



# NZGS Specification

## NZGS\_110 METHODS OF MEASUREMENT

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**NEW ZEALAND  
GEOTECHNICAL  
SOCIETY INC**

A Collaborating Technical Society  
of Engineering New Zealand

## Document Status

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The document may be updated from time to time following the issue date. The latest version is available from the New Zealand Geotechnical Society (NZGS) website [www.nzgs.org](http://www.nzgs.org)

## About the New Zealand Geotechnical Society

The New Zealand Geotechnical Society (NZGS) is the affiliated organisation in New Zealand of the International Societies representing practitioners in Soil Mechanics, Rock Mechanics and Engineering Geology. NZGS is also a collaborating Technical Society of Engineering New Zealand.

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## Foreword

This long-form specification has been developed to be used in conjunction with:

- NZS3910:2013 Conditions of contract for building and civil engineering construction
- NZS4431:2022 Engineered fill construction for lightweight structures
- The other components of the NZGS Specification series, notably:
  - NZGS\_000 Standard Specifications User Guide
  - NZGS\_100 Preliminary and general
  - NZGS\_200 Ground Investigations <sup>1</sup>
  - NZGS\_110 Method of measurement
  - NZGS\_520 Reinstatement
- The project-specific details in the form of NZGS\_0110P

It may be used in conjunction with other specifications where appropriate.

This specification is intended to be appropriate for use on most residential or light commercial development projects with common soil and rock types found in New Zealand. It is also intended to be flexible enough to be used on major earthworks projects, but may require more significant additions to the project-specific details by the Geotechnical Designer.

A separate short-form version of this specification is being developed for smaller projects.

## Acknowledgements

This document was developed by a volunteer subcommittee from the volunteers of the NZS4431 working group comprising Ross Roberts, William Gray, Tony Kao, Tim Farrant, Guy Forrest, Chris Massey, Barbara Rouse, Andrew Rose, Sally Hargraves, Tony Fairclough, Simon Barber, Mark Stringer, and Ali Shokri.

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A draft version of this document was released for industry review in mid-2022. Feedback was received from the following individuals and organisations:

- To be listed following feedback

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<sup>1</sup> Currently presented as Volume 1 of the New Zealand Ground Investigation Specification, NZGS 2017

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## NZGS\_110.1 General

### NZGS\_110.1.1 Introduction and scope

This Specification sets out the method of measurement for Contracts that predominantly comprise geotechnical engineering works. It is expected to be used on projects where geotechnical elements make up all, or the majority, of the works. It is not suitable for general civil engineering projects, unless used only for the geotechnical elements. Where the contract includes other works, appropriate clauses from this document can be included in the project-specific preliminary and general specification for the Contract.

Notes for guidance are presented in blue boxes similar to this example. They do not form part of the Specification or contract.

This document shall be read together with all documents forming part of the Contract.

The order of precedence for the documents that together form the Contract, including the specification(s) should be defined in the Contract. They have not been repeated here in the Specification to avoid contradiction.

### NZGS\_110.1.2 Definitions

These terms are additional to those defined in the Preliminary and General section (100) and the General Conditions of Contract (NZS3910 2013). These are selected definitions and are not intended to be comprehensive.

Term	Definition
<b>Bill of Quantities</b>	A list of items giving brief identifying descriptions and the measured quantities of work included in a contract, and presenting the unit rates for these.
<b>Daywork</b>	The method of valuing work on the basis of time spent by the workers, the materials used, and the plant employed
<b>General conditions of Contract</b>	The relevant general conditions of contract included in the contract documents. The terms defined in the relevant general conditions of contract shall bear the same interpretation in this Standard
<b>Ground Investigation</b>	Any activities described in the NZ Ground Investigation Specification Volume 1 (NZGS, 2017).
<b>Payment Schedule</b>	The Bill of Quantities, when used with an NZS3910 contract.

Term	Definition
<b>Range</b>	The limits of a dimension indicated by the upper and lower limits joined by the word 'to', for example, 80 mm to 100 mm. The range is deemed to include the limiting values.

## NZGS\_110.1.3 General

### NZGS\_110.1.3.1 Pricing of items

A price or rate shall be entered against each item in the Bill of Quantities. Items which the tenderer wishes to include in other items shall have the words 'No separate charge' placed against them, and shall be deemed to be covered by the other prices or rates in the bill.

