

SECTION 815 - CEMENTITIOUS TREATED CRUSHED ROCK FOR PAVEMENT SUBBASE

~~##This section cross-references Sections 175, 306, 801 and 812.~~

~~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.~~

815.01 DESCRIPTION

This section covers the production requirements of 20 mm nominal size for pavement subbase treated with a cementitious binder to produce a bound material.

Crushed rock produced from a variety of raw feed sources including quarries, crushed concrete and Newer Basalt Surface Spalls (NBSS) can be utilised for this application, along with registered crushed rock blends containing supplementary materials.

Construction requirements for cementitious treated pavement subbase is covered by Section 306.

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

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

815.02 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.

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, 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.

Cement Treated Crushed Rock

Cement Treated Crushed Rock (CTCR) is a registered mixture of crushed rock, cement and water produced at a controlled mixing plant to close tolerances of grading, moisture content and binder content.

Fly Ash

A fine powder of pozzolanic material extracted from the flue emissions produced from the burning of black coal complying with requirements of AS 3582.1 - *Supplementary cementitious materials for use with portland and blended cement – fly ash* as listed in Section 175.

Pozzolan

A siliceous or alumino-siliceous material when finely ground can be mixed with lime or Portland cement to form a cementitious 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.

Slag (Ground Granulated Iron Blast Furnace Slag)

Ground Granulated Iron Blast Furnace Slag (GGBFS) complying with requirements of AS 3582.2 - *Supplementary cementitious materials for use with portland and blended cement* - GGBFS as listed in Section 175 is a pozzolan produced by fine grinding of slag produced as a by product from the smelting of iron ore.

Supplementary Material

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

815.03 MATERIAL SOURCE

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

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

815.04 CEMENT TREATED CRUSHED ROCK MIX REGISTRATION

CTCR 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 Cement treated 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.

Mixes registered as "Conditional" shall not used unless the Superintendent Council has been advised of any mix registration conditions and approved the mix for use.

Approval of a registered CTCR 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.

815.05 COMPONENTS

Components of the cement treated crushed rock shall comply with the requirements of VicRoads Standard Section 812.05 (a), (b) and (c).

815.06 CEMENT TREATED CRUSHED ROCK PRODUCT

Prior to the addition of any binder, the crushed rock shall comply with relevant specified requirements for Class 3 crushed rock, as set out in VicRoads Code of Practice RC500.02, Section 801, Section 812 and this specification.

The crushed rock shall be tested in accordance with the frequencies specified in Table 815.141.

815.07 CEMENTITIOUS BINDER

(a) Cement

Portland and blended cements shall be Type GP (rapid setting binder) or GB (medium setting binder) and comply with the requirements of AS 3972 *General purpose and blended cements* as listed in Section 175. It shall be stored in weatherproof structures, and any cement damaged by moisture shall not be used.

If Type GB cement is proposed, only the following blends are permitted:

- (i) Cement/Slag blend (50% to 60% cement content)
- (ii) Cement/Fly Ash blend (70% to 80% cement content)
- (iii) Cement/Slag/Fly Ash blend (55% to 65% cement content).

(b) Slag and Lime Blends

Slag and hydrated lime may be used in blended combination as a slow setting cementitious binder. The requirements for hydrated lime shall be as specified in AS 1672.1 - Limes and limestones as listed in Section 175. Slag used shall be Ground Granulated Iron Blast Furnace Slag (GGBFS) meeting the requirements of AS3582.2 - *Supplementary cementitious materials for use with portland and blended cements* - GGBFS as listed in Section 175. The Contractor shall nominate the type, brand and source of the GGBFS to be used.

Slag/lime shall be blended uniformly in the ratio of 85% slag to 15% hydrated lime unless laboratory testing indicates that superior strength of the CTCR is achieved by using a different ratio. If the blend is to be varied, the proportion of lime shall not be less than 10%. The Contractor shall provide evidence that the blend ratio has been met for all material supplied. Slag/lime blend shall have a mortar bar 7 day compressive strength of 10 MPa and 28 day mortar bar compressive strength of 16 MPa. The test shall be the same test specified for portland and blended cement except that the cement to water ratio shall be adjusted to match the consistency of mortar produced for the compressive strength test for GB cement in accordance with AS 2350.11.

(c) Slow Cementitious Blends Incorporating Alkali-activated Slag or Fly Ash

Special blends of slow setting cementitious stabilising agents incorporating alkali-activated slag or fly ash which do not meet mortar bar strength requirement specified in AS 3582.1 – *Supplementary cementitious materials for use with portland and blended cement* may be used subject to the blend satisfying the mortar bar test requirement specified in Clause 815.07(b). The maximum binder working time shall be determined in accordance with the VicRoads Test Method RC330.02 – *Determination of the Maximum Allowable Working Time for a Cementitious Binder* as listed in Section 175 to confirm that the binder is a slow setting binder.

