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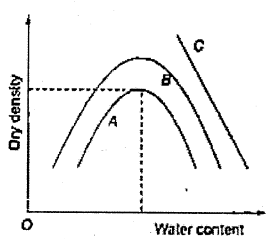
CHAPTER

Soil Compaction

Q.1 Given below are methods of compaction:
1. Vibration technique
2. Flooding the soil
3. Sheep foot roller
4. Tandem roller
5. Heavy weights dropped from a height

The methods suitable for cohesionless soils include:
(a) 1, 2 and 3 (b) 2, 3 and 4
(c) 1, 2 and 5 (d) 3, 4 and 5

Q.2 The standard compaction curve obtained from a laboratory test is shown in the figure



The curve B at the same soil can be obtained if:
(a) compactive effort decreased
(b) moisture content is reduced with same compactive effort
(c) moisture content is increased with same compactive effort
(d) compactive effort is increased

Q.3 Consider the following methods:
1. Core-cuter method
2. Sand replacement method
3. Proctor's needle method
4. Field vane shear method

Which of these methods enable control of field compaction?
(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 1, 3 and 4 (d) 2, 3 and 4

Q.4 Match Column-I (cause) with Column-II (effect) and select the correct answer using the code given below the lists:

	Column-I		Column-II
A.	Tamping	1.	Shearing
B.	Consolidation	2.	Piping
C.	Triaxial	3.	Expulsion of air
D.	Seepage	4.	Reduction in water

	A	B	C	D
(a)	2	4	1	3
(b)	3	1	4	2
(c)	2	1	4	3
(d)	3	4	1	2

Q.5 Pneumatic-tyred rollers are useful for compacting
(a) cohesive soil
(b) cohesionless soils
(c) both (a) and (b)
(d) soils in confined space

Q.6 With increase in compaction energy in compaction tests
(a) γ_{dmax} and OMC both increase
(b) γ_{dmax} decreases and OMC increases
(c) γ_{dmax} increases and OMC decreases
(d) γ_{dmax} and OMC remain constant

Q.7 Consider the following statements:
I. Sheep foot rollers are considered most suitable for compacting clayey soils.
II. Clays compacted at dry-of-optimum undergoes compression more rapidly.

III. Clays compacted on the dry side of optimum are characterized by larger strength.
IV. Clays compacted on the wet side of optimum reduces permeability.

Which of the above statements are CORRECT?

(a) I, II, III and IV (b) I, II and III
(c) II, III and IV (d) I, II and IV

Q.8 **Assertion (A):** Optimum moisture content obtained from Proctor's compaction test represents the water content at which soil is fully saturated.

Reason (R): Presence of water facilitates rearrangement of soil grains under given compactive effort, thereby reducing the voids in between the soil grains.

(a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Q.9 Match List-I (Roller type) with List-II (Soil type) and select the correct answer using the codes given below the lists:

List-I
A. Pneumatic roller
B. Smooth wheeled roller
C. Sheep foot roller
D. Vibratory roller

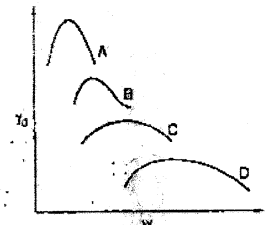
List-II
1. Granular soils
2. Plastic soils of moderate cohesion
3. Cohesionless soils
4. Silty soils of low plasticity

Codes:

	A	B	C	D
(a)	4	2	1	3
(b)	3	1	2	4
(c)	4	1	2	3
(d)	3	2	1	4

Q.10 The zero-air voids curve is non-linear owing to
(a) the standard proctor test data of dry density and corresponding water content plotting as a non-linear curve
(b) the dry density at 100% saturation being a non-linear function of the void ratio
(c) the water content altering during compaction
(d) the soil being compacted with an odd number of below

Q.11 The result (curves *A*, *B*, *C* and *D*) of four compaction tests on different soils are shown in figure below:



Compaction Tests:
1. Silty sand, modified test
2. Silty sand, standard test
3. Fat clay, modified test
4. Fat clay, standard test

Curves *A*, *B*, *C* and *D* correspond respectively to tests

(a) 1, 3, 2 and 4 (b) 1, 2, 3 and 4
(c) 2, 1, 3 and 4 (d) 2, 1, 4 and 3

Q.12 Consider the following statements.
1. 'Relative compaction' is not the same as 'relative density'.
2. Vibro-flotation is not effective in the case of highly cohesive soils.
3. 'Zero air void line' and '100% saturation line' are not identical.

Which of these statement/s is/are correct?

(a) 1 and 2 (b) 1 and 3
(c) 2 and 3 (d) 3 alone

Q.13 The in-situ void ratio of a granular soil deposit is 0.5. The maximum and minimum void ratios of the soil were determined to be 0.75 and 0.4. Specific gravity G_s is 2.8. The relative compaction of the soil deposit is

(a) 66.67% (b) 75%
(c) 90% (d) 93.35%

Q.14 Compaction of an embankment is carried out in 500 mm thick layers. The rammer used for compaction has a foot area of 0.05 m^2 and the energy imparted in every drop of rammer is 400 Nm. Assuming 50% more energy in each pass over the compacted area due to overlap, the number of passes required to develop compactive energy equivalent to Indian Standard light compaction for each layer would be

(a) 10 (b) 16
(c) 20 (d) 26

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Answers Soil Compaction

1. (c) 2. (d) 3. (a) 4. (d) 5. (c) 6. (c) 7. (d) 8. (d) 9. (c) 10. (b)
11. (b) 12. (a) 13. (d) 14. (d)

Explanations Soil Compaction

13. (d)

$$R.C. = \frac{\gamma_{d(insitu)}}{\gamma_{d(max)}} \times 100$$

$$\gamma_{d(max)} = \frac{G_s \gamma_w}{1+e_{min}}$$

$$= \frac{2.8 \times 1}{1+0.4} = 2 gm/cc$$

$$\gamma_{d(insitu)} = \frac{2.8 \times 1}{1.5} = 1.87 gm/c$$

$$\therefore \quad R.C = \frac{1.87}{2} \times 100 = 93.35\%$$

14. (d)

Compactive energy as per IS light compaction test

$$= \frac{2.6(kgf) \times 0.310(m) \times 3(layers) \times 25}{10^{-3} \times 10^{-6} m^3}$$

$$= 60450 \, kgf/m^3 = 604500 \, Nm/m^3$$

Compactive energy per drop provided by rammer per m^3 of the soil

$$= \frac{400}{0.05 \times 500 \times 10^{-3}} = 16000$$

If n number of passes required to develop compactive energy equal to is light compaction.

$n \times 1.5 \times 16000 = 604500 = 25.19 \sim 26$

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