The Bill of Quantities, the Preliminaries and General, the Technical Specification and any project drawings when combined form the scope of works for the project. The rates entered in the Bill of Quantities shall be for the full inclusive value of the work described by this scope.

The pricing given on the Bill of Quantities shall include full allowance for each of the following, unless explicitly identified as a separate item on the Bill of Quantities:

- Establishment charges, overheads, insurance, and profit
- Supply of all miscellaneous equipment and facilities required to undertake the work
- Labour, supervision, management and all related costs
- Plant and all related costs
- Supply and transportation of materials, goods, storage and all related costs in connection with the work including waste storage, removal and disposal
- Liabilities, obligations, and risks involved in the execution of the works including all necessary safety precautions
- All temporary works and traffic management
- Taking all necessary precautions to avoid damage to existing structures, sewers, drains, utilities and services
- Compliance with all regulatory and legal conditions and requirements

### NZGS\_110.1.3.2 Alternative methods of measurement to be described

Alternative methods of measurement, where used, shall be stated in the Project-specific Specifications.

### NZGS\_110.1.3.3 Measurement to be net

Items shall be measured net and no allowance shall be made for laps, cutting, and waste unless specifically stated or otherwise required by the relevant clause in this Specification.





## **NZGS\_110.2**      **Ground investigation**

### **NZGS\_110.2.1**      **Price rates to be inclusive**

The pricing given on the Bill of Quantities shall include full allowance for:

- Informing the Principal and Engineer of any unusual occurrence during any of the ground investigation works
- Maintaining a Site Logbook and providing a copy to the Principal and Engineer on a weekly basis detailing of all work undertaken including quantities for measurement, tests undertaken, water levels before/after drilling, instructions received, hours worked, standing time details including reason and weather conditions
- Waiting time of the drilling rig and crew while scheduled field testing and sampling are being undertaken.
- Waiting time of the drilling rig and crew while piezometers and other instrumentation are being installed, developed and calibrated.
- Transportation, storage, and delivery of all samples and cores
- Liaison with the relevant utility companies, locating nearby services, and any measures identified by risk assessment to ensure that the Exploratory Location is free from services

### **NZGS\_110.2.2**      **Units of measurement**

The units of measurement for ground investigation activities shall be those presented in Volume 3 of the NZ Ground Investigation Specification (NZGS, 2017) unless otherwise defined in the Project-specific Specification.



## NZGS\_110.3 Site clearance

### NZGS\_110.3.1 General

Unless otherwise defined in the Project-specific Specification, the ownership of cleared materials remains with the Principal.

### NZGS\_110.3.2 Price rates to be inclusive

Price rates for site clearance shall include all costs of removal and disposal, except for materials designated for re-use in the works for which the price rates shall include for storage and maintenance.

### NZGS\_110.3.3 Units of measurement

#### NZGS\_110.3.3.1 Vegetation clearance

The units of measurement for vegetation clearance shall be as follows:

Item	Unit	Notes
Vegetation with girth of trunks <300mm	Area (m <sup>2</sup> )	Girth of trees shall be measured at 1.0 m above the original surface of the ground
Vegetation with girth of trunks 300-1000mm	Number	Girth of trees shall be measured at 1.0 m above the original surface of the ground
Vegetation with girth of trunks >1000mm	Number	Girth of trees shall be measured at 1.0 m above the original surface of the ground

#### NZGS\_110.3.3.2 Topsoil stripping

Topsoil stripping shall be measured by area stripped (m<sup>2</sup>) to an agreed depth of topsoil.

