

Design of Irrigation Structures (I)

- All sketches should be clear, neat and well proportioned
- Any missing data may be reasonably assumed

QUESTION (1)

(27 mark)

It is required to design the culvert proposed to pass the canal under the roadway according to the following data:-

CANAL

- Bed level = (10.00),
- Berm level = (13.50),
- H.W.L = (12.70),
- Max discharge = $10.30 \text{ m}^3/\text{sec}$,
- sides slopes are 1:1 and 3:2
- Bed width = 4.50 m
- Bank level = (14.25)
- L.W.L = (12.30)
- Min discharge = $8.0 \text{ m}^3/\text{sec}$

ROAD

- Road width = 8.0 m,
- Road side slopes = 3:2

CULVERT

- Use R.C box-type section,
- Allowable heading up = 10.0 cm

SOIL

- Dry unite weight = 1.80 t/m^3
- Angle of internal friction = 30°

Requirements

1. Find the dimensions of culvert and check of heading up (8 mark)
2. Find the different loads action on the culvert for possible cases of loading, using lorry 20t. (12 mark)
3. Draw to scale P.H.E.R (Plan Half Earth Remove). (7 mark)

QUESTION (2)

(25 mark)

Design a gravity retaining wall for a road according to the following requirements;

- 1- Height of the wall is 3.0 ms
- 2- Angle of repose is 30°
- 3- Live load is 1.0 t/m^2
- 4- Bearing capacity of soil is 15 t/m^2
- 5- Unit weight of dry soil 1.80 t/m^3 and for saturated soil = 2.1 t/m^3
- 6- The groundwater level 1.0m under ground surface.

QUESTION (3)

(use net sketch in your answers)

(25 mark)

- 1) What are the advantages and disadvantages of using R.S.J.B.? (4 mark)
- 2) Give the empirical dimensions of all elements of the Arch Bridge. (6 mark)
- 3) Show how we can design Screw Piles of the R.S.J. Bridge. (5 mark)
- 4) Mention the types of R.C. Bridge constructed on the small canals. (6 mark)
- 5) What are the factors affect the head loss of syphon? (4 mark)

QUESTION (4)**(25 mark)**

- A)** State with neat sketches types of escapes and their functions. **(5 mark)**
- B)** At the end of canal, a Tail Escape is required to be constructed to escape the excess water from the canal to a branch drain provided that the water level in the canal does not exceed 20 cm. Following data are available.

	<u>Canal</u>	<u>Drain</u>
Bed width	3.0 m	4.0 m
Bed level	(10.00) m	(6.50) m
High water level	(12.00) m	(9.00) m
Berm level	(12.50) m	(11.50) m
Bank level	(13.00) m	(13.00) m
Bank width	8.0 m	8.0 m
Side slopes	1:1	3:2
Water surface slope	8.0 cm / Km	10.0 cm / Km

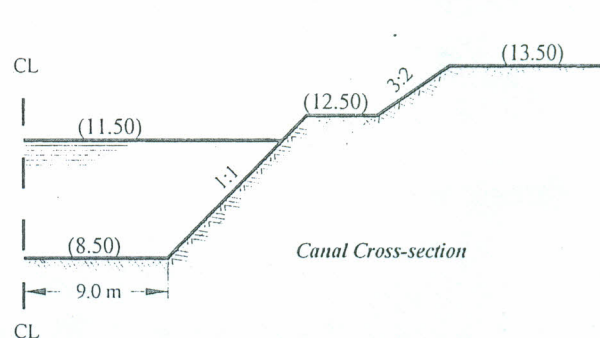
- Design the well and the orifice pipe and *show how* to design the drainage pipe.
(Length of last reach = 3.0 Km) **(12 mark)**
- Draw fully dimensioned sketches for Sectional Elevation of the structure. **(8 mark)**

QUESTION (5)**(23 mark)**

At the intersection of the roadway with a canal, a reinforced concrete bridge is to be constructed of 2 vents 7.5 ms each clear span. The canal cross section is shown in the figure.

