CE8591 FOUNDATION ENGINEERING

CIVIL - FIFTH SEMESTER

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION

TOPIC 1.1 SCOPE AND OBJECTIVES - METHODS OF EXPLORATION - AUGURING AND BORING

1. The depth of exploration for isolated spread footing is _____
a) $1\frac{1}{2}$ the width
b) $2\frac{1}{2}$ the width
c) $\frac{1}{2}$ the width
d) $\frac{1}{4}$ the width

Answer: a
Explanation: The depth of exploration for isolated spread footing is one and a half times the width. While the depth of exploration is twice the height from stream bed to crest for concrete dams.

2. In hand operated rings in 'auger and shell boring' the depth of which it can be used is _____
a) 40 m
b) 30 m
c) 25 m
d) 15 m

Answer: c
Explanation: The hand operated rings in 'auger and shell boring' are used for depths up to 25 m and the mechanised rings up to 50 m. In auger boring, hand augers are used for depths up to about 6 m.

3. Auger is suitable for _____
a) soft to stiff clays
b) very stiff clays
c) sandy soils
d) hard clays

Answer: a
Explanation: Auger boring is suitable for soft to stiff clays as the soil samples can be removed in a less disturbed manner preserving most of the natural structure of sample as compared to the wash boring.

4. In rotator boring _____ is forced down the hallow drillrods.
a) glycerine
b) water solution of bentonite
c) dextrin
d) phenyl

Answer: b
Explanation: In rotator boring, a drilling mud, usually a water solution of bentonite with or without other admixtures is continuously forced down the hollow drilling rods. The mud returning upwards bring the cuttings to the surface.

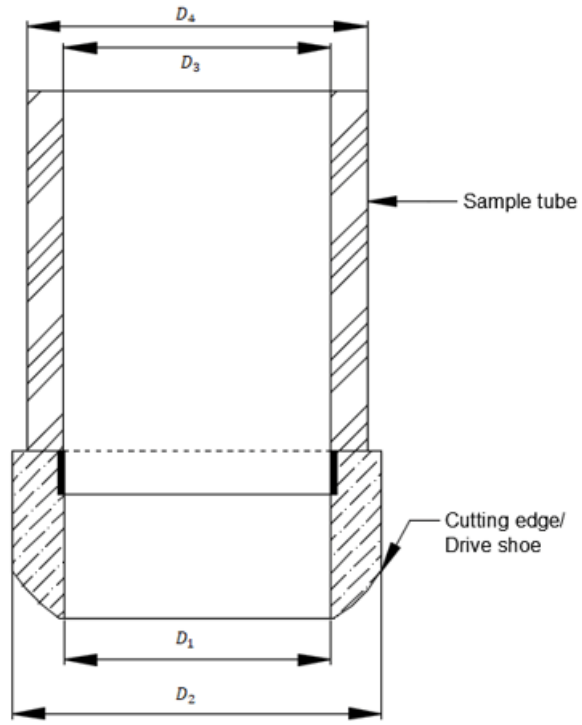
5. A _____ sample has preserved natural structure of soil.
a) undisturbed
b) disturbed
c) non-representative
d) remoulded

Answer: a
Explanation: The undisturbed sample of the soil is the one which has the natural structure in a preserved state which may be obtained by freezing the sand up to the required depth.

6. _____ sample has the natural structure of soil as modified.
a) undisturbed
b) disturbed
c) representative
d) non-remoulded

Answer: a
Explanation: The disturbed sample of the soil has the natural structure of soil as modified due to the disturbance caused while collecting the soil sample. It is usually obtained by pump and shells with trap valve.

