TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R225

CONCRETE INJECTED COLUMNS

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REVISION REGISTER

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Ed 1/Rev 1	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20

GUIDE NOTES

(Not Part of Contract Document)

GN1 General

For the purpose of this Specification, concrete injected columns (CIC) include controlled modulus columns (CMC) or controlled stiffness columns (CSC) for ground improvement.

CIC are constructed using the screwed cast-in-place displacement piling technique (resulting in little or no spoil from the drilling) using a hollow stemmed auger.

The CIC are formed by augering down to the founding material and filling the steel tube with concrete before extracting the auger while allowing the concrete to flow into the excavation to form a monolithic concrete shaft.

If required by the Drawings, a single reinforcing bar or a steel reinforcement cage is then placed into the completed concrete shaft to the nominated depth while the concrete is still plastic.

GN2 Ground Improvement Areas (GIA)

The Works should be divided into separate GIA for which exposure classifications to AS 2159 are determined by the designer. Using the design information, the TfNSW Project Manager enters each GIA identification and their corresponding exposure classification in Annexure R225/A1.

Where exposure classification cannot be determined with confidence before awarding the contract, this information will not be entered in Annexure R225/A1, but during construction, the Contractor will be required to determine the exposure classifications and submit them to TfNSW for concurrence.

GN3 Trial Columns

In order to construct production columns which are conforming and to achieve the tolerances specified in Clause 7, the Contractor must construct a sufficient number of trial columns (refer Clause 4) to confirm the installation parameters and CIC construction sequence.

The Project Manager must enter in Annexure R225/A1 the minimum number of trial columns required. The actual number of trial columns, which must not be less than this minimum, is best determined by the Contractor based on his drilling equipment, procedures and site conditions.

GN4 Construction Sequence

The CIC construction sequence is likely to be dependent on the site geology, installation parameters and type of rig used.

Typically, the sequence may involve construction of columns in a “hit and miss” pattern, i.e. constructing every alternate column along a single row at a time in one direction only, such that the distance between each successive constructed column is spaced at double the centre to centre design column spacing.

The constructed columns, i.e. “hit” columns, should have gained sufficient strength before constructing the in-between columns, i.e. “miss” columns.

Transport for NSW

QA SPECIFICATION R225

CONCRETE INJECTED COLUMNS

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CLAUSE PAGE

FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R225 Edition 1 Revision 0.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

(a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.

(b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

TfNSW QA SPECIFICATION R225

CONCRETE INJECTED COLUMNS

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for ground improvement by the construction of concrete injected columns (CIC) using the screwed cast-in-place displacement piling method.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexure that detail additional requirements.

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure R225/A.

1.2.2 Measurement and Payment

The method of measurement and payment is detailed in Annexure R225/B.

1.2.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure R225/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R225/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R225/D and must be implemented.

1.2.5 Frequency of Testing

Your Inspection and Test Plan must nominate the proposed testing frequency to verify conformity of the item, which must not be less than the frequency specified in Annexure R225/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must conform to the requirements of TfNSW Q.

You may propose to the Principal a reduced minimum frequency of testing. The proposal must be supported by a statistical analysis verifying consistent process capability and product characteristics. The Principal may vary or restore the specified minimum frequency of testing, either provisionally or permanently, at any time.

1.2.6 Referenced Documents

Unless otherwise specified, the applicable issue of a referenced document, other than a TfNSW Specification, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure R225/M.

1.3 DEFINITIONS AND ACRONYMS

1.3.1 Definitions

The terms "you" and "your" mean "the Contractor" and "the Contractor's" respectively.

The following definitions apply to this Specification:

Auger	A hollow stemmed drilling head attached to a steel tube for forming the displacement columns.
Column design depth	Depth to the base level of the production column as shown on the Drawings. Where columns designated as "full depth columns" are shown on the Drawings as terminating at the top of the founding layer, an additional 0.5 metre of penetration into the founding material beyond the base level shown on the Drawings must be added to make up the full column design depth.
Ground Improvement Area	A site defined area to be treated which is not greater than 50 m in length measured along the road alignment.
Production columns	Concrete injected columns shown on the Drawings.
Trial columns	Columns constructed within or in the vicinity of the Ground Improvement Area prior to commencement of production column construction to determine production column construction sequence and other parameters.

