SECTION 820 - CRUSHED CONCRETE FOR PAVEMENT SUBBASE AND LIGHT DUTY BASE

##This section cross-references Section 175 - Section 175 must be included in the specification:

820.01 DESCRIPTION

This section covers the requirements of 20 mm nominal size, crushed concrete and plant mixed wet-mix crushed concrete for Class CC3 subbase, and Class CC4 subbase of various nominal sizes and 20 mm nominal size Class CC2 light duty base. Crushed concrete products may include a nominated percentage of Reclaimed Asphalt Pavement (RAP) or crushed brick as a part of a registered crushed concrete mix design.

820.02 DEFINITIONS

Additive

A durable VicRoads approved material (e.g. fine graded clayey sand and/or very fine clayey filler) that may be added to the crushed concrete mixture in a small quantity to improve its workability and physical properties.

Assigned Los Angeles Value

The assigned Los Angeles Value is a hardness rating derived from Los Angeles Value test results, which is assigned to each source by VicRoads as a part of the accreditation process. The value is assigned on the basis of test data obtained from testing products.

Crushed Brick

Crushed brick is a crushed material which principally consists of crushed fired brick, but may also contain crushed concrete, aggregate and concrete paste. Mud brick or non fired brick is not included in this definition.

Crushed Concrete

Crushed concrete is composed of rock fragments coated with cement with or without RAP, brick, sands and/or filler, produced in a controlled manner to close tolerances of grading and minimum foreign material content.

Light Duty Base Pavement

Light duty base pavement is the layer directly beneath the bituminous surfacing on lightly trafficked roads.

Plant Mixed Wet-Mix Crushed Concrete (PMWMCC)

Plant mixed wet-mix crushed concrete is a mixture of recycled crushed concrete, RAP, any granular additives and water, produced at a controlled mixing plant to close tolerances of grading and moisture content based on the modified optimum moisture content of the material.

Reclaimed Asphalt Pavement (RAP)

Asphalt removed from an existing asphalt pavement, re-processed by crushing and/or screening for recycling into new asphalt.

820.03 COMPONENTS

(a) Coarse and Fine Aggregates

Crushed concrete fragments shall consist of clean, hard, durable, angular fragments of concrete and concrete paste.

(b) Additives

Additives which are non durable or subject to appreciable breakdown will not be permitted. The addition of any additive shall be subject to a registration process in accordance with VicRoads Code of Practice for Registration of Crushed Rock Mix Designs as listed in Section 175

Approved additives (e.g. clayey sand or clay filler) may be incorporated into the crushed concrete mixture to improve its grading and cohesion and other physical properties (e.g. permeability). The total amount of any additive shall not exceed 15% of total dry mass of the crushed concrete product unless otherwise specified. If clayey filler is used as all or part of the total additive, the total amount of clayey filler additive shall not exceed 2% of the total dry mass of the crushed concrete product.

The use of crusher fines passing the 4.75 mm sieve which are not produced from crushing concrete, will be permitted, provided the crusher fines are be produced from an igneous or metamorphic rock source and have a Degradation Factor – Fine Aggregate of not less than 60 when tested in accordance with the current Australian Standard – Degradation Factor - Fine Aggregate as listed in Section 175.

RAP is permitted to be used in combination with crushed concrete. The percentage of RAP in any product shall not exceed 20% unless otherwise approved by the Superintendent. Reclaimed asphalt pavement shall not contain tar.

The use of clayey sands and/or clay filler will be permitted provided the requirements of Table 820.031 are satisfactorily met.

Table 820.031 – Grading and Plasticity Requirements for Clayey Sand or Clayey Filler Additives

AS Sieve Size (mm)	Clayey Sand % Passing by mass	Clayey Filler % Passing by mass
9.5	100	100
4.75	90 - 100	100
2.36	75 - 95	95 - 100
0.425	45 - 65	70 - 100
0.075	30 - 50	50 - 100
Plasticity Index Range	10 - 20	30 - 55
Emerson Class No. (max)	No Requirement	6

The addition of crushed brick to Class CC3 and CC4 subbase may be approved as a part of a VicRoads registered crushed rock mix design. Crushed brick added to Class CC3 subbase shall not exceed 15% and not exceed 50% in the case of Class CC4 subbase.

