those included in Table 306.091, laboratory test results shall be produced to the Superintendent showing that the binder satisfies the required working time determined in accordance with the VicRoads Test Method. In addition, the cementitious treated material using the alternative binder shall meet specified strength requirements.***

Table 306.091 - Maximum Allowable Working Time after Mixing for Common Cementitious Binders

Cementitious Binder	Maximum Allowable Working Time (hours)	
	Construction between October and April (1)	**Construction between May and September**
Rapid Setting Type GP Cement	2	3
Medium Setting Type GB Cements Cement/Slag blend (50% to 60% cement content) Cement/Fly ash blend (70% to 80% cement content) Cement/Slag/Fly ash blend (55% to 65% cement content)	3	5
Slow Setting Slag/Lime Blend and other slow setting Supplementary Cementitous Blends	8	12
Note 1: If the ambient temperature within the period from October to April on any day is less than 15°C, the May to September maximum allowable working times may be applied.		

On completion of compaction, any segregated areas shall be rectified.

The calculation of density ratio shall be based on Modified compactive effort.

The work shall be assessed for compliance with Scale A or Scale B requirements for testing and acceptance of compaction as specified in Clause 306.12 and as provided in Clauses 306.09(b) and (c).

For work to be tested for compliance with Scale A requirements, the number of tests per lot shall be six.

For work to be tested for compliance with Scale B requirements, the number of tests per lot shall be three.

A lot shall consist of a single layer of pavement material placed on the same day and all lots shall be tested for compliance with the requirements of this section. The maximum lot size shall not exceed 4000 m^2.

(b) Scale A Requirements for Testing and Acceptance of Compaction

The work represented by the lot will be accepted as far as compaction is concerned if the characteristic value of density ratio of the lot is not less than 96% .

If the characteristic value of density ratio of the lot is less than 96.0% but greater than or equal to 92% the work represented by the lot may be accepted but the method of rectification or redesign of the pavement shall be approved by the Superintendent. Alternatively, the Superintendent may accept the work at a reduced payment calculated using the formula:

$$P = 4R_c - 284$$

in which R_c is the characteristic value of density ratio of the lot and P is the percentage of the value of work represented by the lot that will be paid provided that the value of P shall not exceed 100. For the application of this formula, the value of work represented by the lot shall be calculated from the unit rate of payment specified in Clause 306.12(b).

If any small lot less than 500 m^2 is to be assessed under Section 173 of this specification where only three tests are required to be undertaken and assessed on the basis of meeting a Mean Density Ratio of 98%, the reduced payment shall be calculated using the formula:

$$P = 4R_m - 292$$

(c) Scale B Requirements for Testing and Acceptance of Compaction

The work represented by the lot will be accepted as far as compaction is concerned if the mean density ratio for the lot is not less than 96.0%.

If the mean of the individual density ratio test values for the lot is less than 96.0%, but greater than or equal to 92% the work represented by the lot may be accepted but the method of rectification and/or redesign of the pavement shall be approved by the Superintendent. Alternatively, the Superintendent may accept the work at a reduced rate calculated using the formula:

$$P = 4R_m - 284$$

in which R_m is the mean of the individual density ratio test values for the lot and P is percentage of the value of work represented by the lot that will be paid provided the value of P shall not exceed 100. For the application of this formula the value of work represented by the lot shall be calculated from the unit rate of payment specified in Clause 306.12(b).

306.10 TEST ROLLING

Test rolling may be carried out in accordance with the requirements of Section 173 on the cementitious treated pavement subbase layer within the maximum allowable working time for the relevant binder and time of year as specified in Table 306.091.

306.11 CURING AND PROTECTION OF COMPACTED LAYERS

Unless there are special design and construction conditions specified for placing of multiple layers, cementitious treated subbase with a pavement design modulus exceeding 500 MPa shall be placed in a single layer. The minimum compacted thickness shall be not less than 100 mm and the maximum compacted thickness shall be no more than 180 mm and constructed within the tolerances specified in Clause 306.03.

(a) Pavement Design Modulus of 500 MPa or where no Pavement Design Modulus is Specified

The surface of each compacted layer shall be kept moist for a period of seven days unless covered at an earlier stage with the succeeding layer or with an approved curing membrane.

Construction or other traffic shall not use a compacted layer within 24 hours of placement without the approval of the Superintendent.

The subbase shall be kept in good order and condition and free from contamination.

(b) Pavement Design Modulus of 2000 MPa

In addition to meeting the requirements of Clause 306.11(a) above, the Contractor shall:

(i) cure the cementitious treated subbase by maintaining the surface in a moist condition for seven days;

(ii) prevent construction plant from using the pavement during the seven day curing period apart from that required to maintain and cure the surface; and

(iii) after the seven day curing period, restrict all construction traffic to vehicles with a maximum axle group load of 4 tonnes until asphalt base and intermediate courses are placed (priming, primersealing and asphalt placement activities excepted).

(c) Pavement Design Modulus of 3500 MPa

In addition to meeting the requirements of Clause 306.11(a) above, the Contractor shall:

(i) apply a size 7 CRS standard grade emulsion primerseal at a rate of application of 1.5 litres per square metre (0.9 litres per square metre of residual binder) to the cementitious treated subbase within 12 to 24 hours after completion of compaction. If after 24 hours ambient conditions are such the material has not dried back to less than 80% of the modified optimum moisture content, the primerseal shall be delayed until such time as the moisture content has reduced below 80% of optimum.

Subject to approval by the Superintendent and if weather conditions during the period from October to April inclusive suit priming, a light or very light cut back bitumen primer may be applied to the surface of the of the cementitious treated material in lieu of the emulsion primerseal. The rate of application of primer shall be a minimum of 0.6 litres per square metre and shall deliver a minimum of 0.3 to 0.4 litres per square metre of residual bitumen to the surface.

HP Requests by the Contractor to vary the rates of application shall be submitted in writing to the Superintendent for review.

Primersealing shall not be carried out within 12 hours of forecast rain and priming, if approved for use, shall not be carried out within 24 hours of forecast rain.

HP The Contractor's Environmental Management Plan shall include procedures to minimise all risks of damage to the environment associated with priming and primersealing.

(ii) allow the cementitious treated subbase to cure for seven days without trafficking (except for the application of a prime or primerseal);

(iii) prevent construction plant from using the pavement during the seven day curing period apart from that required to maintain and cure the surface; and

(iii) after the seven days curing period, restrict construction traffic to vehicles with a maximum axle group load of 4 tonnes until asphalt base and intermediate courses are placed (priming, primersealing and asphalt placement activities excepted).

306.12 SCHEDULE OF DETAILS

*** (a) Requirements for Testing and Acceptance of Compaction (Clause 306.09)

Location and Chainage	Pavement Design Modulus (MPa)	Scale of Surface Level Measurement (A, B or C)	Compaction Scale (A or B)
##:	##:	##:	##:

*** (b) Unit rate of payment to be used to calculate the value of the work represented by the lot for application of payment deduction formulae specified in Clauses 306.03(b)(i), 306.09(b) and 306.09(c) shall be $##:/$m^3$.