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AUSTROADS TECHNICAL SPECIFICATION ATS 3050
Supply of Recycled Crushed Glass Sand

Austroads

Contents

1. Scope

1.1 This Austroads Technical Specification ATS 3050 sets out the minimum requirements for the manufacture and supply of recycled crushed glass (RCG) for use in the following applications:

a) As a granular material, including:

i) bedding and haunching of pipes and conduits

ii) side fill and backfill of pipes and conduits

iii) bedding and joint filling in block paving

iv) drainage medium applications

v) embankment fill and earthworks applications

vi) landscaping applications

vii) partial aggregate replacement (mechanical stabilisation) for granular base and subbase material

b) As a partial aggregate replacement in asphalt;

c) As a partial fine aggregate replacement in concrete for:

i) general works; and

ii) concrete pavement applications.

1.2 All RCG must comply with the properties specified in Clause 6. In addition, RCG used in granular materials and as a partial aggregate replacement in asphalt must comply with the additional requirements specified in Clause 7 and RCG used in concrete must comply with the additional requirements specified in Clause 8.

2. Referenced Documents

2.1 The following documents are referenced in this Specification:

Australian/New Zealand Standards

AS 1012.20.1	Methods of testing concrete: determination of chloride and sulphate in hardened concrete and aggregates (nitric acid extraction method)
AS 1141.3.1	Methods for sampling and testing aggregates: aggregates
AS 1141.4	Methods for sampling and testing aggregates: bulk density of aggregate
AS 1141.5	Methods for sampling and testing aggregates: particle density and water absorption of fine aggregate
AS 1141.11.1	Methods for sampling and testing aggregates: particle size distribution (sieving method)
AS 1141.12	Methods for sampling and testing aggregates: material finer than 75 µm in aggregates (by washing)
AS 1141.24	Methods for sampling and testing aggregates: aggregate soundness: evaluation by exposure to sodium sulfate solution
AS 1141.34	Methods for sampling and testing aggregates: organic impurities other than sugar
AS 1141.35	Methods for sampling and testing aggregates: detection of sugar contamination in concrete aggregates
AS 1141.60.1	Methods for sampling and testing aggregates potential alkali-silica reactivity: accelerated mortar bar method
AS 1141.60.2	Methods for sampling and testing aggregates potential alkali-silica reactivity: concrete prism method
AS 1141.66	Methods for sampling and testing aggregates: methylene blue adsorption value of fine aggregate and mineral fillers
AS 1289.4.1.1	Methods of testing soils for engineering purposes: soil chemical tests – determination of the organic matter content of a soil: normal method
AS 1379	Specification and supply of concrete
AS 2758.1	Aggregates and rock for engineering purposes: concrete aggregates
AS/NZS ISO 9001	Quality management systems: requirements
SA HB 79	Alkali aggregate reaction: guidelines on minimising the risk of damage to concrete structures in Australia

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AP-C87-15	Austroads glossary of terms

ASTM International

ASTM C295	Standard guide for petrographic examination of aggregates for concretes

National Environment Protection Council

NEPC Schedule B	Guideline on laboratory analysis of potentially contaminated soils

Transport for New South Wales

Test Method T281	Determination of total organic contaminants in recycled crushed glass by loss on ignition

United States Environmental Protection Agency

EPA SW 846	Hazardous waste test methods for evaluating solid waste, physical/chemical methods
Method 6010C	Inductively coupled plasma: atomic emission spectrometry
Method 7471B	Mercury in solid or semisolid waste (manual cold vapour technique)