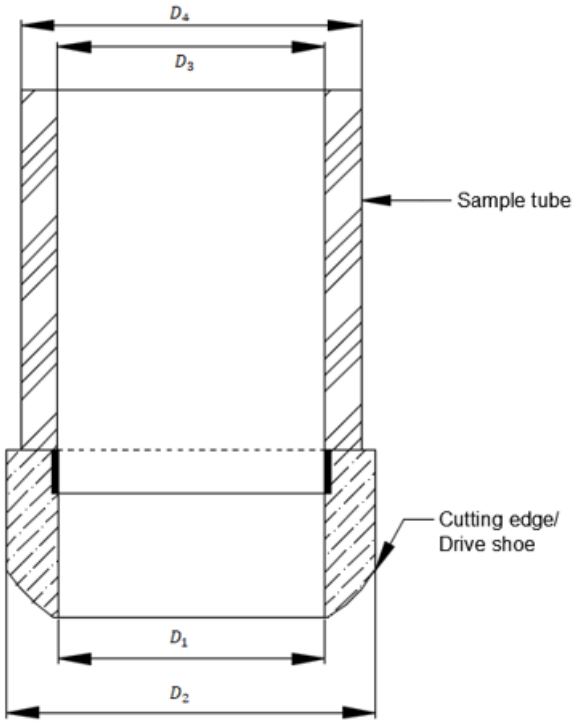
7. The area ratio of the sampler is
_____



a) $\frac{D_2^2-D_1^2}{D_1^2} \times 100$
b) $\frac{D_1^2-D_2^2}{D_1^2} \times 100$
c) $\frac{D_2^3+D_1^3}{D_1^2} \times 100$
d) $\frac{D_2^2-D_1^2}{2D_1^2} \times 100$

Answer: a
Explanation: The area ratio of the soil sampler is defined as the ratio of the volume of the soil sample displaced by the sampler tube in proportion to the volume of sample.
∴ Area ratio=$\frac{D_2^2-D_1^2}{D_1^2} \times 100$.

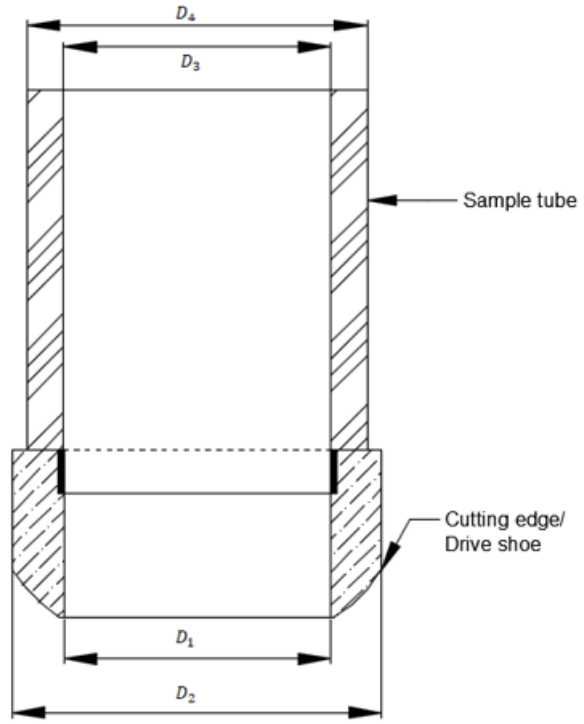
8. The inside clearance of the sampler is
_____



a) $\frac{D_3-D_1}{D_1} \times 100$
b) $\frac{D_3+D_1}{D_1} \times 100$
c) $\frac{D_3-D_1}{D_3}$
d) $\frac{D_3-D_1}{2D_1} \times 100$

Answer: a
Explanation: The inside clearance of the sampler is defined as the difference between the outside diameter and the inside diameter of the core part through which the core enters.
∴ Inside clearance = $\frac{D_3-D_1}{D_1} \times 100$.

9. The outside clearance of the sampler is _____



a) $\frac{D_3-D_1}{D_1} \times 100$
b) $\frac{D_3+D_1}{D_1} \times 100$
c) $\frac{D_2-D_4}{D_4} \times 100$
d) $\frac{D_2+D_4}{D_4} \times 100$

Answer: c
Explanation: Outside clearance is the gap between the outer surface of the cutting edge and the outside surface of the sam¬pling tube. Outside clearance prevents frictional drag between the outside surface of the sampling tube and the walls of the borehole.

10. In the open drive samples, the tube head is provided with vents.
a) True
b) False

Answer: a
Explanation: In the open drive samples, the tube head is provided with vents. The vents or valves are provided so as to permit water and air to escape during driving. The check valve helps to retain sample when the sampler is raised.

