

9209-447

Level 4 Diploma in Civil Engineering

Civil engineering construction techniques

Sample questions and answers

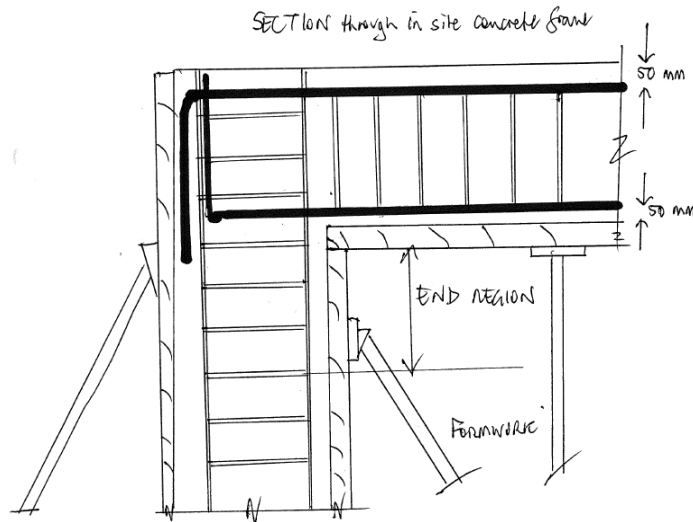
You should have the following for this assessment

- A pen with blue or black ink
- A ruler
- A non-programmable scientific calculator

The purpose of these sample questions is to provide examples of the type of question that will be set, giving an indication of the breadth and depth of knowledge that is expected. It should be noted that these are sample questions and **not** a full sample question paper.

- 1 a) Describe what is meant by the term 'cut and fill' as used in earthworks.
- a) In earthworks, cut and fill is the process of constructing roads etc where the amount of material cut matches the amount needed for fill (1) so reducing the amount of work required.
- b) Differentiate between a 'sidehill cut' and a 'through' cut.
- b) A sidehill cut allows a passage or route around a hill (1), where the slope is transverse to the roadway. Materials can be cut on the high side and used to build up the low side. A through cut has adjacent grades that are higher on both sides of route. All cut material must be removed from the area because there is nowhere for it on the route.
- 2 Describe **two** methods used to provide permanent control of groundwater, by means of physical barriers.
- 2 Two methods from
- Thin grouted membranes – permanent curtain walls or barriers inserted into the ground to enclose the excavation area. Suitable for silts and sands but must be supported by earth on both sides.
 - Contiguous piling – permanent structural wall of interlocking bored piles with alternate, interlocking, bored and cast piles. Suitable for most types of subsoil, economical, with minimal vibration and noise.
 - Diaphragm walls – Structural concrete walls, either cast in situ or precast (1). Expensive but suitable for most soils and can be inserted close to existing buildings.
- 3 a) Compare graders and bulldozers in terms of their uses.
- a) Graders are used to finish or 'grade' the upper surface of the earth in a large area usually as a follow-up operation to scraping or bulldozing. They produce a fine and accurate finish but lack the power of a bulldozer. Bulldozers are powerful machines that can act as a pusher to scrapers, dig shallow excavations (up to 300 mm) and/or clear trees using the raised mould blade.
- b) Explain good health and safety practices for working with excavators.
- b) Keep people away from excavator operations with bunting or fencing. Use plant with minimal tail-swing and 0.5 m clearance from obstructions. Use excavators with high all-round driver visibility. Employ the services of a signaller or banksman. Check bucket attachment – especially 'quick hitches'. Comply with all risk assessments & method statements Correct Personal Protective Equipment (PPE)
- 4 a) Describe the techniques used to construct a culvert to form a path across a stream.
- a) Excavate a trench of sufficient width and depth across the path. Allow for depth of backfill above the pipe to be 50-100% of the pipe's diameter, with a minimum cover of 150 mm. Angle bottom of trench to provide the required fall. Position and align pipe on bedding material, maintaining fall. Lay, level and compact bedding material and top up with compacted backfill.

- b) Describe the resources needed to construct the culvert.
 - b) Multiple-purpose excavator (for trench); dumper (for pipe and equipment); lorry (for backfill); cement/concrete mixer; theodolites, levels, optical plumbing instruments, ranging rods, pegs, profiles (for setting out trench and fall).
- 5 Explain the factors that affect the design of foundations in terms of the following:
- a) Nature of the soil to be built on.
 - a) Unit weight – the cumulative weight of the solid particles, water and air in the material per unit volume.
 - Porosity – the ratio of the volume of voids in a soil to the total volume.
 - Permeability – the ability of water to flow through the soil.
 - Compressibility – the rate of change of volume with effective stress.
 - Shear strength – the shear stress that will cause shear failure.
 - Atterberg Limits – liquid, plastic and shrinkage limits.
 - b) Depth of the water table.
 - b) The height of the water table has a significant effect on the bearing capacity of soil. If the water table is at a depth less than the width of the foundation from the foundation bottom this will reduce the bearing capacity of the soil which will mean wider and deeper foundations.
- 6
- a) Describe the plant and equipment required to erect a steel-frame on existing concrete foundations.
 - a) Mobile cranes or tower cranes will be needed to lift steel structural members into place. Surveying equipment is required to line, level and plumb structural steel members. Wedges, jacks and pull-lifts will be needed to move the members into the desired position, line and level. Spanners and grips are needed to secure bolted connections. Site welding equipment will be needed to form welded connections.
 - b) Provide an annotated sketch of a vertical section through a concrete framed building showing a junction between a beam and a column, including all shuttering and reinforcement.
 - b) Sketch showing reinforcement, shuttering, dimensions and cover (example below):



- c) Identify **four** items of construction plant or equipment used to construct a concrete framed building
- c) Four items from
Concrete mixer, concrete skip, crane, carpentry equipment (for shuttering), cutters, scaffolding any other suitable plant
- 7 A new soakaway is to be constructed beside a live open road.
- a) Describe the main features of the soakaway and the resources required to construct it.
- a) A soakaway is a large hole in the ground to allow controlled percolation of rainwater in the ground. It's filled with granular material, should be at least 5m from the road it's draining, and ground should be level to discourage runoff. Constructed with digger / tipper.
- b) Describe the construction of the soakaway.
- b) Hole dug alongside road.
Excavated material removed offsite.
Hole lined with geotextile material
Filled with granulated material.
- c) Identify health & safety control measures used for safe construction of the soakaway.
- c) considerations during construction:
Separation barrier
Traffic management
Signage
PPE
Banks person
Good housekeeping
Lighting
Temporary restraint of the sides of the hole