1.3.2 Acronyms

CIC	Concrete injected column
GIA	Ground improvement area
LTP	Load transfer platform

2 MATERIALS

2.1 GENERAL

All materials used in the Works must conform to the relevant standards, except where the requirements in these standards conflict with those in this Specification, in which case the requirements in this Specification take precedence.

2.2 CONCRETE AND STEEL REINFORCEMENT

2.2.1 Concrete - General

Unless otherwise specified, concrete used for CIC, and the associated testing requirements, must comply with Specification TfNSW R53.

In addition to consideration of the exposure classification, the concrete mix design must also satisfy other durability requirements such as the potential corrosion of steel reinforcement and sulfate attack of concrete (if any).

Submit details of your nominated concrete mix to the Principal for approval prior to commencement of any concrete works.

2.2.2 Exposure Classification

The exposure classifications of the various GIA are stated in Annexure R225/A1. Where the exposure classifications are not stated in Annexure R225/A1, assess the ground conditions and determine the exposure classification in accordance with AS 2159.

Submit your determined exposure classifications to the Principal for concurrence and include it in your method statement.

Payment for this work where carried out will be made in accordance with Pay Item R225P1.

2.2.3 Concrete Strength

Unless shown otherwise on the Drawings, concrete strength must comply with Table R225.1 for the relevant exposure classifications.

Table R225.1 – Concrete Strength in Relation to Exposure Classification

Exposure Classification (1)	**Minimum Concrete Strength** (2) **(MPa)**
Non-aggressive, mild or moderate environment	32
Severe or very severe environment	40

Notes:

(1) Exposure classification determined in accordance with AS 2159.

(2) 28 day unconfined compressive strength, in accordance with AS 1012.8.1 and AS 1012.9.

2.2.4 Supplementary Cementitious Material

Where used, fly ash must be 25% by weight of the total binder content.

2.2.5 Steel Reinforcement

Steel reinforcement, where required, must be in accordance with Specification TfNSW B80.

3 CONSTRUCTION – GENERAL

3.1 PROGRAM, SAFETY AND WORKING PLATFORM

3.1.1 Program

Provide a program showing the trial column construction (refer Clause 4) and production column construction (refer Clause 5), including their sequence and timing.

3.1.2 Safety

Prior to commencement of work on the CIC each day, carry out a safety inspection of the entire concreting line and associated equipment to ensure safe working conditions. Examine all lines for wear, joints for correct coupling and coupling clamps for tightness.

This safety inspection is additional to all other WHS requirements that are applicable to the site and associated construction activities.

3.1.3 Working Platform

Construct working platforms as required to suit your CIC construction plant. Maintain the working platforms for the safe movement and working of your plant, including repairing any damage caused by your works, flooding or other causes.

Unless otherwise approved by the Principal, use granular material for construction of the working platforms.

3.2 METHOD STATEMENT

Prior to commencement of any column construction, submit a method statement as part of your PROJECT QUALITY PLAN incorporating, as a minimum, the following:

(a) plan(s) showing each GIA and trial columns within or in the vicinity of each GIA (refer Clause 4.1), and proposed sequence of column construction (refer Clause 3.4);

(b) concrete mix design details for the CIC construction (refer Clause 2.2);

(c) plant and equipment details, including monitoring systems (refer Clause 3.5);

(d) work methods, including that to achieve the specified founding depth such as pre-boring if necessary (refer Clause 3.6);

(e) measures to protect adjacent structures or previously constructed columns against ground heave (refer Clause 3.4.2) and lateral movement arising from the CIC construction;

(f) procedures for handling possible interruptions during the CIC construction (refer Clause 3.6);

(g) method for placing steel reinforcement (where required) (refer Clause 3.7);

(h) construction accuracy, and methods to verify compliance with the specified tolerances (refer Clause 7.1);

(i) procedures for identification and control of nonconformities;

(j) spoil management;

(k) details of construction records and their submission (refer Clause 3.8);

(l) safety and environment risk assessment;

(m) calibration record of all instruments used.

