SECTION 813 - BASE AND SUBBASE FOR LOWER TRAFFICKED ROADS

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##This section cross-references Sections 175, 801, 304 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:

813.01 DESCRIPTION

This section covers the requirements of crushed rock (includes recycled materials and other supplementary materials) for Lower Trafficked Roads. Crushed rock may be produced from a variety of raw feed sources including traditional hard rock quarries, crushed concrete, Newer Basalt Surface Spalls (NBSS) and blended crushed rock mixes containing a variety of supplementary materials.

This section specifies the requirements of crushed rock and plant mixed wet‑mix crushed rock for 20 mm nominal size Class LTB, and for 20 mm and 40 mm Class LTS for lower trafficked roads and other light duty applications. 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.

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

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

813.02 STANDARDS

Documents referred to in this section are listed in Table 813.021.

Table 813.021 Referenced Documents

|  |  |
| --- | --- |
| WorkSafe Victoria | |
| Compliance Code | Managing Asbestos in Workplaces - Edition 2 December 2019 |
| Australian Standards | |
| AS 1141.11.1 | Particle size distribution – Sieving method |
| AS 1141.18 | Crushed particles in coarse aggregate derived from gravel |
| AS 1141.22 | Wet/dry strength variation |
| AS 1141.23 | Los Angeles value (LAV) |
| AS 1289.2.1.6 | Determination of the moisture content of a soil – Hot plate drying method |
| AS 1289.3.1.1 | Determination of the liquid limit of a soil – Four point Casagrande method. |
| AS 1289.3.1.2 | Determination of the liquid limit of a soil – One point Casagrande method. |
| AS 1289.3.2.1 | Determination of the plastic limit of a soil |
| AS 1289.3.3.1 | Calculation of the plasticity index of a soil |
| AS 1289.3.6.1 | Determination of the particle size distribution of a soil |
| AS 1289.4.3.1 | Determination of the pH value of a soil – Electrometric method |
| AS 1289.6.1.1 | Determination of the California Bearing Ratio of a soil |
| Codes of Practice | |
| RC 500.00 | Source Rock Investigations |
| RC 500.02 | Registration of Crushed Rock Mixes |
| VicRoads Test Methods | |
| RC 353.09 | Soluble Salts in Soil (Conductivity Method) |
| RC 370.05 | Degradation Factor- Fine Aggregate Test Method for Surface Texture by Sand Patch |
| RC 372.01 | Coarse Aggregate Quality by Visual Assessment |
| RC 372.04 | Foreign Materials in Crushed Concrete |
| **Other** | |
|  | VicRoads Integrated Water Management Guidelines |

Section 175 details the revision dates of the relevant references in this section.

813.03 DEFINITIONS

For the purpose of this specification, the crushed rock product to be supplied is defined as follows:

**Lower Trafficked Base (LTB)**

Class LTB is a base material for lower trafficked unbound flexible pavements lying directly beneath the bituminous surfacing; i.e. pavements carrying < 3500 Average Annual Daily Traffic (AADT) and < 10% heavy vehicles.

**Lower Trafficked Subbase (LTS)**

Class LTS is a subbase material for lower trafficked unbound flexible pavements; i.e. roads carrying < 3500 Average Annual Daily Traffic (AADT) and < 10% heavy vehicles.

**Plant Mixed Wet‑Mix Crushed Rock (PMWMCR)**

PMWMCR is a mixture of crushed rock 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.

**Other Definitions**

Other applicable specification definitions for crushed rock (such as aggregate coarse and fine fraction, assigned Los Angeles Value (LAV), crushed brick, crushed rock, electric arc furnace slag (EAF), glass fines and supplementary material), are contained in RC 500.02.

813.04 MATERIAL SOURCE

Crushed rock products shall only be supplied from a Department of Transport accredited material source.

Crushed rock manufactured at a quarry, non-quarry site or recycling site shall not be used until the source has been investigated and accredited in accordance with RC 500.00.

Sources used in the product of crushed rock and aggregates shall comply with the requirements of Section 801.

**Department of Transport approval must be obtained prior to changing the source of material.**

813.05 COMPONENTS

This specification permits the use of traditional crushed rock as well as crushed concrete as conforming alternatives. If crushed concrete or blends of crushed concrete are used, they shall also comply with the applicable requirements of Table 813.061.

