

RIICPL401D

APPLY THE PRINCIPLES FOR THE INSTALLATION OF UNDERGROUND SERVICE USING OPEN EXCAVATION

THEORY EXAM INSTRUCTIONS

- This exam will occur under standard assessment conditions.
 - An oral examination may be allowed under certain circumstances. Answers will be documented and FT003 (Oral examination declaration form) must be completed.
 - Participants must provide enough detail in their responses to demonstrate their knowledge and skills.
 - Please fill in the details below providing your name, signature and date of assessment.
 - Your signature acknowledges that this is your own work.
- If a participant initially answers a question incorrectly but modifies their response, they must follow the instructions below:
- If a participant changes their response in writing, they must put their initials next to the written change.
 - If a participant changes their response verbally, this must be noted on the exam paper by the assessor.

Participant name _____

Participant signature _____

Assessor name _____

Assessor signature _____

Date _____

Number of questions	Number of questions answered correctly	Satisfactory?	
		Yes	No
20			

1. List two (2) types of statutory compliance that is relevant to installing underground service using open excavation. (LG p11-25) Any of these or specific reference to state-based legislation applies
 - AS/NZS 3000:2007 – Wiring Rules
 - State based WHS Act & Regulations
 - State based (e.g. Qld) Electrical Safety Act
 - Code of Practice – Electricity transmission and distribution asset management
 - Safe Work Australia Guide – Working in the vicinity of overhead and underground electrical cables

2. Where, in your workplace, would you locate procedures relevant to the installation of underground service using open excavation? (LG p19) Candidate responses will be specific to their work environment and organisation. They should be able to provide information that alludes to the internal systems in place or site office filing systems

In the Technical or Engineering department you will find drawings and plans, and procedures may be stored on a central database or form part of a 'Job Pack' that may be sent to each Project.

3. Identify two (2) methods used to identify and locate other related underground services and utilities. (LG p13) Any two of these
 - Use the national Dial-before-you-dig service
 - Reference engineering drawings of the area that identify underground services
 - Use a locator device to identify any underground services such as radio frequency detectors, hum devices, transmitter –receivers or metal detectors

4. Identify two (2) engineering survey principles that relate to the installation of underground service using open excavation. (LG p25) Any two of these
 - Providing a Framework
 - Planning
 - Independent Checks
 - Safeguarding

5. In the space below, explain how environmental management principles impact on the task of installing underground service using open excavation. (LG p28) In their own words or copied from the Learner Guide, the responses below apply

Principle	Explanation
During Installation:	The civil works during this time can have considerable consequences for the environment. Trenches need to be excavated and access to the construction site has to be cleared for heavy machinery needed for cable transportation and trenching. Animals such as beetles, amphibians, reptiles and bats, as well as plants, such as ferns and seed plants, are particularly affected by the construction works. The construction may also cause soil compaction, which in turn can have considerable negative impacts on biodiversity.
Sensitive areas:	From an environmental point of view, wetlands, swamps and bogs should be avoided when planning underground cables as these habitats may suffer severe or even irreparable harm. Also, sensitive water flows and archaeological sites should factor into the route planning process.
Land use:	After the installation is done there are only minor limitations regarding land use. Agriculture and farming are generally possible on top of the cable trench. However, deep-rooting plants and vineyards have to be avoided to prevent the cables from damage.