3.3 COLUMN POSITION AND DIMENSIONS

3.3.1 Set Out

Set out the columns to the positions and spacing(s) shown on the Drawings.

3.3.2 Check Position and Verticality

Check the position and verticality of the drilling stem prior to commencement of augering of each CIC.

3.3.3 Column Diameter and Depth

Construct the columns to the diameter and depth(s) shown on the Drawings.

Where columns designated as “full depth columns” are shown on the Drawings as terminating at the top of the founding layer, construct the columns with an additional 0.5 metre of penetration into the founding material beyond the base level shown on the Drawings.

3.4 COLUMN CONSTRUCTION SEQUENCE

3.4.1 General

Based on the findings of the trial column construction (refer Clause 4), construct the CIC in such sequence as to minimise ground heave and lateral movement, and avoid potential damage to adjacent structures and previously constructed columns.

3.4.2 Ground Heave

The maximum allowable ground heave due to CIC construction is 25 mm, provided that at this amount of ground heave, no damage occurs to the adjacent structures or previously constructed columns. This limit may be reduced if there are signs of damage to adjacent structures or columns.

If the 25 mm limit (or a reduced limit) is exceeded, revise the column construction sequence or method, including installation parameters.

Submit a revised work method statement incorporating the changes to the construction sequence or method to the Principal.

3.4.3 Construction Adjacent to Existing Structures

Where columns are to be constructed adjacent to an existing structure, commence the construction from the columns closest to that structure and work away from it.

Install sufficient monitoring instrumentation near and/or at the existing structure to monitor its response to the construction of the CIC.

3.4.4 Construction Adjacent to Constructed Columns

Unless otherwise approved by the Principal, do not construct columns within a centre to centre distance of less than double the design column spacing from adjacent columns cast within the previous

24 hours. You may propose to change this minimum distance based on the findings of the trial column construction (refer Clause 4).

3.5 EQUIPMENT

3.5.1 General

Carry out the augering using only soil displacement methods that will not result in spoil rising to the surface. Use cutting heads suitable for boring into the founding material to achieve the specified socket length or founding level.

The piling rig for construction of the CIC must have sufficient torque and downward force (crowd) capable of penetrating the ground at a rate sufficient to avoid drawing surrounding soils laterally into the bore, i.e. side loading.

Inspect and clean all joints to keep the auger and concrete supply line water tight.

3.5.2 Monitoring

The piling rigs used for CIC construction must be equipped with on-board computers that monitor drilling and concrete injection parameters over the full length of the column shaft.

3.5.3 Priming Concrete Lines

Keep the length of concrete hose to a workable minimum to facilitate easy pumping.

Prior to augering the first column of the day, prime the line with a cement/water mix and pump concrete through the full length of the line.

3.6 DRILLING AND CONCRETING

3.6.1 Augering

Keep the rate of penetration as uniform as possible. Monitor and record the drilling rate, penetration rate and drilling torque.

The auger stem must not be lifted at any stage during augering, to ensure that the toe sealing device does not become detached and the auger string remains watertight.

Take measures to avoid any delay during augering. Do not leave columns partially bored.

If extensions are required to achieve the required depths, preassemble the extensions in one length. The auger stem must be dry prior to joining extensions.

The founding level and socket length of each column must conform to the requirements of the column design, as evidenced by the penetration rate, drilling rate and torque record registered by the on-board computers.

3.6.2 Pre-boring

Notify the Principal where obstructions are encountered below the ground surface which cannot be penetrated using normal augering methods.

Where appropriate, you may use pre-boring to clear obstructions and facilitate the construction of CIC. Where used, the depth of pre-boring must not extend more than 300 mm past the obstructions into the underlying compressible soil.

The pre-bored holes must be covered to prevent surface water ingress and danger to personnel traversing the site.