11. In open drive samples, the tube is split into two parts.
a) True
b) False
Answer: a
Explanation: In open drive samples, the tube can be split into two parts. This type of sampler is known as the split-spoon sampler. The split tube may also contain an inside thin wall liner.

12. The depth up to which the increase in pressure due to structural loading is likely to cause perceptible settlement is _____
a) insignificant depth
b) significant depth
c) trifling depth
d) nugatory

Answer: b
Explanation: The depth of exploration is carried to a depth up to which the increase in pressure due to structural loading is likely to cause perceptible settlement or shear failure. This depth is known as significant depth.

13. The significant depth is assumed up to a level at which the net increase in vertical pressure becomes _____ of initial overburden pressure.
a) 10% to 20%
b) less than 10%
c) 20% to 30%
d) 50% to 70%

Answer: b
Explanation: The significant depth is assumed up to a level at which the net increase in vertical pressure becomes less than 10% of initial overburden pressure. Also a pressure bulb bounded by an isobar of 1/5 or 1/10 of the surface loading intensity is assumed as minimum depth of exploration.

TOPIC 1.2 WASH BORING AND ROTARY DRILLING - DEPTH AND SPACING OF BORE HOLES

1. Hand auger can be used for depths up to _____
a) 7 m
b) 6 m
c) 2 m
d) 10 m

Answer: b
Explanation: Mechanical augers are used for greater depth and Hand augers are used for depth up to 6 m.

2. Auger boring is used in _____ type of soil.
a) Cohesion less soil
b) Cohesive soil
c) Coarse-grained soil
d) Pervious soil

Answer: b
Explanation: Augers are used in cohesive and other soft soils above the water table.

3. The type of boring, used for making deep excavations is _____
a) Cylindrical augers
b) Percussion boring
c) Rotary boring
d) Wash boring

Answer: a
Explanation: Cylindrical augers and shell with cutting edge on teeth at the lower end can be used for making deep boring.

4. Which of the following method is adopted for fast boring?
a) Cylindrical augers
b) Percussion boring
c) Rotary boring
d) Wash boring

Answer: d
Explanation: Wash boring is a fast and simple method for advancing holes for all types of soils.

5. Rotary boring can also be called as _____
a) Percussion boring
b) Wash boring
c) Core boring
d) Pit boring

Answer: c
Explanation: Rotary borings are used for rotary drilling and simultaneously obtaining the rock cores or samples. The method is then also known as core boring or core drilling.

6. Auger boring is most suitable for _____ type of work.
a) Air field pavement
b) Highway exploration
c) Dam construction
d) Buildings

Answer: b
Explanation: Auger boring is fairly satisfactory for highway explorations at shallow depths and for exploring borrow pits.

7. Wash boring cannot be used for _____ type of soil strata.
a) Cohesive soil
b) Cohesion less soil
c) Boulder
d) All of the mentioned

Answer: c
Explanation: Wash boring cannot be used for strata containing boulders and rocks, as they cannot be penetrated by this method.

8. Mud rotary drilling belongs to _____ type of boring method.
a) Percussion boring
b) Rotary boring
c) Wash boring
d) Auger boring

Answer: b
Explanation: A drilling mud is forced downed in rotary boring, hence the method is also known as mud rotary drilling.

9. The Instruments used in hand augers are _____
a) Post hole auger
b) Sand pump
c) Wash boring apparatus
d) Stationary piston

Answer: a
Explanation: Helical auger and Post hole auger are the common types of Hand auger in use.

10. The type of boring method that can be used for both rock and soils are _____
a) Shell boring
b) Wash boring
c) Auger boring
d) Rotary boring

Answer: d
Explanation: Rotary boring or rotary drilling is a very fast method of advancing hole in both rocks and soil by drill rod.

11. The commonly used geophysical method for site exploration is _____
a) Gravitational method
b) Electrical resistivity
c) Magnetic method
d) All of the mentioned

Answer: b
Explanation: The electrical resistivity and seismic refraction methods are the most commonly used for civil engineering purposes.