## NZGS\_110.4 Earthworks

### NZGS\_110.4.1 Price rates to be inclusive

The pricing given on the Bill of Quantities shall include full allowance for:

- Preparation and delivery of a Quality Management Plan (QMP) including
  - Job safety and environmental analysis
  - Developing the Inspection & Testing Plan
  - Ongoing liaison with the Certifier to agree any changes to the ITP
  - Heritage accidental discovery protocol
  - Contamination accidental discovery protocol
  - Erosion and sediment control plan
  - Contaminated site management plan
- Time spent enabling the Certifier to undertake testing in accordance with the Inspection & Testing Plan, and Random Verification Tests
- Full delivery of all inspections and tests required in the agreed ITP, to enable proactive and informed decision making on site
- Documenting all sampling and testing, including surveying sample/test locations where required by the ITP
- Liaison with the relevant utility companies, locating nearby services, and any measures identified by risk assessment to ensure that the area is free from services
- Identifying, reporting on, and remediating any non-compliance
- Traffic management
- Compliance with all conditions of consent and relevant legislation and bylaws

### NZGS\_110.4.2 Units of measurement

#### NZGS\_110.4.2.1 General

For all cut and fill works, the measurement of quantities shall be by direct survey of the material as specified for payment, based on solid in place measure using a baseline topographic survey of the site that shall be taken once the Topsoil is removed, and before any other cutting or filling takes place, unless otherwise directed by the Engineer.

Where agreement is reached between the Engineer and Contractor, the direct survey may be wholly or partly based on information available from the Contract construction drawings.

The measurement of other quantities for as built and payment purposes shall be by direct measurement using calibrated measuring equipment on site.

#### NZGS\_110.4.2.2 Excavation

Excavation shall be measured based on Material Type as defined in NZGS\_510 Earthworks Specification.

Item	Unit	Notes
<b>Material Type T (topsoil),</b>	Pre-excavation volume (m <sup>3</sup> )	
<b>Material Type F (fine-grained soil), Material Type I (intermediate grained soil), and Material Type C (coarse-grained soil or aggregate)</b>	Pre-excavation volume (m <sup>3</sup> )	
<b>Material Type R (rock)</b>	Pre-excavation volume (m <sup>3</sup> )	Rock may be split into differing hardness categories (R1, R2, R3) for the purposes of payment as shown in the following table.

Rock materials that need to be ripped prior to use may be categorised as R1, R2 or R3 according to the table below for payment purposes where allowed by the Contract. Where ripping is performed, the Contractor shall make use of appropriate plant (i.e. crawler tractors or tracked excavators which have been fitted with hydraulic rippers or ripper tipped buckets) that are modern, well-maintained and appropriately sized. The equipment should be operated safely at full power when assessing the Rock Type category for a material being excavated.

Rock type	Measured and recorded production	Tractor or excavator selection
<b>R1</b>	>75m <sup>3</sup> /hour	crawler tractor fitted with a twin shanked hydraulic ripper having net engine power up to 180kW or: 30 tonne tracked excavator using a rock ripper tipped bucket
<b>R2</b>	<75m <sup>3</sup> /hour	crawler tractor fitted with a twin shanked hydraulic ripper having net engine power up to 385kW or: 30 tonne tracked excavator using a single rock ripper off the boom
<b>R3</b>	N/A	rock materials which cannot be ripped and require drill and blast techniques to dislodge and move the material and to allow the subsequent construction by-products to be used as specified.

Should the Contractor choose to use larger construction plant to speed up a normal excavation process, and the material being excavated could have been productively ripped and moved as shown in the table above, then the material will not be re-classified upwards as either R2 or R3.

### NZGS\_110.4.2.3 Handling, stockpiling and storage

All costs associated with handling, stockpiling and storage of earthworks materials shall be included within either the rate for excavation or the rate for placement.

#### NZGS\_110.4.2.4 Fill placement and compaction

Excavation shall be measured based on Material Type as defined in NZGS\_510 Earthworks Specification, and based on solid in place measure using a baseline topographic survey of the site that shall be taken once the Topsoil is removed, and before any other cutting or filling takes place, unless otherwise directed by the Engineer

Item	Unit	Notes
<b>Material Type T (topsoil),</b>	Compacted volume (m <sup>3</sup> )	
<b>Material Type F (fine-grained soil), Material Type I (intermediate grained soil), and Material Type C (coarse-grained soil or aggregate)</b>	Compacted volume (m <sup>3</sup> )	
<b>Material Type R (rock)</b>	Compacted volume (m <sup>3</sup> )	
<b>Material Type M (manufactured)</b>	Compacted volume (m <sup>3</sup> )	

#### NZGS\_110.4.2.5 Testing

All source material acceptance testing, production testing and compaction acceptance testing by a Recognised Laboratory shall be charged as a unit rate per test, and including factual reporting in both agreed digital and paper forms.