

Technical Note 204

Mix design registration of plant-mixed cementitiously stabilised pavement material

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Introduction

The purpose of this Technical Note is to outline the process for Contractors and Suppliers (Applicants) to apply for registration of mix designs for plant-mixed cementitiously stabilised pavement materials for use on Department of Transport and Main Roads projects.

This Technical Note is applicable to materials specified through the following Technical Specifications:

- MRTS08 *Plant-mixed Heavily Bound (Cemented) Pavements*
 - Category 1 materials, and
 - Category 2 materials.
- MRTS10 *Plant-mixed Lightly Bound Pavements*
 - Lightly bound base (LBB) materials
 - Lightly bound subbase (LBSB) materials, and
 - Lightly bound improved layer (LBIL) materials.

This Technical Note is not applicable to:

- Insitu stabilised materials (cementitious, lime or foamed bitumen), and
- Plant-mixed foamed bitumen stabilised materials.

This Technical Note sets out the process for registration in two parts as follows:

- Part A: Mix design registration, and
- Part B: Mix design technical requirements.

Part A: Mix design registration

1 Purpose

Where specified in the relevant Technical Specification, mix design registration is required to supply plant-mixed cementitiously stabilised materials to departmental projects.

A mix design will only be registered if the mix design submission contains all required details as described in this Technical Note and satisfies the requirements of this Technical Note and the applicable specifications.

Mix designs may be submitted for registration by either a:

1. Transport and Main Roads Registered Quarry* (Supplier) supplying plant-mixed cementitiously stabilised materials from a single quarry source and location that may serve one or more projects, or
2. A Contractor supplying plant-mixed cementitiously stabilised material to one or more projects using unbound pavement material sourced from a single Transport and Main Roads Registered Quarry but with the stabilising agent added by the Contractor (typically using 'mobile plant' operations).

Note *: In relation to Transport and Main Roads Quarry Registration System (QRS), a quarry may also include a material recycler.

Where a supplier operates multiple quarries or wishes to supply multiple materials from the same quarry, a separate and complete mix design submission is needed for each quarry and unique combination of materials and mixing plant.

Where a Contractor wishes to supply multiple plant-mixed stabilised materials, a separate and complete mix design submission is needed for each site and unique combination of materials and mixing plant.

A Contractor may seek to register a single mix design to use material of the same classification on multiple project sites, provided the same unique combination of materials and mixing plant are being used.

If any of the elements (quarry, mixing plant, stabilising agent, unbound material subtype, admixture or material classification) of a registered mix design change, then it is no longer valid and a separate and complete mix design re-submission is required.

Mix designs that are registered in accordance with this Technical Note will be listed on the *Mix Design Register* available on the Transport and Main Roads [Approved products and suppliers webpage - Pavements, materials and geotechnical](#).

2 Confidentiality of mix design submissions

All documents submitted to Transport and Main Roads for any purposes, including mix design registration, are covered by the requirements of the department's document management policies and guidelines, and all relevant state and federal laws.

All documentation submitted to Transport and Main Roads for mix design registration purposes, shall be treated as commercial-in-confidence.

Registered mix designs will be identified on the *Mix Design Register* as described in Section 3.3. This register will be publicly available through the Transport and Main Roads [Approved products and suppliers webpage - Pavements, materials and geotechnical](#).

Applicants will be issued a Stabilised Mix Design Certificate for each registered mix design as described in Section 3.3. These certificates and the mix design information related to them will not be publicly available (i.e., not published on the Transport and Main Roads website).

Where a Quarry is supplying material to a project in accordance with a registered mix design, the Quarry shall provide the relevant Stabilised Mix Design Certificate to the Contractor and Contract Administrator prior to the commencement of works and in accordance with the relevant Technical Specification(s). The Quarry shall provide the relevant mix design submission attachments to the Contractor and Contract Administrator if requested.

Where a Contractor is supplying material to a project in accordance with a registered mix design, the Contractor shall provide the relevant Stabilised Mix Design Certificate to the Contract Administrator prior to the commencement of works and in accordance with the relevant Technical Specification(s). The Contractor shall provide the relevant mix design submission attachments to the Contract Administrator if requested.

For Transport and Main Roads projects, the Mix Design Registrar may provide copies of the Stabilised Mix Design Certificate to the Contract Administrator or Principal's staff if requested.

Contractor mix designs cannot be used by other Contractors without the express written permission of the Contractor to whom the mix design is registered.

