ProRail

Asset management

Product specification

Aggregates for quartzless railway ballast

Ballast free of crystalline silica and asbestos

This document is a translation of the Dutch version ref.: SPC00353-1 V001
An English translation of the Dutch version has been made available for market parties participating in this market consultation. In the event of unexpected discrepancies, the original Dutch version shall in all cases have precedence.

Managing body:	AM Architectuur en Techniek
Responsibility for content:	Manager Architectuur en Techniek
Status:	Final

Effective date:	version:	Document number:
01-08-2022	**001**	**SPC00353-1**

CONTENT

1 Revision details

Date	Version	Chapter/paragraph	Effective date
01/07/2022	001	Document	Initial version

2 Introduction

This product specification contains the requirements and delivery conditions that ProRail sets for the direct and/or indirect supply to ProRail of "***Quartzless railway ballast"***. These are aggregates of mineral origin suitable for use as railway ballast which is *free of crystalline silica and asbestos*. This means that this railway ballast shall not contain either crystalline quartz or any other crystalline silica (e.g. tridymite and cristobalite) and also no asbestos. In the SPC00353-2 "Quartzless railway ballast - Ballast free of crystalline silica and asbestos – Explanation" this is explained in more detail under chapter 2 "Introduction".

This product specification must be used when certifying "***quartzless railway ballast"*** for ProRail by a Certification Body (CB) recognized by ProRail. A product certificate can only be issued if all requirements of this product specification are met.

2.1 Purpose

Railway ballast is used in the ballast bed for the purpose of transferring and distributing the dynamic and static loads exerted on the superstructure to the subsoil. Railway ballast also provides the necessary transverse and longitudinal resistance to give the track a stable position. In addition, the ballast bed facilitates water transport to the subgrade (drainage).
The purpose of this product specification of aggregates free of crystalline silica and asbestos for railway ballast is to set requirements for certification.

Whether this document refers to ***ballast, quartzless ballast or railway ballast, the intended meaning is railway ballast free of crystalline silica and asbestos.***

2.2 Scope and context

This product specification applies to the rail infrastructure managed by ProRail in the Netherlands.

ProRail has three types of railway ballast *free of crystalline silica and asbestos*:

- Type 1a: Railway ballast size 13.5/50 mm,
- Type 2a: Railway ballast size 22/40 mm,

Comment: SPC00033 applies to the certification of quartz-containing (recycle) railway ballast (type 1 and 2). No requirements are set for ballast types 1 and 2 with regards to e.g. Crystalline or asbestos.

2.3 Scope and interfaces with other products

Interfaces with other products/systems are depicted schematically in figure 1 below:

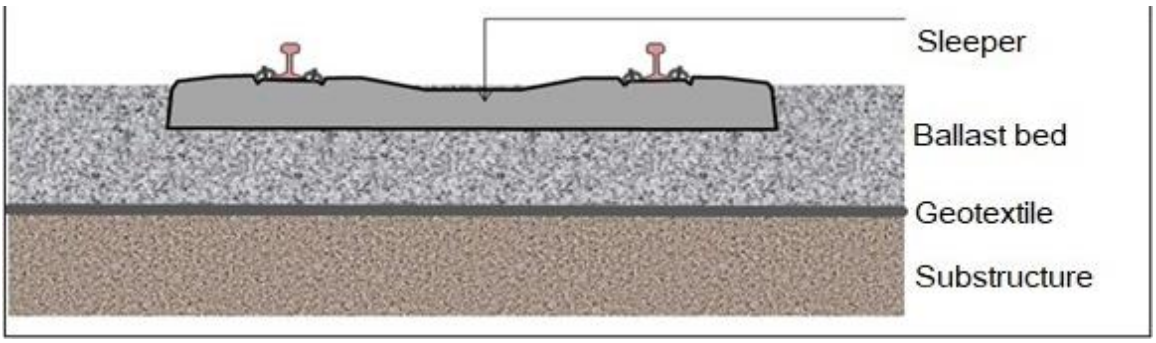


Figure 1: Interfaces with other Systems.

2.4 Definitions and abbreviations

Flakiness Index):

The flakiness index is a measure of the content of flat stones.

Shape index
The Shape index is a measure of the content of non-cubic stones.

Quartzless railway ballast – ballast free of crystalline silica and asbestos:
Quartzless railway ballast refers to railways ballast free of crystalline silica and asbestos, made of broken natural stone from natural quarries where 100% of the surface of the stone can be described as completely broken **and** the presence of crystalline silica has been excluded with X-ray diffraction (XRD) **and** the presence of asbestos has been excluded with SEM/EDX.

Ballast bed:
The ballast bed is the layer of crushed stone from the top of the sleeper or bearer to the substructure (earth track or structure), see figure 1.

Railway ballast size:
Railway ballast size is defined by one pair of sieves in mm with “d” as the lower limit and “D” as the upper limit between which the majority (mass) of the sieve distribution lies.

XRD:
X-ray diffraction (XRD) is a non-destructive technique (NDT) used in laboratories to determine the structure of solids. This allows for e.g. crystalline minerals such as quartz to be identified and quantified.