Fly ash shall be supplied to meet the requirements of AS 3582.1 - *Supplementary cementitious materials for use with portland and blended cements – fly ash* as listed in Section 175.

815.08 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 $\mu\text{S}/\text{cm}$ 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 the 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.

815.09 MIXING

The crushed rock, supplementary materials (if any), cementitious binder and water shall be combined via a controlled process utilising hopper bins, cement dispensing silo and a pugmill.

The mixing period and the time of addition of water shall be such as to produce a uniform mixture of the components.

815.10 CEMENTITIOUS BINDER CONTENT AND UNCONFINED COMPRESSIVE STRENGTH (UCS) REQUIREMENTS

(a) Cementitious Binder Content

The Contractor shall determine the content of cementitious binder required to meet the minimum 7 day UCS specified in Table 815.101 using modified compaction. The cementitious binder content may be further increased to allow for the effects of production variability. The binder content so determined shall become the Design Cementitious Binder Content which shall not be less than the minimum cementitious binder content specified in Table 815.101. During manufacture, the cementitious binder content shall be determined in accordance with AS 5101.3.3 *Cement content of cement stabilized materials* as listed in Section 175.

Cementitious binder shall be added and mixed into the crushed rock to produce a uniform binder content.

After mixing, the cementitious binder content of the mixture, expressed as a percentage by mass of the dry crushed rock, shall be within $\pm 0.3\%$ of the Design Cementitious Binder Content.

(b) Unconfined Compressive Strength Test

The Contractor shall carry out UCS testing in accordance with the test frequency specified in Table 815.141. The UCS test result shall be the mean UCS determined from a pair of specimens tested in accordance with AS 5101.4 *Unconfined compressive strength of compacted materials* as listed in Section 175 and compacted using modified compactive effort.

For the purposes of UCS testing, one representative sample of fully mixed cement treated material shall be taken either from the plant or at the point of delivery in accordance with AS 5101.2.2 *Sampling – Preparation of stabilised pavement materials* as listed in Section 175 and compacted in the mould within two hours of mixing.

The UCS during production shall be assessed on a 'rolling average' basis where the average of the most recent three UCS test results shall not be less than the minimum value specified in Table 815.101.

Table 815.101 Cementitious Binder Content and Unconfined Compressive Strength

Pavement Design Modulus (MPa)	Minimum Design Cementitious Binder Content (% by mass)	Minimum 7 day Mean UCS (MPa)		
		Rapid Setting (GP Cement)	Medium Setting (GB Cement)	Slow Setting (Supplementary Cementitious Blends)
≤ 500	3	4	#	#
> 500 or ≤ 3500	3	5	3.5	3

815.11 MOISTURE CONTENT

~~Where 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 +0.5% to -1.0% of the target nominated by the Superintendent.~~

815.12 STOCKPILING OF MIXTURE

Where CTCR is temporarily stockpiled, prior to loading, the batching time shall be recorded on the delivery docket.

815.13 HANDLING OF MIXTURE

Handling of the mixture, including discharging from mixing plant and loading of trucks, shall minimise segregation.

815.14 MINIMUM TESTING REQUIREMENTS

The Contractor shall test CTCR products at such a frequency and within the relevant time limits to ensure that the supplied material consistently complies with the relevant 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 815.141, except that the test frequency for Grading, Unsound Rock Content, Plasticity Index, UCS and Degradation Factor – Fine Aggregate may be halved, where the most recent ten successive test results have met 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 frequency specified in Table 815.141 and the Contractor shall not return to half the test frequency until a further ten successive test results comply with the specified requirements.

Table 815.141 Minimum Frequency of Testing

Test	Minimum Frequency of Testing
Grading	On each production day: One per 500 tonnes or part thereof except where the total production on any day less than 100 tonnes.
Unsound Rock/Foreign Materials Content	One per production day of a sample taken from the crushed rock product prior to addition of cementitious binder.
Cementitious Binder Content	On each production day: One per 500 tonnes or part thereof except where the total production on any day is less than 100 tonnes.
Moisture Content	On each production day: One per 500 tonnes or part thereof except when total production on any day is less than 100 tonnes.
Plasticity Index	In each production month: One per 5000 tonnes or part thereof.
Degradation Factor - Fine Aggregate	One per production day for crusher fines imported from another source or location within the source to that of the course aggregates. Or where specified as a condition of a crushed rock mix.
Mean Unconfined Compressive Strength	In each week: One per 2000 tonnes or part thereof. If production in any week is less than 500 tonnes, the quantity may be added to the total production in the following week(s) until a total of 500 tonnes is reached.