Information provided for the registration of mix designs, including the mix design submission spreadsheet, test results and supporting information may be used to develop and manage Transport and Main Roads assets – this may include, but not be limited to specification development or research purposes. Test reports may be made available and used by third-party organisations, contracted to the department for specific research projects and where the contract provisions of such contracts include relevant confidentiality provisions. The reports resulting from any research work, whether conducted by employees or third-party organisations, shall not include the identity of any specific applicant unless such identification is specifically authorised by the relevant party.

3 Application Process

Applications for registration must be submitted by a Quarry or Contractor (applicants) seeking registration for the plant-mixed cementitiously stabilised materials they will produce. Applications must be certified by a nominated representative of the Company seeking registration.

Third parties may be engaged to assist with the development of mix design submission, but the submission must be endorsed by the nominated representative of the Company seeking registration.

Applications for registration will not be accepted on behalf of third parties – for example a Contractor cannot request registration of a mix design on behalf of a Quarry.

3.1 Submission of applications

The applicant shall submit the mix design and supporting documents in the nominated electronic format, using the folder structure provided in the submission spreadsheet developed by Transport and Main Roads.

The submission spreadsheet can be obtained by emailing stabilisedmixdesign@tmr.qld.gov.au.

Refer Section 4 for further information.

Applications shall be submitted to the Mix Design Registrar at the following email address: stabilisedmixdesign@tmr.qld.gov.au.

Applications must be submitted at least 28 days prior to the date the mix designs are required to be used.

A separate application must be submitted for each mix design that is proposed to be registered.

3.2 Evaluation of applications

Where a mix design submission and associated attachments does not, in the opinion of the Mix Design Registrar, comply with all requirements of this Technical Note or Transport and Main Roads Technical Specifications, the Mix Design Registrar may:

- request additional supporting information be provided by the applicant, or
- decline to register the mix design.

Where additional supporting information is requested by the Mix Design Registrar, the mix design review period will recommence on the date of submission of this information. Further additional information may be requested if the supporting information provided by the applicant is insufficient.

3.3 Registration of applications

A mix design will only be registered if the mix design submission contains all required details as described in this Technical Note.

Where an application complies with all of the requirements of this Technical Note, Transport and Main Roads Technical Specifications, and is deemed suitable by the Mix Design Registrar:

- a unique identifier will be assigned to the mix design (a mix design code) – refer Appendix A for details
- a Stabilised Mix Design Certificate will be issued to the applicant – refer Appendix B for example, and
- the mix will be added to Transport and Main Roads *Mix Design Register* in the next update.

A copy of the *Mix Design Register* will be available on the Transport and Main Roads [Approved products and suppliers webpage - Pavements, materials and geotechnical..](#)

Registered mix designs will be conditionally valid for the lesser of:

- 24 months* from the date registration is granted, or
- the expiry date of the relevant Quarry Registration Certificate (issued under the Transport and Main Roads Quarry Registration System)

Note *: Subject to a mandatory review at 12 months from initial date registration was granted. Refer Section 3.4 for further information.

For example, if a quarry's registration expires within 24 months of the date the mix design registration is granted, the expiration date for the mix design registration will be the same as the quarry registration expiration date.

Where a quarry is subsequently re-registered, the applicant may request the mix design registration expiry date be revised (up to 24 months from the initial date registration was granted). This can be done by emailing the request to the Mix Design Registrar at stabilisedmixdesign@tmr.qld.gov.au and will not require the mix design to be resubmitted unless the manufacturing process or materials being used have changed. A revised Stabilised Mix Design Certificate will be issued to the applicant and the *Mix Design Register* updated accordingly.

The registration of a mix design does not attest to the Quarry or Contractor's ability to manufacture or construct a pavement which consistently complies with the requirement of the relevant Technical Specification. The use of registered mix designs does not reduce or negate the need for testing and compliance of material on a lot basis as required in the relevant Technical Specification.

3.4 Mandatory 12-month review of registered mix design

The expiry date of the registered mix design is conditional and subject to a mandatory review at 12 months from initial date registration was granted. The mandatory review date of a registered mix design will be shown on both the Stabilised Mix Design Certificate and the *Mix Design Register*.

The applicant should submit a request with supporting documents for the 12-month review to the Mix Design Registrar by emailing stabilisedmixdesign@tmr.qld.gov.au, between:

- 2 months prior to the mandatory review date, and
- 10 working days prior to the mandatory review date.

The information required for the mandatory 12-month review will depend on if production data is available or not available (refer Section 3.4.1 and 3.4.2). In either case the Mix Design Registrar will review the submission and determine if the mix design is suitable for continuing use.

Where the review request is received more than 10 working days prior to the mandatory review date, the mix design status shown in the register will remain current until the review request has been assessed.