SEM/EDX:
SEM/EDX is a combination of two techniques: Scanning Electron Microscopy (SEM) where the surface structure of the sample can be determined in detail, and X-ray micro-analysis, also known as “energy-dispersive X-ray examination” (EDX) where the composition of the sample can be determined.

2.5 References

2.5.1 Standards and norms

No.	Number/code		Title
1.	NEN-EN 13450:2003+C1:2006 (nl)	–	Aggregates for railway ballast
2.	EN 13450 (en) December 2002	–	Aggregates for railway ballast
3.	NEN 2034 (nl) July 2010	–	Dutch implementation of NEN-EN 13450 “Aggregates for railways ballast”
4.	NEN-EN 932-1 (nl) September 1996	–	Test methods for general properties of aggregates – Part 1: Sampling methods
5.	NEN-EN 932-3 (nl) September 1996	–	Test methods for general properties of aggregates – Part 3: Procedure and terminology for a simplified petrographic description
6.	NEN-EN 933-1 (en) January 2012	–	Test methods for geometric properties of aggregates – Part 1: Determining the size distribution – Sieve method
7.	NEN-EN 933-2 (en) July 2020	–	Test methods for geometric properties of aggregates – Part 2: Determining the size distribution – Control sieves, nominal dimensions of the openings
8.	NEN-EN 933-3 (en) January 2012	–	Test methods for geometric properties of aggregates – Part 3: Determining the particle shape - Flakiness index

9.	NEN-EN 933-4 (en) April 2008	–	Test methods for geometric properties of aggregates – Part 4: Determining the particle shape - shape index
10.	NEN-EN 1097-1 (en) January 2011	–	Test methods for determining physical properties of aggregates – Part 1: Determining wear-resistance (Micro-Deval)
11.	NEN-EN 1097-2 (en) April 2010	–	Test methods for determining physical properties of aggregates – Part 2: Methods for determining resistance to fragmentation
12.	NEN-EN 1097-6 (en) October 2000	–	Test methods for determining physical properties of aggregates – Part 6: Determining particle density and water absorption
13.	NEN-EN 1367-2 (en) November 2009	–	Test methods for thermal properties and degradation of aggregates – Part 2: Magnesium sulphate test
14.	NEN-EN 1367-3 (en) April 2001	–	Test methods for thermal properties and degradation of aggregates – Part 3: Boiling test for “Sonnenbrand basalt”
15.	NEN-EN 1367-3/C1 (en) August 2006 Correction sheet	–	Test methods for thermal properties and degradation of aggregates – Part 3: Boiling test for “Sonnenbrand basalt”
16.	NEN-EN 12670 (en) January 2002	–	Natural stone - Terminology
17	NEN-EN 13925-1 (en) April 2003	–	Non-destructive testing – X-ray diffraction from polycrystalline and amorphous material – Part 1: General principles
18.	NEN-EN 13925-2 (en) April 2003	–	Non-destructive testing – X-ray diffraction from polycrystalline and amorphous material – Part 2: Procedures
19.	NEN-EN 13925-3 (en) May 2005	–	Non-destructive testing – X-ray diffraction from polycrystalline and amorphous material – Part 3: Instruments
20.	IFA-AM_7487 BIA-Arbeitsmappe 18 Lfg. IV/97	–	Verfahren zur analytischen Bestimmung geringer Massengehalte von Asbestfasern in Pulvern, Pudern und Stäuben mit REM/EDX (Kennzahl 7487) siehe IFA-Arbeitsmappedigital

2.5.2 Regulations and procedures

Number/code		Title
OVS00056-5.1	–	Track and superstructure rail in ballast
Bbk	–	Besluit bodemkwaliteit [Soil Quality Decree] and the associated Regeling Bodemkwaliteit [Soil Quality Regulation] published on 21-12-2007
PBE00012 V2.1 16 Feb 2021	–	Railway Infrastructure Products Procurement Policy - Railway-specific products to be purchased freely in the market.

3 Technical requirements

The foundation for the technical requirements in SPC00353-1 is NEN-EN 13450:2003+C1:2006 (nl) "Aggregates for railway ballast" of February 2003. It is a translation in Dutch of EN 13450 of December 2002 (English version). This European Standard specifies properties of aggregates for use as railway ballast in the construction and maintenance of railway lines. Wherever SPC00353-1 deviates from NEN-EN 13450, this is specifically stated. SPC00353-1 prevails in such a case.

3.1 Functional requirements

1. Only ballast that meets both definitions of "3.2 railway ballast" and "3.3 natural railway ballast" from NEN-EN 13450:2003+C1:2006, chapter 3 "Terms and definitions" is permitted for deliveries to ProRail.

2. According to requirement 1, railway ballast must be free of crystalline silica (see 3.1.1 Quartzless railway ballast).

3. According to requirement 1, railway ballast must be free of asbestos (see 3.1.2 Asbestos-free railway ballast).

3.1.1 Quartzless railway ballast

Requirements to demonstrate that the ballast is free of crystalline silica.

4. The quantitative XRD analyses performed by the supplier/quarry and the counter expertises must contain the result "*crystalline silica not detectable* ".