3.6.3 Hold Point

HOLD POINT	
Process Held	Pre-boring for trial or production columns (where required).
Submission Details	Details of method and depth of pre-boring, methods to remove material from GIA to prevent contamination of the holes, to prevent surface water ingress and to ensure site safety, at least five working days prior to commencement.
Release of Hold Point	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

3.6.4 Concreting/Auger Extraction

Commence concreting as soon as practicable after completion of augering.

Verify from the concrete delivery docket that the concrete delivered is that specified, prior to discharge of any concrete. Visually check the mix, and carry out slump tests in accordance with and at the frequency stated in TfNSW R53.

Take moulded cylinder samples for testing at 28 days at the frequency stated in Annexure R225/L.

Place concrete for the column using a suitable tube constructed such that concrete does not leak through joints and fitments.

Concreting must be continuous to form a monolithic column shaft, of the full cross section shown on the Drawings, and free from debris or segregated material.

During concreting, keep the auger rotating and use a rate of extraction in accordance with the manufacturer's instructions over the entire concreted length.

Extraction of the auger must be smooth without jerks, whilst maintaining a positive concrete oversupply not less than 5% in accordance with the requirements of AS 2159.

During auger extraction, if the concrete oversupply drops to zero or below, note the depth at which this occurred, stop the extraction and immediately re-auger to 500 mm below that depth and then recommence extraction and concreting.

Continue concrete pumping until the auger tip rises to 300 mm above the ground level to ensure that no contamination of concrete occurs. Inclusions of soil or other debris within the concrete mass is not permitted.

3.7 PLACEMENT OF STEEL REINFORCEMENT

3.7.1 General

Where steel reinforcement are shown on the Drawings to be required, place the reinforcing bar(s) or cage in the CIC within one hour from completion of its concreting.

Check reinforcement bars/cages prior to placement, to ensure that they are clean and straight.

3.7.2 Spacers

Attach suitable spacers to the reinforcement at locations and intervals not exceeding 3 m, to maintain the specified minimum concrete cover. Where a single central steel bar is specified, the bar must not deviate by more than 75 mm from the centre of the column.

3.7.3 Installation

Remove all spoil from around the newly concreted column before inserting reinforcement into the newly concreted column.

You may insert bars into the concrete by hand, supplemented by the use of vibrators where required. Keep the bars vertical during insertion.

Place reinforcement to the specified cut-off level shown on the Drawings and secure in position until the concrete hardens. Unless otherwise approved, permanent projection of steel bars or cages above the final cut-off level is not allowed.

3.8 CONSTRUCTION RECORDS

For each trial and production column, take construction records containing the following details as a minimum:

Before commencement of each CIC

(a) date and start/finish time of construction;

(b) column reference number and diameter;

(c) working platform and ground levels (Australian Height Datum);

(d) operator and supervisor details;

(e) plant details;

(f) mix design of the concrete used;

During augering

(g) continuous log of penetration rate (m/sec);

(h) continuous log of drilling rate (mm/rev);

(i) continuous log of drilling torque (% of maximum available);

(j) continuous log of downward force (crowd) (kN);

During concreting/auger extraction

(k) continuous log of auger extraction rate (m/sec);

(l) continuous log of concreting pressure (bar);

(m) log of concrete oversupply levels at 0.1 m intervals (%);

(n) log of volume of concrete injected at 0.1 m intervals (m^3);

On completion of concreting

(o) total concrete volume used (m^3);

(p) details of steel reinforcement installed if any, including length and depth;

(q) column verticality, positional and dimensional values achieved;

(r) toe level.

Submit to the Principal construction records taken for each column, no later than two working days after construction of the column, in the form of a signed paper copy, and an electronic copy.

4 TRIAL COLUMNS

4.1 GENERAL

Determine the number of trial columns required for each GIA, which must not be less than the number shown in Annexure R225/A1, taking into consideration your equipment type, methods and the site conditions.

In consultation with the Principal, locate those columns to be constructed as trial columns.