Crushed brick added to any crushed concrete product shall have a wet strength not less than 100 kN and a wet/dry strength variation not greater than 35 when tested in accordance with the current Australian Standard – Wet/Dry Strength Variation as specified in Section 175.

Where the Contractor elects to use an additive component with the crushed concrete, the additive shall:

(i) not be cementitious in nature;

(ii) be free of vegetable matter, lumps and balls of clay and any oversize particles;

(iii) be sized such that it can be effectively and uniformly distributed throughout the crushed concrete;

(iv) be kept dry to ensure that a free-flowing additive is incorporated into the mixture;

(v) be uniformly mixed through the crushed concrete by use of a pugmill unless otherwise approved by the Superintendent.

820.04 PRODUCT

(a) The crushed concrete product shall not be used until investigated and accredited in accordance with VicRoads Code of Practice for Source Rock Investigations as listed in Section 175, and it complies with the relevant requirements of Table 820.041.

Table 820.041 - Physical Properties

Test	Test Value		
	Class CC2	Class CC3	Class CC4
Liquid Limit % (max)	35	35	40
Plasticity Index (max)	6	10	20
California Bearing Ratio (%) (min) (1)	100	80	20
Los Angeles Abrasion Loss (max)	35	40	45
Flakiness Index	35	-	-

Note: (1) Value applicable to material passing 19.0 mm sieve: initially at optimum moisture content and 98% of maximum dry density as determined by test using Modified compactive effort, but then soaked for 4 days prior to the CBR test.

(b) Foreign materials in that fraction of the product retained on a 4.75 mm sieve shall not exceed the percentages by mass specified in Table 820.042.

Table 820.042 - Foreign Material (Max Allowable %)

Foreign Material Type	Class CC2	Class CC3	Class CC4
High density materials such as metal, brick (1) and glass	2	3	5
Low density materials such as plastic, rubber, plaster, clay lumps and other friable material	0.5	1	3
Wood and other vegetable or decomposable matter	0.1	0.2	0.5

Note: (1) Higher percentages of crushed brick may be allowed as an additive conforming to the requirements of Clause 820.02(b) in a registered crushed concrete mix design.

Any material which may contain asbestos must be managed and tested in accordance with the requirements of WorkSafe Victoria including the current Occupational Health and Safety (Asbestos) Regulations.

(c) For PMWMCC, the aggregates and water shall be mixed at a mixing plant by continuous or batch mixing.

820.05 ADDITION OF WATER

Water added to the crushed concrete 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 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 by Superintendent. 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 in the opinion of the Superintendent 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.

820.06 GRADING OF UNCOMPACTED CRUSHED CONCRETE AND PMWMCC LIGHT DUTY BASE

After completion of production, but before compaction, crushed concrete and PMWMCC light duty base shall comply with the relevant grading requirements of Tables 820.061.

The Contractor shall aim to produce the crushed concrete and PMWMCC in such a way that the grading coincides with the relevant target grading specified in Table 820.061.

Table 820.061 - Grading Requirements for Class CC2, 20 mm Light Duty Base

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value Before Compaction	
		Limits of Grading (% Passing)	% Retained Between Sieves
26.5	100	100	
			0 - 5
19.0	100	95 – 100	
			7 - 18
13.2	85	78 - 92	
			10 - 16
9.5	73	63 - 83	
			14 - 24
4.75	54	44 - 64	
			10 - 20
2.36	39	30 – 48	
			15 - 29
0.425	17	13 – 21	
			7 - 14
0.075	7	5 - 9	

The Superintendent may revise the target grading requirements for the 2.36 mm, 0.425 mm and 0.075 mm sieves specified in Table 820.061. The magnitude of the range of the limits of grading shall remain unchanged for the revised target grading and the range shall remain centred on the target grading. Changes made to the target grading shall be limited to a maximum of two percentage units for the 2.36 mm and 0.425 mm sieves and one percentage unit for the 0.075 mm sieve.