(a) Coarse Aggregates

Coarse aggregates shall consist of clean, hard, durable, angular fragments of uniform quality complying with unsound and marginal rock requirements and/or foreign materials specified in Tables 813.062 and 813.063.

(b) Fine Aggregates

Fine aggregates shall consist predominantly of clean, hard, durable, angular fragments and crusher fines of uniform quality.

All fine aggregates will be accepted as sound, if produced from the same material within the source as the coarse aggregates, such that on any day, the quality of the fine aggregates are fully represented by the Unsound and Marginal Rock Content and/or Foreign Material tests undertaken on the coarse aggregates.

The Degradation Factor – Fine Aggregate of a sample of the combined fine aggregates prior to mixing in of any supplementary material, shall not be less than 60.

Where a Crushed Rock is a blend of crushed rock and crushed concrete, the Degradation Factor – Fine Aggregate test shall be undertaken on the crushed rock component prior to blending and prior to mixing in of any supplementary material.

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(c) Supplementary Materials

Approved supplementary materials e.g. crushed brick, glass fines, EAF slag, clayey sands and RAP, may be added to crushed rock/crushed concrete products provided the specified criteria is adhered to.

Supplementary materials which are non-durable or subject to appreciable breakdown will not be permitted.

Department of Transport will only approve the addition of a supplementary material as a part of a registered crushed rock mix submitted in accordance with RC 500.02.

The total amount of supplementary materials shall not exceed 20% (Class LTB) and 50% (Class LTS) of total dry mass of the crushed rock product unless otherwise approved by the Department of Transport as a part of a registered mix. If clayey filler is used as a supplementary material to improve the cohesion and workability of the crushed rock product, the total amount of clayey filler shall not exceed 1.5% of the total dry mass.

Glass fines added to crushed rock mixes shall:

(i) be manufactured by crushing recycled glass

(ii) contain no more than 2% by mass of contaminants such as paper, corks, metals, and other harmful materials

(iii) be primarily container glass and not include glass from ceramics, cathode ray tubes, fluorescent light fittings and laboratory glassware

(iv) be 5 mm minus

(v) be cubical in shape, not sharp edged or elongated.

Where the percentage of crushed brick used in Class LTB is greater than 10%, the crushed rock product shall have a wet strength not less than 80 kN and wet/dry strength variation not greater than 40% of the dry strength when tested in accordance with AS 1141.22.

Supplementary materials shall be:

(i) manufactured and/or processed to consistent grading and plasticity requirements prior to use

(ii) non-cementitious in nature except for lime added under the provision of Clause 813.06(d)

(iii) free of organic matter

(iv) screened if necessary, to remove all oversize particles, lumps and balls of clay or in the case of clay filler; any particles exceeding 4 mm in size

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

(vi) distributed into the crushed rock by a method that is capable of verifying that the registered mix distribution rate has been achieved

(vii) uniformly mixed through the crushed rock and moisture conditioned by use of a pugmill.

(d) Blending of Crushed Rock Products

Two or more crushed rock products containing coarse and fine aggregates from different sources can only be combined as a part of a Department of Transport registered crushed rock mix, which shall clearly state the proportions by mass retained on each sieve for each source that will be used in the blend.

Blending of crushed rock products shall be subject to the following conditions:

(i) all sources in the blend shall individually comply with the relevant requirements of Section 801 and any applicable unsound and marginal rock and foreign material requirements specified in Clause 813.06(b) for the combined blend

(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 fine aggregates in the blend shall comply with the relevant requirements of Clause 813.05(b)

(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 this and other relevant specifications

(v) once a suitable blend has been developed and registered, the total proportions by mass of each crushed rock product in the blend shall not be varied by more than plus or minus 5% by mass.

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813.06 PRODUCT

(a) Crushed rock in stockpile shall be free from organic matter and lumps or balls of clay and shall comply with all specified requirements including relevant test requirements of Table 813.061. Crushed rock shall be tested in accordance with the frequencies specified in Table 813.131.