4.2 CONSTRUCTION OF TRIAL COLUMNS

4.2.1 Confirmation of Construction Method

Construct the trial columns using the concrete mix and installation parameters proposed in your method statement (refer Clause 3.2), to determine and confirm:

(a) appropriate method of construction, including use of pre-boring where necessary;

(b) adequacy of your construction methods to comply with this Specification;

(c) installation parameters;

(d) construction sequence of the production columns.

Verify that all constructed trial columns satisfy the position and verticality tolerances specified in Clause 7.1.

Following testing (refer Clause 4.3) and acceptance of the trial columns (refer Clause 4.4), finalise the installation parameters and sequence for the production columns using the same material, equipment and plant used for the trial columns.

4.2.2 Hold Point and Witness Point

HOLD POINT	
Process Held:	Construction of the first trial column in each GIA.
Submission Details:	Method statement (refer Clause 3.2), proposed concrete mix details, installation parameters and location of the trial column, at least 10 working days prior to commencement.
Release of Hold Point:	The Principal will consider the submitted documents and may inspect arrangements for monitoring of columns prior to release of the Hold Point.

WITNESS POINT	
Process Witnessed:	Construction of subsequent trial columns, after the first trial column in each GIA.
Submission Details:	Notification of the time and location of the trial column construction, at least one working day prior to commencement.

4.3 TESTING OF TRIAL COLUMNS

4.3.1 Frequency of Testing

Carry out the tests and at the frequencies specified in Annexure R225/L on the constructed trial columns.

4.3.2 Testing Methods

Carry out the testing in accordance with the testing methods specified in Clause 6.

4.3.3 Trial Column Test Report

Following completion of testing for each GIA, prepare and submit a trial column test report containing the following details as a minimum:

(a) Installation parameters and sequence used in the construction of the trial columns.

(b) Monitoring records taken during construction for each of the trial columns.

(c) Results of the trial columns testing, and analysis and discussion of the results.

(d) Recommended installation parameters and construction sequence for production columns.

(e) Certification that the recommended installation parameters, equipment and procedures for construction of the production columns will be suitable to meet the specified design requirements.

4.4 ACCEPTANCE OF TRIAL COLUMNS

Trial columns satisfying the conformity requirements of Clause 7 may be accepted by the Principal as production columns.

5 PRODUCTION COLUMNS

5.1 CONSTRUCTION OF PRODUCTION COLUMNS

5.1.1 Hold Point and Witness Point

HOLD POINT	
Process Held:	Construction of the first production column in each GIA.
Submission Details:	Trial column test report (refer Clause 4.3.3) and construction program (refer Clause 3.1.1), at least seven working days prior to commencement.
Release of Hold Point:	The Principal will consider the submitted documents and assess the recommended installation parameters and sequence prior to authorising the release of the Hold Point.

WITNESS POINT	
Process Witnessed:	Construction of subsequent production columns, after the first column in each GIA.
Submission Details:	Notification of the time and location of the column construction, at least one working day prior to commencing.

5.1.2 Variations in Diameter

Notify the Principal immediately of any variations in diameter, spacing or depth of the columns arising from site conditions which have not been anticipated in the design, and take corrective actions as required.

5.2 TESTING OF PRODUCTION COLUMNS

5.2.1 Frequency of Testing

Carry out the tests and at the frequencies specified in Annexure R225/L on the constructed production columns.

The Principal will nominate the columns and core samples to be tested under this Clause.

5.2.2 Testing Methods

Carry out the testing in accordance with the testing methods specified in Clause 6.

5.2.3 Submission of Test Results

Submit all test results within 48 hours of testing to the Principal for review.

6 TESTING METHODS

6.1 GENERAL

Carry out testing of the trial and production columns in accordance with Clauses 6.2 to 6.6.

You may propose for the Principal's approval alternative methods of sample recovery and insitu testing of columns. Alternative sample recovery methods must be capable of obtaining an undisturbed sample of sufficient diameter and length for the proposed testing.

6.2 COMPRESSIVE STRENGTH – CYLINDERS

Prepare, cure and test the concrete cylinder samples in accordance with AS 1012.8.1 and AS 1012.9 at 28 days age.

