



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **MSL974013A Monitor performance of structures**

**Revision Number: 1**

## MSL974013A Monitor performance of structures

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the ability to monitor civil engineering structures (such as roads, dams, embankments, open cut faces, bridges, tunnels, towers and other concrete/steel erections) to measure their performance, confirm design parameters or measure the effects of improvements or rehabilitation. The unit involves confirming the requirements of the monitoring activities, liaising with site personnel, performing monitoring activities, setting up monitoring equipment, collecting reliable data and reporting results. Personnel are also expected to interpret results in the field, recognise/rectify obvious errors or unexpected results and troubleshoot common problems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency is applicable to laboratory personnel working in the geotechnical, construction material testing, civil engineering and mining industry sectors.</p> <p>Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These can be found at the end of this unit of competency under the section 'This competency in practice'.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		
	<i>MSL973009A</i>	<i>Conduct field-based acceptance tests for construction materials</i>

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<p>1. Confirm requirements for monitoring activities with supervising staff</p>	<p>1.1. Review job request to confirm the purpose and objectives of monitoring activities</p> <p>1.2. Review emergency plans, risk assessments, safe work procedures, environmental requirements associated with the monitoring activities and site requirements</p> <p>1.3. Review any available data from previous monitoring at the site to identify expected values and any trends in results</p> <p>1.4. Liaise with client to arrange site access, confirm timing and clarify the need for permits, induction training or any other special requirements</p> <p>1.5. Confirm details of monitoring instruments to be used, parameters to be measured and the data formats required by users</p>
<p>2. Prepare for monitoring activities</p>	<p>2.1. Complete all administrative requirements and obtain appropriate approvals/permits</p> <p>2.2. Arrange appropriate transport to and from site and accommodation as necessary</p> <p>2.3. Assemble all required instruments, equipment and supplies and check that they are fit for purpose</p> <p>2.4. Stow monitoring instruments, equipment and supplies to ensure their safe transport</p> <p>2.5. Liaise with appropriate personnel on arrival at site to ensure safety and minimise disruption to other workers during monitoring</p> <p>2.6. Complete site induction as necessary</p>
<p>3. Collect and verify monitoring data</p>	<p>3.1. Use barriers and signage to control access to work area in accordance with enterprise safety procedures</p> <p>3.2. Perform pre-use checks of instruments and trial measurements to ensure they are operating within specifications</p> <p>3.3. Identify location for monitoring in accordance with work instructions and/or test method</p> <p>3.4. Operate instruments safely and in accordance with work instructions, test method, and/or manufacturer's specifications</p> <p>3.5. Take sufficient measurements to ensure that data meets quality requirements</p> <p>3.6. Recognise obvious errors or atypical data and take</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>appropriate corrective actions</p> <p>3.7. Recognise and record/photograph details of site conditions that may impact on data quality</p> <p>3.8. Seek advice to deal with any situation beyond own technical competence</p>
4. Finalise monitoring activities	<p>4.1. Remove signage and barriers and reinstate all disturbed surfaces in accordance with enterprise procedures</p> <p>4.2. Ensure all data are stored safely before shutdown of instrument/equipment</p> <p>4.3. Clean all instruments and equipment (and vehicle as necessary) to avoid environmental damage including stormwater run-off and/or transfer of pests</p> <p>4.4. Check that all instruments, equipment and supplies are present and undamaged before re-stowing them for safe transport</p> <p>4.5. Notify appropriate site personnel on completion of monitoring activities and prior to leaving site</p> <p>4.6. On return to base, check serviceability of instruments and equipment before storage</p> <p>4.7. Download data into laboratory/enterprise information management system in accordance with enterprise procedures</p> <p>4.8. Complete site safety plans, instrument/equipment logs and test reports in accordance with enterprise procedures</p> <p>4.9. Notify supervising staff upon completion of activities</p> <p>4.10. Report any significant issues arising from monitoring activities to appropriate personnel</p>
5. Maintain a safe work environment	<p>5.1. Use safe work procedures and personal protective equipment to ensure personal safety and that of others</p> <p>5.2. Minimise environmental impacts of monitoring activities and generation of waste</p> <p>5.3. Collect and/or dispose of all waste in accordance with environmental/quarantine requirements and enterprise procedures</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying resource requirements for field monitoring activities
- liaising with clients and site personnel about monitoring activities
- interpreting safety information (e.g. site safety plans) and working safely
- applying work instructions, test methods and enterprise procedures with close attention to detail
- checking and using monitoring instruments and equipment in accordance with test methods and/or enterprise procedures
- cleaning and troubleshooting/maintaining instruments and equipment in the field
- operating communication systems
- estimating/calculating simple scientific quantities (e.g. stress, strain and pressure)
- recording and presenting results accurately and legibly
- using laboratory software (e.g. spreadsheets, file management and data logger control)
- maintaining security, integrity and traceability of all samples, data/results and documentation
- demonstrating a professional approach and positive company/organisation image

#### Required knowledge

Required knowledge includes:

- monitoring activities routinely performed in job role, including:
  - purpose and principles of monitoring
  - properties of materials and/or structures being monitored
  - key steps in setup, operation and shutdown of monitoring instruments
  - calculation steps to give results in appropriate units and precision
  - expected measurement values for materials or structures
- monitoring instruments and equipment routinely used in job role, including the function of key components, effects of varying key controls, connections, data acquisition fundamentals and common problems
- basic instrument fault identification and rectification procedures pre-use checks and operating procedures for monitoring instruments and equipment routinely used in job role
- expected values and sources of uncertainty (and methods for control) in monitoring activities routinely performed in job role
- procedures for verifying and recording data, reporting results, calculations, site

**REQUIRED SKILLS AND KNOWLEDGE**

- observations and unexpected or atypical results, and equipment problems
- procedures for ensuring traceability of data and results
- health, site safety and environmental management requirements relevant to job role
- confidentiality requirements relevant to job role

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors should ensure that candidates can:</p> <ul style="list-style-type: none"> <li>• liaise effectively with site personnel to arrange for monitoring to be performed safely and efficiently</li> <li>• set up, operate and troubleshoot monitoring equipment in the field</li> <li>• conduct monitoring activities safely and produce reliable data within the required timeframe</li> <li>• work semi-autonomously.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit of competency is to be assessed in the workplace or simulated workplace environment.</p> <p>This unit of competency may be assessed with other relevant units of competency such as:</p> <ul style="list-style-type: none"> <li>• <i>MSL924001A Process and interpret data</i></li> <li>• <i>MSL924002A Use laboratory application software</i></li> <li>• <i>MSL943002A Participate in laboratory/field workplace safety.</i></li> </ul> <p>Resources may include:</p> <ul style="list-style-type: none"> <li>• data sets and records</li> <li>• test methods and description of monitoring activities</li> <li>• monitoring instruments and equipment</li> <li>• data logger, computer and relevant software or laboratory information system</li> <li>• relevant enterprise procedures.</li> </ul>
<b>Method of assessment</b>	<p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> <li>• review of monitoring data, results and records generated by the candidate</li> <li>• feedback from supervisors and clients regarding the candidate's ability to work independently and conduct a range of monitoring activities reliably, safely and efficiently</li> <li>• questions to assess understanding of enterprise procedures, monitoring activities and test methods relevant to their job role.</li> </ul>



<b>EVIDENCE GUIDE</b>	
	<p>In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required.</p> <p>The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.</p>
<b>This competency in practice</b>	<p>Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting.</p> <p><b>Construction materials testing (1)</b></p> <p>A contracting engineer has requested daily monitoring of a large cutting on a major new highway for at least several months. The new cutting has exposed a major geological fault that may result in significant slippage or total failure of the slope. A technician is assigned the task of monitoring the site which is approximately 10 km from the laboratory. He/she confirms the site location, specified monitoring points and the data required by the engineer. He/she then contacts the site manager to arrange access and schedule the monitoring times. The technician confirms that he/she has a current first aid certificate and has previously completed the construction company's site induction program. Because there is only 4WD access to the cutting, the technician arranges to use an appropriate vehicle. On arrival at the site, the technician meets key company staff. He/she locates the boreholes and identifies each monitoring point on the site plan. He/she then assembles the laboratory's inclinometer taking care to check the torpedo probe, data logger, graduated support cable, electrical cables and connectors. He/she carefully checks the first borehole and uses a dummy probe to clean the keyways and ensure that it is free of obstructions. He/she records a trial set of orthogonal readings @ 0.5 m intervals over the 10 m depth. The technician then obtains a complete set of baseline data being careful to conduct</p>

**EVIDENCE GUIDE**

repeat measurements and record each depth precisely so that subsequent measurements can be recorded at the same point and small changes in inclination can be detected. On return to base, he/she verifies the data and discusses the results with the laboratory manager before issuing them to the client. He/she then documents the site details and work instructions for the team to ensure rapid turnaround of data for the client.

**Construction materials testing (2)**

Two technicians have been assigned the task of surveying the condition of a stretch of highway to determine the extent of deterioration and whether it needs to be re-sealed. They locate the test method (Q702) and conduct a routine pre-use check of the laboratory's dedicated vehicle and confirm that all monitoring systems are functioning correctly. They examine the previous road roughness data and schedule the test for 8 pm in order to minimise interferences. On reaching the site, they drive the specified route to check for hazards such as cross roads, wildlife and other traffic. After commencing the test, the driver maintains constant speed while the operator records 'chainage' data and key road features on a laptop computer to reference the data set. After one pass, the technician reviews the data file to identify problem spikes, gaps or anomalies in the data. Then they perform repeat runs for both lanes in both directions, being careful to use the same wheel path in each case. On return to base, they download the data files, run data quality checks and use laboratory software to smooth the data. They then store the data files in accordance with enterprise procedures and complete the test report.