Where the review request is received less than 10 working days prior to the mandatory review date, the mix design status shown in the register will be changed to 'under review' after the mandatory review date and remain so until the review is completed, and a decision made.

Where no review request is received prior to the mandatory review date, the mix design status shown in the register will be changed to 'suspended' until the review request is received, review completed, and a decision made.

Review requests will not be accepted after 6 months from the mandatory review date. In this circumstance, a new mix design registration submission is required.

In all circumstances, after assessing the applicant's 12-month review request, where in the opinion of the Mix Design Registrar the mix design is unsuitable for continuing use, the mix design status shown in the register will be changed to 'suspended'.

Registered mix designs that have been suspended shall not be used to supply material to Transport and Main Roads projects.

3.4.1 12-month review request – production data is available

Where the mix design has been used in production since being registered, the applicant shall submit all production test results from that mix design since it is registered. The 12-month review request submission shall include:

- 7 and 28 day unconfined compressive strength (UCS) test results (28 day UCS results are only required where specified by the relevant Technical Specification), including moisture content and density of the UCS specimens.
- Stabilising agent contents (measured using Heat of Neutralisation).
- Grading and Atterberg Limit test results, and
- Re-calculation of Mixing Plant Variability (refer to Section 7.1).

Individual Test reports shall be provided as well as process control charts. All test results shall be traceable to a consistent lot structure.

Production data shall be provided to the Mix Design Registrar using the Mix Design 12-Month Review spreadsheet developed by Transport and Main Roads.

The spreadsheet can be obtained by emailing stabilisedmixdesign@tmr.qld.gov.au.

3.4.2 12-month review request – production data is not available

Where the mix design has not been used in production since being registered, the applicant shall undertake laboratory UCS testing to validate the mix design.

The laboratory validation shall be:

- 3 x UCS tests with each test being an average of three specimens and cured for:
 - 7 days for Lightly Bound Improved Layer material, or
 - 28 days for Category 1, Category 2, Lightly Bound Base, and Lightly Bound Subbase materials.
- Tested within 2 months prior to the submission of the 12-month review request.
- Tested separately using the unbound pavement material sampled from different lots or sublots and stabilising agent that are available for production at the time of submission of the 12-month review request (i.e., materials that would be used for production).
- Tested at a stabilising agent content that is within the allowable target content range stated on the Stabilised Mix Design Certificate, and
- Tested in accordance with Section 5.2.

Laboratory verification data shall be provided to the Mix Design Registrar using the Mix Design 12-Month Review spreadsheet developed by Transport and Main Roads.

The spreadsheet can be obtained by emailing stabilisedmixdesign@tmr.qld.gov.au.

3.5 Expiration of registered mix design

The mix design status shown in the register will be changed to 'expired' after the expiration date shown on the Stabilised Mix Design Certificate.

Unless specifically requested by the applicant, expired mix designs will remain on the *Mix Design Register*. Expired mixes may be removed periodically.

Expired registered mix designs shall not be used to supply material to Transport and Main Roads projects.

Expired mix designs may be re-registered by resubmitting the mix design in its entirety (refer Section 3.1).

3.6 Changes in manufacturing processes or materials

The mixing plant and constituent materials used in production must always be the same as those shown on the Stabilised Mix Design Certificate. Where the mixing plant and/or constituent material changes, a new mix design submission must be made. This includes, but is not limited to changes in:

- The production process for unbound paving materials – including source material, crushing and blending.
- The stabilising agent supplier, type, blend proportions or dosage rates.
- Admixture supplier, product, or dosage rate, and
- The mixing plant (pugmill) used to mix materials.

3.7 Deregistration of mix designs

Mix designs may be deregistered at the discretion of the Mix Design Registrar. Deregistered mix designs will be removed from the *Mix Design Register* published on the Transport and Main Roads [Approved products and suppliers webpage - Pavements, materials and geotechnical](#).

Reasons for deregistering a mix may include, but not be limited to:

- A mix design being used to produce material that does not comply with the intent of the relevant Transport and Main Road Technical Specification(s).
- Material being supplied that does not comply with the constituents or manufacturing process stated on the nominated Stabilised Mix Design Certificate.
- The ongoing mixing plant variability exceeds the value nominated on the Stabilised Mix Design Certificate, and
- There being recurring production non-conformances.

Prior to deregistering a mix design, the Mix Design Registrar will request a response from the applicant as to why the mix design should not be deregistered (show cause notice).

The applicant must provide a response within 28 days of the show cause notice being sent, unless otherwise agreed in advance with the Mix Design Registrar. The applicant's response will be considered when deciding whether to deregister a mix or not.

