



# Capital Projects Group Crushed Rock Track Ballast Specification

Specification 32 11 25

Revision 2  
Date: October 2019



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## Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes
Rev 1	July 23 2018	Revision 1 of the Go Track Ballast Specification clarifies Metrolinx's track ballast type testing process and track ballast handling requirements.
Rev 2	October 2019	Revision 2 has been developed to elaborate on the production process requirements, update the gradation table and the handling and loading procedures for the supply of track ballast on Metrolinx track capital and maintenance programs.

## GENERAL REQUIREMENTS

### 1.1 DESCRIPTION OF SPECIFICATION

This document outlines the material, stockpiling, and handling specifications of ballast. It covers the supply of ballast from the quarry site to the storage yard for the two following classes of crushed rock ballast:

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

Class 2 - Crushed rock ballast for use only on non-main line track and shall include rail equipment layover yards and maintenance facility tracks.

This specification is intended to identify suitable supply sources for track ballast on Metrolinx new, rehabilitated, and maintenance track infrastructure.

### 1.2 DEFINITIONS

- .1 Ballast: Ballast is a free draining coarse aggregate used to support railway tracks.
- .2 Consultant: In this Specification, Consultant means the duly authorized representative of Metrolinx.
- .3 Nominal Size: The designation of an aggregate which gives an indication of the largest size particle present.

### 1.3 TEST STANDARDS

This Specification includes references to other publications. These references are noted in the text as appropriate. All tests shall be carried out according to the latest revision of the standard test methods referred to in this Specification.

- .1 ASTM D75, Standard Practice for Sampling Aggregates.
- .2 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- .3 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
- .4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .5 ASTM C117, Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
- .6 ASTM C535, Standard Test Method for Resistance to Degradation of Large-

Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

- .7 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Course Aggregate.
- .8 MTO LS-609 examination form shall be completed in the petrographic analysis process, on a representative ballast sample, by a qualified petrologist certified by the Canadian Council of Independent Laboratories in accordance with LS-609.

## **PART 2 - DETAIL REQUIREMENTS**

### **2.1 MATERIALS**

- .1 The ballast shall be composed of hard, dense, of an angular particle structure providing sharp corners and cubical fragments and minimal deleterious materials, such as but not limited to clay, shale, dust or elongated pieces. The ballast shall provide high resistance to temperature changes, chemical attack, have a high electrical resistance, low absorption properties and be free of cementing characteristics.
- .2 The ballast shall contain no more than 0.5% deleterious material and at least 99% by mass granites, granitic-gneiss, traprocks, or quartzites.
- .3 In rail equipment layover yards and maintenance facilities the ballast type may also include a gneiss-amphibolite-schist.
- .4 The ballast shall have a petrographic number of less than or equal to 110.
- .5 Carbonated materials such as limestones, dolomites, and dolomitic limestones shall not be accepted as ballast materials.
- .6 Blast or steel furnace slags shall not be accepted as ballast material.
- .7 Before crushed rock ballast is accepted from a new source, or from a new seam, bed or formation in any existing pit that in the judgement of Metrolinx is substantially different from material previously inspected and approved, the material shall be inspected by a qualified petrologist and approved by Metrolinx.
- .8 Where a discrepancy arises between the petrographic analysis and other test results, the petrographic analysis shall have precedence unless otherwise approved by Metrolinx.

### **2.2 METHODS OF TEST**

Unless otherwise specified below, sampling and testing shall be carried out in accordance with the applicable standards.

### 2.3 SAMPLING

The sample testing shall be obtained from the point of delivery (storage yard) or at the source of the supply. The material shall be sampled according to ASTM D75. The sample size for the grading test and the complete testing shall be not less than 50 kg and 125 kg, respectively. In any event, the sample size shall be adjusted to give the desired confidence in test results.

### 2.4 FRACTURED FACES

The crushed rock ballast shall be fully issued from crushing operations. The crushed rock ballast 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 ¾ inch (19 mm).

### 2.5 FLAT PIECES

The crushed rock ballast shall not exceed 5 % by weight of flat and elongated particles and shall be determined in accordance with Method A of ASTM D4791. Flat and elongated particles are particles with the ratio between the largest dimension and the smallest dimension exceeding four (4).