5. The quantitative XRD analysis must be performed on a representative sample from the quarry in accordance with NEN-EN 932-1 under the responsibility of the supplier/producer.

6. Natural stone of mineral origin that is processed into railway ballast must be demonstrably free of crystalline silica (by means of a *quantitativeX-ray diffraction<] (XRD) study) (result: {lu>crystalline silica not detectable).*

7. The quantitative X-ray diffraction (XRD) study must meet NEN-EN 13925-2 and NEN-EN 13925-3 and Annex 4 "Additional provisions regarding XRD analyses".

8. If a quantitative XRD analysis finds any crystalline silica, this must be reported to ProRail immediately.

9. If a quantitative XRD analysis demonstrates the presence of crystalline silica, it may be decided, with ProRail's written permission only to perform an *extra quantitative XRD analysis* at the supplier's/quarry's expense to replace a negative result caused by the (incidental) presence of non-primary crystalline silica.

10. The extra XRD analysis may be deployed only once a year.

11. ProRail requires that each extra quantitative XRD analysis (in accordance with requirement 9) contains the result "*crystalline silica not detectable*.

12. If the extra quantitative XRD analysis demonstrates the presence of crystalline silica, the certificate must be withdrawn immediately.

13. ProRail may commission third parties at any time for a counter expertise in order to determine the crystalline silica content of a representative sample taken from the quarry in accordance with NEN-EN 932-1 by a party or laboratory appointed by ProRail; the quarry/supplier must comply and declares this in writing.

3.1.2 Asbestos-free railway ballast

Requirements to demonstrate that the ballast is free of asbestos.

14. The quantitative SEM/EDX analyses performed by the supplier/quarry and the counter expertises must contain the result "*crystalline silica not detectable*.

15. The SEM/EDX analysis must be performed on a representative sample taken from the quarry in accordance with NEN-EN 932-1 under the responsibility of the supplier/producer.

16. Natural stone of mineral origin that is processed into railway ballast must be demonstrably free of asbestos by means of an SEM/EDX analysis (result: {lu>asbestos not detectable).

17. The SEM/EDX analysis must be performed in accordance with IFA-AM 7487 "Verfahren zur analytischen Bestimmung geringer Massengehalte von Asbestfasern in Pulvern, Pudern und Stäuben mit REM/EDX" and Annex 5 "Additional provisions for SEM/EDX analyses".

18. If an SEM/EDX analysis finds any asbestos, this must be reported to ProRail immediately.

19. If an SEM/EDX analysis demonstrates the presence of asbestos, it may be decided, with ProRail's written permission only to perform an *extra SEM/EDX analysis* at the supplier's/quarry's expense to replace a negative result caused by the (incidental) presence of asbestos.

20. The extra SEM/EDX analysis may be deployed only once a year.

21. ProRail requires that each extra SEM/EDX analysis (in accordance with requirement 19) contains the result "asbestos not detectable".

22. If the extra SEM/EDX analysis demonstrates the presence of asbestos, the certificate must be withdrawn immediately.

23. ProRail may commission third parties at any time for a counter expertise in order to determine the asbestos content of a representative sample taken from the quarry in accordance with NEN-EN 932-1 by a party or laboratory appointed by ProRail; the quarry/supplier must comply and declares this in writing.

24. The supplier/producer must assure, in the quality management system of the quarry, that no asbestos is present or is able to end up in the railway ballast product.

25. An external expert appointed by ProRail will assess whether the assurance in the quality management system of the quarry meets requirement 24 (*required result: acceptable*) by means of a written statement signed by ProRail.

3.1.3 Conversion reactions of rocks

26. If the rock reacts with the environment (CO_2 and moisture), so-called carbonation reactions or more generally "weathering", the supplier/quarry must demonstrate with quantitative XRD that the products formed do not contain crystalline silica *during their lifetime.*

27. If the rock reacts with the environment (CO2 and moisture), so-called carbonation reactions or more generally "weathering", the supplier/quarry must demonstrate with SEM/EDX that the products formed do not contain asbestos during their lifetime.

28. Requirements 26 and 27 must be met using virgin weathered rock from the quarry.

29. If the rock from the quarry is applied as railway ballast by a railway infrastructure manager, requirements 26 and 27 must also be demonstrated with a sample taken from the railway ballast track that has been used in an operational track for at least 10 years.

30. Through modelling or a numerical calculation model, the supplier must demonstrate that if the rock reacts with the environment, no more than 8% of the original material is converted in the space of 30 years, to be assessed by an expert appointed by ProRail via a written statement signed by ProRail.

3.1.4 Environmental requirements: Dutch Soil Quality Decree

For the direct and/or indirect supply to ProRail of railway ballast free of crystalline silica and asbestos in accordance with the aforementioned definitions from 3.1.1, a supplement applies to NEN-EN 13450:

31. The railway ballast must meet the latest effective version of the Dutch Soil Quality Decree/Soil Quality Regulation (first publication in the Official Gazette of the Kingdom of the Netherlands no. 247 dated 21-12-2007 with the associated edits).

32. Products created in the conversion reactions of rocks must also demonstrably meet requirement 31 (Dutch Soil Quality Decree).