3.8 Application Fees

Application fees are payable for the assessment of mix design registration applications. The application fee is given in Table 3.8 and is applicable for each mix design regardless of whether multiple mix designs are submitted together. The only exception is when the Lightly Bound Base mix design and Lightly Bound Subbase mix design are submitted together using exact the same test results (i.e. same type 2.1 unbound material, stabilising agent, chemical admixture if applicable, mixing plant, and so on) which will only incur one application fee.

Application fees shall be paid upfront by the Applicant and are payable regardless of the outcome of the mix design review.

Table 3.8 – Application Fee

Application Details	Application Fee (Excl GST)
Each Mix Design	\$500.00

No fee will be charged for the 12-month review.

4 Submission Format

Mix design applications must be made using the submission template developed by Transport and Main Roads.

The Mix Design Submission Spreadsheet can be obtained by emailing stabilisedmixdesign@tmr.qld.gov.au.

The submission should include a mix design submission spreadsheet as well as a folder structure to provide supporting information:

Using this spreadsheet, the following key documents must be submitted:

- Completed mix design submission spreadsheet (Version A).
- Attachment 1 – Transport and Main Roads Quarry Registration Certificate.

- c) Attachment 2 – Test reports for the unbound pavement material used in the mix design testing.
- d) Attachment 3 – Stabilising agent conformance information.
- e) Attachment 4 – Test reports for historic stabilising agent content results.
- f) Attachment 5 – 7 and 28 day UCS test reports.
- g) Attachment 6 – Working time test reports.
- h) Attachment 7 – Chemical Admixture Technical Data Sheet (if used in mix design), and
- i) Attachment 8 – Any other relevant supporting information.

Further detail of each key document to be submitted are detailed below.

a) Mix design submission spreadsheet

All aspects within the submission spreadsheet must be completed. These include:

- i. Sheet 1 Mix Design Submission
- ii. Sheet 2 Unbound Pavement Material Details
- iii. Sheet 3 Historic Production & MPV
- iv. Sheet 4 Target Content (complete only one Sheet 4 as below)
 - Sheet 4a Lightly Bound Base (LBB) and Lightly Bound Subbase (LBSB)
 - Sheet 4b Lightly Bound Improved Layer (LBIL)
 - Sheet 4c Heavily Bound, and
- v. Sheet 5 Working Time

b) Attachment 1 – Transport and Main Roads Quarry Registration Certificate

Submission of Transport and Main Roads Quarry Registration Certificates are to include the following:

- i. Transport and Main Roads Quarry Registration Certificate, and
- ii. Registered Overall Testing Frequency Schedule.

c) Attachment 2 – Test reports for the unbound pavement material used in the UCS testing

All supporting documents of unbound pavement materials listed in the Mix Design Submission Spreadsheet submission spreadsheet (see '(a)' above) detailing information of its conformance with MRTS05 *Unbound Pavements*.

d) Attachment 3 – Written certification from the agent's Supplier

Written certification from the agent's Supplier detailing the blend type used in the mix design.

e) Attachment 4 – All test reports for the historic production test results

All test reports for the historic production test results used to determine the MPV listed in the Mix Design Submission Spreadsheet.

f) Attachment 5 – 7 and 28 day UCS test reports

All 7 and 28 day UCS test reports in accordance with Section 5.1 used in determining Target Content in the Mix Design Submission Spreadsheet. The associated Q142A moisture / density relationship (MDR) test reports shall also be provided.

g) Attachment 6 – Working time supporting test reports

All working time test result documents used in determining working time in the Mix Design Submission Spreadsheet. The associated Q115 UCS test reports and associated Q142A moisture / density relationship (MDR) test reports shall also be provided.

h) Attachment 7 – Chemical Admixture Technical Data Sheet

If chemical admixtures were used in the mix design, a technical data sheet is to be provided.

i) Attachment 8 – Any other relevant supporting information

Any other relevant documents supporting the plant-mixed cementitiously stabilised mix design application.

Part B: Mix design technical requirements**5 General**

Plant-mixed cementitiously stabilised pavement materials to be registered in accordance with this Technical Note shall comply with the following requirements.

The applicant shall be responsible for undertaking all testing and design required to develop a mix design that conforms with the requirement given in this Technical Note as well as the production requirements of the relevant Technical Specification.

5.1 Material classification

Plant-mixed cementitiously stabilised pavement materials are typically defined as being either lightly bound or heavily bound as per Table 5.1.

