



Australian Government

Department of Education, Employment and Workplace Relations

CPPSIS5026A Design road and railway

Release: 1

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Modification History

Not Applicable

Unit Descriptor

Unit descriptor

This unit of competency specifies the outcomes required to design and set out basic roads, railways and associated engineering structures. It requires the ability to undertake all aspects of survey design from understanding client and registered surveyor requirements and the special characteristics of a given site, to applying relevant legal and statutory requirements to the design. The selection of appropriate equipment and procedures is essential to performing the task safely and efficiently. Functions would be carried out within organisational guidelines.

Application of the Unit

Application of the unit

This unit of competency supports the application of self-management, accuracy and problem-solving skills; designing data and implementing specifications; and high-level understanding of technology. The skills and knowledge acquired upon completion of this unit would support the needs of employees in surveying.

Licensing, legislative, regulatory and certification requirements may impact on this unit. Incorporate these requirements according to state, territory and federal legislation.

Licensing/Regulatory Information

Refer to Application of the Unit

Pre-Requisites

Prerequisite units Nil

Employability Skills Information

Employability skills The required outcomes described in this unit of competency contain applicable facets of employability skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged, will assist in identifying employability skills requirements.

Elements and Performance Criteria Pre-Content

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

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Organise resources.	<p>1.1 Characteristics of the operating environment and any special equipment or resource requirements are identified according to <i>organisational guidelines</i>.</p> <p>1.2 Equipment is checked to be in good working order.</p> <p>1.3 <i>Manufacturer specifications</i> with regard to the use of equipment are complied with.</p>
2 Follow specifications to design roads and railways.	<p>2.1 <i>Objectives, principal work activities</i> and <i>constraints</i> are defined and documented according to written survey specifications and <i>client requirements</i>.</p> <p>2.2 Objectives and principal work activities are communicated to <i>relevant personnel</i>.</p> <p>2.3 Details of instruments and basic <i>techniques</i> to be used are considered and evaluated.</p> <p>2.4 <i>Road or railway type</i> is determined according to objectives.</p>
3 Conduct the design of a road or railway.	<p>3.1 <i>Appropriate calculations</i> are conducted according to <i>design type</i>.</p> <p>3.2 Calculations are placed into a design plan.</p> <p>3.3 Natural surface terrain model is developed according to design type.</p> <p>3.4 Vertical alignment is designed according to design type.</p> <p>3.5 Plot design, natural surface cross-section and long section plots are designed according to design type.</p> <p>3.6 Report is generated on set out information.</p> <p>3.7 Existing plans are edited.</p> <p>3.8 Correct <i>OHS</i> procedures are observed throughout the process.</p> <p>3.9 Pertinent <i>legislative requirements</i> and <i>legal and statutory standards</i> are considered and adhered to.</p>
4 Discuss design report with work team.	<p>4.1 Feedback on <i>surveying data components</i> provided by team members is discussed and acted upon according to organisational guidelines.</p> <p>4.2 Skills and knowledge are updated to accommodate road and railway design requirements.</p>
5 Complete project to clients' requirements.	<p>5.1 Completed work is checked against clients' requirements according to the specifications.</p> <p>5.2 Required <i>documentation</i> is completed according to organisational guidelines.</p> <p>5.3 Relevant personnel are informed of the results</p>

ELEMENT**PERFORMANCE CRITERIA**

according to organisational guidelines.
5.4 Survey data is archived according to project specifications.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- ability to relate to people from a range of social, cultural and ethnic backgrounds and with a range of physical and mental abilities
- analytical skills
- ability to translate requirements into design
- communication skills to:
 - consult effectively with clients and colleagues
 - impart knowledge and ideas through oral, written and visual means
- computer skills (high technical user level) to complete business documentation
- instrument use (high level)
- literacy skills to:
 - assess and use workplace information
 - locate and interpret legislation and other written documentation
 - prepare and manage documentation
 - read and write technical reports
 - research and evaluate
- negotiation skills
- numeracy skills to:
 - analyse errors
 - conduct image analysis
 - interpret and analyse statistics
 - perform mental calculations
 - record with accuracy and precision
 - undertake high level computations
- organisational skills to:
 - coordinate technical and human resource inputs to research activities
 - prioritise activities to meet contractual requirements

REQUIRED SKILLS AND KNOWLEDGE

- perform road alignment design or stormwater system and associated computations
- spatial skills to:
 - exercise precision and accuracy in relation to spatial and aspatial data design
 - perform spatial data archival and retrieval and train others in this task
 - perform spatial data management and manipulation and train others in this task
 - perform file management and train others in this task
 - solve problems relating to height, depth, breadth, dimension, direction and position in actual operational activity and virtual representation
 - understand implications of height, depth, breadth, dimension and position to actual operational activity and virtual representation
- working in a team.

Required knowledge and understanding:

- advanced data reduction
- calibration of specialised surveying equipment
- data formats
- errors, accuracy and precision in design
- high-level, relevant engineering-related tasks and associated computations
- industry standards
- limitations of equipment
- organisational policies and guidelines, such as OHS guidelines
- planning and control processes
- road alignment design or stormwater system and associated computations
- safe work practices
- surveying computation skills (high level)
- surveying reference systems
- surveying data capture and data set out methodologies.

Evidence Guide

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the Assessment Guidelines for this Training Package.