The following data are available:

- Road width over bridge = 6.00ms.
- Water velocity in the canal = 0.70 m/sec
- Live load consists of a 20 tons lorry and uniform load of 600 kg/m²



It is required to:

- Calculate the heading up caused by the structure. **(4 mark)**
- Calculate B.M used for design of the slab and girder. **(13 mark)**
- Draw Sectional Elevation of the R.C. Bridge. **(6 mark)**

With Best Wishes

Time Allowed 2:00 hrs.

1. What are the factors which affecting the soil bearing capacity
10%
2. State using clear sketches the different types of shallow foundations and mention their application.
10%
3. A silo, 60.00 m by 25.00 m in plan, is to be constructed on a slab foundation 4.00 m below ground level in a uniform clay deposit with an average undrained shearing strength of 80.00 kN/m². The clay has saturated density of 19.00 kN/m³ and the water table, although normally at 1.00 m below the ground surface, may rise to 2.00 m above it in times of flooding. Determine the maximum uniform vertical load which the silo may carry, assuming the dead weight of the complete structure to be 210×10^3 kN. Allow for soil adhesion on walls of the silo of 30.00 kN/m². What is the effect on the factor of safety of the rise of the water level?
10%
4. Fig.1 shows the dimensions of an existing isolated footing made to support a column of skeleton type building. The load exerted on the column per floor is 15.00 tons. Determine the maximum number of floors for this building such that the maximum stress beneath the footing does not exceed the permissible limit. Make complete design and draw neat sketches for this footing. The net allowable bearing capacity of the supporting soil is 1.50 kg/cm² at the foundation level.
25%
5. What is your foundation recommendations and choose the most suitable type of foundation for the following structures to be constructed on the soil conditions given in the borehole log shown in Fig.2.
 - A two storey labor house of bearing wall type.
 - An 18 story office building25%
6. For the trial slip surface shown in Fig.3, determine the overall factor of safety against slope failure.
20%