Alternatively, you may prepare and test another pair at an earlier age.

6.3 COMPRESSIVE STRENGTH – CORES

6.3.1 Coring Method

Carry out coring of the columns in accordance with AS 1012.14 or other approved insitu sampling method, to the full depth of the test column, at between 7 and 14 days after the CIC construction.

6.3.2 Core Sampling

From the recovered core, take 3 sets of samples, with each set comprising a pair of test cylinders, at locations within the core selected by the Principal.

The number of sets of samples may be reduced if approved by the Principal in instances where the length of intact core samples retrieved is limited.

6.3.3 Storage and Curing

Prepare, store and cure the samples in accordance with AS 1012.14.

6.3.4 Testing

For all of the samples taken, test one set at 28 days age in accordance with AS 1012.14. You may use one of the remaining two sets to test at an earlier age.

Store the remaining set(s) of samples and the remainder of the core under the same humid environment as that specified in Clause 6.3.3 until conformity with the 28 days strength is verified, or use them for further testing if required. Hand any remaining samples over to the Principal.

6.4 INTEGRITY TESTING

Carry out integrity testing in accordance with AS 2159.

Integrity testing and interpretation must be carried out by an approved TfNSW high strain dynamic load test or low strain integrity test specialist contractor.

6.5 VISUAL EXAMINATION

In the event that the integrity test results for a GIA fail to satisfy the acceptance criterion (Clause 7.2.4), expose 1% of the cracked columns, with a minimum of two, by excavating to a minimum depth of 4 m below surface of the working platform around the column for a visual inspection by the Principal.

6.6 LOAD TESTING

Where visual examination reveals unacceptable cracking, the Principal may request that a high strain dynamic or static load testing in accordance with AS 2159 be carried out on at least one of the cracked columns.

6.7 TEST HOLE REINSTATEMENT

Fill with cement grout all core test holes at completion of testing.

7 CONFORMITY REQUIREMENTS

7.1 POSITION AND VERTICALITY TOLERANCES

7.1.1 Plan Position

The maximum deviation of the column centre from its design plan position is 75 mm in any horizontal direction, measured at the column cut off level.

7.1.2 Verticality

The maximum deviation from the vertical at any level of CIC at any stage of the construction is 1:100 (H:V).

7.2 ACCEPTANCE CRITERIA

7.2.1 General

The compressive strength used in these acceptance criteria for trial and production columns, is based on the 28 day strength specified in Clause 2.2.

Where this strength is verified as achieved by testing at an earlier age, the Principal will waive the 28 day testing requirement.

For the columns to be conforming, the acceptance criteria stated in Clauses 7.2.2 to 7.2.6 must be met.

7.2.2 Compressive Strength – Moulded Cylinders

Average of the test results from the pair of cylinders tested conforms to the specified strength.

7.2.3 Compressive Strength – Cores

Not more than 10% of the test results fall below the specified strength, provided that all test results are equal to or greater than 75% of the specified strength.

7.2.4 Integrity Testing

At least 75% of the tested columns are free from cracking or any other defects.

7.2.5 Visual Examination

No diagonal cracks or discontinuities visible.

7.2.6 Load Testing

The resistance of the tested column is greater than the design load shown on the Drawings.

7.3 TREATMENT OF NONCONFORMITY

For columns which do not meet the acceptance criteria, you may propose further testing of the columns, or demonstrate that the nonconformity will not compromise the design intent of the CIC, or carry out remedial measures approved by the Principal, at your own cost.

8 ACCEPTANCE

Following completion of construction and testing of the production columns, filling of all core holes and rectification of all nonconformities to the satisfaction of the Principal, submit all outstanding construction records and results of tests carried out on the production columns, together with a written certification that the constructed Works conform to the requirements of this Specification and the Drawings.

Completion will not be achieved until the above documents have been submitted and reviewed by the Principal, and all columns have been accepted by the Principal.

