



Australian Government

CPPSIS5065 Design basic engineering structures

Release: 1

CPPSIS5065 Design basic engineering structures

Modification History

Release 1.

New unit of competency.

This version first released with CPP Property Services Training Package Version 3.

Application

This unit of competency specifies the outcomes required to design and create drawings for basic engineering structures. Basic engineering structures refer to small scale designs for structures, such as rural or urban roads, railway, and sewer and stormwater drainage lines. The unit covers interpreting plans and design standards and specifications, organising resources, and using surveying methods and equipment to conduct measurements and calculations and develop a design. The unit also covers preparing design documents and accompanying forms to gain engineering construction approval, and creating engineering drawings using design software functions and features. The unit requires the ability to perform calculations appropriate to the engineering structure, including volume relating to contours, spot heights and cross-sections. It also requires the ability to check and validate measurements against specifications and complete reports and documentation, including a schedule of quantities (SOQ). The unit requires knowledge of key design features of basic engineering structures.

The unit supports those who work under limited supervision in a surveying team.

No licensing, legislative, regulatory, or certification requirements apply to this unit of competency at the time of endorsement.

Pre-requisite Unit

Nil

Unit Sector

Surveying and spatial information services

Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the range of conditions.

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|--|--|
| 1. Organise resources for design work. | 1.1. Plans, maps, planning approvals, and design and drafting <i>specifications</i> are identified, accessed and analysed to define type of engineering structure, principal work |
|--|--|

- activities, and constraints.
- 1.2. Characteristics of operating environment and equipment and resource requirements are identified according to organisational requirements.
 - 1.3. Surveying equipment and tools are selected, calibrated and checked to ensure correct operation and functionality according to manufacturer specifications.
 - 1.4. Work is planned in consultation with **appropriate persons** to meet safety requirements, project specifications and timeframes.
2. Develop design of basic engineering structure.
- 2.1. Equipment is used to perform measurements and calculations according to **design type**, project specifications and organisational requirements.
 - 2.2. Design plan is developed based on calculations and according to project specifications.
 - 2.3. Natural surface terrain model is developed according to project specifications.
 - 2.4. Vertical alignment is designed according to project specifications.
 - 2.5. Plot design, natural surface cross-section and long section plots are designed according to project specifications.
 - 2.6. Measurements are checked to ensure correct size, plan position and reduced level according to plans and specifications, and problems are resolved or reported.
 - 2.7. Report is generated on set-out information and existing plans are edited according to organisational requirements.
3. Create engineering drawings.
- 3.1. Hardware and software systems are set up and used according to organisational requirements.
 - 3.2. Drawing menus and drawing defaults are customised to suit project specifications according to organisational requirements.

- 3.3. Drawings for basic engineering structure are created using available software ***drawing functions and features*** to meet project specifications.
 - 3.4. Drawing entities are linked to database attributes to suit project specifications.
 - 3.5. Supplementary data is extracted from existing engineering drawings to meet project specifications.
 - 3.6. Detailed views are created using various scales to meet project specifications.
 - 3.7. Plots are produced at required scale to meet project specifications.
 - 3.8. Files are saved in various formats according to organisational requirements.
 - 3.9. Entities are produced from drawing files or database and listed in required format to meet project specifications.
4. Finalise drawings of structure.
 - 4.1. Drawings and SOQ are finalised and checked for compliance with project specifications and organisational requirements.
 - 4.2. Appropriate persons are notified of results according to organisational requirements.
 - 4.3. Documentation is completed and spatial data archived according to organisational requirements.

Foundation Skills

This section describes the language, literacy, numeracy and employment skills essential to performance in this unit but not explicit in the performance criteria.

Skill

Initiative and enterprise skills to:

Performance feature

- translate specifications into design.

- Planning and organising skills to:
- prioritise work to meet project timeframes.
- Numeracy skills to:
- apply understanding of height, depth, dimension and position to actual operational activity and virtual representation
 - perform surveying calculations relating to height, distances, slope, angles and coordinates
 - reduce surveying data to required levels.
- Oral communication skills to:
- ask questions to clarify design requirements.
- Reading skills to:
- interpret graphical information in plans, drawings and maps
 - interpret technical drawing standards.
- Writing skills to:
- record field notes in a format that can be interpreted by a third party.
- Technology skills to:
- connect surveying equipment to coordinate systems
 - load spatial data into software applications.
- Problem-solving skills to:
- identify non-conforming aspects of design.

Range of Conditions

This section specifies work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included. Bold italicised wording, if used in the performance criteria, is detailed below.

