

[Technical Specification](#)

**[Transport and Main Roads Specifications](#)
[MRTS270 Supply of Geopolymer Concrete](#)**

[July 2025](#)

[\(ATS 5330 Supply of Geopolymer, Ed 1.0 January 2020\)](#)



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Purpose

This ancillary document outlines the adopted national Austroads Technical Specification ATS 5330 *Supply of Geopolymer Concrete* and modified Queensland-specific content with tracked changes.

The following table summarises the relationship between the Austroads Technical Specification ATS 5330 *Supply of Geopolymer Concrete* and this document:

Type of Content	Display
National content adopted	National content adopted
National content not adopted	National content not adopted
Queensland-specific content	<u>Queensland-specific content</u>

About this document

The document adopts and modifies [Austroads Technical Specification ATS 5330 Supply of Geopolymer Concrete](#) as part of national harmonisation. It sets out the requirements for supply, delivery and use of geopolymer concrete.

How to use this document

This document includes the national guidance and Queensland-specific advice while following the structure established in [Austroads Technical Specifications](#).

Queensland-specific advice includes practices which vary from national practice because of local environmental conditions (such as geography, soil types, climate); different funding practices; local research; local legislation requirements; and to expand instruction on particular issues.

This document:

- [sets out how the Austroads Technical Specification ATS 5330 Supply of Geopolymer Concrete applies in Queensland](#)
- [has precedence over the Austroads Technical Specification ATS 5330 Supply of Geopolymer Concrete when applied in Queensland](#)
- [has the same clause numbering and headings as the Austroads Technical Specification ATS 5330 Supply of Geopolymer Concrete.](#)

[Transport and Mains Roads provides an ancillary document which outlines adopted national and modified Queensland-specific content with tracked changes. To access a copy click on the below link: Ancillary documents for harmonised Technical Specifications.](#)

Terminology

The following general amended definitions apply when reading this document.

<u>Reference to...</u>	<u>Means</u>
Shall	Denotes mandatory requirements.
Must	Denotes mandatory requirements.
Principal	The State of Queensland acting through the Department of Transport and Main Roads.
Administrator	The Administrator will be responsible for the overall administration of this Contract.

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1 Scope

1.1 This ~~Austrroads~~ Technical Specification covers the requirements for the [construction of road and marine structures supply and delivery of](#) Geopolymer Concrete in strength grades up to 50 MPa for use in the following applications:

- a) ~~insitu surface drainage, light duty pavement (e.g. footpaths) and minor footings (e.g. lighting pole footings) gutters, kerbing, drainage channels, footpaths, driveways, shared paths, post footings and safety barrier anchor blocks,~~ and
- b) ~~minor cast-in-place works or the production of~~ precast elements with a design life not exceeding 50 years, such as ~~noise panels and boating infrastructure stormwater pits and headwalls, and~~
- b)c) ~~where permitted in the relevant design criteria or project documentation.~~

[Under this Technical Specification, geopolymers are intended for use in elements with a 50-year or below design life.](#)

1.2 [This Technical Specification shall be read in conjunction with MRTS70 Concrete, and where MRTS70 is referenced the special-class provisions are applicable.](#)

[This means that MRTS270 essentially modifies Clauses 6 to 10 and 15 to 16 of MRTS70 Concrete.](#)

1.3 [This Technical Specification shall be read in conjunction with MRTS01 Introduction to Technical Specifications, MRTS50 Specific Quality System Requirements and other Technical Specifications as appropriate.](#)

1.4 [This Technical Specification forms part of the Transport and Main Roads Specifications Manual.](#)

2 Definitions

2.1 The following definitions apply to this [Technical](#) Specification.

Table 2.1 – Definitions of terms

Term	Definition
Geopolymer Binder	Polymeric binder formed by reacting alumina-silicate pre-cursors with alkaline activator(s).
Geopolymer Concrete	Geopolymer Binder with aggregates, water and additives. Geopolymer concrete contains no General Purpose Cement.

3 Referenced documents

3.1 The following documents are referenced in this [Technical](#) Specification or are relevant to this [Technical](#) Specification.

Table 3.1 – Referenced documents

Reference	Title
Australian / New Zealand Standards	
AS 1012.3.1	<i>Methods of testing concrete, Method 3.1: Determination of properties related to the consistency of concrete—Slump test</i>
AS/NZS 1379	<i>The Specification and Supply of Concrete</i>
AS 3582.1	<i>Supplementary cementitious materials for use with portland and blended cement – Part 1: Fly ash</i>
AS 3582.2	<i>Supplementary cementitious materials for use with portland and blended cement – Part 2: Slag Ground granulated iron blast furnace</i>
AS/NZS 3582.3	<i>Supplementary cementitious materials for use with portland and blended cement – Part 3: Amorphous silica</i>
ISO/AS/NZS 9001	<i>Quality management systems – Requirements</i>
SP43	ATIC SPEC SP43
Transport and Main Roads Technical Documents	
MRTS01	Introduction to Technical Specifications
MRTS50	Specific Quality Systems – Requirements
MRTS70	Concrete
MRTS271	Glass Fibre Reinforced Polymer (GFRP) Reinforcement
MRTS272	Shotcrete for Aboveground Applications
:	Supplier Registration Scheme: Bridges and Other Structures

4 Quality System Requirements

4.1 The Geopolymer Concrete must be manufactured under a quality management system which has been independently certified by a JASANZ accredited organisation as fully complying with AS/NZS ISO 9001.

