

Title	Evaluate ground conditions and support methods for maintaining stability in underground operations		
Level	6	Credits	15

Purpose	People credited with this unit standard are able to demonstrate knowledge: of rock mechanics; the principles for ground support for underground operations; and monitoring and evaluating the performance of ground support systems.
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Classification	Extractive Industries > Underground Extraction
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Available grade	Achieved
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Guidance Information

- 1 Performance of the outcomes of this unit standard must comply with the following:
Health and Safety at Work Act 2015 (HSW);
Health and Safety at Work (General Risk and Workplace Management) Regulations 2016;
Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016;
Health and Safety at Work (Worker Engagement, Participation, and Representation) Regulations 2016;
approved codes of practice issued pursuant to the HSW Act.
- 2 Any new, amended, or replacement Acts, regulations, standards, codes of practice, guidelines, or authority requirements or conditions affecting this unit standard will take precedence for assessment purposes, pending review of this unit standard.
- 3 Joint assessment must be conducted in the assessment of this unit standard because of the high degree of risk. To conduct a joint assessment, two assessors, or one assessor and one technical verifier, must have witnessed the learner undertaking the tasks required in the unit standard and have come to the same conclusion in regards to the learner being competent or not yet competent.

At least one assessor or verifier must hold the unit standard they are assessing on their NZQA Record of Learning.

- 4 **Definitions**
Company procedures mean the documented methods for performing work activities and include health and safety, operational, environmental, and quality management requirements. They may refer to legislation, regulations, guidelines, standard operating procedures, manuals, codes of practice, or policy statements.
Industry best practice may be documented in management plans, control plans, company procedures, managers' rules, occupational health and safety policy,

industry guidelines, codes of practice, manufacturers' instructions, and safe working and/or job procedures (or equivalent).

5 An *underground operation* includes extractive or tunnelling operations.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of rock mechanics.

Performance criteria

1.1 The nature and distribution of force effects around openings in underground excavations are explained and analysed in terms of potential ground failures.

Range compressive stress, tensile stress, shear stress, strain, elasticity, Young's modulus, Modulus of Rigidity, Poisson's ratio, pillar and ground stiffness, stress distribution.

1.2 The distribution of ground force effects is explained in terms of the geological conditions in underground operations.

Range includes but is not limited to – faulting, folding, fracture zones, in-ground stress orientation, ground water, rock permeability, depth of workings, roadway orientation, rock bursts.

1.3 Rock found in underground operations is described and analysed in terms of its support and anchorage properties.

Range includes but is not limited to – tensile strength, compressive strength, shear strength, hardness, porosity, specific gravity, elasticity, granular structure.

1.4 Hazards arising from unpredicted ground movement are identified and described in terms of the stability of the excavation and control measures required.

Outcome 2

Demonstrate knowledge of the principles for ground support for underground operations.

Performance criteria

2.1 The characteristics and effectiveness of ground support methods are analysed in terms of the stability of the excavation.

Range may include but is not limited to – roof bolts, cable bolts, rod bolts, megastrand bolts, split sets, hydraulic supports, mesh, shotcrete, timber props, timber sets, steel sets, poured concrete, concrete lining.

2.2 Ground support requirements for underground operations are evaluated in terms of ground conditions and opening dimensions.

Range pressure distribution effects, geological characteristics, support methods, anchorage properties, hazards.

Outcome 3

Demonstrate knowledge of monitoring and evaluating the performance of ground support systems.

Performance criteria

3.1 Monitoring systems are described and evaluated in accordance with industry best practice and company procedures.

Range deformation and convergence methods, stress cells, sonic extensometer, bolt loading, reinforcement performance methods.

3.2 Ground support inspection requirements are described in accordance with industry best practice and company procedures.

3.3 The process for reporting deficiencies in ground support systems, and the response requirements when deficiencies and departures are found to exist, are described in accordance with industry best practice and company procedures, including Trigger Action Response Plans (TARPs).

Planned review date	31 December 2022
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	25 July 1999	31 December 2017
Review	2	24 November 2005	31 December 2017
Rollover and Revision	3	16 July 2010	31 December 2017
Review	4	18 June 2015	31 December 2019
Review	5		N/A

Consent and Moderation Requirements (CMR) reference	0114
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Comments on this unit standard

Please contact MITO New Zealand Incorporated info@mito.org.nz if you wish to suggest changes to the content of this unit standard.