33. The production process of the supplier/producer must be organised such that supplies that fail to meet the Dutch Soil Quality Regulation cannot occur.
A “producer's own declaration” can be used as an environmentally hygienic certification of the ballast: http://www.bodemplus.nl/aanvragen/fabrikant/.

3.1.5 Sampling

34. Sampling must proceed in accordance with NEN-EN 932-1 with the exception of sampling from a carriage or from a track.

3.1.5.1 Other samples (carriage, track):

Sampling from a carriage or track must take place in accordance with NEN-EN 13450, Annex A and B.
Sampling from the track in accordance with NEN-EN 13450 Annex A must take place before the railway ballast is tamped.
This sampling is not part of the supplier’s/producer’s responsibilities.

3.1.6 Production

35. For the production of natural railway ballast without crystalline silica and asbestos, materials of different geological origin shall not be mixed.

3.2 Geometrical requirements

3.2.1 Railway ballast size

36. For type 1a the railway ballast size is characterized by the sieves d 31.5 mm and D 50 mm,
37. For type 2a the railway ballast size is characterized by the sieves d 22 mm and D 40 mm.

3.2.2 Grading

38. Determination of the particle (size) distribution (sieve curve) of railway ballast must be done in accordance with NEN-EN 933-1.

39. For railway ballast type 1a, ProRail requires in accordance with NEN-EN 13450 article 6.3 particle (size) distribution, category A (see Annex 1).

40. For railway ballast type 2a (22/40), the particle (size) distribution is not included in NEN-EN 13450. Railway ballast type 2a must meet the following sieve curve (see Annex 1):
Particle (size) distribution type 2a (22/40):

Sieve size (mm)	Percentage passing through the sieve
50.	100.
40.	90 to 100
31.5.	60 to 98
22.4.	15 to 60
16.	0 to 15
8.	0 to 2

3.2.3 Fine particles

41. Determination of the content of fine particles must proceed in accordance with EN-933-1.

42. For railway ballast types 1a and 2a, ProRail requires in accordance with NEN-EN 13450 article 6.4, category A (maximum mass percentage passing through the sieve 0.5 mm is 0.6).

3.2.4 Fines

43. Determination of the content of fines (dust content) must proceed in accordance with EN-933-1.

44. For railway ballast types 1a and 2a, ProRail requires in accordance with NEN-EN 13450 article 6.5, category A.

3.2.4.1 Dust simulation test

For investigations in dust emissions in the working chain (from quarry to the track) of inhalable and respirable dust, dust simulation measurements will be carried out on a representative sample of quartzless railway ballast from the quarry type 1a (and potentially 2a) on behalf of ProRail by an independent institution in accordance with paragraph 3.2 of TNO report R11703 of 31 August 2021.

45. The supplier/producer must declare, in writing, their cooperation in dust simulation measurements as commissioned by ProRail.

3.2.5 Flakiness Index

46. Determination of the Flakiness index must proceed in accordance with EN-933-3.

47. For Quartzless railway ballast types 1a and 2a, ProRail requires in accordance with NEN-EN 13450 article 6.6.1, category FI_{15}.

3.2.6 Shape index

48. Determination of the Shape index must proceed in accordance with EN-933-4.

49. For Quartzless railway ballast types 1a and 2a, ProRail requires in accordance with NEN-EN 13450 article 6.6.2, category SI_{20}.

3.2.7 Particle length

50. For quartzless railway ballast types 1a and 2a, ProRail requires in accordance with NEN-EN 13450, article 6.7, category C (mass percentage of fractions with a length of 100 mm or greater shall not exceed 8 out of a sample greater than 40 kg).

3.3 Physical requirements

3.3.1 Resistance to fragmentation

51. Determination of the LA_{RB} must be done in accordance with NEN-EN 1097-2.

52. For railway ballast types 1a and 2a, ProRail requires in accordance with NEN-EN 13450 article 7.2, category LA_{RB} 12.

53. The value used for the LA_{RB} for certification or annual audit by the CB is based on the latest available test data and should therefore not be older than 6 months.

    Comment: There are no requirements for the Impact Value (SZ).

3.3.2 Resistance to wear

54. Determination of the M_{DE} must be done in accordance with NEN-EN 1097-1.

55. For quartzless railway ballast types 1a and 2a, ProRail requires, in deviation from NEN-EN 13450 article 7.3, that the Micro-Deval coefficient is determined and recorded without reference to a category.

3.4 Durability

3.4.1 Resistance to freezing and thawing

56. For railway ballast types 1a and 2a, the freeze and thaw resistance must be determined in accordance with NEN-EN 13450 article 7.4.1, in accordance with Annex G (magnesium sulphate test).

57. Determination of the freeze and thaw resistance in accordance with Annex G must be done in accordance with NEN-EN 1367-2 with the adjustments described in Annex G.

58. ProRail requires that the value in accordance with Annex G (magnesium sulphate test) is less than or equal (≤) to 2.0% mass.

59. The value used for the magnesium sulphate test for certification or annual audit by the CB is based on the latest available test data and should therefore not be older than 6 months.

3.4.2 Water absorption

60. For quartzless railway ballast types 1a and 2a the water absorption must be determined in accordance with NEN-EN 1097-6 Annex B.