12. Electrical resistivity method is based on measurement of _____
a) Specific resistance
b) Voltage
c) Potential drop
d) Current

Answer: a
Explanation: The electrical resistivity method is based on the measurement and recording of changes in the mean resistivity or apparent specific resistance of the various soils.

13. The method used for studying of horizontal changes in the sub-soil is _____
a) Resistive soundings
b) Resistive mapping
c) Mean resistivity
d) Critical distance

Answer: b
Explanation: For knowing the horizontal changes in the sub-soil, the electrodes kept at a constant spacing are moved as a group along the line of test. This method is known as resistive mapping.

14. The commonly used penetration test are _____
a) IS penetration test
b) Cone penetration test
c) Dutch standard test
d) All of the mentioned

Answer: b
Explanation: Standard penetration test and the cone penetration test is the two commonly used penetration test.

15. In the seismic refraction method, the waves sent along the ground surface is picked by _____
a) Geo satellite instrument
b) Geophone
c) Wave detector
d) All of the mentioned

Answer: b
Explanation: The radiating shock waves created in to the soil at the ground level are picked up by the vibration detector known as a geophone.

TOPIC 1.3 SOIL SAMPLES - REPRESENTATIVE AND UNDISTURBED - SAMPLING METHODS - SPLIT SPOON SAMPLER, THIN WALL SAMPLER, STATIONARY PISTON SAMPLER

1. Thick wall samplers have area ratio_____
a) greater than 20 -35%
b) greater than 10- 25%
c) lesser than 10 -25%
d) lesser than 15 -35%

Answer: b
Explanation: Thin-wall samplers are the samplers in which the wall thickness of the sampling tube is less than 2.5% of the diam¬eter. Samplers for which the area ratio is greater than 10- 25% are known as thick-wall samplers.

2. _____ sampler is suitable for soft soils.
a) Open drive sampler
b) Rotary sampler
c) Stationary position
d) No sampler

Answer: c
Explanation: The stationary position sampler is suitable for soft soils. The stationary position sampler contains a piston or plug attached to a long piston rod extending up to the ground surface through the drill rod.

3. For soft sensitive soil, the area ratio of sample _____
a) should not exceed 20%
b) should not exceed 10%
c) should not exceed 15%
d) should not exceed 40%

Answer: b
Explanation: For soft sensitive soil, the area ratio of sample should preferably not exceed 10%. The thin-wall samplers are those for which the area ratio is less than or equal to 10%. Samplers for which the area ratio is more than 10% are known as thick-wall samplers.

4. The inside clearance of the sampler should _____
a) lie between 1 to 3%
b) be less than 1%
c) lie between 2 to 6%
d) lie between 1 to 6%

Answer: a
Explanation: The inside clearance of the sampler should lie between 1 to 3%. The outside clearance of the sampler should not be much greater than the inside clearance of the sampler.

5. For sampling saturated cohesion-less soils _____ is inserted.
a) inner liner
b) oil
c) trap valve
d) wood

Answer: c
Explanation: For sampling saturated cohesion-less soils, a trap valve or a spring sample retainer is inserted in the drive shoe or the cutting edge. This helps to retain the sample when the sampler is raised.

6. The undistributed samples are obtained by _____
a) thin wall samplers
b) thick wall samplers
c) both thin and thick wall samplers
d) no type of samplers

Answer: a
Explanation: The undistributed samples are obtained by thin wall samplers in which the wall thickness of the sampling tube is less than 2.5% of the diam¬eter or the area ratio is less than or equal to 10 %.

7. To impart cohesion, _____ is used.
a) water
b) asphaltic emulsions
c) lime
d) powder soda

Answer: b
Explanation: For obtaining undistributed samples of soils, cohesion to the sand is imparted by adding asphaltic emulsions, or to freeze the sand at the sampling depth or near the lower end of the sampler.

8. For undistributed samples _____ is used.
a) compressed air sampler
b) thick sampler
c) care cutter
d) rotary sampler

Answer: a
Explanation: For obtaining undistributed samples, compressed air samplers are used. It enables the sample to be removed from the ground into an air chamber and then lifted to the ground surface without contact with water.