9 LOAD TRANSFER PLATFORM

9.1 GENERAL

Construct a load transfer platform (LTP) in accordance with the Drawings, to transfer the load from the embankment onto the columns, and to control bending of the columns due to excessive ground lateral movement.

Use appropriate high strength geosynthetic reinforcement complying with Specification TfNSW R67 and Selected Material complying with Specification TfNSW R44 to construct the LTP.

Payment for this work will be made under the appropriate Pay Items in TfNSW R67 and TfNSW R44.

9.2 DESIGN OF LTP

Where the LTP details are not shown on the Drawings, in consultation with the Principal, carry out a design of the LTP and submit it for review and acceptance prior to its construction.

Payment for this work will be made under Pay Item R225P9.

9.3 CONSTRUCTION OF LTP

9.3.1 General

Construction of the LTP must be in accordance with TfNSW R67 and TfNSW R44.

9.3.2 Hold Point

HOLD POINT	
Process Held:	Construction of load transfer platform.
Submission Details:	Certification of conformity of the production columns, including construction records and test results of production columns in accordance with Clause 8, and Contractor's LTP design if applicable.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

ANNEXURE R225/A – PROJECT SPECIFIC REQUIREMENTS

Refer to Clause 1.2.1.

A1 GIA AND TRIAL COLUMNS

NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure R225/A1)

Complete the table below by filling in the required details. Insert additional rows as necessary to include all GIA.

Under the column "Description of GIA Location", insert details of the GIA location, e.g. "Shallow Creek Bridge Abutment B approach".

Determine the exposure classification in accordance with AS 2159. The possible exposure classifications are:

- *Non-aggressive;*
- *Mild;*
- *Moderate;*
- *Severe;*
- *Very severe.*

GIA Identification	Description of GIA Location	Exposure Classification (1)	Number of Trial Columns (2)

Notes:

(1) Exposure classification determined in accordance with AS 2159.

(2) The number of trial columns stated above is the minimum required. The Contractor may propose, or the Principal may direct, an increase in the number of trial columns.

ANNEXURE R225/B – MEASUREMENT AND PAYMENT

Refer to Clause 1.2.2.

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract. This applies to the costs of sampling and testing of concrete delivered.

Unless otherwise specified, a lump sum price for any of these items will not be accepted.

Pay Item R225P1 Determination of Exposure Classification

This Pay Item only applies where the exposure classifications of the various GIA are not stated in Annexure R225/A1.

The unit of measurement is "each" area tested.

The schedule rate must cover all costs associated with determination of the exposure classification, including excavation, back filling, soil sampling and testing, and reporting in accordance with AS 2159.

Pay Item R225P2 Drilling and Concreting of Columns

The unit of measurement is per lineal metre of trial and production column drilled and concreted.

The schedule rate must cover all costs associated with the drilling and concreting (including supply of concrete) to the column design depth or to a level directed by the Principal, cutting off to suit design levels and removal and disposal of any excavated material from the Site.

Pay Item R225P3 Pre-boring of Columns – Provisional Quantity

The unit of measurement is per lineal metre of pre-boring carried out.

The schedule rate must cover all costs associated with pre-boring for the columns, as directed by the Principal including establishment/disestablishment of equipment, boring, and removal of excavated material from site.

Pay Item R225P4 Supply and Placement of Reinforcement

The unit of measurement is per tonne of reinforcement placed to the column design depth.

Pay Item R225P5 Coring of Columns and Testing of Core Samples

Pay Item R225P5.1 Coring of Columns

The unit of measurement is per lineal metre of column cored.

The schedule rate must cover all costs associated with coring of the columns to the required depth, including establishment and disestablishment of the coring equipment and storage and curing of the cores.

Pay Item R225P5.2 Testing of Core Samples

The unit of measurement is "each" set (pair) of core samples tested.

The schedule rate must cover all costs associated with preparation of the core samples, compressive testing of the cores and reporting.

Pay Item R225P6 Integrity Testing of Column

The unit of measurement is "each" column tested.

The schedule rate must cover all costs associated with carrying out column integrity testing, including construction and subsequent removal of any temporary measures required to carry out the test.