61. ProRail requires that the value in accordance with NEN-EN 1097-6 Annex B is less than or equal (≤) to **1.0%.**

62. The value used for the water absorption for certification or annual audit by the CB is based on the latest available test data and should therefore not be older than 6 months.

3.4.3 Particle density

63. For quartzless railway ballast types 1a and 2a the density must be determined in accordance with NEN-EN 1097-6 Annex B.

64. ProRail requires that the value in accordance with NEN-EN 1097-6 Annex B (ρ_{cm}) is greater than or equal (≥) to 2.6 Mg/m^3.

3.4.4 Sonnenbrand

65. In deviation from NEN-EN 13450 article 7.5 “Sonnenbrand”, ProRail requires that basalt or closely related rocks are always subjected to a boiling test in accordance with NEN-EN 1367-3.

66. Basalt or closely related rocks must remain free of signs of Sonnenbrand both before and after the boiling test in accordance with NEN-EN 1367-3 8.1 “Visual determination of signs of Sonnenbrand in a piece of basalt”.

3.4.5 Harmful components

67. For railway ballast types 1a and 2a, in accordance with NEN-EN 13450 chapter 8., no components or substances other than those specified in this SPC may be present.

68. Residues of ignition wires and detonators may be present in quartzless railway ballast and are tolerated by ProRail. Any other contamination is not allowed.

3.4.6 Magnetism

There are no special requirements with regard to rocks that can contain magnetic minerals such as magnetite.

3.4.7 Evaluation of conformity

69. For quartzless railway ballast types 1a and 2a, in accordance with NEN-EN 13450, the whole of chapter 9 applies.

3.4.8 Designation and description

70. For quartzless railway ballast types 1a and 2a, in accordance with NEN-EN 13450, the whole of chapter 10 applies.

3.4.9 Marking and labelling

71. For quartzless railway ballast types 1a and 2a, in accordance with NEN-EN 13450, the whole of chapter 11 applies.

72. In addition to requirement 71, a certificate (copy) in accordance with this SPC00353 must be supplied with each delivery in addition to the delivery note.

3.4.10 Transport

Requirements 73 through 76 only apply to that part for which the producer/supplier is responsible.

73. Degradation of railway ballast type 1a (31.5/50) due to transport must meet NEN-EN 13450 Annex B, category A (maximum mass percentage that passes the 22.4 mm sieve is 5).

74. Degradation of railway ballast type 2a (22/40) due to transport must meet NEN-EN 13450 Annex B, category C (no requirement).

75. All common methods of transport are allowed.

76. Transport by ship by sea is permitted provided that the crushed stone is transported below deck whereby contact with seawater is excluded.

4 Inspection

Inspections and the associated costs (in accordance with NEN-EN 13450, Annex I Factory Production Control (PFC)) that are carried out by the supplier/producer, are fully borne by the supplier/producer.
Inspections and the associated costs (in accordance with NEN-EN 13450, Annex ZA) performed by a certification body are fully borne by the supplier/producer.
The counter-expertise performed by an independent party on behalf of ProRail to determine the quartz content in the rock using QXRD or to determine the presence of asbestos using SEM/EDX will be borne by ProRail.
Any dust simulation measurements to be carried out on request by an independent party will be borne by ProRail.

4.1 Minimum test frequencies

77. For railway ballast types 1a and 2a, the minimum test frequencies apply in accordance with NEN-EN 13450, Annex I table I.1 “Minimum test frequencies for general properties”, see Annex 2 “minimum test frequencies” (supplemented with XRD and SEM/EDX).

78. In addition to requirement 77, the test frequency for determining the crystalline silica content with QXRD must be spread evenly over a whole year.

79. In addition to requirement 77, the test frequency for detecting the presence of asbestos using SEM/EDX must be evenly distributed throughout the entire year.

4.2 Declaration of quality

80. A supplier/producer must demonstrate compliance with all requirements of this SPC by having a ProRail-approved Certifying Body (CB) conduct an admission test.

81. If one of the requirements cannot be met due to circumstances, ProRail must be consulted. Certification can only proceed upon written approval by ProRail.

82. In the event of a positive result, the Certifying Body issues a quality declaration to the producer (certificate, valid for 3 years) and submits a copy to ProRail.

83. The Certifying Body must determine, on an annual basis and at the production location, whether the producer continues to meet the requirements of this product specification.

84. The interval between the initial product location assessment and subsequent annual assessments must be between 11 and 13 months.

85. The certificate must clearly state which type of railway ballast (1a and/or 2a) has been certified in accordance with this SPC00353.

86. The certificate must state the name and address details of the quarry.

87. The certificate must state the classification of the rock in accordance with NEN-EN 12670 (en) Natural Stone – Terminology or the simplified petrographic name in accordance with NEN-EN 932-3 (nl).

88. The brand name, if any, may be mentioned on the certificate as well.

89. The certificate must state its issue date and expiry date.

4.3 Documentation certification

90. The (audit) documentation drawn up by the CB and the producer for the purpose of obtaining or retaining a certificate in accordance with this SPC must be kept for at least 10 years.