- Specifications*** must include at least one of the following:
- industry-accepted standards and specifications
 - local government design standards and specifications
 - state government design standards and specifications.

Appropriate persons must include at least one of the following:

- client
- colleague
- engineer
- registered or qualified surveyor
- manager.

Design type must include at least one of the following:

- railway
- rural road
- sewer line
- stormwater drainage line
- urban road
- other basic engineering structure.

Drawing functions and features must include at least eight of the following:

- batters
- chainages
- dimensions
- drawing features, such as polylines and texts
- drawing functions
- edit functions
- horizontal and vertical alignments
- isometrics and perspectives
- longitudinal sections and cross sections
- macros
- methods for drawing lines
- plotting and printing
- plotting in two dimensions (2-D)
- super elevation
- using attributes to make project report
- using geospatial techniques
- vertical curves
- view displays
- volumes
- working with layers
- three-dimensional (3-D) techniques, including displaying 3-D views.

Unit Mapping Information

No equivalent unit.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=6f3f9672-30e8-4835-b348-205dfcf13d9b>

Assessment Requirements for CPPSIS5065 Design basic engineering structures

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Performance Evidence

A person demonstrating competency in this unit must satisfy the requirements of the elements, performance criteria, foundation skills and range of conditions of this unit. The person must also prepare a design and drawings for two projects using a basic engineering structure from one of the following categories:

- railway
- rural road
- urban road
- sewer line
- stormwater drainage line
- other basic engineering structure.

While designing the above basic engineering structures and creating related drawings, the person must:

- communicate clearly with others to clarify and report project information
- comply with organisational and legislative requirements for:
 - identifying hazards and working safely, using personal protective equipment (PPE)
 - recording, storing and filing data
 - reporting and completing documentation
 - setting up and using surveying equipment
- comply with manufacturer specifications when calibrating and using equipment
- create designs for basic engineering structures which include:
 - construction layout
 - cul de sac design
 - kerb returns
 - long section plots
 - natural surface cross-section
 - natural surface terrain model
 - plot design
 - vertical alignment design

- create drawings that comply with design requirements, including:
 - data extracted from existing engineering drawings
 - drawing entities that are linked to database attributes
 - producing drawings, views and plots at required scale
- create, extract and output information from engineering plans
- organise resources and equipment appropriate to perform required work tasks
- perform advanced data reduction techniques to reduce and manipulate surveying data
- perform calculations appropriate to the type of engineering structure within industry-accepted tolerances for accuracy
- plan work tasks by checking plans, drawings, maps and specifications
- prepare the drawing environment by setting up the hardware and software system, drawing defaults and customising menus
- measure components and design specifications within industry-accepted tolerances for accuracy and using two of the following pieces of equipment:
 - hand-held laser measuring device
 - global navigation satellite system (GNSS)
 - level
 - total station
- save drawing files in a range of formats relating to the design software, including one of the following:
 - data exchange format (DXF)
 - format used in triangulation process to define position of points and triangles (PTS)
 - Excel spreadsheet format (XLS)
- use a broad range of software features and functions to produce engineering drawings.

Knowledge Evidence

A person demonstrating competency in this unit must demonstrate knowledge of:

- calculations relating to the design of basic roads, including:
 - cross-sections
 - cut and fill volumes
 - grades and levels of grades
 - grade intersections
 - vertical curves, including levels and length
- drawing software display principles, including:
 - colour
 - composition
 - font type
 - legends
 - media
 - scale

- size
- text and line style
- industry drawing standards, data formats, and precision and accuracy requirements for preparing engineering drawings using software
- key design considerations for the basic engineering structures specified in the performance evidence
- methods for calculating volume relating to:
 - contours and spot heights
 - cross-sections: mean area and end area using trapezoidal, prismoidal and Simpson's rules
- methods for calculating surveying data and verifying its accuracy
- methods for setting up, levelling and calibrating equipment
- reference and coordinate systems for surveying data, including Australian Height Datum and Map Grid of Australia
- standard construction and engineering plan design and presentation conventions.

Assessment Conditions

The following must be present and available to learners during assessment activities:

- equipment:
 - as specified in the performance evidence, including PPE
- specifications:
 - job specifications, drawings, maps and related engineering plans
 - organisational policies, procedures and documentation relating to work health and safety
- physical conditions:
 - access to equipped work station
- relationships with team members and supervisor:
 - working in a team.

Timeframe:

- as specified by project requirements.

Assessor requirements

As a minimum, assessors must satisfy the assessor requirements in the Standards for Registered Training Organisations (RTOs) current at the time of assessment.

Links

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