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Codes of practice

Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used

#### Standards, codes, procedures and/or enterprise requirements

Standards, codes, procedures and/or enterprise requirements may include:

- Australian and international standards, such as:
  - AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
  - AS/NZS ISO 14000 Set:2005 Environmental management standards set
  - AS/NZS ISO 9000 Set:2008 Quality management systems set
- AustRoads test methods
- enterprise quality manual, customer quality plan
- enterprise recording and reporting procedures
- enterprise sampling procedures for specific samples, sites and clients
- environmental legislation and regulations
- equipment manuals and warranty, supplier catalogues and handbooks
- equipment startup, operation and shutdown procedures
- industry codes of practice
- maps and site plans
- material safety data sheets (MSDS)
- material, production and product specifications
- National Association of Testing Authorities (NATA) documents regarding construction materials testing (Field application document)
- national measurement regulations and guidelines

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• occupational health and safety (OHS) national standards and codes of practice</li> <li>• quality manuals</li> <li>• sampling and test procedures, enterprise or standard operating procedures (SOPs)</li> <li>• site safety plans</li> <li>• State/Territory Road Authority test methods</li> <li>• test methods</li> </ul>
<b>Hazards</b>	<p>Hazards may include:</p> <ul style="list-style-type: none"> <li>• dust and noise</li> <li>• extreme weather (e.g. sunlight, wind, hail, rain and heat)</li> <li>• manual/handling of heavy equipment or materials</li> <li>• crushing, entanglement and cuts associated with moving machinery</li> <li>• vehicular traffic on roads and sites</li> <li>• injuries caused by falling objects and working conditions such as uneven surfaces, heights, slopes, wet surfaces, trenches and confined spaces</li> <li>• nuclear density/moisture gauges and industrial X-ray equipment</li> <li>• driving vehicles over long distances, in rural or remote areas and over difficult terrain</li> <li>• fatigue</li> </ul>
<b>Enterprise safe work procedures</b>	<p>Enterprise safe work procedures may include:</p> <ul style="list-style-type: none"> <li>• use of site safety plans and MSDS</li> <li>• use of personal protective equipment, such as hard hats, sunscreen lotion, hearing protection, gloves, goggles, coveralls, respirators and safety boots</li> <li>• handling and storing hazardous material and equipment in accordance with labels, MSDS, manufacturer's instructions, enterprise procedures and regulations</li> <li>• regular cleaning and/or decontaminating of equipment</li> <li>• signage, barriers, traffic control and flashing lights</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Monitoring activities</b>	<p>Monitoring activities may include measuring:</p> <ul style="list-style-type: none"> <li>• displacement and vibration</li> <li>• pressure and force</li> <li>• temperature</li> <li>• setting time</li> <li>• strain</li> <li>• cracking (visual assessment of road condition)</li> <li>• defect mapping</li> <li>• moisture</li> <li>• water levels</li> <li>• movement of chemical ions through structures</li> </ul>
<b>Monitoring instruments and equipment</b>	<p>Monitoring instruments and equipment may include:</p> <ul style="list-style-type: none"> <li>• transducers, such as accelerometers, load cells, piezometers, strain gauges and thermocouples</li> <li>• signal conditioning and data storage devices such as amplifiers, data loggers and portable computers</li> <li>• global position system (GPS)</li> <li>• digital camera</li> <li>• survey equipment, steel ruler/tape and verniers</li> <li>• signage, warning lights and boundary tape/cones</li> <li>• worksheets and test methods</li> <li>• umbrellas and shade structures</li> <li>• communication equipment (e.g. radio)</li> </ul>
<b>Administrative requirements and appropriate approvals</b>	<p>Administrative requirements and appropriate approvals may include:</p> <ul style="list-style-type: none"> <li>• travel requisitions, insurance</li> <li>• authority for procurement of supplies, use of vehicles and equipment</li> <li>• access permits</li> </ul>
<b>Appropriate corrective actions</b>	<p>Appropriate corrective actions may include:</p> <ul style="list-style-type: none"> <li>• logical check of equipment setup</li> <li>• check of calibration, zero error, drift for measuring instrument, data entry/storage and transfer</li> <li>• replacement of batteries, instrument boards/cards and leads and connectors</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>careful re-reading of procedures and checklists</li> <li>repeat measurements</li> <li>seek advice</li> </ul>
<b>Minimising environmental impacts</b>	<p>Minimising environmental impacts may include:</p> <ul style="list-style-type: none"> <li>damage from movement of vehicles</li> <li>disposal of surplus or spent or materials</li> <li>containing run-off of water</li> <li>recycling of wastes</li> <li>compliance with quarantine requirements, including cleaning of vehicles to prevent transfer of pests (e.g. fire ants and seeds) and contaminants</li> <li>compliance with environmental, cultural and heritage protection requirements</li> </ul>
<b>Occupational health and safety (OHS) and environmental management requirements</b>	<p>OHS and environmental management requirements:</p> <ul style="list-style-type: none"> <li>all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time</li> <li>all operations assume the potentially hazardous nature of samples and require standard precautions to be applied</li> <li>where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Testing
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## Competency field

<b>Competency field</b>	
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## Co-requisite units

<b>Co-requisite units</b>		