Table 5.1 – UCS mix design requirements

Material	UCS Limits		UCS Gain [^]	Working Time	Time for UCS Test
	Minimum	Maximum	Minimum	Minimum	
MRTS08 Plant-mixed Heavily Bound (Cemented) Pavements					
Category 1	-	-	1.0 MPa	6 hours	7 days*
	3.0 MPa	6.0 MPa			28 days*
Category 2	-	-	n/a	n/a	7 days*
	2.0 MPa	4.0 MPa			28 days*

Material	UCS Limits		UCS Gain [^]	Working Time	Time for UCS Test
	Minimum	Maximum	Minimum	Minimum	
MRTS10 Plant-mixed Lightly Bound Pavements					
Lightly Bound Base	-	-	n/a		7 days*
	1.0 MPa	2.0 MPa			28 days*
Lightly Bound Subbase	-	-	n/a		7 days*
	1.0 MPa	2.0 MPa			28 days*
Lightly Bound Improved Layer	1.0 MPa	2.0 MPa	n/a		7 days

Notes:

* For mix design purposes, the Contractor shall prepare duplicate specimens from the same sample for testing after both 7 and 28 days of curing, however assessment against the UCS limits is based on 28 day results.

[^] UCS gain is the difference between the 7 and 28 day UCS values (calculated at the mid-point of the acceptable range for target content of stabilising agent)

5.2 Standard Test methods

The standard test methods specified in Table 5.2 are to be used when undertaking mix designs.

Further details of test numbers and test descriptions are specified in Clause 4 of MRTS01 *Introduction to Technical Specifications*.

Table 5.2 – Standard test methods used in mix design

Property to be Tested	Method No.
Sampling of soils, crushed rock and aggregates	AS 1141.3.1
Unconfined compressive strength	Q115*
Working Time of stabilised materials	Q136A

Note:

* UCS testing shall be carried out at (standard) optimum moisture content (OMC) and maximum dry density (MDD) as detailed in Test Method Q142A and Q251A.

6 Materials

6.1 Unbound pavement materials

Unbound pavement materials used for mix design testing shall:

- comply with the requirements of Table 5.2
- be provided by a supplier registered to supply the applicable MRTS05 *Unbound Pavements* Material Subtype in accordance with the Transport and Main Roads Quarry Registration System requirements
- be sourced for a single lot (as defined in MRTS05 *Unbound Pavements*), and
- be sampled in accordance with Test Method AS 1141.3.1.

Recycled materials that comply with the requirements of MRTS05 *Unbound Pavements* may be incorporated in any mix design submission however conditions on the use of the material may be provided based on the requirements of the relevant Technical Specification

Table 6.1 – Unbound pavement material requirements

Material	Permissible MRTS05 Material Subtype
MRTS08 Plant-mixed Heavily Bound (Cemented) Pavements	
Category 1	Subtype 2.1
Category 2 *	Subtype 2.1, or Subtype 2.2
MRTS10 Plant-mixed Lightly Bound Pavements	
Lightly Bound Base	Subtype 2.1
Lightly Bound Subbase *	Subtype 2.1, Subtype 2.2 or Subtype 2.3
Lightly Bound Improved Layer *	

Note:

* The Contractor shall nominate in their mix design the standard of unbound pavement material to be incorporated into the material from the permissible materials given in Table 6.1.

6.2 Stabilising agent

The stabilising agent used in the mix design shall be produced from one or more of the constituents given in Table 6.2.

Table 6.2 – Stabilising agent constituents

Constituent	Type	Specification
Cement	GP or GB	AS 3972
Fly Ash	Special Grade or Grade 1	AS/NZS 3582.1
Ground granulated blast-furnace slag (GGBFS)	-	AS 3582.2
Hydrated Lime	-	MRTS23 <i>Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation.</i>

The overall stabilising agent type, the proportion of each constituent and the supplier(s) of the combined / individual constituents to be used shall be nominated by the Contractor as part of their mix design submission.

All of the components of the stabilising agent shall be completely, homogeneously and accurately blended before they are incorporated into the unbound pavement material.

At the time of undertaking mix design testing the stabilising agent shall not be more than three months old, measured from its date of manufacture to the date of testing, unless it has been retested for conformance within one month of use.

Bagged stabilising agent sourced from retailers (such as hardware stores) shall not be used in mix design testing.

6.3 Chemical admixture details

The use of chemical admixtures may be nominated by the Contractor as part of their mix design. Admixtures shall comply with and be used in accordance with AS 1478.1.

Where a chemical admixture is proposed to be used, the following information must be provided:

- the admixture manufacturers name
- the admixture product name, and
- the dose rate the admixture will be used at (stated in units of litres per 100 kg of stabilising agent).

7 Mix Design

7.1 Mixing plant variability

The Mixing Plant Variability (MPV) is an estimate of the likely variability in stabilising agent content that can be expected during production for the actual mixing plant to be used in the Works.