820.07 GRADING OF UNCOMPACTED CRUSHED CONCRETE SUBBASE

(a) Class CC3 Crushed Concrete

After completion of production, but before compaction, Class CC3 crushed concrete and PMWMCC shall comply with the grading requirements of Table 820.071.

The Contractor shall aim to produce the crushed concrete in such a way that the grading coincides with the relevant target grading specified in Table 820.071. The permitted ranges of grading in these tables provide for random fluctuations in the production process.

The crushed concrete shall not be graded from near the coarse limit on one sieve to near the fine limit on the following sieve or vice versa.

Table 820.071 - Grading Requirements for 20 mm Class CC3 Crushed Concrete

Sieve Size AS (mm)	Target Grading (% Passing)	Limits of Grading Test Value before Compaction (% Passing)
26.5	100	100
19.0	100	95 - 100
13.2	85	75 - 95
9.5	75	60 - 90
4.75	59	42 - 76
2.36	44	28 - 60
0.425	19	10 - 28
0.075	6	2 - 10

The Superintendent may revise the target grading requirements for the 2.36 mm, 0.425 mm and 0.075 mm sieves specified in Tables 820.071. The magnitude of the range of the limits of grading shall remain unchanged for the revised target grading and the range shall remain centred on the target grading. Changes made to the target grading shall be limited to a maximum of two percentage units for the 2.36 mm and 0.425 mm sieves and one percentage unit for the 0.075 mm sieve.

(b) Class CC4 Crushed Concrete

After completion of production, but before compaction, Class CC4 crushed concrete shall comply with the relevant grading requirements of Table 820.072. The crushed concrete shall not be graded from near the coarse limit on one sieve to near the fine limit on the following sieve or vice versa.

Class CC4 crushed concrete of nominal size differing from that specified may be accepted by the Superintendent provided it meets the grading requirement of Table 820.072 corresponding to a nominal size adjacent to that specified.

Table 820.072 - Grading Requirements for Class CC4 Crushed Concrete

Sieve Size AS (mm)	Limits of Grading - Test Value before Compaction (% Passing) Nominal Size (mm)					
	50	40	30	25	20	14
75.0	100					
53.0		100				
37.5			100	100		
26.5					100	
19.0	54 - 75	64 - 90				100
9.50			48 - 70	54 - 75		
4.75					42 - 76	54 - 75
0.425	7 - 21	7 - 23	9 - 24	10 - 26	10 - 28	15 – 32
0.075	2 - 10	2 - 12	2 - 12	2 - 13	2 - 14	6 – 17

820.08 CRUSHED CONCRETE MIX DESIGN

Crushed concrete mixes proposed for use on specified works can be registered in accordance with VicRoads Code of Practice for Registration of Crushed Rock Mix Designs as listed in Section 175.

All mix designs registered with VicRoads are issued a status according to compliance as:

General The requirements of Code of Practice RC500.02 have been met.

Conditional Mixes which do not comply in all respects with the requirements of Code of Practice, but which are considered appropriate for use subject to conditions attached to the registration.

Experimental A mix that does not comply with the requirements of Code of Practice and for which there is little or no history of successful performance and requires more trials to be undertaken and monitored before it is registered as a Conditional mix.

Superseded Superseded by another registered mix but details are retained for record purposes.

Withdrawn Withdrawn from use because of unsatisfactory field performance but details are retained for record purposes.

No conditional or experimental crushed concrete mix shall be supplied until the mix has been registered and the Superintendent has been advised of any conditions attached.

Approval of a registered crushed concrete mix for use under the Contract does not guarantee the handling properties or performance of the mix nor relieve the Contractor from contractual obligations in regards to rectification of defects.

New mix designs shall be submitted for registration:

- where it is proposed to change the source, grading or nature of the components; and
- when current registered crushed concrete mix designs are more than two years old unless the VicRoads agrees to an extension of this period.

If a registered crushed concrete mix has unsatisfactory handling or field performance, the Contractor or Superintendent may request the mix be de-registered in accordance with VicRoads Code of Practice for Registration of Crushed Rock Mix Designs.