6. Describe three (3) processes that are involved in developing a 'work plan'. (LG p29-30) Any three of these

Planning Process	Description
List the tasks to complete the job	Having a clear objective helps you make sure all tasks/steps are developed for the plan and that all the information and data needed can be included in the plan.
Develop a list of actions for each task	- Brainstorm a list of actions with others, if you can, and make sure you have someone else check your list as a way of ensuring you haven't missed anything. - When planning, you will achieve a better and more efficient outcome if you involve others who have knowledge and experience in the areas of work you are planning for.
Prepare a timeline/schedule	- Starting from the point of 'Now' and ending at 'Job Completed', build a timeline that includes dates for the completion of the tasks and actions you developed in your list. - It is important you get the sequence and timing right so that the job goes smoothly and achieves the timeframes required.
Allocate resources	- All resources need to be allocated to your plan, this includes: - Financial (e.g. budget) - Physical (e.g. plant & equipment) - Human (e.g. work crews with specific skill sets for the task) - If you don't have sufficient resources, you may need to consider contracting the resources you require. This will impact on your financial resources so careful planning is needed.
Identify possible problems	Make a list of all the things, you can think of, that could go wrong; then identify the causes and suitable actions to resolve them. This will be the start of your 'Issues Register' for the job. Over time, you may need to add more entries as the job progresses.
Develop strategies for monitoring progress	Make a list of ways in which the progress of the job can be monitored. These monitoring events should also be included on your timeline.
Assign tasks	- For each point you have on your timeline, ask: - Who will do that? - When will it be completed? - What needs to be achieved? - These questions will help you make sure the right information is provided to the right person or group when it comes time to assign tasks to your crew.
Estimate costs	- All costs have to be taken into account and if the funds are not available you will have to review the tasks and look for more cost effective and efficient ways of getting the job done. - Identify all of the materials needed for the job, where you will get them from, and when they need to be available for the job. This will also form part of your schedule of activities.
Implement the plan	- When you are happy with the plan and it includes all of the information needed for the job, to be completed safely, efficiently, and effectively, you need to make sure it is available to all involved in the project; e.g. Contractors via email, site inductions, pre-starts, work instructions, and access to site office documents

	• Work crews via site inductions, pre-starts, work instructions, and access to site office documents • Management receiving a copy of the plan and all of its updates, email, and the organisational records management system • Suppliers via email, purchase order, and phone calls • Councils or other governing bodies via receiving a copy of the plan and all of its updates
Continuously improve	• Through your monitoring you may need to update or make changes to the plan. Every time the plan is updated and/or changed you must ensure all stakeholders are made aware of what has changed and how it will impact them. • Also, you will need to complete a report at the end of the job; this is where you make recommendations for improvements, based on the outcomes of your plan and the job performance.

7. Describe two (2) estimating principles that are relevant to you in planning for the installation of underground service using open excavation. (LG p33) Any two of these

ESTIMATION PRINCIPLE	DESCRIPTION
What: Scope definition	• Equipment required • Layout • Material requirements • Engineering standards
How: Execution strategy	• Project organisation • Contracting requirements • Constraints
When: Schedule	• Delivery timeline and date • Escalation of costs • Currency conversions
Where: Location specifics	• Supply sources • Import regulations • Cost of local sourcing • Productivity • Engineering and approvals processes

8. Identify three (3) principles of leadership and how they apply to you in your role as a Supervisor in the installation of underground service using open excavation. (LG p38) In their own words or copied from the Learner Guide, any three of the responses below apply

Leadership Principle	Application in the workplace
Demonstrate Safety Leadership	Safety leadership involves communicating the importance of safety in all interactions with subordinates, subcontractors, suppliers and other project stakeholders throughout all processes within the life of the construction project.
Promote Design for Safety	Effective safety management at the design stage can minimise risks to the health and safety of people who subsequently construct, occupy and maintain a facility/ structure.
Communicate safety and project related information	Communication and consultation are essential to the management of safety and the overall project. Within construction projects, safety and project information should be exchanged between the different stakeholders. Open and honest dialogue regarding issues between the client, the designer and the constructor (including subcontractors) should be maintained throughout the life of the project. This may be verbal or non-verbal, formal or informal.
Manage risk	The systematic management of safety risks through the elimination or reduction of risks is a requisite for improved safety performance within the construction industry. At all stages in the project process decisions should be made on the basis of careful consideration of the safety implications of available options. Decisions made about project options, design of the permanent facility/ structure, design of the construction process, choice of plant, equipment, materials and construction methods, and project organisational arrangements should be made following an assessment of safety risks, using an appropriate and recognised risk assessment method
Continuously improve performance	Safety management should strive for continuous improvement by regularly reviewing safety performance, seeking feedback from project stakeholders, and using the lessons learned to improve performance and to share and promote best practices in the construction industry
Entrench safety practices	Expect safety to be the core of the culture in the workplace – safe working behaviours should be promoted and recognised as part of the operation.