The nominated MPV is specific to the mixing plant (pugmill) that is proposed to be using during production.

The applicant shall nominate the MPV, expressed as a percentage (by dry mass) of the unbound pavement material rounded up to the nearest 0.1%.

Where a minimum of 30 consecutive historic production results are available, the nominated MPV shall be as follows. The most recent historic production results available must be used to determine the MPV.

$$MPV \geq z\sigma$$

where:

$z = 1.28$, representing an 80% confidence interval (for normally distributed data)

σ = the standard deviation of historic production results for the difference between the Target Content and the Actual Content of stabilising agent for the actual mixing plant to be used for the Works, expressed as a percentage (by dry mass) of unbound pavement material.

Where there are no historic production test results available for the mixing plant to be used in the Works, the applicant shall nominate an interim MPV value. This interim value shall be a minimum of 0.5%.

As soon as 30 production tests for stabilising agent content have been completed (using Heat of Neutralisation testing in accordance with the relevant Technical Specification), the applicant shall:

- review this interim value and nominate an MPV value in accordance with the requirements above, and
- advise the Mix Design Registrar of the actual MPV by emailing stabilisedmixdesign@tmr.qld.gov.au.

The Mix Design Registrar will review the mix design and advise the applicant if the mix design needs to be revised.

The Mixing Plant Variability (MPV) to be used for each project will be nominated by the applicant. The nominated value may be greater than the minimum value obtained by analysing the actual standard deviation of historic production results.

For example, if the standard deviation (σ) of historic production results is 0.18%, the MPV must be greater than or equal to 0.23% and rounded up to the nearest 0.1%. The applicant may elect, for their processes, to adopt an MPV of any value greater than or equal to 0.3%.

When selecting the MPV, it is important that the applicant considers both mix design and production compliance requirements:

- Selecting the minimum permitted MPV will increase the acceptable target content range, which will generally allow the applicant to target a lower stabilising agent content.
- Selecting the minimum permitted MPV will also minimise the allowable tolerances on the actual stabilising agent content in production (refer to MRTS10 *Plant-Mixed Lightly Bound Pavements*).
- Selecting a higher MPV will increase the allowable tolerances which will also reduce the acceptable target content range. This may result in the applicant needing to use more stabilising agent to achieve the required UCS.

7.2 Mix design testing

Using the proposed unbound pavement material and stabilising agent to be incorporated into the works, the applicant shall undertake:

- testing which demonstrates that the lot from which the unbound pavement material used in the mix design tests was sampled conforms to MRTS05 *Unbound Pavements*
- UCS testing as follows:
 - For lightly bound improved layer material, a minimum of three 7-day UCS tests at three different stabilising agent contents such that the required stabilising agent content can be plotted across the full 7-day UCS range specified in Table 5.1 with at least one 7-day UCS test result falling between the Minimum and Maximum UCS values, or
 - For Category 1, Category 2, lightly bound base, and lightly bound subbase material, a minimum of three 7-day UCS tests and three 28-day UCS tests at three different stabilising agent contents such that the required stabilising agent content can be plotted across the full 28-day UCS range specified in Table 5.1 with at least one 28-day UCS test result falling between the Minimum and Maximum UCS values, and
- working time testing.

All mix design sampling and testing shall be carried out by laboratories that are:

- accredited by NATA,
- certified for the appropriate tests, and
- registered as Transport Main Roads Construction Materials Testing (CMT) Suppliers.

All test results used in the mix design shall be less than 6 months old at the time of submission to the Mix Design Registrar. All test reports shall be NATA endorsed.

For the purposes of undertaking the mix design process, all testing shall be undertaken on specimens from the same unbound material lot (as defined in MRTS05 *Unbound Pavements*). Enough material needs to be sampled to allow the full suite of mix design testing to be undertaken allowing for possible additional testing if the mix design needs to be optimised.

UCS test results shall be used by the applicant to determine the acceptable range for target content of stabilising agent.

UCS testing shall be undertaken after each laboratory prepared specimen has been cured for the time specified in Table 5.1.

Where a chemical admixture is proposed to be used in the Works, the same chemical admixture and dose rate shall be used in all mix design (UCS and working time) testing. The type, product name and application rate of chemical admixtures must be shown on all relevant mix design testing reports.

7.3 Acceptable range for target content of stabilising agent

The Contractor shall use the MPV nominated in accordance with Section 7.1 and UCS test results obtained in accordance with Section 7.2 to determine the acceptable range for the Target Content of Stabilising Agent in accordance with the following requirements:

- a) the UCS at the Maximum Target Content plus MPV shall be \leq the maximum UCS value specified in Table 5.1, and
- b) the UCS at the Minimum Target Content minus MPV shall be \geq the minimum UCS value specified in Table 5.1.