Pay Item R225P7 Inspection of Cracked Columns

The unit of measurement is "each" column exposed by excavation and inspected.

The schedule rate must cover all costs associated with excavation to a minimum depth of 4 m as directed by the Principal and back filling with approved material, visual inspection of cracked columns and reporting, including establishment and disestablishment of excavation equipment.

Pay Item R225P8 High Strain Dynamic/Static Load Testing of Columns – Provisional Quantity

Pay Item R225P8.1 Site Establishment

The unit of measurement is "each" establishment of the testing equipment on site.

The schedule rate must cover all costs associated with establishing on site and subsequent removal of the testing equipment. No additional payment will be made for relocation of the testing equipment within the site.

Pay Item R225P8.2 Load Testing

The unit of measurement is "each" column tested.

The schedule rate must covers all costs associated with carrying out high strain dynamic/static load column testing, including construction and subsequent removal of any temporary measures required to carry out the testing, and the preparation and submission of the test result reports.

Pay Item R225P9 Design of Load Transfer Platform

This Pay Item only applies where the design of the LTP is not shown on the Drawings.

This is a Lump Sum item.

The schedule rate must cover all costs associated with the design of the LTP, including production of associated drawings.

ANNEXURE R225/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD AND WITNESS POINTS

Clause	Type	Description
3.6.3	Hold	Pre-boring, where required
4.2.2	Hold	Construction of first trial column in each GIA
4.2.2	Witness	Construction of subsequent trial columns
5.1.1	Hold	Construction of first production column in each GIA
5.1.1	Witness	Construction of subsequent production columns
9.3.2	Hold	Construction of load transfer platform

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

Clause	Description of Identified Record
3.8, 8	Certification of conformity, including construction records and reports of tests carried out on production columns
4.3.3	Trial column test report
9.2	Load transfer platform design

ANNEXURE R225/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the Contract must be reviewed to determine additional documentation requirements.

Clause	Description of Document
3.2	Method statement for CIC works

ANNEXURE R225/E TO R225/K – (NOT USED)

ANNEXURE R225/L – MINIMUM FREQUENCY OF TESTING

Carry out the tests and at the frequencies specified in Table R225/L.1 to verify conformity of both trial and production columns.

Table R225/L.1 – Testing Types and Frequencies

Type of Tests	Trial Columns	Production Columns (1)
Slump	In accordance with TfNSW R53	
Compressive strength (2)		
Moulded cylinders (3)	2 pairs at start of concreting day; 2 pairs at end of concreting day	2 pairs at start of concreting day; 2 pairs at end of concreting day
Cores	N/A	1% of columns in each GIA (4)
Integrity testing	100% of all trial columns	10% of columns in each GIA
Visual examination (5)	N/A	1% of cracked columns, with a minimum of two
Load testing (6)	N/A	One cracked column

Notes:

(1) Tests carried out on trial columns which have subsequently been accepted as production columns do not count towards the percentage of production columns to be tested.

(2) Unconfined compressive strength, tested in accordance with AS 1012.8.1 and AS 1012.9 for moulded cylinders and AS 1012.14 for core cylinders.

(3) Each pair of moulded cylinders must be from a different batch.

(4) Refer Clause 6.3.2. Three sets (pairs) of cylinders taken from each core, and one pair tested at 28 days.

(5) Only required when criterion for integrity testing is not satisfied.

(6) Where requested by the Principal subsequent to visual examination.

ANNEXURE R225/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

TfNSW Specifications

TfNSW B80	Concrete Work for Bridges
TfNSW Q	Quality Management System
TfNSW R44	Earthworks
TfNSW R53	Concrete for General Works
TfNSW R67	High Strength Geosynthetic Reinforcement

Australian Standards

AS 1012	Methods of testing concrete
AS 1012.8.1	Method for making and curing concrete - Compressive and indirect tensile test specimens
AS 1012.9	Compressive strength tests - Concrete, mortar and grout specimens
AS 1012.14	Method of securing and testing cores from hardened concrete for compressive strength
AS 2159	Piling - Design and installation