

APPENDIX 'D'

CN CRUSHED ROCK BALLAST MATERIAL SPECIFICATION

12-20C
(July 2003)

Superseding
Specification
12-20B

CRUSHED ROCK BALLAST

- 1 SCOPE: This specification covers two classes of crushed rock ballast and one class of trowelling stone.

Class 1 - Crushed rock ballast for use primarily on main line track.

Class 2 - Crushed rock ballast for use only on other than main line track.

Trowelling stone shall be supplied in one class only.

GENERAL REQUIREMENTS

2 Material

- 2.1 The ballast and trowelling stone shall be composed of hard, strong and durable particles, clean and free from clay and shale and from an excess of dust or elongated pieces.
- 2.2 Before crushed rock ballast is accepted from any new pit, or from a new seam, bed or formation in any existing pit that in the judgement of the Inspector is substantially different from material previously inspected and approved, the material shall be inspected by a qualified petrologist and approved by the Senior Geotechnical Engineer of the Railway.
- 2.3 The word "Inspector" occurring in this specification shall mean the duly authorized representative of the Railways' Chief Engineer.

DETAILED REQUIREMENTS

3 Methods of Test

All tests shall be carried out according to the latest revision of the standard test methods referred to in this specification.

4 Fractured Faces

The crushed rock ballast or trowelling stone shall have at least 75% of the particles by mass with two or more fractured faces and at least 98% of the particles by mass with one fractured face. The above percentages will be required within each sieve size coarser than 3/4-inch (19 mm).

5 Flat Pieces

The crushed rock ballast or trowelling stone shall contain less than 30% by mass of flat pieces. In cases of dispute the test method "Determination of Flakiness Index" contained in British Standard 812 shall be used.

6 Absorption

The absorption of the ballast or trowelling stone shall be less than 0.5%. ASTM C 127

Note: Vertical bar on left margin indicates location of latest revision.

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7 Soundness and Resistance to Abrasion

Property	Requirement		Tested in Accordance with ASTM Method	Testing Remarks
Soundness	Class 1 Ballast & Trowelling Stone	Class 2 Ballast	C 88	Coarse aggregate only, magnesium sulphate solution.
	Less than 7.0% at 5 cycles.	Less than 10.0% at 5 cycles.		
Abrasion Loss	Less than 20%.	Less than 30%.	C 535	ASTM Grading "2".

8 Grading

The ballast and trowelling stone shall conform to the grading requirements shown below.

% Passing by Mass

Sieve Size		Class 1 & 2 Ballast	Trowelling Stone
2-1/2"	(63 mm)	100	-
2"	(50 mm)	70-90	-
1-1/2"	(37.5 mm)	40-70	-
1"	(25 mm)	0-25	100
3/4"	(19 mm)	0-3	90-100
1/2"	(12.5 mm)	-	15-55
No. 4	(4.75 mm)	-	0-5
No. 200)	(0.75 mm)	0-1	0-1

ASTM C 136

ASTM C 117 (for material passing the No. 200 sieve).

9 Ballast Resistivity

9.1 When tested as described in Appendix A, ballast resistivity shall not be less than 3000 ohm-meters.

10 Frequency of Testing

10.1 At the start of production the Producer shall carry out all tests described in Sections 4 to 9 inclusive to establish compliance with this specification.

10.2 During production the Producer shall carry out the grading test twice per day, the abrasion loss test once on each 10,000 metric tonnes of production, and all other tests once on each 30,000 metric tonnes of production thereafter. The ballast or trowelling stone shall be tested more frequently if there is any indication of a change in quality.

11 Handling and Loading

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- 11.1 Ballast and trowelling stone shall be handled, stockpiled and/or loaded into cars in such a manner as to minimize the abrasion of particles and the segregation of sizes.
- 11.2 Under no circumstances shall rubber tired or crawler type vehicles be allowed to operate or traverse repeatedly over the stockpile of crushed material.
- 11.3 The handling and loading procedures shall have the prior approval of the Senior Geotechnical Engineer of the Railway.

12 Weighing

- 12.1 All ballast and trowelling stone delivered to the Railway shall be weighed by the Producer at his expense and proof of such weight shall be supplied to the Inspector.
- 12.2 All measurement shall be by actual weight in net tonnes (1000 kg).
- 12.3 The weighing device or method used must be approved by the Railway in writing. The Producer shall arrange for and obtain certification by the Weights and Measures Division of the Federal Department of Consumer and Corporate Affairs of any weighing device before it goes into service and thereafter as required by the Inspector. In no case shall calibration be done less than once after each 100,000 tonnes of production.
- 12.4 The accuracy of any weighing device may be checked by the Inspector at any time and should any discrepancies be found in the reading adjustments to the production quantities will be made by the Inspector.

QUALITY ASSURANCE13 Application

Material ordered to this specification is subject to inspection by the Railway with respect to all the requirements of this specification.

14 Plant Access

The Inspector shall have, during working hours, free entry to all parts of the producer's plant and laboratory facilities used in the production or testing of material ordered to this specification.

15 Quality Assurance Provisions

It is the producer's responsibility to satisfy the Inspector that the ballast and trowelling stone conforms to this specification. This may be accomplished either by performing the tests (preferably on-site) prescribed in this specification or by demonstrating to the Inspector that the production, handling and stockpiling are so controlled that conformity to this specification is assured.

The Railway reserves the right to perform any of the tests set forth in the specification where such tests are deemed necessary to assure conformity to the prescribed requirements.

16 Test Samples

The incidence of sampling and the location at which samples are selected for testing by the Railway shall be at the discretion of the Inspector. The samples shall be taken in such a manner as to ensure

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that they truly represent the material being produced. The sample size for complete testing shall be not less than 50 kg.

17 Defective Material

Material which has been or is being produced which does not comply with this specification shall be rejected by the Inspector. The Producer shall stop further production until the fault has been corrected and shall dispose of all rejected material without cost to the Railway.

CRUSHED ROCK BALLASTAPPENDIX A

Ballast Resistivity Testing

1. Load ballast into the covered plexiglass resistivity box (see Diagram A below – minimum dimensions $h=0.15\text{m}$ and $L=0.2\text{m}$). Ensure that the box is filled level. If necessary, shake the box to settle material.
2. Measure and record the resistance of the material as produced / received.
3. Record ambient temperature.
4. Using an atomizer, add de-ionized water 50 ml at a time waiting 3 minutes between applications until bottom of sample is wet. Water may not be allowed to accumulate at the base of the box. Record volume of water added and cover sample.
5. The resistivity of the material will decrease as water disperses through the sample. Record resistivity every hour for the first 6 hours and then take a minimum of three additional measurements over the next 36 hours.
6. Minimum resistivity will be calculated by multiplying the lowest recorded resistivity by the ballast box factor (h^2/L where h and L are the ballast box dimensions shown in Diagram A)
7. Replace sample and repeat test a minimum of 4 times. Ballast resistivity shall be the average of the minimum resistivity of all valid tests.