91. When the certificate is issued, a copy of the (audit) documentation drawn up by the CB and the producer (requirement 89) must be provided to ProRail, Architecture and Technology Manager, Moreelsepark 3, PO Box 2038, 3500 GA Utrecht.

92. For each certification and annual audit, ProRail must be provided with the data in accordance with Annex 3.

93. ProRail must approve the (audit) documents of the very first certification procedure of a supplier/producer/quarry before a certificate can be issued.

4.4 Validity

94. Once a certificate has been issued by a CB, it remains valid for a maximum of 3 years provided that the annual recertification or audit is sufficient.

    Comment: If a counter expertise performed by ProRail does not suffice, ProRail will ask the CB to withdraw the certificate.

95. Certificates with a validity period beyond three years will not be accepted.

5 Quality Assurance

5.1 Producer recognition

A supplier/producer must possess a valid certificate before railway ballast free of crystalline silica and asbestos can be produced and delivered for ProRail. This must be demonstrated by means of the certificate and audit report referred to in Chapter 4, including Annex 3 and the other requirements from that chapter.

5.2 Certified quality system

The supplier/producer must comply with the NEN-EN 13450 Annex ZA “Clauses of this European Standard addressing essential requirements or other provisions of EU Directives”. The attestation of conformity required by ProRail must be in accordance with Table ZA.2a- System of attestation of conformity for aggregates for uses with high safety requirements (where third party intervention is required) - Attestation of conformity system 2+.

5.3 Authorised producers

No limitations.

5.4 CE quality mark

In accordance with NEN-EN 13450 Annex ZA “Clauses of this European Standard addressing essential requirements or other provisions of EU Directives”, ZA 2.2 and ZA.3.

5.5 Lifecycle analysis (LCA)

96. The supplier/producer must submit a lifecycle analysis for the railway ballast.

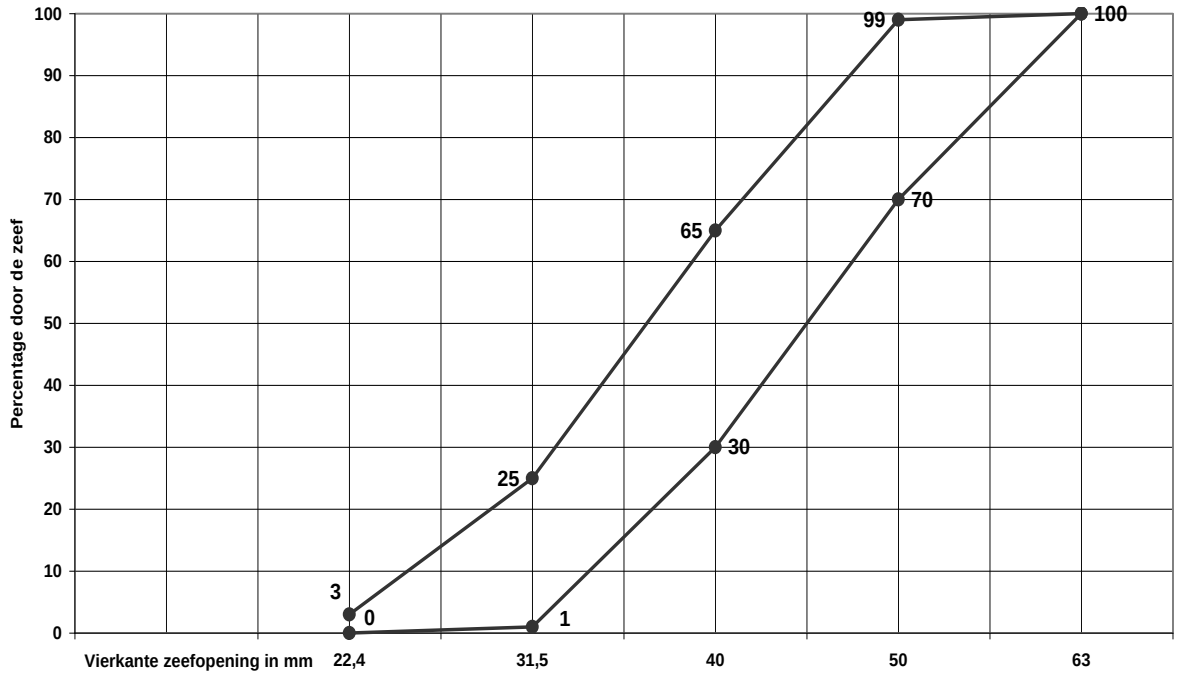
97. The lifecycle analysis (LCA) must meet the following sub-requirements:
    a. The LCA must be drafted in accordance with version 3.0 of the “Bepalingsmethode Milieuprestaties Gebouwen” [assessment method for the environmental performance of buildings] and GWW Werken (including amendment sheets) or a more recent version.
    b. The LCA must be verified by an independent recognised LCA consultant.
    c. The recognised LCA consultant must be registered in the list of the environment database: https://www.milieudatabase.nl/index.php?q=erkende-LCA-deskundigen
    d. The LCA must pertain to the production phase (A1, A2 and A3).
    e. The LCA must provide insight into the MKI value of the product.
    f. The LCA report must consist of a full LCA background report which will be treated confidentially by the principal. EPDs (Environmental Product Declarations) are not accepted*.