~~For Works constructed in Queensland, the following additional requirement applies:~~

~~4.2 Fly ash, slag and amorphous silica pre-cursors must be a Transport and Main Roads registered product and the manufacturer must be a Registered Supplier.~~

~~Further details are available from:~~

~~<https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers>~~

5 Manufacturer competency

5.1 Geopolymer Concrete must be supplied by a manufacturer ~~/licensed technology provider~~ with at least 12 months experience in the commercial supply of Geopolymer Concrete.

- 5.2 The manufacturer ~~/licensed technology provider~~ must have submitted the following to [E&T Structures](#), and had it approved ~~the Principal~~ within the 12 months preceding the supply of Geopolymer Concrete under this [Technical](#) Specification:
- a) details of the mix design, ~~including all details and test results as listed in MRTS70 Concrete (including strength grade, nominated slump, and types, proportion by mass, sources, and registration numbers of the various constituent materials)~~, except that only a generic description of each chemical component of the activator is required, and
 - b) test results from a NATA accredited laboratory demonstrating that the proposed Geopolymer Concrete complies with the properties listed in this [Technical](#) Specification ([Table 8.2](#)). **Hold Point 1 Milestone Record**

HOLD POINT 1	
Process Held	Supply of Geopolymer Concrete.
Submission Details	Mix design approval certificate from E&T Structures Evidence that the manufacturer / licensed technology provider has complied with Clause 55.2 must be provided at least 7 14 days prior to the manufacture supply of the Geopolymer Concrete.

5.3 [Mix design variations within approval are permitted as per MRTS70 Concrete.](#)

6 ~~Manufacture~~[Batching](#) of Geopolymer Concrete

~~General~~[Materials](#)

6.1 [Alumino-silicate precursors \(for example, fly ash, slag\) must:](#)

- a) [comply with the requirements of the relevant part of AS 3582 and ATIC SPEC SP43](#)
- b) [be registered under the Cementitious Material Registration Scheme \(CMRS\) in accordance with ATIC SPEC SP43](#)
- c) [be registered by Transport and Main Roads under the *Supplier Registration Scheme: Bridges and Other Structures*, and](#)
- d) [not be used in the manufacture of Geopolymer Concrete if it is more than 3 months old, unless it is re-tested to demonstrate compliance with this Technical Specification.](#)

6.2 [The quality of water to be used in the mix of Geopolymer Concrete must comply with the requirements of Clause 2.4 of AS 1379.](#)

[Manufactured pozzolans under AS 3582.4 are not yet covered by SP43 or the *Registration Scheme*. Geopolymer materials containing these precursors should be discussed with E&T Structures for individual assessment.](#)

Batching

~~6.1~~—The Geopolymer Concrete and its constituent materials must conform to this Specification.

~~6.26.3~~ The manufacturing plant and equipment, production, and delivery, ~~sampling and testing~~ of Geopolymer Concrete must comply with the requirements specified ~~for concrete~~ in AS 1379 MRTS70 Concrete, except as modified by this Technical Specification.

~~6.36.4~~ The mix design for each Geopolymer Concrete strength grade must have a unique identification number.

~~6.4~~—Flyash, slag and silica fume must:

- ~~a)~~—comply with the requirements of AS 3582.1 and ATIC SPEC SP43
- ~~b)~~—be registered under the Cementitious Material Registration Scheme (CMRS) in accordance with ATIC SPEC SP43, and
- ~~c)~~—not be used in the manufacture of Geopolymer Concrete if it is more than 3 months old, unless it is re-tested to demonstrate compliance with this Specification.

6.5 Super-workable and highly-workable Geopolymer Concrete ~~is not permitted~~ shall comply with the requirements of MRTS70 Concrete.

Water

~~6.6~~—The quality of water to be used in the mix and for the curing of Geopolymer Concrete must comply with the requirements of Clause 2.4 of AS 1379. However, for sources other than water drawn from a stable reticulated drinking water supply, the amounts of chloride in the water must be not greater than 0.03% and the amount of sulphate (as SO₄) in water must not be greater than 0.04% when tested in accordance with the test methods listed in Table 2.3 of AS 1379.