9. Sampler is over driven to avoid the compression of sample.
a) False
b) True

Answer: a
Explanation: The sampler should never be over driven so as to compress the sample. When the sampler is over driven, the soil sample gets compressed due to the air locked between the sampler and the sample.

10. For undisturbed sampling, the penetration of the sampler should be periodic.
a) False
b) True

Answer: a
Explanation: For undisturbed sampling, the penetration of the sampler into the soil should be continuous and rapid. The sampler should not be penetrated in a slow and periodic manner.

11. For transport of sample to laboratory, the sample is _____
a) wrapped in wax paper
b) mixed with other samples
c) given disturbance
d) saturated with lime

Answer: a
Explanation: For transport of sample to laboratory, the samples can be cut out and trimmed to regular shapes. The samples are then wrapped in wax paper or polyethylene sheet and is given a wax coating.

TOPIC 1.4 PENETRATION TESTS (SPT AND SCPT) - DATA INTERPRETATION - STRENGTH PARAMETERS - BORE LOG REPORT AND SELECTION OF FOUNDATION.

1. The two commonly used penetration tests are _____
a) Standard penetration test
b) Cone penetration test
c) All of the mentioned
d) None of the mentioned

Answer: c
Explanation: According to Indian standard, the two commonly used penetration tests are static cone penetration test and standard penetration test.

2. The values derived from penetration tests can be used for finding _____
a) Depth of hard stratum and Strength of soil
b) Soil saturation
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The penetration test are useful

for general exploration of erratic soil profiles, for finding depth to bed rock or hard stratum, and to have an approximation indication of the strength and other properties of soils.

3. The observed value of N in static cone penetration test is corrected by _____
a) Overburden and Dilatancy /submergence
b) Effective pressure
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The N-value for cohesion less soil shall be corrected for overburden and the values N0 obtained after overburden correction is corrected further for dilatancy.

4. Correction for increasing effective overburden pressure have been proposed by _____
a) Gibbs and Holtz
b) Peck
c) Thornburn
d) All of the mentioned

Answer: d
Explanation: For a constant density index, the N value increase with increasing effective overburden pressure for which correction have been proposed by Gibbs and Holtz, peck, Thornburn, Whitman and others.

5. The split tube used in static cone penetration test, is commonly known as _____
a) Split spoon sampler
b) Split tube sampler
c) Tube sampler
d) All of the mentioned

Answer: a
Explanation: The split tube sampler, used in a test for standard penetration is commonly known as split spoon sampler resting on the bottom of the bore hole which is allowed to sink under its own weight.

6. The total blow required for the second and third 15 cm of penetration in standard penetration test is taken as _____
a) Seating drive
b) Penetration resistance
c) Overburden pressure
d) Dilatancy/submergence

Answer: a
Explanation: In standard penetration test, the first 15 cm of drive may be considered to be a seating drive. The total blows required for the second and third 15 cm of penetration is termed as the penetration resistance N.

7. The expression for C n as given by Lio and Whitman is _____
a) $C_n = \sqrt{(\sigma')}$
b) $C_n = \sqrt{(100/\sigma')}$
c) $C_n = 0.77\log_{10}(2000/\sigma')$
d) None of the mentioned

Answer: b
Explanation: In 1986, Lio and Whitman gave the following expression for Normalizing factor C n:
$C_n = \sqrt{(100/\sigma')}$.

8. The cone test is useful in determining the bearing capacity of _____
a) Cohesion less soil and Fine sand
b) Clay soil
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The cone test is considered very useful in determining the bearing capacity of pits in cohesion less soils, particularly in fine sands of varying density.

9. The cone resistance qc, for sandy silt type of soil is _____
a) 3.5
b) 6
c) 2
d) 5

Answer: c
Explanation: For silts, sandy silts, slightly cohesive silt sand mixture type of soil, the cone resistance q c is 2.