### 2.6 ABSORPTION

The percentage of absorption of the ballast shall be determined in accordance with ASTM C127. It shall be less than 0.5 %. When conducting the absorption test, the value for relative density (specific gravity) shall be taken and verified against the AREMA minimum value of 2.6.

### 2.7 SOUNDNESS AND RESISTANCE TO ABRASION

The soundness and the resistance to abrasion of ballast aggregates shall conform to the requirements set out in the table below.

Property	Requirement		Test Method	Testing Remarks
Soundness	Class 1 Ballast	Class 2 Ballast	ASTM C 88	Coarse aggregate only, magnesium sulfate is preferred.
	Less than 7.0 % at 5 immersion cycles in magnesium sulfate. Less than 5.0 % at 5 immersion cycles in sodium sulfate.	Less than 10.0 % at 5 immersion cycles in magnesium sulphate.		
Abrasion Loss	Less than 20 %.	Less than 30 %.	ASTM C 535	ASTM Grading “2”

## 2.8 GRADING

The particle size distribution (grading) of ballast aggregates shall conform to the requirements set out below. The grading analysis shall be performed in accordance with ASTM C136. Any track ballast material that is finer than the No.200 sieve shall be determined in accordance with ASTM C117.

% Passing by Mass

Ballast Aggregates			
Sieve Nominal Size		Concrete & Timber Ties on main and non-main tracks (except yard tracks)	Steel Ties on all track types, and Rail Equipment Layover Yard & Maintenance Facility Tracks (AREMA - 4)
2½"	(63mm)	100	100
2"	(50mm)	70-90	100
1½"	(37.5mm)	40-70	90 -100
1"	(25mm)	0-25	20 – 55
¾"	(19mm)	0-3	0 – 15
3/8"	(9.5mm)	--	0 – 5
No.4	(4.75mm)	--	--
No.200	(0.075mm)	0-1	0 – 1

## 2.9 BALLAST RESISTIVITY

When tested as described in Appendix A, ballast resistivity shall not be less than 3,000 ohm-meters, and all tests shall indicate average mean low value.

## 2.10 FREQUENCY OF TESTING

- .1 At the start of production, the producer shall carry out all tests described in Sections 2.3 to 2.9 inclusive to establish compliance with this Specification.
- .2 During production, the producer shall carry out the grading test twice per day or at least once on each 1,000 metric tonnes, the abrasion loss test once on each 10,000 metric tonnes of production, and all other tests once on each 20,000 metric tonnes of production thereafter. The ballast shall be tested more frequently if there is any indication of a change in quality.
- .3 The producer shall carry out additional sampling and testing when the Consultant suspects that the material is not to specification.

## 2.11 HANDLING AND LOADING

- .1 Ballast shall be handled, stockpiled and/or loaded into hopper type rail cars, or haul trucks in such a manner as to minimize the abrasion of particles and the segregation of sizes.
- .2 Metrolinx requires that the ballast be rescreened as necessary to assure that the ballast gradation passing the  $\frac{3}{4}$  inch sieve is as defined by this specification prior to stockpiling in operations using stockpiles or immediately prior to loading operations.
- .3 Vehicles and equipment used for transportation, loading, and unloading shall be clean and free from rubbish and substances which may impair the quality of the ballast.
- .4 Unless for limiting the segregation of stock piled ballast particles, under no circumstances shall rubber tired, crawler type vehicles or other machinery be allowed to operate or traverse repeatedly over the stockpile of crushed material.
- .5 Ballast shall be stored stockpiled and handled in conditions which prevent material contamination, segregation, and degradation. Storage on a concrete or asphalt surface shall be provided at all intermediate ballast stockpiled sites.
- .6 The loading process shall include provisions for the prevention of ballast contamination from the base of stockpiles or other sources.
- .7 The handling and loading procedures shall have the prior approval of Metrolinx.
- .8 The application of a chemical thawing agent to frozen track ballast must be reviewed and approved by Metrolinx-GO Transit, Corridor Maintenance, Senior Manager of Track and Structures.