**Table 813.061 Test Requirements**

|  |  |  |
| --- | --- | --- |
| **Test** | **Test Value** | |
| **Class LTB** | **Class LTS** |
| Liquid Limit % (max.) | 35 | 40 |
| Plasticity Index (range) (+) | 0 - 10 | 0 - 15 |
| California Bearing Ratio (%) (min.) (++) | 80 | 30 |
| PI x % passing 0.425 mm sieve (max.) | - | 420 |
| Crushed Particles (%) (min.) (+++) | 50 | - |
| Allowable % of Supplementary Materials | 20% | 50% |
| (+) Unless otherwise advised as a part of the crushed rock mix registration process, the Plasticity Index shall initially be targeted to the low to middle point of the nominated range.  (++) 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 four days prior to the CBR test.  (+++) Applicable to crushed river gravels, if approved for use. | | |

(b) Unsound and marginal rock and/or foreign materials in that fraction of the product retained on a 4.75 mm AS sieve shall not exceed the percentages specified in Table 813.062 and Table 813.063.

**Table 813.062 - Unsound and Marginal Rock Content**

|  |  |  |
| --- | --- | --- |
| **Class** | **Total of Marginal and Unsound Rock**  **% (max.)** | **Unsound Rock**  **% (max.)** |
| LTB | 20 | 10 |
| LTS | - | - |

**Table 813.063 – Foreign Material Content in Crushed Concrete**

|  |  |  |
| --- | --- | --- |
| **Foreign Material**  **Type** | **Class LTB** | **Class LTS** |
| **Allowable % (max)** | |
| High density materials such as metal, brick(1), ceramic whiteware, masonry materials, glass(1) and RAP(1) | 3 | 5 |
| Low density materials such as plastic, rubber, plaster, clay lumps and other friable material | 1 | 3 |
| Wood and other vegetable or decomposable | 0.2 | 0.5 |

**Notes on Table 813.063**

(1) Up to 20% of crushed brick, glass, RAP and/or EAF slag may be allowed.

Where a Crushed Rock is a blend of crushed rock and crushed concrete, the Unsound and Marginal Rock Content test and the Foreign Material Content test, as applicable to the component, shall be undertaken on the individual components prior to blending.

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Where a registered crushed rock mix allows a higher percentage of crushed brick or glass fines to be used; the percentage of unsound rock and/or foreign materials is to be determined on the total dry mass of the test sample, excluding the crushed brick, glass, RAP and EAF slag components.

Foreign material limits in Table 813.063 apply to contamination that cannot be practically removed and are not permitted as deliberate additions, except where supplementary materials such as brick, glass, RAP and EAF slag are accepted as part of a registered crushed rock mix.

(c) Products shall be supplied as PMWMCR if specified in Table 813.064.

For PMWMCR, the component aggregates and water shall be mixed in a pugmill. 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 Table 813.064. If not specified, material may either be supplied as PMWMCR or as crushed rock.

**Table 813.064 Material to be Supplied as PMWMCR** ##(delete all # symbols and insert "yes" as applicable):

|  |  |  |
| --- | --- | --- |
| **Location** | **Material** | |
| **Class LTB** | **Class LTS** |
| ##: | ##: | ##: |
|  |  |  |
|  |  |  |

(d) Sulphide Mineralisation

Sources which have been identified as containing sulphide/sulphate mineralisation shall not be used without the approval of the Department of Transport. Sources may be considered for use, if they meet the test requirements and/or are treated in accordance with the requirements of Section 812 Clause 812.06(d).

813.07 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 the Department of Transport.

The use of reclaimed water will require the approval of the Superintendent and shall conform to the VicRoads - Integrated Water Management Guidelines.

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.

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813.08 GRADING OF UNCOMPACTED CLASSES LTB AND LTS CRUSHED ROCK

(a) Class LTB Crushed Rock

After completion of production, but before compaction, Class LTB crushed rock shall comply with the relevant grading requirements of Table 813.081 corresponding to the assigned Los Angeles Value (LAV) and the nominal size of the material. 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 any specified post-compaction grading. The specified grading limits shall remain unchanged regardless of the target grading.