UNIT II SHALLOW FOUNDATION

TOPIC 2.1 LOCATION AND DEPTH OF FOUNDATION - CODAL PROVISIONS - BEARING CAPACITY OF SHALLOW FOUNDATION ON HOMOGENEOUS DEPOSITS

1. Foundations can be broadly classified under _____
a) Shallow foundation and Deep foundation
b) Pile foundation
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Foundations may be broadly classified under two heads: shallow foundations and deep foundations.

2. A foundation is said to be shallow if its depth is _____ than its width.
a) Equal to and Less than
b) Greater than
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: According to Terzaghi, a foundation is shallow if its depth is equal to or less than its width. In the case of deep foundations, the depth is equal to or greater than the width.

3. which of the following, is a type of shallow footing?
a) Spread footing
b) Pile foundation
c) Pier foundation
d) Well foundation

Answer: a
Explanation: The shallow foundations are of the following types: spread footing (or simple footing), strap footing, combined footing, and mat footing or raft footing.

4. Which of the below is the most commonly used shallow foundation?
a) Strap footing
b) Spread footing
c) Combined footing
d) Raft footing

Answer: b
Explanation: In spread footing, load is transmitted through an isolated column or wall to the subsoil; hence this is most common type of foundation.

5. The pressure intensity beneath the footing depends upon _____
a) Rigidity of the footing
b) Soil type
c) Condition of soil
d) All of the mentioned

Answer: d
Explanation: Both from observations as well as the analytical studies from elasticity, it is known that the pressure distribution beneath footing is not uniform and it depends on the rigidity of footing, the soil type, and the condition of the soil.

6. Once the pressure distribution is known _____ in the reinforced concrete footing can be calculated.
a) Bending moment and Shear force
b) Bearing pressure
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Knowing the pressure distribution is known, the bending moment and shear force can be calculated, and the thickness of the structural member of the member can be calculated using properties of reinforced concrete.

7. In conventional design, allowable bearing capacity should be taken smaller than which of the following value?
a) Safe bearing capacity and Allowable bearing pressure
b) The pressure intensities beneath the footing
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: In conventional design, the allowable bearing capacity should be taken as the smaller of the following two values: i) the safe bearing capacity based on ultimate capacity, and ii) the allowable bearing pressure on tolerable settlement.

8. In cohesive soil, the pressure distribution beneath the footing is _____
a) Linear
b) Non linear
c) Zero
d) None of the mentioned

Answer: a
Explanation: When a footing rests on cohesive soil, the edge stresses may be very large, but the pressure distribution may be considered to be linear.

9. When do strap footings are used in foundation?
a) To transfer load of an isolated column
b) Distance between the columns are long
c) Two column loads are unequal
d) All of the mentioned

Answer: b
Explanation: A strap footing may be used where the distance between the columns is so great that the combined trapezoidal footing becomes quite narrow, with a high bending moment.

10. When two column loads are unequal, which of the possible footing can be provided?
a) Strap footing
b) Raft footing
c) Trapezoidal combined footing
d) Mat footing

Answer: c
Explanation: When the two columns load are unequal, with the outer column carrying a heavier load, and when there is space limitation beyond the outer column, a trapezoidal footing is provided.

TOPIC 2.2 TERZAGHIÃ¢Â,¬Â„¢S FORMULA AND BIS FORMULA - FACTORS AFFECTING BEARING CAPACITY

1. An analysis of the condition of complete bearing capacity failure is usually termed as _____
a) General shear failure
b) Terzaghi’s analysis
c) Bearing failure
d) All of the mentioned

Answer: a
Explanation: An analysis of the condition of complete bearing capacity failure is termed as a general shear failure, can be made by assuming that the soil behaves like an ideally plastic failure.

2. The concept of analysis of bearing capacity failure was first developed by _____
a) Terzaghi
b) Meyerhof
c) Prandtl
d) Darcy

Answer: c
Explanation: The concept of failure analysis was first developed by Prandtl, and later extended by Terzaghi, Meyerhof and others.

