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| AUSTROADS TECHNICAL SPECIFICATION ATS 3050  Supply of Recycled Crushed Glass Sand | A close up of a flag  Description automatically generated |

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# Scope

Austroads Technical Specification ATS 3050 sets out the requirements for the manufacture and supply of recycled crushed glass (RCG) as a sand aggregate replacement in the following applications:

1. As a granular material, including:
2. bedding and haunching of pipes and conduits
3. side fill and backfill of pipes and conduits
4. bedding and joint filling in block paving
5. drainage medium applications
6. embankment fill and earthworks applications
7. landscaping applications
8. partial aggregate replacement (mechanical stabilisation) for granular base and subbase material
9. As a partial aggregate replacement in asphalt;
10. As a partial fine aggregate replacement in:
11. Normal Class Concrete used in general works; and
12. Special Class Concrete used in road pavements.

RCG used in Special Class Concrete for bridgeworks and other structures, such as retaining walls, is excluded from the scope of this Specification.

All RCG must comply with Clause 6. Where RCG is used as a granular material or used in concrete, it must also comply with the properties specified in Clause 7 or Clause 8 respectively.

# Referenced Documents

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 |
| **Austroads**  AP-C87-15 Austroads glossary of terms |
| **NSW Environmental Protection Authority**  EPA RRO Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - The recovered glass sand order 2014 |
| **ASTM International**  ASTM C295 Standard guide for petrographic examination of aggregates for concretes |

# Definitions

In addition to the definitions in AP-C87-15 and AS 1379, 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.

# Quality System Requirements

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

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.

The Contractor must prepare and implement a Quality Plan that includes the documentation in Table 4.3. However, if the Quality Plan has previously been provided to the Principal or the manufacturer has been approved / registered by the Principal, it is not necessary to resubmit the Quality Plan, unless there has been a change to the manufacturing process or the source of the unprocessed materials.

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 |

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| --- | --- |
| **HOLD POINT 1** | |
| Process Held | Quality system conformance. |
| Submission Details | Where applicable, 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. |

# Glass Source

The Quality Plan must include details of:

1. the source of glass;
2. the production plant and processes; and
3. methods to ensure that the level of contamination complies with this Specification.

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:

1. cathode ray tubes;
2. fluorescent and incandescent lights;
3. glass recovered from electrical equipment;
4. glass recovered from a laboratory source;
5. porcelain products or cook tops; and
6. glass from hazardous waste containers.

RCG must be free from any putrid odour.

# Chemical and Other Material Requirements

The Quality Plan must include:

1. details of the applicable Legislative Requirements; and
2. procedures for ensuring that the manufacture of RCG is carried out in accordance with the Legislative Requirements.

The Contractor must ensure that the chemical concentrations and other characteristics of the RCG comply with any applicable requirements specified in the Legislative Requirements.

If maximum permissible levels of contaminants are not specified in the applicable Legislative Requirements, the maximum levels in Table 1 of the EPA RRO apply and the sampling and testing for contaminants must comply with Clauses 4.1 to 4.8 (inclusive) of the EPA RRO.

For Attributes 12 -14 in Table 1 of the EPA RRO, the Principal may approve an alternative test method. Details of any proposed alternative test method must be included in the Quality Plan. This Clause 6.4 does not apply in New South Wales.

# Properties for use as a Granular Material

This Clause 7 only applies where RCG is used as a granular material.

RCG particles must be cubic in shape and free from sharp edges and elongated particles.

The particle size distribution for RCG must be determined in accordance with AS 1141.11.1.

The applicable grading classification type must be determined from Table 7.4 for the nominated RCG application.

Table 7.4: 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 |
| Partial aggregate replacement in asphalt | Type G |

Notes:

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

The particle size distribution must comply with Table 7.5 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 7.5: 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 | Type G |
| 9.50 | 100 | 100 | – | – | 100 | 100 |  |
| 6.7 | – | – | – | – | – | – | 100 |
| 4.75 | 85–100 | 95–100 | – | 100 | 70–100 | 85–100 | 98 - 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. Unless specified otherwise, the grading limits specified in Table 7.5 (except for Type G) do not apply when the RCG is a component of a blend.

# Properties of RCG Used in Concrete

## General

This Clause 8 only applies where RCG is used in the manufacture of concrete.

RCG used as a fine aggregate in the manufacture of concrete must:

1. comply with AS 2758.1;
2. comprise of particles which are predominantly cubic in shape, free from sharp edges and elongated particles; and
3. have a maximum nominal size of 5 mm.

The proportion of RCG must not exceed 15% of the fine aggregate (measured by mass) in the concrete.

The Contractor may submit a proposal to the Principal to accept the following for Normal Class Concrete:

1. RCG comprising up to 20% of the fine aggregate; or
2. Unwashed RCG comprising up to 10% of the fine aggregate.

The Principal is under no obligation to accept any such proposal.

The RCG must be tested for compliance with Table 8.5.

Table 8.5: Requirements for Recycled Crushed Glass Used in Concrete

| 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/m3 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.

The particle size distribution for RCG must be determined in accordance with AS 1141.11.1 and AS 1141.12. The particle size distribution must 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 8.6.

Table 8.6: RCG Limits of Derivation

| **Sieve Aperture (mm)** | **Limits of Deviation**  **Sieve Aperture (%)** |
| --- | --- |
| 4.75  2.36  1.18  0.60  0.30  0.15  0.075 | ± 5  ± 10  ± 15  ± 15  ± 10  ± 5  ± 5 |

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

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

## Alkali-Silica Reactivity

Unless the Principal has approved the concrete mix 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.

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 must be in accordance with SA HB 79.

# Testing and Conformance

Sampling must be carried out in accordance with AS 1141.3.1.

The maximum Lot size is 500 tonnes, unless otherwise relaxed under Clause 9.3. Nonconforming Lots must not be incorporated into the Works.

The Contractor may submit a proposal to the Principal to increase the size of a Lot 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 9.3. The Principal is under no obligation to accept any such proposal.

Table 9.3: Revision to Maximum Lot Size

|  |  |
| --- | --- |
| Number of Consecutive Complying Lots | Maximum Lot Size |
| < 5 | 500 tonnes |
| ≥ 5 | 1000 tonnes |

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. The test certificates must include details about the source of the RCG, test results and any other relevant information.

| **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 |
| 9.4 | 1. Incorporation of RCG into the Works. |  | Test Certificates |

Amendment Record

|  |  |  |  |
| --- | --- | --- | --- |
| Amendment no. | Clauses amended | Action | Date |
| - | New specification | New | January 2022 |
| 1 | 1. Scope clarified. | Substitution | December 2023 |
| 6. Clause rewritten. Table 6.2 deleted and replaced with a reference to legislative requirements. | Substitution |
| 7. Clause rewritten. Grading for RCG used in asphalt inserted. | Substitution |
| 8. Clause rewritten. Changes to limits of RCG incorporated into concrete. | Substitution |
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| --- | --- |
| **Key** |  |
| Format | Change in format |
| Substitution | Old clause removed and replaced with new clause |
| New | Insertion of new clause |
| Removed | Old clauses removed |