SECTION 812 - PRODUCTION OF CRUSHED ROCK FOR PAVEMENT BASE AND SUBBASE

~~##This section cross-references Sections 175, 304, 801 and 818.~~
~~If any of the above sections are relevant, they should be included in the specification.~~
~~If they are not included, all references to those sections should be struck out, to ensure that the remaining text is still coherent.:~~

812.01 DESCRIPTION

This section covers the production requirements for crushed rock produced from a variety of raw feed sources including quarries, crushed concrete, Newer Basalt Surface Spalls (NBSS) and blended crushed rock mixes containing supplementary materials.

The section specifies the requirements for plant mixed wet-mix crushed rock products including 20 mm nominal size Classes 1 and 2 base, 20 mm and 40 mm nominal size, Class 3 upper subbase and for Class 4 lower subbase.

The material class, pavement course use and nominal sizes shall be as specified in the special clauses and/or the drawings and/or the schedule.

Sources from which crushed rock can be produced for base and subbase are specified in Section 801 - Source Requirements for the Production of Crushed Rock and Aggregates.

~~Requirements for crushed pyroclastic rocks (Scoria) are covered in Section 818 - Crushed Scoria for Pavement Base and Subbase.~~

Construction requirements for unbound flexible pavements incorporating crushed rock products are covered in Section 304 - Construction of Unbound Flexible Pavements.

Section 175 details the relevant references to Australian Standards (AS), Test Methods and Codes of Practice referenced in this section.

812.02 DEFINITIONS

Crushed Rock

A crushed rock is a material composed of graded coarse and fine aggregate components produced by the crushing, scalping and screening of a raw rock feed source, Newer Basalt Surface Spalls (NBSS) and/or crushed concrete, and may also be a blend of components which includes limited quantities of supplementary materials.

Crushed Rock Class

For the purpose of this specification, Crushed Rock products are to be supplied in various classes broadly defined as follows:

Class 1 is a premium cohesive pavement base material for unbound pavements where a very high standard of surface preparation for a sprayed sealed or thin asphalt surfacing is required. It has a minimum plasticity index requirement and will likely have additional requirement for maximum permeability when used for heavy duty unbound pavements.

Class 2 is a high quality pavement base material for unbound flexible pavements in locations where a very high standard of surface preparation may not be required. Class 2 crushed rock product does not have a minimum plasticity index or a maximum permeability requirement. Recycled materials are permitted for Class 2 crushed rock.

Class 3 is a high quality upper subbase material for heavy duty unbound flexible pavements. It may have a minimum permeability requirement to provide positive drainage to the sub-surface drains and overlying unbound pavement layer. Where specified, Class 3 may be used as base for lightly trafficked pavements provided the material produces sufficient cohesive fines during compaction. Recycled materials are permitted for Class 3 crushed rock.

Class 4 is a lower subbase material for heavy duty unbound and/or bound pavements or a subbase material for most other types of pavements. It may have a maximum permeability requirement. Recycled materials are permitted for Class 4 crushed rock.

Plant Mixed Wet-Mix Crushed Rock (PMWMCR)

Plant mixed wet-mix crushed rock is a mixture of crushed rock and water, produced at a controlled mixing plant to close tolerances of moisture content based on the modified optimum moisture content of the material.

Recycled Material

Materials obtained from a construction and/or demolition site which are crushed and re-processed to produce a crushed rock or a supplementary material.

Supplementary Material

A durable material added to a crushed rock to improve the workability and physical properties.

812.03 MATERIAL SOURCE

Crushed rock manufactured at a quarry or non-quarry site shall not be used until the material source has been investigated and accredited in accordance with VicRoads Code of Practice for Source Investigations RC500.00 as listed in Section 175.

Material sources used in the production of crushed rock shall comply with the relevant requirements of Section 801 - Source Requirements for the Production of Crushed Rock and Aggregates.

812.04 CRUSHED ROCK MIX REGISTRATION

Crushed rock mixes proposed for use on specified works shall be registered in accordance with VicRoads Code of Practice for Registration of Crushed Rock Mixes RC500.02 as listed in Section 175.