3. For purely cohesive soil, the bearing capacity is given by which of the following equation?
a) $qf = 5.7\ c + \bar{\sigma}$
b) $qf = c + \bar{\sigma}$
c) $qf = 5.7\ c$
d) All of the mentioned

Answer: a
Explanation: For purely cohesive soil the bearing capacity is
$qf = c\ Nc + \bar{\sigma}\ Nq = 5.7\ c + \bar{\sigma}$
Where $\bar{\sigma} = \gamma\ D$ if the water table is below the base of the footing.

4. The parameters Nc, Nq, Nγ in the equations of bearing capacity failure are known as _____
a) Constant head
b) Bearing capacity factors
c) Effective pressure
d) Load intensity

Answer: b
Explanation: The parameters Nc, Nq, Nγ are the dimensionless numbers, known as bearing capacity factors depending only on the angle of shearing resistance of the soil.

5. For purely cohesive soil, local shear failure may be assumed to occur when the soil is _____
a) Medium to soft
b) Soft to medium
c) Hard
d) All of the mentioned

Answer: b
Explanation: For purely cohesive soil, local shear failure may be assumed to occur when the soil is soft to medium, with an unconfined compressive strength $qu \leq 100\ kN/m^2$.

6. Which of the following is a limitation, of assumption in Terzaghi's analysis?
a) φ changes when the soil is compressed and strip footing has a rough base
b) Soil is homogeneous
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: As the soil compress, φ changes; slight downward movement of footing may not develop fully the plastic planes.

7. Which of the following are original Terzaghi values for Nγ?
a) 34° and 48°
b) 60°
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The values of Nγ for φ of 34° and 48° are the original Terzaghi values which were used by Bowles to back compute Kpγ.

8. According to the assumptions in Terzaghi's analysis, the soil is _____
a) Homogeneous and Isotropic
b) Non Homogeneous
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: In Terzaghi's analysis the soil is homogeneous and isotropic and its shear strength is represented by Coulomb's equation.

9. The Terzaghi's general bearing capacity equation is represented as _____
a) $qf = 5.7\ c + \bar{\sigma}$
b) $qf = c\ Nc + \bar{\sigma}.\ Nq + 0.5\gamma BN\gamma$
c) $qf = c\ Nc + \bar{\sigma}.\ Nq$
d) $qf = c\ Nc$

Answer: b
Explanation: "qf = c Nc + $\bar{\sigma}$. Nq + 0.5γBNγ" is known as Terzaghi's general bearing capacity equation for a continuous footing.

10. Local shear failure generally occurs in

_____
a) Dense sand
b) Non-cohesive soil
c) Loose sand
d) All of the mentioned

Answer: c
Explanation: Local shear failure generally occurs in loose sand while general shear failure occurs in dense sand.

11. The curve for Nq and Nγ for the transition state from φ = 28° and φ = 38° was given by

_____
a) Peck
b) Hanson
c) Thorn burn
d) All of the mentioned

Answer: d
Explanation: Peck, Hansen, and Thorn burn gave curves for Nq and Nγ for the transition state from φ = 28° and φ = 38°, in which they assumed general shear failure when φ > 28°.

12. Terzaghi's bearing capacity equation is not applicable for _____
a) Depth effect and Inclination factor
b) Narrow slope
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Terzaghi assumed the value of angle ψ = φ, which is not true. Since footings are normally rough, ψ has been found close to 45° + φ/2 than to φ, thus Terzaghi's bearing capacity equations do not have provision for including depth effects, inclination factors, etc.

TOPIC 2.3 BEARING CAPACITY FROM IN-SITU TESTS (SPT, SCPT AND PLATE LOAD) - ALLOWABLE BEARING PRESSURE - SEISMIC CONSIDERATIONS IN BEARING CAPACITY EVALUATION

1. The plate load test is essentially a

_____
a) Laboratory test
b) Field test
c) Graphical method analysis
d) None of the mentioned

Answer: b
Explanation: Plate load test is a field test to determine the ultimate bearing capacity of the soil, and the probable settlement under a given loading.

2. The plate load test consists in loading a rigid plate at the _____
a) Base of the footing
b) Bottom of the construction
c) Foundation level
d) All of the mentioned

Answer: c
Explanation: The plate load test essentially consists in loading a rigid plate at the foundation level, and determining the corresponding to each load increment.