Overview of assessment

This unit of competency could be assessed on its own or in combination with other units relevant to the job function, for example units CPPSIS5016A Design a stormwater system, CPPSIS5018A Conduct an engineering survey, CPPSIS19A Conduct an engineering

surveying project, and CPPSIS5027A Carry out a precision survey.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of:

- matching objectives with resources to ensure the design of a road or railway proceeds in an organised and timely manner
- ensuring that achievement of required accuracy has been attempted by:
 - accessing and interpreting design information to identify the components to be measured and monitored
 - applying solutions to a range of problems
 - documenting and reporting
 - organising and prioritising activity
 - performing measurements
 - planning resources
 - reducing and manipulating survey data
- ensuring that non-conformity aspects are recorded and reported
- taking responsibility for own outputs in work and learning.

Specific resources for assessment

Resource implications for assessment include access to:

- assessment instruments, including personal planner and assessment record book
- assignment instructions, work plans and schedules, policy documents and duty statements
- registered training provider of assessment services
- relevant guidelines, regulations and codes of practice
- suitable venue and equipment.

Access must be provided to appropriate learning and assessment support when required.

Where applicable, physical resources should include equipment modified for people with disabilities.

Context of assessment

Holistic: based on the performance criteria, evidence guide, range statement, and required skills and knowledge.

Method of assessment

Demonstrated over a period of time and observed by the assessor (or assessment team working together to conduct the assessment).

Demonstrated competency in a range of situations, that

may include customer/workplace interruptions and involvement in related activities normally experienced in the workplace.

Obtained by observing activities in the field and reviewing induction information. If this is not practicable, observation in realistic simulated environments may be substituted.

Guidance information for assessment

Assessment requires that the clients' objectives and industry expectations are met. If the clients' objectives are narrowly defined or not representative of industry needs, it may be necessary to refer to portfolio case studies of a variety of spatial information services requirements to assess competency.

Oral questioning or written assessment and hypothetical situations (scenarios) may be used to assess underpinning knowledge (in assessment situations where the candidate is offered a preference between oral questioning or written assessment, questions are to be identical).

Supplementary evidence may be obtained from relevant authenticated correspondence from existing supervisors, team leaders or specialist training staff.

All practical demonstration must adhere to the safety and environmental regulations relevant to each State or Territory.

Where assessment is for the purpose of recognition (recognition of current competencies [RCC] or recognition of prior learning [RPL]), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time.

In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge.

Assessment processes will be appropriate to the language and literacy levels of the candidate and any cultural issues that may affect responses to the questions, and will reflect the requirements of the competency and the work being performed.

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 in the performance criteria is detailed below. Add any 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.

Organisational guidelines may include:

- appropriate timelines
- code of ethics
- company policy
- final product formats
- formal design parameters
- legislation relevant to the work or service function
- manuals
- OHS policies and procedures
- personnel practices and guidelines outlining teamwork, work roles and responsibilities
- requirements for data processing.

Manufacturer specifications may include:

- equipment specifications
- operator manuals.

Objectives may include:

- agreed client requirements
- written survey specifications.

Principal work activities may include the survey design of:

- railway construction
- road construction.

Constraints may include:

- coverage
- datum
- environmental factors
- industry requirements
- legal and statutory
- financial
- resource availability
- time.

Client requirements refer to description of outputs and may be contained in:

- contracts
- memos
- tender briefs
- verbal instructions
- written instructions.

- Relevant personnel*** may include:
- colleagues
 - registered surveyors
 - site personnel
 - staff or employee representatives
 - supervisors or line managers
 - suppliers
 - users.
- Techniques*** may include:
- field
 - office procedures.
- Road or railway type*** may include:
- expressways
 - motorways
 - pavement width and type
 - relation to speed
 - requirement of:
 - overtaking distance on straights and curves
 - stopping distance
 - sight distance
 - road design:
 - berm
 - carriageway
 - chainage
 - crossfall
 - curve radii
 - grade
 - kerb and gutter
 - relation to speed sight distances
 - safety issues
 - super-elevation
 - table drain
 - rural
 - railway:
 - connection to existing
 - underground
 - urban.
- Appropriate calculations*** may include:
- calculations for a two lane rural road, which may include:
 - cross-sections
 - grades and levels on grades
 - grade intersections
 - high and low points and levels in cross-sections

- vertical curves, including levels and length
- calculations for an urban road, which may include cut and fill volumes
- calculation types, including:
 - graphical and mechanical (planimeter) methods
 - mathematical rules such as:
 - mid-ordinate
 - trapezoidal and offsets at regular and irregular intervals from traverse to irregular boundaries
 - radiation for irregular boundaries
 - volume from contours and spot heights
 - volume from cross-sections: mean area and end area using trapezoidal, prismoidal and Simpson's rules
 - volume of regular objects such as cone, cylinder, pyramid, wedge, frustum and sphen.

Design type may include:

- design details:
 - digital information
 - hard copy plans
 - maps
 - written instructions
- railway
- rural road
- urban road.

OHS may include:

- Australian standards
- development of site safety plan
- identification of potential hazards
- inspection of work sites
- training staff in OHS requirements
- use of personal protective clothing
- use of safety equipment and signage.

Legislative requirements may include:

- Australian standards
- award and enterprise agreements
- certification requirements
- codes of practice
- equal employment opportunity (EEO)
- quality assurance requirements.

Legal and statutory standards may include:

- local government requirements
- national standards
- state statutes and regulations.

Surveying data components

- depth

may include:

- dimension
- direction
- flow rates
- position
- slope.

Clients may include:

- customers with routine or special requests
- external to organisation
- internal to organisation
- regular and new customers, including:
 - members of the public
 - business enterprises
 - government agencies
 - suppliers.

Documentation may include:

- electronic or paper-based correspondence with client
- field records
- final report
- records of conversation
- survey plots
- organisational work activity sheets.

Unit Sector(s)

Unit sector

Spatial information services