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

General	The requirements of VicRoads Code of Practice RC500.02 have been met.
Conditional	Mixes which do not comply in all respects with the requirements of the Code of Practice but which are considered appropriate for use subject to conditions attached to the registration.
Expired	A mix which has passed the expiry date, but mix details are retained for record purposes.
Withdrawn	Withdrawn from use because of unsatisfactory field performance but details are retained for record purposes.

HP All crushed rock proposed for use ~~on VicRoads funded works~~ shall be current registered mixes in accordance with VicRoads Code of Practice RC500.02 and conform to specified requirements applicable to that class of product.

The supplied registered mix shall not be changed unless ~~the Superintendent~~ Council has been advised of the change and given written approval.

Crushed rock mixes registered as “Conditional” shall not be used unless ~~the Superintendent~~ Council has been advised of any mix registration conditions and approved the mix for use.

Approval of a registered crushed rock 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.

812.05 COMPONENTS

(a) Coarse and Fine Aggregates

Coarse and fine aggregates shall consist of clean, hard, durable, angular fragments of uniform quality.

If all or part of the fine aggregate is produced from a different source or location and/or is separately added into the production process, the combined fraction of fine aggregates shall be tested for Degradation Factor – Fine Aggregate as listed in Section 175.

The Degradation Factor – Fine Aggregate of a sample of the combined fine aggregates, shall not be less than 60. The frequency of testing shall be as specified in Table 812.121.

(b) Supplementary Materials

Supplementary materials shall only be incorporated in a crushed rock as a part of a registered crushed rock mix. Supplementary materials which are non durable or subject to appreciable breakdown will not be permitted.

The amount of any supplementary materials (e.g. crushed rock/concrete, brick, glass, clayey sand and clay filler etc.) used shall not exceed the maximum allowable percentage of the total dry mass of the crushed product as specified in the registered crushed rock mix.

Supplementary materials included in a registered crushed rock mix shall be:

(i) non-cementitious in nature except for lime added under the provision of Clause 812.06(d);

(ii) free of any organic matter; and screened, if necessary to remove all oversize particles, lumps and balls of clay or particles exceeding 4 mm in the case of a clayey filler;

(iii) stored and maintained in a dry and free flowing state and added to the product as a separate component at any stage after completion of primary crushing;

(iv) distributed into the product by a method that is capable of verifying that the pre-determined distribution rate has been achieved;

(v) uniformly mixed through the product by use of a pugmill.

(c) Blending of Products Containing Coarse Aggregates

The blending of two or more crushed rock products containing coarse aggregates from different sources or rock types will only be permitted as a part of a registered crushed rock mix. The submitted crushed rock mix shall clearly state the proportions by mass retained on each sieve for each component type that will be used in the blend.

A crushed rock mix containing a blend of coarse aggregates shall be subject to the following conditions:

(i) each component of the crushed rock blend shall individually comply with the applicable requirements of VicRoads Standard Section 801 and Code of Practice RC500.02, unless otherwise approved by VicRoads;

(ii) all material to be blended shall be fully crushed and screened to the maximum aggregate size permitted in the product prior to blending;

(iii) all coarse and fine aggregates in the blend shall comply with the relevant requirements of Clause 812.05(a);

(iv) if the blend has not been subjected to field placement and compaction, the Contractor shall prove that the material is capable of consistently meeting all requirements of relevant specifications;

(v) where a suitable blend has been registered as a crushed rock mix, the total proportions by mass of each rock type in the blend shall not be varied by more than + or - 5% by mass.

812.06 CRUSHED ROCK PRODUCT

(a) Crushed Rock in Stockpile

Crushed rock in stockpile shall comply with all applicable test requirements for that class of crushed rock product, as set out in VicRoads Code of Practice RC500.02 and this standard section. Crushed rock shall be tested in accordance with the frequencies specified in Table 812.121.

(b) Permeability

Where permeability values are specified; the crushed rock shall comply with the values listed below in Table 812.061.

*** **Table 812.061 Permeability Test Requirements** ~~##(in the table below, delete # symbols and insert required value - if not applicable insert 'not applicable', refer Guide Notes Clause 812.06 for further information):~~

Test	Test Value			
	Class 1	**Class 2**	**Class 3**	**Class 4**
Permeability (m/sec) (+)	5×10^{-8} (max.)	5×10^{-8} (max.)	2.5×10^{-8} (min.)	5×10^{-9} (max.)
(+) 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. The Contractor shall provide to ~~the Superintendent~~ Council the target grading and Plasticity Index required to satisfy the specified permeability requirement.				
(*****) The permeability of Class 3 crushed rock shall be a minimum value which complies with conditional formula presented below.				