Addition of water at the slump stand

~~6.76.6~~ Slump stand water meters must be initially zeroed and actual amounts of water added into the agitator drum must be accurately recorded. The following records must be included on the delivery docket ~~made available for review by the Principal upon request:~~

- a) actual amount of water added into the agitator drum at the slump stand
- b) time that the water is added, and
- c) calculated maximum permissible amount of water that can be added.

7 Delivery of geopolymer concrete

General

7.1 Transport and delivery of Geopolymer Concrete must be in accordance with MRTS70 Concrete, except as modified by this Technical Specification.

7.2 Prior to the discharge of Geopolymer Concrete at the site, the mixer or agitator must be operated at the mixing speed, listed on the compliance plate, for not less than 3 minutes.

Water additions

~~7.47.3~~ Water may be added to the freshly mixed Geopolymer Concrete prior to commencement of discharge, subject to:

- a) obtaining the manufacturer's prior approval
- b) no more than 10 ~~l~~/m³ is added
- ~~c) the records generated under Clause 6.7 are available for inspection~~
- ~~d) no more than 45 minutes has elapsed since batching~~
- ~~e) the maximum water / Geopolymer Binder ratio is not exceeded, and~~
- ~~e) a means of accurately measuring the volume of water is utilised.~~
- f) the load is remixed in accordance with AS 1379
- g) no more than a single slump sample has been taken previously, and
- h) the maximum water available to be added has been listed on the delivery docket.

This clause replaces the list of conditions in MRTS70 Concrete Clause 11.3.1 but is essentially the same other than (a).

~~7.27.4~~ Water must not be added after commencement of discharge of Geopolymer Concrete (ignoring any testing sample taken). **Record**

~~7.3~~ Prior to the discharge of Geopolymer Concrete at the site, the mixer or agitator must be operated at mixing speed for not less than three minutes.

Delivery docket

~~7.47.5~~ In addition to the information required by Clause 1.7.3 of AS 1379, the following information must also be recorded on each delivery docket:

- a) the total water in the batch, including:
 - i. the moisture content (in litres), beyond SSD, of ~~both fine and coarse~~ aggregates
 - ii. batch water
 - iii. water added at the slump stand
 - iv. total amount of water permitted to be added on site
 - v. water added on site before commencement of discharge, including water used to wash down the mixing blades of the mixer or agitator.
- b) total specified mass of Geopolymer Binder
- c) nominated slumps, ~~including:~~
 - ~~i. nominated slump~~
 - ~~ii. measured slump.~~
- d) any other additions to a batch, and

- e) the unique identification number allocated to the mix design.

~~7.57.6~~ Further to the above requirements, the following information must be traceable to the supplier's batching plant(s) for each batch (truck load) of Geopolymer ~~Binder Concrete~~ used in the works and must be made available for review upon request by the Principal.

- a) Geopolymer Binder brand and type, including:
- proportions of components (by mass), and
 - total actual mass of Geopolymer Binder.
- b) chemical admixtures, including:
- types, and
 - amounts.

~~Acceptance of plastic Geopolymer Concrete~~~~Period for completion of discharge~~

~~7.67.7~~ Geopolymer Concrete must be placed and compacted within 60 minutes of the commencement of mixing.

~~7.77.8~~ The consistency ~~of each load~~ of the Geopolymer Concrete must be determined ~~by a slump test~~ in accordance with AS 1012.3.4. ~~No reduced testing is permitted.~~

~~7.87.9~~ ~~Assessment and acceptance of plastic~~ Geopolymer Concrete ~~shall be as per~~ ~~MRTS70 Concrete~~. ~~must not be incorporated into the works if its consistency is outside the tolerance specified in Table 7.8 for the corresponding specified slump.~~

~~Table 7.8 – Slump tolerance~~

Specified slump, mm	Tolerance, mm
<60	±10
≥60 ≤80	±15
>80 ≤110	±20
>110 ≤150	±30
>150 <180	±40

Water left in the mixer or agitator

~~7.97.10~~ Water left in the mixer or agitator from the previous load must be discharged prior to reloading new Geopolymer Concrete in accordance with the requirements of Clause 4.1.3(c)(ii) water in mixing chamber of AS 1379.

8 Hardened Geopolymer concrete properties

8.1 If the Geopolymer Concrete is cast in place with a strength grade not exceeding 4025 MPa:

Record

- concrete must be sampled, tested and assessed for compressive strength as per MRTS70 Concrete (N-class clauses), and
- for mix design approval, the hardened Geopolymer Concrete must be tested to demonstrated conformance with the properties as listed in Table 8.2.