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**Table 813.081 Grading Requirements for Class LTB Crushed Rock**

|  |  |  |  |
| --- | --- | --- | --- |
| **LAV < 25** | | **LAV > 26** | |
| **Sieve Size**  **AS (mm)** | **Test Value before Compaction – Limits of Grading**  **(% Passing by mass)** | **Sieve Size**  **AS (mm)** | **Test Value before Compaction – Limits of Grading (%Passing by mass)** |
| 26.5 | 100 | 26.5 | 100 |
| 19.0 | 95 – 100 | 19.0 | 95 – 100 |
| 13.2 | 75 – 95 | 13.2 | 75 – 95 |
| 9.5 | 60 – 90 | 9.5 | 60 – 90 |
| 4.75 | 42 – 76 | 4.75 | 42 – 76 |
| 2.36 | 28 – 60 | 2.36 | 28 – 60 |
| 0.425 | 14 – 28 | 0.425 | 10 – 28 |
| 0.075 | 6 – 13 | 0.075 | 2 – 10 |

(b) Class LTS Crushed Rock

After completion of production, but before compaction, 20 mm or 40 mm Class LTS crushed rock subbase shall comply with the relevant grading requirements of Table 813.082. The crushed rock grading shall not extend from near the coarse limit on one sieve to near 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 any specified post-compaction grading. The specified grading limits shall remain unchanged regardless of the target grading.

**Table 813.082 Grading Requirements for Class LTS Crushed Rock**

|  |  |  |
| --- | --- | --- |
| **Sieve Size**  **AS (mm)** | **Test Value before Compaction**  **- Limits of Grading**  **(% Passing by mass)** | |
| **Nominal Size (mm)** | |
| **40** | **20** |
| 53.0 | 100 |  |
| 37.5 |  |  |
| 26.5 |  | 100 |
| 19.0 | 64-90 |  |
| 9.5 |  |  |
| 4.75 |  | 42-76 |
| 0.425 | 7-23 | 10-28 |
| 0.075 | 2-12 | 2-14 |

813.09 CRUSHED ROCK MIX REGISTRATION

Crushed rock mixes proposed for use in the works shall have a current registered mix with Department of Transport in accordance with RC 500.02.

All mixes registered with Department of Transport are issued a status according to compliance as:

**General** The requirements ofRC 500.02 have been met.

**Conditional** Mixes which do not comply in all respects with the requirements of the RC 500.02, but which are considered appropriate for use subject to conditions attached to the registration.

**Expired** Previously registered mixes which have exceeded the registration period. Details are retained in Department of Transport mix registration system for record purposes.

**Withdrawn** Mixes which are no longer available for use. Details are retained in the Department of Transport mix registration system for record purposes.

**HP All crushed rock mixes proposed for use on the works shall be registered and current at the time of use and conform to specified requirements applicable to that class of product.**

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

Crushed rock mixes registered as “Conditional” shall not be used unless the Superintendent has been advised of any mix registration conditions and given approval for their 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.

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813.10 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 (PMWMCR)

Where the Contract includes supply and delivery only, the moisture content of the PMWMCR 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 Contractor.

813.11 CRUSHED ROCK SUPPLIED TO STOCKPILE

Where the Contractor is required to supply PMWMCR or crushed rock 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) 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.

813.12 HANDLING OF CRUSHED ROCK PRODUCTS

Handling of crushed rock products including stockpiling, handling and loading into trucks shall minimise any segregation.

813.13 MINIMUM TESTING REQUIREMENTS

The Contractor shall test all crushed rock products at such a frequency to ensure that the supplied material consistently complies with the specified requirements of the Standard Section, 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 813.131. The testing 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 813.131 and the Contractor shall not return to half the test frequency until a further ten successive test results comply with the specified requirements.

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**Table 813.131 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 | Classes LTB, LTS and PMWMCR: In each production month - One per 5000 tonnes or part thereof. |
| California Bearing Ratio (4) | CBR values shall be re-tested annually for each registered mix during supply or when the Superintendent judges, the physical properties of the crushed rock have changed. |
| Deg Factor - Fine Aggregate (1) | One per 1000 tonnes prior to addition of any additives. |
| Los Angeles Value (3) | One per month or when the Superintendent judges the physical properties of the crushed rock has changed |
| Wet & Dry Strength Variation (6) | One per production month |
| Crushed Particles (7) | One per production month |
| pH and Conductivity (5) | One per production month |
| Supplementary Materials | One per 1000 tonnes on each production day, where specified as a condition of the crushed rock mix. |
| **Notes on Table 813.131**  (1) Not applicable to Class LTS crushed rock, 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 all base and subbase products.  (5) Applicable only to sources containing sulphide/sulphate mineralisation  (6) Applicable to crushed rock products containing more than 10% crushed brick.  (7) Applicable to crushed rock manufactured from river gravel only | |
|  | |

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