The maximum permeability values for Class 1 and Class 4 crushed rock as specified in Table 812.061 shall not be exceeded, unless otherwise approved by ~~the Superintendent~~ Council.

The minimum permeability value (m/sec), p_3, for the Class 3 crushed rock shall comply with the following:

$$p_1 < p_3 \geq 5 \times p_4$$

where: p_1 is the permeability value (m/sec) for the Class 1 crushed rock based on the lowest of either the value provided in Table 812.061 or that submitted in the registered crushed rock mix; and

p_4 is the permeability value (m/sec) for the Class 4 crushed rock based on the lowest of either the value provided in Table 812.061 or that submitted in the registered crushed rock mix.

Where the grading of the supplied crushed rock varies by more than + or – 2% of the nominated target grading in the crushed rock mix, the Contractor will provide any additional information requested by VicRoads to demonstrate that specified requirements (e.g. permeability) are still being met.

(c) Plant Mixed Wet Mix Crushed Rock

~~Where specified in Table 812.062, crushed rock shall be supplied as Plant Mixed Wet Mixed Crushed Rock (PMWMCR).~~

For PMWMCR, the aggregates and water shall be mixed in a pug mill. PMWMCR shall be supplied at the moisture content as nominated by the Contractor to suit the weather conditions and the methods used for spreading and compaction of the material in the roadbed.

PMWMCR shall be supplied to the roadbed as specified ~~in~~ on the Drawings. ~~Table 812.062~~. If not specified, material may either be supplied as PMWMCR or as crushed rock.

*** ~~**Table 812.062 Material to be Supplied as PMWMCR** ##(delete all # symbols and insert 'yes' as applicable):~~

~~Location~~	~~Material~~			
	~~Class 1~~	~~Class 2~~	~~Class 3~~	~~Class 4~~
~~##:~~	~~##:~~	~~##:~~	~~##:~~	~~##:~~

(d) Sulphide Mineralisation

Crushed rock manufactured from sources containing sulphide/sulphate mineralisation shall not be used unless the fraction of the crushed rock passing the 2.36 mm sieve complies with the pH and conductivity test requirements specified in Table 812.063.

Table 812.063 pH and Conductivity Test Requirements

Test	Test Value	Soil to Water Ratio
pH (units)	6.0 (min)	1 : 2.5
Conductivity (µS/cm)	1500 (max)	1 : 1

~~The Superintendent~~Council may only accept a non-conforming material by exception and agreement.~~, if it is treated with hydrated or quick lime~~.

~~The Contractor is required to specify the method and amount of hydrated or quick lime to be combined with the product to meet the requirements of Table 812.063 and Table 812.064.~~

~~**Table 812.064 pH of Material after Addition of Lime**~~

~~Test~~	~~Test Value~~
~~pH (units)~~	~~10.0 (minimum)~~

~~The lime stabilising agent shall be added at the time of production of the crushed rock and prior to stockpiling.~~

812.07 GRADING OF UNCOMPACTED CLASSES 1, 2, 3 AND 4 CRUSHED ROCK AND PMWMCR BASE/SUBBASE

After completion of manufacture, but before compaction, Classes 1, 2, 3 and 4 crushed rock and PMWMCR base/subbase shall comply with the relevant grading requirements (% passing and where specified retained on each sieve) of VicRoads Code of Practice RC500.02 as listed in Section 175.

The crushed rock grading shall not extend from the coarse limit on one sieve to the fine limit on the following sieve or vice versa.

Unless otherwise advised as a part of the crushed rock mix registration process, the initial target grading shall be at or near the centre of the specified grading envelope. The target grading may be varied from time to time to achieve the specified post compaction grading contained in Section 304. The specified grading limits shall remain unchanged regardless of the target grading.

Class 4 subbase of a different nominal size to that specified may be accepted by ~~the Superintendent~~ Council, provided it meets the grading requirements for the nominal size as described in VicRoads Code of Practice RC500.02.