~~8.1 —, the Contractor must ensure that production assessment reports are prepared in accordance with Clause 6.4.2 Reports for Production Assessment of AS 1379 and provided to the Principal. The reports must identify the mix as Geopolymer Concrete.~~

8.2 ~~For all other~~If the Geopolymer Concrete ~~is used in the manufacture of precast elements or is placed cast in place with a strength grade of 50 MPa:~~ **Record**

- a) ~~concrete must be sampled, tested and assessed for compressive strength as per MRTS70 Concrete (S-class clause), Clause 6.5.2 Additional project assessment for plants subject to production assessment of AS 1379 applies;~~ and
- b) ~~for mix design approval,~~ the hardened Geopolymer Concrete must be tested to demonstrated conformance with the properties as listed in Table 8.2 ~~and the test results are provided to the Principal.~~

Table 8.2 – Hardened geopolymer concrete properties

Property	Test Method	Criteria	Age
Compressive Strength	AS 1012.9	As per design	28 days
Flexural Strength ¹	AS 1012.11	≥ 2.5 MPa	28 days
<u>Abrasion Resistance¹</u>	<u>AS/NZS 4456.9</u>	<u>Report only</u>	<u>28 days</u>
Shrinkage ¹	AS 1012.13	≤ 750 µε	91 days
Modulus of Elasticity ¹	AS 1012.17	30 GPa ± 20%	28 days
Density	AS 1012.12	2.1 – 2.8 t/m ³	28 days
Chloride Permeability ¹	ASTM C1202	< 1000 C	56 days
AASR resistance ¹	AS 1141.60.1	< 0.1 %	to 21 days
Carbonation resistance ¹	ISO 1920-12	Reported only	to 91 days
Chloride ion content ²	AS 1012.20.1	< 0.4 kg/m ³ (Exposure classification <u>C1/C2</u>) < 0.8 kg/m ³ (Exposure classification <u>B1/B2</u>)	28 days

Notes:

¹ Testing required on representative mixes only (see commentary).

² May be calculated by component as per MRTS70 Concrete.

While mix design approval is granted on a per-mix basis, the representative tests noted above should be conducted on a per-grade or per-(binder) system basis. Consult with E&T Structures.

9 Additional requirements for **placement of** geopolymer concrete

[9.1 Formwork, placement, finishing of Geopolymer Concrete must comply with MRTS70 Concrete, including Hold Points.](#)

~~9.19.2 Curing of the~~ [Notwithstanding any requirements specified elsewhere in this Contract for formwork, placement, finishing and curing of concrete,](#) Geopolymer Concrete must comply with the following:

- a) curing must be [in accordance with MRTS70 Concrete \(S-class provisions\)](#) by either: steam, membrane, polyethylene sheet or maintaining the formwork in place
- b) water curing is not permitted
- c) where steam curing is used, care must be taken to prevent condensation pooling on the surface of Geopolymer Concrete, [and](#)
- d) if temperature-matched curing tanks are used, the manufacturer must protect the sample cylinders from water infiltration, ~~and~~
- ~~e) steamed precast units must be coated with a curing membrane within 1 hour of removal from the enclosure.~~

[9.3 Surface finish and dimensional tolerances must comply with MRTS70 Concrete and the underlying element specification.](#)

[9.4 Fibrecrete \(to MRTS271 Glass Fibre Reinforced Polymer \(GFRP\) Reinforcement\) and shotcrete \(to MRTS272 Shotcrete for Aboveground Applications\) versions of geopolymer are permitted, subject to approval of E&T Structures on a case-by-case basis. Switching to geopolymers will have implications for design and material compatibility.](#)

[The underlying element specification is usually where the Work Item Number resides and MRTS70 Concrete and/or MRTS270 are referenced from.](#)

AppendixAnnexure A: Summary of Hold Points, Witness Points, Milestones and Records

General requirements for Hold Points, Witness Points, Milestones and Records, are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points, Milestones and Records 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 Administrator to demonstrate compliance with this Technical Specification are summarised in Table A. There are no Witness Points defined.

Clause	Hold Point	Witness Point	<u>Record</u>
5.2	1. <u>Manufacture of the Geopolymer Concrete</u>		<u>Evidence that the manufacturer / licensed technology provider has complied with Clause 5.2</u>
7.4			<u>Delivery docket with additional information</u>
8.1			<u>Production assessment reports</u>
8.2			<u>Project assessment test results</u>

Table A – Hold Points, Witness Points, Milestones and Records

<u>Clause</u>	<u>Hold Point</u>	<u>Witness Point</u>	<u>Milestone</u>	<u>Record</u>
<u>5.2</u>	<u>1. Supply of the Geopolymer Concrete</u>		<u>Submission of mix design details</u>	<u>Mix design approval certificate</u>
<u>7.4</u>				<u>Delivery docket with additional information</u>
<u>8.1</u>				<u>Production assessment reports</u>
<u>8.2</u>				<u>Test reports</u>