Interpolation between data points is permitted in checking compliance with the above limits. Unless otherwise accepted by the Mix Design Registrar, extrapolation beyond the range of test results is not permitted, and further testing must be undertaken if the range of UCS limits given in Table 5.1 is not covered.

To undertake this process, 28 day UCS test results shall be used, except for LBIL material where 7 day UCS test results shall be used.

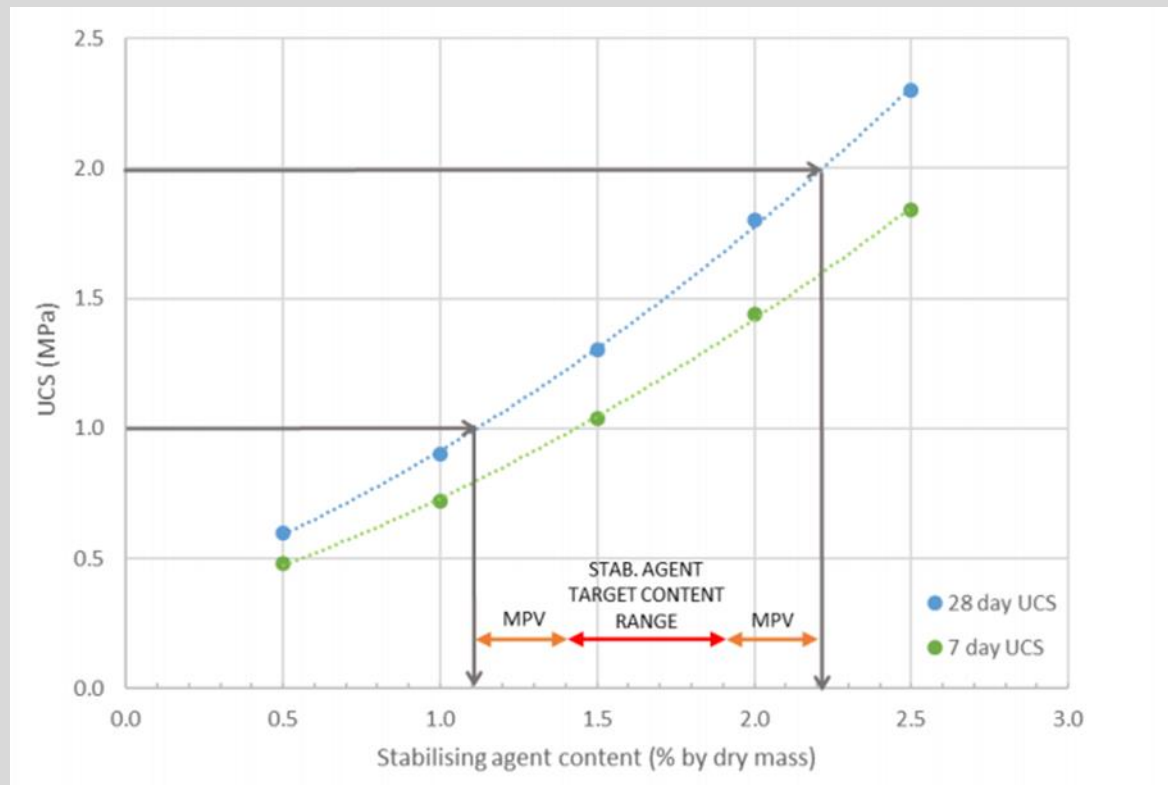
The equation used to interpolate between data points is not specified.

When preparing the mix design, the applicant shall determine the most appropriate trendline to be used. The R2 value of the trendline should be as close to 1 as possible.

Example determination of target stabilising agent content from UCS test results

Based on example UCS test results and a MPV of 0.3%, the acceptable stabilising agent target range is shown in Figure 7.3 for this example. In this example the range that a target content may be nominated is from 1.4% to 1.9%.

Figure 7.3 – Mix design example (lightly bound base)



The Contractor shall carry out works at a stabilising agent content within the acceptable target content range. During construction the Contractor may adjust the Target Content of stabilising agent within the acceptable target content range in accordance with the requirements on the relevant Technical Specification.

7.4 Working time

Working time testing shall be carried out using Test Method Q136A, at a stabilising agent content within the acceptable target content range (refer Section 7.3).