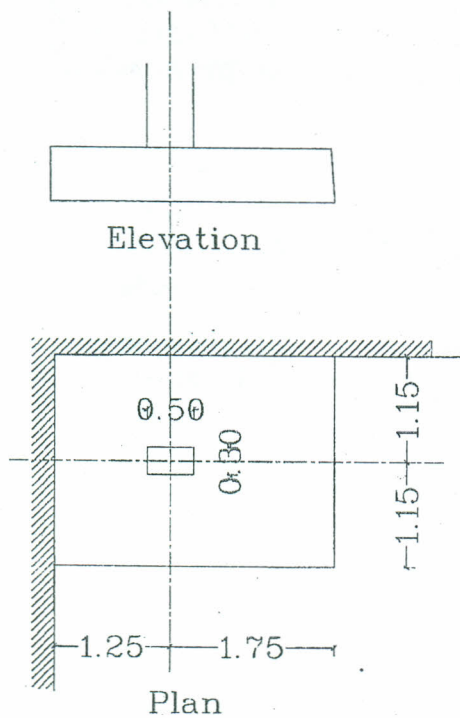


Fig.1

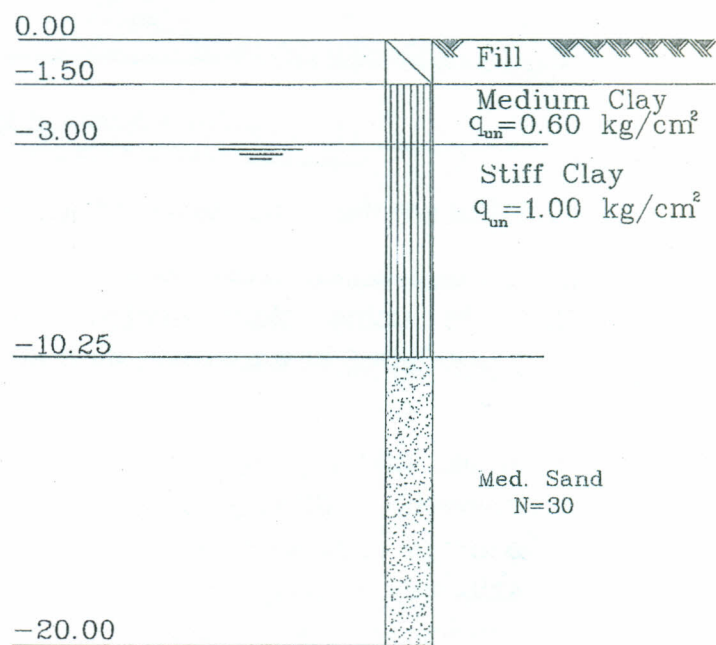


Fig.2

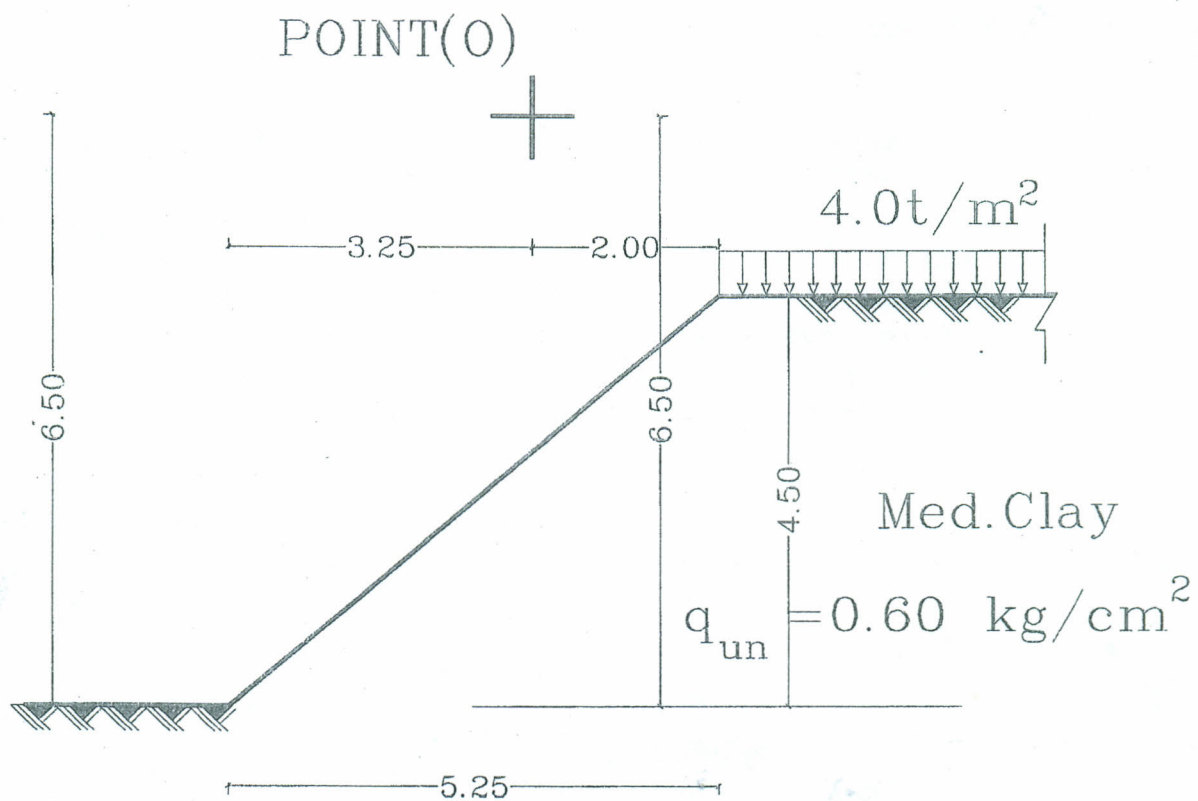


Fig.3