Clarification: *) EPDs are summaries of verified LCAs where the confidential information has been removed. One drawback is that ProRail cannot derive what assumptions, principles and sustainability measures apply.

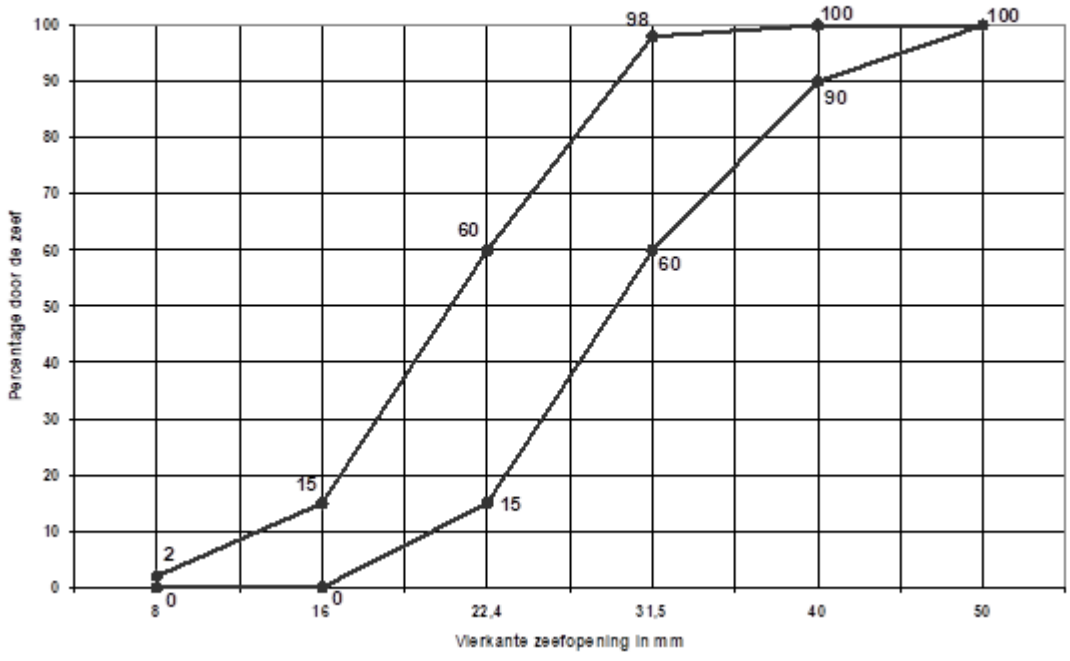
Annex 1 Sieve curves

Railway ballast 31.5/50

Zeefkromme 31,5/50 Categorie A (NEN-EN 13450 artikel 6.3)



Spoorwegballast 22/40



Annex 2 Minimum test frequencies

Table I.1 — Minimum test frequencies for general properties

Property		Initials	Test method	Minimum-test-frequency
1.	Particle (size) distribution	6.3.	EN 933-1	1 per week
2.	Fine particles	6.4.	EN 933-1	1 per week
3.	Very fine particles	6.5.	EN 933-1	1 per week
4.	Particle shape	6.6.	EN 933-3 EN 933-4	1 per month
5.	Particle length	6.7.	-	1 per month
6.	Resistance to fragmentation - Los Angeles - Impact value	7.2.	EN 1097-2	2 per year
7.	Resistance to wear (micro-Deval)	7.3.	EN 1097-1	2 per year
8.	Freeze and thaw resistance	7.4.1	EN 1367-1 EN 1367-2	2 per year
9.	Density	7.4.2	EN 1097-6:2000, Annex B	2 per year
10.	Water absorption	7.4.3	EN 1097-6:2000, Annex B	2 per year
11.	Sonnenbrand	7.5.	EN 1367-3	2 per year
12.	Harmful components [a]	I.3.3 I.4	[a]	If required and when in doubt
13.	Crystalline silica (QXRD)	SPC00353 3.1.1	NEN-EN 13925-1, NEN-EN 13925-2, NEN-EN 13925-3, Annex 4	4 per year
14.	Crystalline silica (Extra QXRD)	SPC00353 3.1.1	NEN-EN 13925-1, NEN-EN 13925-2, NEN-EN 13925-3, Annex 4	Maximum 1 per year
15.	Asbestos content (SEM/EDX)	SPC00353 3.1.2	IFA-AM 7487 Annex 5	4 per year
16.	Asbestos content (extra SEM/EDX)	SPC00353 3.1.2	IFA-AM 7487 Annex 5	Maximum 1 per year

[a] Unless prescribed otherwise, only necessary for the CE quality mark (see Annex ZA)