9. List three (3) key factors that influence the selection of operational techniques when planning to install underground service using open excavation. (LG p39) any three of these or a similar response, that is based on the candidate's experience, and makes logical sense in its relationship to the responses below
 - The nature of the ground conditions – such as soil make up, drainage capability, and activity related to movement.
 - Proximity to other services
 - The tightness of the operating environment to be able to employ equipment of a particular size
 - The depth and length of the underground service installation
 - The type of installation – i.e. Culvert, pipe, conduit etc.
 - The type and energy level of the utility being installed – voltage level, fibre-optic cable etc.

10. List three (3) key factors that influence your selection of resources when planning to install underground service using open excavation. (LG p39) any three of these or a similar response, that is based on the candidate's experience, and makes logical sense in its relationship to the responses below
 - The type of utility – i.e. electrical, telecommunication, data, water etc.
 - The expected duration or life of product
 - The installation housing – concrete, poly pipe etc.
 - The availability of plant & equipment
 - The environment itself – high traffic, remote location, near water etc.
 - Access to qualified/skilled personnel

11. Explain the principle of scheduling tasks and activities. (LG p40) As a minimum, the candidate's response should list the 4 steps
 - Construction project scheduling has evolved into a powerful and complex management tool.
 - Planning establishes what, how, where and in what order work will be performed, while scheduling sets forth who and when. Construction planning is the development of a feasible operational design for completing the work. The process involves the selection of work sequence and methods, and provides information for the scheduling process.
 - Scheduling determines the timing and specific sequence of tasks necessary to carry out the plan. The schedule is a result of the planning process and reflects the selected plan. The steps to developing a schedule are:
 - Estimating the time required for each activity
 - Computing the time required for project completion
 - Establishing time intervals in which each activity must start and finish
 - Identifying the activities crucial to timely project completion

12. In your workplace, what are two (2) key things you must consider when scheduling the delivery of materials to site? (LG p40) any two of these
 - Tasks for the job,
 - Sequence of tasks to get the job done,
 - Relationship of the tasks to other site activities,
 - Deliveries and suppliers,
 - Access to site,
 - The risk assessments for the site and the specific job,
 - Timeframes for completion,
 - Availability of resources and equipment, and
 - Client/organisational requirements.

13. In the generalised list below, number each task in order of sequence for the installation of underground service using open excavation. (LG p40) Candidate responses must be in this order

1	Plan the work	4	Excavate the trench
8	Backfill the trench	10	Update service plans and drawings
5	Prepare and maintain batters	2	Check for any underground or overhead services
3	Prepare the work environment	6	Lay service piping & install services
7	Enclose with bedding materials	9	Clean up work area

14. List three (3) key aspects relevant to managing open excavation underground service installation.

(LG p47) any three of these or a similar response, that is based on the candidate's experience, and makes logical sense in its relationship to the responses below

- Permit to work in the area – may be related to the risk assessment, council by-laws, site requirements or corporate requirements
- Use the 'Dial-before-you-dig' service or utilise own locator systems to identify the location of any existing underground services so as to not elevate risk unnecessarily
- Use of equipment to dig the trench – such as Excavator, Auger or Drill
- The depth of the trench and it's need to be supported to prevent unplanned movement / inundation
- Public safety
- Where to locate the spoil dump

15. List five (5) daily tasks you conduct (as the Project Manager / Lead), when managing client and site operational requirements, in relation to the installation of underground service using open excavation. (LG p48) any five of these or a similar response, that is based on the candidate's experience, and makes logical sense in its relationship to the responses below