The allowable production tolerances on the nominated target grading will be the full range of the grading envelope. However, where the supplied grading varies by more than + or – 2% of the target grading nominated, the Contractor will be required to provide any additional information requested to clearly demonstrate that all requirements (e.g. permeability) of the specification is still being met.

820.09 MOISTURE CONTENT

(a) Crushed Concrete

Where payment is to be made on a mass basis, the average moisture content of crushed concrete at the plant shall not exceed 8.5% by mass unless otherwise specified or unless the Contractor has, at the time of tendering, nominated an upper limit of average moisture content greater than 8.5%. In the latter case the difference between the nominated value and the specified value will be taken into account when tenders are being considered. The average moisture content of crushed concrete supplied on any one day will be determined from three samples taken at random from that days supply. If the average moisture content is greater than that specified or nominated, the material may be rejected. If at the discretion of the Superintendent the material is accepted, payment will be made for the mass determined by deducting the calculated mass of excess moisture from the net mass shown on the delivery dockets.

(b) PMWMCC

Where the work of the Contract includes supply and delivery only, the moisture content of the mixture at the point of delivery, expressed as a percentage by mass, shall be within plus 0.5 to minus 1.0 of the target nominated from time to time by the Superintendent.

820.10 STOCKPILING PRIOR TO DELIVERY

If the Contractor elects or is required to supply PMWMCC or crushed concrete to stockpile prior to delivery to the roadbed the following requirements shall be met:

(a) the product, after recovery from the stockpile, complies with this specification;

(b) the stockpile site is clean, adequately paved, and well drained;

(c) if a stockpile is constructed in more than one layer, each layer is fully contained within the area occupied by the upper surface of the preceding layer;

(d) unless otherwise specified or approved by the Superintendent, all crushed concrete supplied to stockpile shall have a minimum moisture content of 3.5% by mass unless the stockpile is located at the supply point for producing PMWMCC;

(e) all PMWMCC delivered to stockpile shall be supplied at a moisture content of not less than the optimum moisture content unless the material is to be wet mixed again prior to delivery to the roadbed where the minimum moisture content in stockpile shall be not less than 3.5% by mass;

(f) the surface of the stockpile shall be kept damp to prevent a net loss of moisture and to minimise the generation of airborne dust;

(g) no cementitious filler is used.

820.11 HANDLING OF CRUSHED CONCRETE

Handling of crushed concrete, including the loading of trucks and stockpiling, shall be effected in such a manner as to minimise segregation.

820.12 MINIMUM TESTING REQUIREMENTS

The Contractor shall test the crushed concrete and PMWMCC at such a frequency to ensure that the material consistently complies with specified requirements. The test frequency shall initially not be less than that shown in Table 820.111, except that the test frequency for Grading, Foreign Material Content, Moisture Content, and Degradation Factor, may be halved where the most recent 10 test results in succession have met specification requirements. If any subsequent test result fails to meet specification requirements, another test shall be immediately undertaken. If the second test fails the test frequency shall revert to the minimum test frequency specified in Table 820.121 and the Contractor shall not return to half the test frequency until a further 10 successive test results comply with specification requirements.

Table 820.121 - Minimum Frequency of Testing

Test	Minimum Frequency of Testing
Grading	On each day - one per 500 tonnes or part thereof
Foreign Material Content	On each day - one per 500 tonnes or part thereof
Moisture Content - Crushed Concrete (+) - PMWMCC	 On each day - 3 No. One per 500 tonnes or part thereof on each day
Plasticity Index	In each month - one per 5,000 tonnes or part thereof
California Bearing Ratio for Class CC2, CC3 and CC4	When in the opinion of the Superintendent the nature of the material has changed significantly.
Los Angeles Abrasion	Once per month or when in the opinion of the Superintendent the nature of the material has changed significantly.
Testing of Additives	On each production day - Grading and Plasticity Index per 250 tonnes of additive, unless otherwise specified in the VicRoads registered mix design.
(+) Applicable only when payment is to be made on a mass basis	