## 2.12 WEIGHING

- .1 All ballast delivered to Metrolinx shall be weighed by the producer, at the producer's expense, and weight tickets or records shall be supplied to the Consultant.
- .2 All measurement shall be by actual weight in net tonnes (1,000 kg).
- .3 The weighing device or method used must be approved by Metrolinx in writing. The producer shall arrange for and obtain a Class Approval from Measurement Canada's Approval Calibration Services Laboratory (ACSL) for any weighing device before it goes into service and thereafter as required by the Consultant. In no case shall calibration be done less than once after each 100,000 metric tonnes of production.



- .4 The accuracy of any weighing device may be checked by the Consultant at any time and should any discrepancies be found in the reading adjustments to the production quantities will be made by the Consultant.
- .5 The quantity of prepared ballast shall be monitored continuously and the quantity recorded.

## **PART 3 - QUALITY ASSURANCE**

### **3.1 APPLICATION**

Material ordered to this Specification is subject to inspection by the Consultant with respect to all the requirements of this Specification.

### **3.2 PLANT ACCESS**

The Consultant 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 for the purpose of:

- .1 Observing sampling and testing procedures;
- .2 Review plant and ballast production facilities;
- .3 Carry out any additional sampling and testing.

### **3.3 QUALITY ASSURANCE PROVISIONS**

- .1 It is the producer's responsibility to satisfy the Consultant that the ballast conforms to this Specification. This may be accomplished either by performing the tests (preferably at the storage yard) prescribed in this Specification or by demonstrating to the Consultant that the production, handling, and stockpiling are so controlled that conformity to this Specification is assured.
- .2 Metrolinx 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.

### **3.4 TEST SAMPLES**

The incidence of sampling and the location at which samples are selected for testing by Metrolinx shall be at the discretion of the Consultant. The samples shall be taken in such a manner as to ensure that they truly represent the material being produced, the avoidance of ballast particle segregation, and in accordance with ASTM D75.

### **3.5 DEFECTIVE MATERIAL**

- .1 Material which has been or is being produced which does not comply with this Specification shall be rejected by the Consultant. The producer shall stop

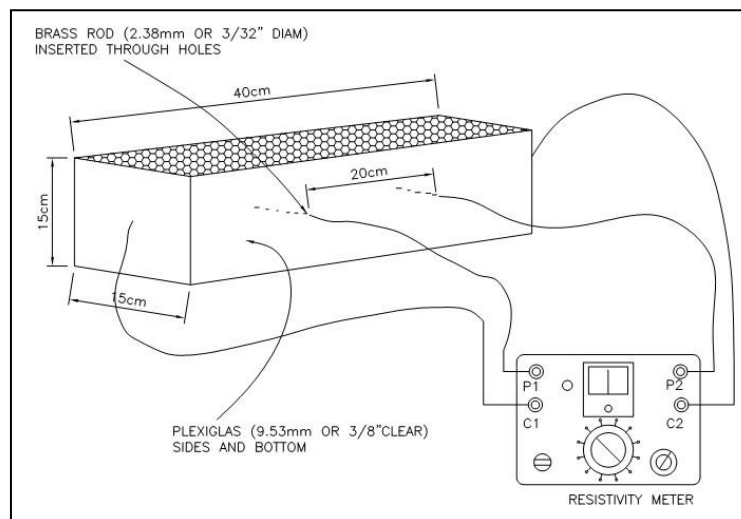
further production until the fault has been corrected and shall dispose of all rejected material without cost to Metrolinx.

- .2 Metrolinx can decide to downgrade to Class 2, crushed rock ballast which does not comply with Class 1 Specification. Metrolinx can decide to downgrade to an unspecified class, crushed rock ballast which does not comply with Class 2 Specification. Metrolinx has no obligation to do so and such acceptance shall not in any way reduce the producer's contractual obligations.

## APPENDIX A

### Ballast Resistivity Testing

1. Load ballast into the covered Plexiglas resistivity box (see Diagram A below – minimum dimensions  $h=0.15$  m and  $L=0.2$  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.



*Diagram A – Ballast Box Dimensions and Wiring Diagram*

**END OF SECTION**