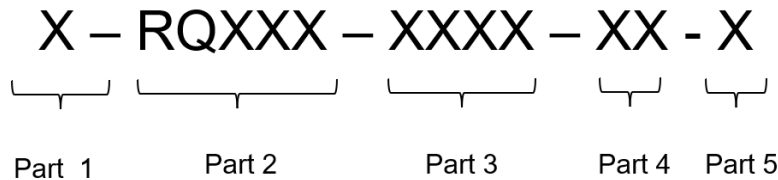
Where a chemical admixture is proposed to be used in the Works, the same chemical admixture and dose rate shall be used to determine the working time.

When undertaking the working time calculation, the applicant shall determine the most appropriate trendline or smooth line to be used. The trendline or smooth line used to interpolate between datapoints to determine working time may vary between different mix designs.

The working time trendline used to determine working time will be reviewed and if deemed unsuitable the Mix Design Registrar will request a response from the applicant as to why the working time trendline or smooth line adopted best represents the calculation for working. If deemed unsuitable, the applicant will be required to change to a more suitable option in the opinion of the Mix Design Registrar.

Appendix A – Mix design code

As per Section 3.3, registered mixes will be given a unique mix design code. The mix design code is specific in its structure and shall be comprised of 5 distinct parts denoting different aspects of the mix design. The code parts are summarised with the following structure:



Part 1 – X (1 letter)

Denotes the part that submitted the mix design. This can be one of the following:

- C (Contractor submitted Mix Design)
- Q (Quarry submitted Mix Design)

Part 2 - RQXXX (5 letters / digits)

Denotes the registration number of the Transport and Main Roads registered quarry that will supply the unbound pavement material.

Part 3 – XXXX (3 or 4 letters)

Denotes the mix type. This can be one of the following:

- Cat1 (Category 1)
- Cat2 (Category 2)
- LBB (Lightly Bound Base)
- LBSB (Lightly bound Subbase)
- LBIL (Lightly Bound Improved Layer)

Part 4 – XX (2 digits)

Denotes the last 2 digits of the year the mix design was initially registered.

Part 5 – X (1 letter)

Used to denote different mix designs (alphabetically) that may otherwise have the same mix code. For example, if a lightly bound base mix design is submitted by a quarry with a retarder and another is submitted by the same quarry, in the same year, without a retarder.

Examples of mix design codes:

C-RQ123-LBB-22-A

- Contractor submitted mix design
- Unbound material supplied from RQ123
- Lightly Bound Base Material
- Registered in 2022, and
- First mix design registered using this code.

Q-RQ456-LBIL-23-A

- Quarry submitted mix design
- Material supplied from RQ456
- Lightly Bound Improved Layer Material
- Registered in 2023, and
- First mix design registered using this code.

Q-RQ456-LBIL-23-B

- Quarry submitted mix design
- Material supplied from RQ456
- Lightly Bound Improved Layer Material
- Registered in 2023, and
- Second mix design registered using this code (for example this mix design may be similar to the previous mix but include a retarder).

Appendix B – Example Mix Design Registration Certificate

Department of Transport and Main Roads

STABILISED MIX DESIGN CERTIFICATE

Mix Type	Lightly Bound Base	Mix Design Code	Q-RQ001-LBB-21-A
Initial Registration Date	1/01/2021	Expiry Date	1/01/2023
Mandatory Review Date	1/01/2022	Revision	R01

Mix Design Registration Details

Mix Design Owner	Quarry Supplier A		
ABN	123	ACN	123

Quarry Details

Nominated Operator (Legal Entity)	Quarry Supplier A		
Registered Quarry Name	Quarry A	Registered Quarry Number	RQ001

Unbound materials

Unbound Pavement Material Type	Subtype 2.1	Pugmill Serial Number	1 2345 67
Recycled Materials	Yes	Recycled Material Blend	Containing greater than 70% of recycled materials

Stabilising agent supplier

Supplier	Stabilising Agent Supplier B	ATIC Number	ATIC169
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Stabilising Agent Constituents

Cement in stabilising agent (%)	70.0%	Slag in stabilising agent (%)	0%
Fly Ash in stabilising agent (%)	30.0%	Hydrated Lime in stabilising agent (%)	0%

Chemical Admixture Details

Chemical Admixture Type	None	Admixture Supplier	N/A
Admixture Product Name	N/A	Chemical Admixture nominated dosage rate	N/A

Mix Design

MPV	0.3%	Tested Working Time	3.5 Hours
Acceptable range for target content of stabilising agent	1.5% - 1.8%		

Conditions:

The expiry date is subject to a review by the mandatory review date. For the latest registration status, check the Mix Design Register.

Signed (Mix Design Registrar)

Date Signed