3. Definitions

3.1 In addition to the definitions in AP-C87-15, the following definitions apply to this Specification:

Backfill material	Material placed in confined excavations for culverts, structures, conduits, pits, or in some instances, to fill excavations of unsuitable material. Backfill includes bedding material and materials placed in the foundation bedding, haunch, side and overlay zones during culvert backfill.
Bedding material	Material suitable for use in the foundation bedding zone of culverts, pipes, conduits, pits, and similar structures, and in the haunching of pipes and conduits.
Concrete applications	Includes low-risk applications such as footings and plinths (sign support for general works structures, lighting columns, traffic signals, etc.), kerbs and channel, paving for bicycle paths/shared paths, footpaths, medians, driveways, and aesthetic structures such as park benches, small planter boxes and garden reliefs.
Concrete pavement	A pavement structure made from concrete materials which may contain reinforcement. This is inclusive of the concrete base layer and lean mix concrete subbase.
Drainage medium	A free draining backfill material used in subsoil drainage applications material including, but not limited to subsoil drains, sheet filter drains and vertical/wick drains.
Embankment core zone	The central zone of an embankment adjacent to the embankment (outer zone) and overlying embankment (upper zone) and pavement structure.
Embankment fill material	Material placed in an embankment to subgrade level, and used to backfill subgrade treatments or to replace unsuitable material. Includes both earth fill and rock fill.
Fine aggregates	A general term for aggregate that substantially passes the 4.75 mm sieve. Mostly composed of sand.
Haunch material	The material immediately above the foundation bedding zone for the installation of pipe culverts.
Legislative Requirements	The regulations, policies and codes of practice issued pursuant to any legislation for the protection or management of the environment which are applicable to the manufacture of RCG.
Side fill	The material placed adjacent to the centre of pipe culverts.
Total fine aggregates	The sum of the fine aggregates from all sources within the concrete fine aggregate mix.

4. Quality System Requirements

4.1 RCG must be manufactured under a Quality Management System which conforms to AS/NZS ISO 9001.

4.2 The manufacturer of the RCG must have a current license or exemption for the recovery of resources from waste issued by the relevant state or territory environmental authority.

4.3 The Contractor must prepare and implement a Quality Plan that includes the documentation in Table 4.3.

Table 4.3: Quality plan

Clause	Description of document
5.1	Details of the source of glass and manufacturing process
6.1	Applicable Legislative Requirements
8.1	Target material properties
9	Procedures for stockpile management, management of Lots and testing

HOLD POINT 1	
Process Held	Quality system conformance.
Submission Details	The documentation listed in Clause 4 must be submitted to the Principal at least 10 working days prior to the commencement of the supply of the RCG to the Site.

5. Glass Source

5.1 The Quality Plan must include details of:

a) the source of glass;

b) the production plant and processes; and

c) methods to ensure that the RCG is free of contamination.

5.2 RCG must be produced from food and beverage container glass, or window glass. The source material must be essentially free of glass from the following sources:

a) cathode ray tubes;

b) fluorescent and incandescent lights;

c) glass recovered from electrical equipment;

d) glass recovered from a laboratory source;

e) porcelain products or cook tops; and

f) glass from hazardous waste containers.

5.3 RCG must be free from contaminants and the maximum average concentration (when measured by mass) must not exceed the levels in Table 5.3.

Table 5.3: Maximum levels of contaminants

Contaminant	Maximum average concentration (%)	Absolute maximum concentration (%)
Metal and ceramics	0.25	0.5
Brick, plaster, clay lumps and other friable materials	0.25	0.5
Rubber, plastic, bitumen, paper, cloth, paint, cork, wood, organic matter and other deleterious materials(1)	0.3	0.5

Note:

1. Determined through Test Method T281.

5.4 When used in concrete for general works, RCG must be essentially free from contaminants, such as ceramics, paper, cork, metals, brick, plaster, rubber, wood, clay, paint, and other deleterious materials.

5.5 RCG must be free from any putrid odour.

6. Chemical and Other Material Requirements

6.1 The Quality Plan must include:

a) details of the applicable Legislative Requirements; and

b) procedures for ensuring that the manufacture of RCG is carried out in accordance with the Legislative Requirements.

6.2 The Contractor must ensure that the properties of the RCG do not exceed the higher of:

a) any applicable limits specified in the Legislative Requirements; and

b) the values in Table 6.2.