Annex 3 Data and values of performed tests

Table annex 3 Data and values of performed tests

Property		SPC00353 Par nr.	Test method	To be submitted[1)]
1.	Particle (size) distribution	3.2.2	NEN-EN 933-1	Progressive annual average and 4 most recent sieve curves
2.	Fine particles	3.2.3	NEN-EN 933-1	Progressive annual average and 4 most recent test results
3.	Very fine particles	3.2.4	NEN-EN 933-1	Progressive annual average and 4 most recent test results
4.	Flakiness index	3.2.5	NEN-EN 933-3	12 most recent test results
5.	Shape index	3.2.6	NEN-EN 933-4	12 most recent test results
6.	Particle length	3.2.7	NEN-EN 13450 par. 6.7.	12 most recent test results
7.	Resistance to fragmentation - Los Angeles	3.3.1	NEN-EN 1097-2	Progressive 3-year average and 2 most recent test results
8.	Wear resistance - micro–Deval	3.3.2	NEN-EN 1097-1	Progressive 3-year average and 2 most recent test results
9.	Freeze and thaw resistance (magnesium sulphate test)	3.4.1	NEN-EN 1367-2	Progressive 3-year average and 2 most recent test results
10.	Water absorption	3.4.2	NEN-EN 1097-6 Annex B	6 most recent test results
11.	Density	3.4.3	EN 1097-6:2000, Annex B	6 most recent test results
12.	Sonnenbrand	3.4.4	NEN-EN 1367-3	6 most recent test results
13.	Harmful components	3.4.5	NEN-EN 13450 chapter 8	Clarification
14.	Crystalline silica (QXRD)	3.1.1	NEN-EN 13925-1, NEN-EN 13925-2, NEN-EN 13925-3, Annex 4.	6 most recent test results
15.	Asbestos content (SEM/EDX)	3.1.2	IFA-AM 7487, Annex 5	6 most recent test results

1) Insofar as data is available to ProRail from the start of the certification process

Annex 4 Additional provisions quantitative XRD analysis

1. Sample preparation

The sample for XRD analysis should be split into a representative sub-sample using quarters, a *riffle type* sample divider or another method of choice. After initial crushing of the larger stones, the representative sub-sample should be mechanically ground in a liquid (usually alcohol) until a powder with a d50 of no more than 15µm is obtained. Optionally, the sample may be treated in a manner that prevents/reduces preferred orientation (e.g. via *side loading* of the powder in the XRD holder).

2. The measurement

For the measurement, the X-ray diffraction device must be configured as follows:

- with a Cu or Co X-ray tube,
- with an angle range of 5 to 65°2thèta (the X-ray diffraction analysis must have this angle range at a minimum),
- With a step size of max. 0.02°2thèta,
- And a measurement time per step of no less than 50s.

3. Data processing

After identification of the minerals present, data processing must be carried out using a *pattern decomposition* method (see EN 13925-2:2003).

4. Analysis report

The analysis report shall contain the following information at a minimum:

1. The type of device used to grind the material,
2. Whether preferential orientation was avoided or limited,
3. A description of the method/way in which preferential orientation was avoided or limited,
4. The name and type of device used to perform the X-ray diffraction analysis,
5. The type of radiation used,
6. The angle range of the measurement,
7. The detector type (point detector, Position Sensitive Detector (PSD), Area detector),
8. The measurement time per step,
9. The step size
10. The way in which the assessment/quantification was performed: software used + type full pattern fitting method,
11. A figure with the measured diffraction pattern, the modelled diffraction pattern as well as an enlargement of the zone where the most important reflection of quartz occurs (and potentially other forms of crystalline silica) with an indication of the exact position of that reflection/those reflections).

Annex 5 Additional criteria for SEM/EDX analysis

1}{The SEM/EDX analyses performed by the supplier/quarry and the counter expertises must always contain the result ”asbestos not detectable” (see paragraph 3.1.2).

The SEM/EDX analysis must observe a detectable determination limit of smaller than or equal to 0.001% (10mg/kg). This means that a minimum of 10µg of powder on the filter must be analysed. Calculation of the quantity of powder on the filter searched is as follows:

$$inweeg\ (mg) \times \frac{deelvolume\ op\ filter\ (mL)}{totaal\ volume\ (500\ mL)} \times \frac{getelde\ beelvelden\ \times beelveldgrootte\ (mm^2)}{totaal\ filteroppervlak\ (mm^2)}$$

The determination limit can only be lowered by increasing the weighted sample, part volume and/or number of image fields counted.

Substantiation:

The Soil Quality Regulation sets out so-called maximum (composition) values for applications of building materials on the soil. A newly standardised substance for building materials is asbestos. Most building materials will not contain any asbestos. These building materials are subject to a zero-requirement for the composition value according to the “Productenbesluit Asbest” [Asbestos Product Decree]. This decree states that a zero-requirement applies except to products where no asbestos has been deliberately added and where the weighted concentration (serpentine asbestos, multiplied with ten times the concentration of amphibole asbestos) does not exceed 100 mg/kg d.s. This means that a more stringent requirement of 10 mg/kg d.s. Applies to amphibole asbestos.

IFA-AM 7487 prescribes a weighted sample of 10 – 50 mg where a sub-volume of 10 – 50 ml out of a total volume of 500 ml is applied to a gold-coated polycarbonate filter. If no asbestos fibres are found, the determination limit is estimated to be 0.008% (80 mg/kg). In reality, the determination limit varies depending on the weighted sample and the sub-volume and lies between 0.001 and 0.03% (10 – 300 mg/kg).