- Site inspection for hazards, damage or other issues of concern
- Inventory control to ensure no unexpected overuse of materials
- Authorising overtime
- Providing required explanations for the builders and other professionals associated with the project,
- Coordinating and collaborating with the architects, engineers, client and specialists.
- Pre-start meeting attendance
- Review of previous days reports, progress and incidents
- Maintain open communication with authorities and the client

16. From the list below, circle all areas of civil works that are related to the installation of underground service using open excavation. (LG p49) Candidate responses must be in this order

Environmental conservation	Road construction/maintenance
Infrastructure development	Pipeline construction
Bridge construction	Ship building
Commercial development	Industrial development
Rail construction	Systems development
Lifting and crange	Road transport

17. Identify two (2) places where you can locate information that relates to plant and equipment capabilities and operation. (LG p49-50) any two of these or a similar response, that is based on the candidate's experience, and makes logical sense in its relationship to the responses below

- The Project Plan should outline the suite of relevant information pertaining to pre-planning prior to work (including manning levels, equipment requirements, materials, contingency plans etc), the process of works (including drawings, plans, checklists, registers, forms etc) and post project works (including de-briefing record, budget reconciliation, SWOT analysis etc).
- The OEM that comes with the equipment/plant when purchased
- The organisation's records management system
- The manufacturer's representatives/trainers

18. Describe the process for maintaining plant, equipment, and tools. (LG p49-50) The candidate must identify the following in their response

- Plant and equipment is to be ***maintained in accordance with the Original Equipment Manufacturer (OEM) requirements, specifications and service schedule***, as well as some ***high risk plant requiring compliance checks*** at intervals by Engineer's and Regulators.
- Plant & Equipment is to be ***checked each time prior to operation*** for the first time of each shift, or when handed over to another operator – with any ***defects reported*** immediately for action and rectification as appropriate.

19. In your own words, explain three (3) terms that are commonly used in the installation of underground service using open excavation. (Glossary in the back of the LG) any three of these

TERMINOLOGY	DEFINITION
BACKFILL	To fill the earth, any remaining space after placing concrete, brickwork, timber, pipes etc in an excavation.
BATTER	The slope of a wall of buttress built at an inclination to the vertical plane.
BENCHMARK (BM)	A fixed point of reference, the elevation of which is known and referred to during levelling operations.
BRACE	A member, usually a diagonal, which resists lateral loads and/or movements of a structure

TERMINOLOGY	DEFINITION
CAST IN-SITU	Concrete cast or poured in its permanent position in prepared forms (eg concrete steps, hearth slabs, floors, beams, lintels)
COMPRESSIVE STRENGTH	Resistance of a material to a crushing force.
CONCRETE	Artificial rock of cement, sand and aggregate
CONTOUR LINE	A line drawn on a site plan joining points of the same elevation
CROSS BRACE	Any crosspiece which diverts, transmits, or resists the pressure of a load
CURING	Treatment of concrete or cement rendering to facilitate hardening
DATUM	A predetermined level on a site from which all other levels are established.
EXCAVATION	A hole made by removing earth
FOOTING	The construction whereby the weight of the structure is transferred from the base structure to the foundation
FORMS	Prepared forms of timber or other material for the casting of concrete
FOUNDATION	The ground upon which the footings of a building are constructed.
GROUND LINE	The ground level or natural grade line
GROUND PLAN (FLOOR)	Plan view of a horizontal section of a building showing the layout of rooms on the ground floor
HOIST	Any device or machine used in building for lifting materials.
IDENTIFICATION SURVEY	A survey which indicates whether a building is erected on the correct allotment and does not encroach on any of the side boundaries
LEVELLING INSTRUMENT	Device consisting of a spirit level attached to a sighting tube and the whole mounted on a tripod and used for levelling a surface to a horizontal plane (eg dumpy level).
LIVE LOAD	The load arising from the intended use or purpose of the building or structure, but excluding wind, snow and earthquake loads.
PRE-CAST	Poured or cast in any place other than its ultimate position
PVC (POLYVINYL CHLORIDE)	A widely used plastic - the main uses include water pipes, waste pipes and floor covering.
REINFORCED CONCRETE CONSTRUCTION	Building construction in which the principal structural members are made of concrete which is poured around isolated steel bars, or steel meshwork, in such a way that the two materials act together.
SERVICES	Supply or distribution pipes for cold or hot water, steam or gas; also power cables, telephone cables, lift machinery, transformers, drains, ventilation ducts, and so on.
SOIL TEST	A core of earth taken from specific positions on a building site to test and select the type of footing needed.
TRENCH	In joinery, a groove. In drainage and plumbing, the excavation in which pipes are laid. In foundations, the excavation in which footings are placed.