Table 6.2: Chemical concentrations and other characteristics

Attributes	Test method	Unit of measurement	Minimum test frequency	Maximum average concentration[1]	Absolute maximum concentration
Chemical concentration					
1. Mercury	EPA SW 846 Method 7471B[2]	mg/kg 'dry weight'	1 test per Lot	0.5	1
2. Cadmium	EPA SW 846 Method 6010C[3]	mg/kg 'dry weight'	1 test per Lot	0.5	1.5
3. Lead				50	100
4. Arsenic				10	20
5. Chromium (total)				20	40
6. Copper				40	120
7. Molybdenum				5	10
8. Nickel				10	20
9. Zinc				100	300
Total organic carbon	NEPC Schedule B[3] Method 105 (Organic Carbon)[4]	%	1 test per Lot	1.0	2.0
Electrical conductivity	NEPC Schedule B[3] Method 104 (Electrical Conductivity)[5]	µS/cm	1 test per Lot	1000	2000

Notes:

1. *The average calculation must be based on the 5 most recent test results.*
2. *An equivalent analytical method with a detection limit < 20% of the stated absolute maximum concentration may be used.*
3. *An equivalent analytical method with a detection limit < 10% of the stated absolute maximum concentration may be used.*
4. *Other published or validated classical chemistry technique or instrumentation techniques may be used.*
5. *The material sample must be prepared by mixing 1 part RCG sand 'as received' with 5 parts distilled water.*

6.3 For chemicals 2 to 9, sample preparation must be in accordance with EPA SW 846 Method 3051A.

7. Properties for use as a Granular Material

7.1 RCG particles must be cubic in shape and free from sharp edges and elongated particles. Material coarser than 4.75 mm must not have more than 1% of particles with a maximum to minimum dimension ratio greater than 3 (or 5 for embankment applications).

7.2 The particle size distribution (PSD) for RCG as identified in Section 1 shall be determined in accordance with AS 1141.11.1.

7.3 The applicable grading classification type must be determined from Table 7.3 for the nominated RCG application.

Table 7.3: Grading classification type

Application[1]	Grading classification type
Bedding and haunch of drainage pipes, conduits, and services	Type A
Side zone and backfill of drainage trenches	Type A
Bedding for segmental or block paving	Type B
Joint filling (i.e. filling the voids between individual segmental or block pavers)	Type C
Drainage medium	Type D
Embankment (core zone) fill[2]	Type E
Landscaping	Type F

Notes:

1. *These grading classifications do not apply to RCG for partial aggregate replacement for use in granular materials or asphalt.*
2. *RCG shall be used in the core zone of embankments. RCG shall not be placed within upper or outer zones of the embankment.*

7.4 The particle size distribution must comply with Table 7.4 for the applicable grading classification type. The minimum frequency of testing is one test per Lot. If the RCG is a component of a blend with other materials, other grading limits may apply.

Table 7.4: Particle size distribution[1]

AS sieve (mm)	Percentage passing by mass for each grading classification					
	Type A	Type B	Type C	Type D	Type E	Type F
9.50	100	100	–	–	100	100
4.75	85–100	95–100	–	100	70–100	85–100
2.36	50–100	80–100	100	–	–	–
1.18	–	50–85	90–100	0–2	–	–
0.60	20–90	25–60	60–90	–	–	–
0.30	10–60	10–30	30–60	–	–	–
0.15	0–25	5–15	15–30	–	–	–
0.075	0–10	0–10	5–10	–	–	–

Note:

1. *The grading limits specified in Table 7.4 does not apply when the RCG is a component of a blend.*

8. Properties of RCG used in Concrete

General

8.1 RCG used as fine aggregates in the manufacture of concrete must:

a) comply with AS 2758.1;

b) comprise of particles which are predominantly cubic in shape, free from sharp edges and elongated particles,

c) have a maximum nominal size of 5 mm; and

d) comply with the requirements in Table 8.1.