812.08 ADDITION OF WATER

Water added to the crushed rock products either onsite or in PMWMCR 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. The electrical conductivity shall not be more than 3500 µS/cm and pH within the range of 6 to 10, unless otherwise approved by VicRoads.

The use of reclaimed water will require the approval of ~~the Superintendent~~ Council and shall conform to VicRoads guidelines for reclaimed water – *Integrated Water Management Guidelines* as listed under other referenced documents in Section 175.

Water sources added to crushed rock shall be tested at a maximum of twelve monthly intervals during the course of supply or when the nature of the water source has changed.

Water sources classified by the relevant water authority as potable water shall be exempt from the above requirements.

812.09 MOISTURE CONTENT

(a) Crushed Rock in Stockpile

Crushed rock manufactured and placed in stockpile at the quarry or processing plant shall have a minimum moisture content of 3.5% by mass.

(b) Plant Mixed Wet Mixed Crushed Rock

~~Where the Contract includes supply and delivery only, the~~ The moisture content of the crushed rock at the point of delivery, expressed as a percentage by dry mass, shall be within +0.5% to - 1.0% of the target nominated from time to time by ~~the Superintendent~~ Council.

812.10 MATERIAL SUPPLIED TO STOCKPILE

Where the Contractor is required to supply PMWMCR or crushed rock to stockpile prior to delivery to the roadbed to the following requirements:

(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) crushed rock supplied to stockpile shall have a minimum moisture content of 3.5% by mass;

(e) all PMWMCR delivered to stockpile shall be supplied at a moisture content of not less than OMC 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.

812.11 HANDLING OF CRUSHED ROCK PRODUCTS

Handling of crushed rock including stockpiling and loading of trucks shall be undertaken to minimise segregation.

812.12 MINIMUM TESTING REQUIREMENTS

The Contractor shall test crushed rock products and PMWMCR at such a frequency to ensure that the supplied material consistently complies with the specified requirements of VicRoads Standard Sections, Code of Practice 500.02 and any additional testing specified as a condition of registration of the crushed rock mix.

The test frequency shall initially not be less than that shown in Table 812.121, except that the test frequency for Grading, Plasticity Index, Unsound Rock Content, pH and Conductivity, and Degradation Factor, may be halved where the most recent ten successive test results meet the specified requirements. If any subsequent test result fails, another test shall be immediately undertaken. If the second test fails the test frequency shall revert to the minimum test frequency specified in Table 812.121 and the Contractor shall not return to half the test frequency until a further ten successive test results comply with the specified requirements.

Table 812.121 Minimum Frequency of Testing

Test	Minimum Frequency of Testing
Grading - Final Product	On each production day - One per 500 tonnes or part thereof.
Unsound Rock Content (1)	One per production day of a sample taken from the final product.
Foreign Material Content (3)	On each day - one per 500 tonnes
Moisture Content - Crushed Rock (2) - PMWMCR	 One per production day On each production day - One per 500 tonnes.
Plasticity Index	**Class 1 Base** In each production week - One test per 2500 tonnes. **Class 2 Base and Classes 3 and 4 Subbase** In each production month - One test per 5000 tonnes.
California Bearing Ratio (4)	CBR values shall be re-tested annually for each registered mix during supply or when ~~the Superintendent~~ Council/VicRoads judges, the physical properties of the crushed rock have changed.
Degradation Factor - Fine Aggregate (1)	One per 1000 tonnes on each production day, where specified as a condition of the crushed rock mix.
Permeability	Permeability values, where specified, shall be re-tested annually for each registered mix during supply or when ~~the Superintendent~~ Council/VicRoads judges the physical properties of the crushed rock have changed.
Los Angeles Value (3)	Once per month or when ~~the Superintendent~~ Council/VicRoads judges the physical properties of the crushed rock has changed.
pH and Conductivity (5)	One per production month
Flakiness Index	One per production month
Crushed Particles (6)	One per production month
Supplementary Materials	One per 1000 tonnes on each production day, where specified as a condition of the crushed rock mix

(1) Not applicable to Class 4 subbase, unless otherwise specified
(2) Applicable only when payment is to be made on a mass basis
(3) Applicable to Crushed Concrete products only.
(4) Applicable to Crushed Concrete and all Class 4 subbase products.
(5) Applicable only to sources containing sulphide/sulphate mineralisation
(6) Applicable to crushed rock manufactured from river gravel only