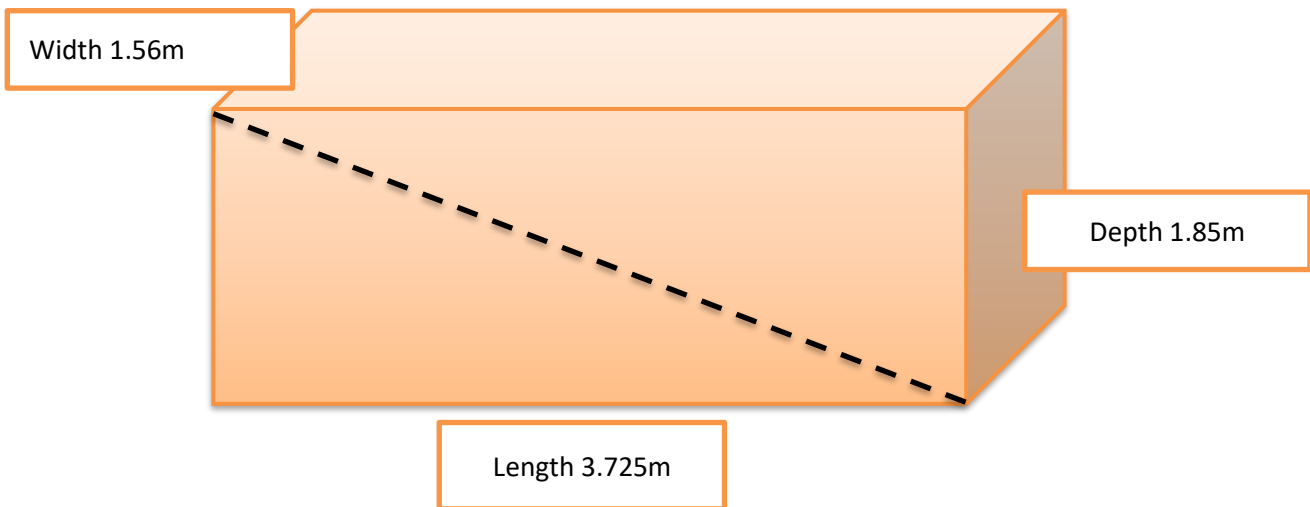
20. Calculate the following:

- What is the total volume of the shape below? **10.75035 cubic m ($V = L \times W \times D$)**
- What is the surface area of the shape below? **5.811 square m ($A = L \times W$)**
- In the shape below, calculate the percent grade of the dotted line. What is the total grade amount?

(Rise $\div$ Run $\times$ 100)

$1.850 \div 3.725 = 0.4966$

$0.4966 \times 100 = 49.66\%$ grade



- You need an excavator for 3 days and have been asked to make sure there is enough diesel to last the whole 3 days. The excavator uses 15 litres per hour and will be operating for approximately 6 hours per day. The company buys its diesel at cost (\$1.10 p/l) and it has a policy that requires all orders include a contingency of 10%.
 - What is the total consumption of diesel for the 3 days? **270 Litres**
 - How much diesel will you need to order? **297 Litres**
 - What is the total cost of your order? **\$326.70**