Table 8.1: Recycled crushed glass requirements

Property	Standards and test methods	Minimum test frequency	Requirements
Particle size distribution	AS 1141.11.1 and AS 1141.12.	2 tests per Lot (1)	The limits of deviation for manufactured fine aggregate in Table 2 of AS 2758.1
Sugar in aggregate	AS 1141.35	1 test per Lot	Less than one part in 10 000
Sulfates	AS 1379 AS 1012.20.1	1 test per Lot	Report if exceeds 0.01%
Chloride content	AS 1379 AS 1012.20.1	1 test per Lot	Report if exceeds 0.01% Max 0.04% for embedded steel reinforcement concrete Max 0.15% for plain concrete
Organic impurities (vegetable matter and wood particles)	AS 1141.34 AS 1289.4.1.1	1 test per Lot	Test fails if colour is darker than reference colour (AS 1141.34) max 0.5% (AS 1289.4.1.1)
Durability	AS 2758.1, Clause 9.2.2.3	1 test per Lot	AS 2758.1, Clause 9.2.2.3
Methylene Blue Absorption Value (MBV)(2)	AS 1141.66	1 test per Lot	≤ 5.0%
Deleterious fines index (DFI) (3)	AS 2758.1	1 test per Lot	≤ 150
Bulk density (compacted)	AS 1141.4	1 test per Lot	1 200 kg/m^3 minimum
Water absorption	AS 1141.5	1 test per Lot	≤ 1.0%
Soundness (sodium sulphate)	AS 1141.24	1 test per Lot	6.0% max weighted average loss

Notes:

1. *If the lot size is between 500 and 1 000 tonnes, the minimum test frequency is 3 tests per Lot.*
2. *Required if material finer that 2 µm is more than 1.0% of grading.*
3. *DFI is the product of the MBV and the passing 75 µm value.*

8.2 The PSD for RCG shall be determined in accordance with AS 1141.11.1 and AS 1141.12. The PSD shall not deviate from the submitted grading (as defined by AS 2758.1) by more than the limits of deviation for manufactured fine aggregate in AS 2758.1, as summarised in Table 8.2.

Table 8.2: RCG limits of derivation

Sieve aperture (mm)	Limits of deviation Sieve aperture (%)
4.75	± 5
2.36	± 10
1.18	± 15
0.60	± 15
0.30	± 10
0.15	± 5
0.075	± 5

8.3 Apparent particle density, dry particle density, saturated surface dry density and water absorption must be determined in accordance with AS 1141.5.

8.4 Aggregates shall be assessed for any unstable silica minerals by petrographic examination in accordance with ASTM C295.

Alkali-Silica Reactivity

8.5 Unless the Principal has approved a concrete mix which complies with AS 5100.5 Clause 4.10 and waived the requirement for Alkali-Silica Reactivity (ASR) testing, RCG as fine aggregate replacement must be tested in accordance with AS 1141.60.1. However, if AS1141.60.1 is not suitable for the type of aggregate being tested, or its suitability is unknown, testing in accordance with AS 1141.60.2 must be undertaken.

8.6 If the RCG is identified as having a potential for ASR when tested in accordance with AS 1141.60.1 or AS 1141.60.2, then treatment to control the effect shall be in accordance with SA HB 79.

9. Testing and Conformance

9.1 Sampling must be carried out in accordance with AS 1141.3.1

9.2 The maximum Lot size is 500 tonnes, unless otherwise relaxed under Clause 9.4. Nonconforming Lots must not be incorporated into the Works.

9.3 Test certificates must include details about the source of the RCG and any other relevant information.

9.4 The Contractor may submit a request to the Principal for reduced testing where the process control has achieved a consistent product as demonstrated by 5 consecutive Lots conforming to the requirements of this Specification. The maximum Lot size may be increased as specified in Table 9.4.

Table 9.4: Revision to maximum Lot size

Number of consecutive complying Lot	Maximum Lot size
< 5	500 tonnes
≥ 5	1000 tonnes

9.5 Unless the requirement to provide test certificates is waived by the Principal, the Contractor must submit test certificates to demonstrate compliance with the requirements of this Specification prior to Incorporation of the RCG into the Works.

HOLD POINT 2	
Process Held	Incorporation of RCG into the Works.
Submission Details	The test results must be submitted to the Principal prior to the incorporation of the RCG into the Works.

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points/Hold Points that apply to this specification and the Records that the Contractor must submit to the Principal to demonstrate compliance with this specification.

Clause	Hold point	Witness point	Record
4.1	1. Quality system conformance.		Quality Plan
9.5	2. Incorporation of RCG into the Works.		Test Certificates

Amendment Record

Amendment no.	Clauses amended	Action	Date
-	New specification	New	January 2022

Key

Format	Change in format
Substitution	Old clause removed and replaced with new clause
New	Insertion of new clause
Removed	Old clauses removed