

**Draft 0.1**

This is a draft update to CPPSIS5065 Design basic engineering structures:  
<https://training.gov.au/Training/Details/CPPSIS5065>

Changed PCs to active voice.

Changed 'person' to 'candidate' in PE.

Range of Conditions (below) has not been added to this unit.

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 of Competency

### CPPSUR5065 Design basic engineering structures

#### Modification history

Release	Comments
1	New unit of competency. This version first released with CPP Property Services Training Package Version 3

#### Application

This unit specifies the skills and knowledge 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 publication.

#### Prerequisite Unit

None

#### Unit Sector

Surveying and spatial information services

#### Elements and Performance Criteria

1. Organise resources for design work.	1.1. Identify, access and analyse plans, maps, planning approvals, and design and drafting specifications to define type of engineering structure, principal work activities and constraints. 1.2. Identify characteristics of operating environment and equipment and resource requirements according to organisational requirements. 1.3. Select, calibrate and check surveying equipment and tools to ensure correct operation and functionality according to manufacturer specifications. 1.4. Plan work in consultation with appropriate persons to meet safety requirements, project specifications and timeframes.
2. Develop design of basic engineering structure.	2.1. Use equipment to perform measurements and calculations according to design type, project specifications and organisational requirements.

	<p>2.2. Develop design plan based on calculations and according to project specifications.</p> <p>2.3. Develop natural surface terrain model according to project specifications.</p> <p>2.4. Design vertical alignment according to project specifications.</p> <p>2.5. Design plot design, natural surface cross-section and long section plots according to project specifications.</p> <p>2.6. Check measurements to ensure correct size, plan position and reduced level according to plans and specifications and resolve or report problems.</p> <p>2.7. Generate report on set-out information and edit existing plans according to organisational requirements.</p>
3. Create engineering drawings.	<p>3.1. Set up and use hardware and software systems according to organisational requirements.</p> <p>3.2. Customise drawing menus and drawing defaults to suit project specifications according to organisational requirements.</p> <p>3.3. Create drawings for basic engineering structure using available software drawing functions and features to meet project specifications.</p> <p>3.4. Link drawing entities to database attributes to suit project specifications.</p> <p>3.5. Extract supplementary data from existing engineering drawings to meet project specifications.</p> <p>3.6. Create detailed views using various scales to meet project specifications.</p> <p>3.7. Produce plots at required scale to meet project specifications.</p> <p>3.8. Save files in various formats according to organisational requirements.</p> <p>3.9. Produce entities from drawing files or database and listed in required format to meet project specifications.</p>
4. Finalise drawings of structure.	<p>4.1. Finalise and check drawings and SOQ for compliance with project specifications and organisational requirements.</p> <p>4.2. Notify appropriate persons of results according to organisational requirements.</p> <p>4.3. Complete and archive documentation and spatial data according to organisational requirements.</p>

### Foundation Skills

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

- initiative and enterprise skills to 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

### **Unit Mapping Information**

Supersedes and is equivalent to CPPSIS5065 Design basic engineering structures

### **Links**

Companion Volume Implementation Guide:

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

## Assessment Requirements for CPPSUR5065 Design basic engineering structures

### Modification history

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### Performance Evidence

To demonstrate competency, a candidate must meet the performance criteria of this unit by:

- preparing 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 candidate 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

To be competent in this unit, a candidate 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

Assessors must meet the requirements for assessors contained in the Standards for Registered Training Organisations.

Assessment must be conducted in the workplace or a simulated workplace using realistic conditions, materials, activities, responsibilities, procedures, safety requirements and environmental considerations.

Candidates must have access to:

- 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.

## Links

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