3. The bearing plate used in plate load test is in the shape of _____
a) Square
b) Rectangular and Circular
c) None of the mentioned
d) All of the mentioned

Answer: b
Explanation: The bearing plate is either circular or square, made of mild steel of not less than 25 mm in thickness.

4. The size of bearing plate, which used in plate load test varies from _____
a) 300 to 750 mm
b) 25 to 100 mm
c) 100 to 300 mm
d) 25 to 300 mm

Answer: a
Explanation: The bearing plate used varies in size from 300 to 750 mm with a chequered or grooved bottom.

5. The loading to the test plate is applied with _____
a) Fluid tube
b) Hydraulic jack
c) Sand bags
d) Cross-joists

Answer: b
Explanation: The loading to the test plate may be applied with the help of a hydraulic jack. The reaction of the hydraulic jack may be borne by either any of gravity loading methodor reaction truss method.

6. For clayey and silty soils, which of the following bearing plate can be used?
a) Square plate and Concrete block
b) Circular plate
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: For clayey and silty soils and for loose medium dense sandy soils with N < 15, a 450 mm square plate or concrete block shall be used.

7. The settlement of the plate in a load test is measured with the help of _____
a) Sensitive dial gauges
b) Test plate
c) Measuring unit
d) Datum bar

Answer: a
Explanation: The settlement of the plate is measured with the help of sensitive dial gauges. For square plate, two dial gauges are used. The dial gauges are mounted on independently supported datum bar.

8. According to Indian standard method, the loading of the plate should be borne with either by _____
a) Gravity loading platform and Reaction truss
b) Concrete blocks
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Indian standards (IS: 1888: 1982) recommend that the loading of the plate should invariably be borne either by gravity loading platform or by the reaction truss.

9. A seating pressure of _____ is applied on the plate before starting the load test.
a) 70 g/cm^2
b) 30 g/cm^2
c) 50 g/cm^2
d) 100 g/cm^2

Answer: a
Explanation: A minimum seating pressure of 70 g/cm^2 (0.7 t/m^2), shall be applied and removed before starting the load test.

10. Which of the following type of loading method is popular now-a-days?
a) Gravity loading platform
b) Reaction truss
c) Concrete blocks
d) All of the mentioned

Answer: b
Explanation: The use of reaction truss is more popular now-a-days since this is simple, quick and less clumsy.

11. The value of factor of safety used, for finding safe bearing capacity is _____
a) 2.5
b) 2
c) 4
d) 3

Answer: b
Explanation: In order to determine the safe bearing capacity, it would be normally sufficient to use a factor of safety of 2 or 2.5 on the ultimate bearing capacity.

12. Which of the following pose a limitation to plate load test?
a) Effect of size of foundation and Test on cohesive soil
b) Load increment
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: A limitation of plate load test is
i) Effect of the size of foundation. For clayey soils the ultimate pressure for a large foundation is the same as that of the test plate. But in dense sandy soils, the bearing capacity increases, with the size of the foundation
ii) Plate load test is essentially a short duration test, and hence the test does not give the ultimate settlement, particularly in the case of cohesive soil.

13. For a c-φ soil, Housel suggested which of the following expression?
a) Q = A .q + P .s
b) Q = A .q
c) q f = M + N(BF/B p)
d) All of the mentioned

Answer: a
Explanation: In 1929, Housel suggested the following expression for a c-φ soil:
Q = A .q + P .s
Where, Q = total load on bearing area;
P = perimeter of footing;
S = perimeter shear;
A = contact area of footing or plate.

14. For clay soil the value of n can be taken as _____ in the absence of test data.
a) 0. 4 to 0.5
b) 0.20 to 0.25
c) 0.003 to 0.05
d) 0.08 to 0.10

Answer: c
Explanation: The value of index n can be determined by carrying out two or more plate load tests on different size plate. In absence of test data, the following values of n can be adopted:
Dense sand : 0.4 to 0.5
Loose sand : 0.20 to 0.25
Clay : 0.003 to 0.05
Sand clay : 0.08 to 0.10.

TOPIC 2.4 DETERMINATION OF SETTLEMENT OF FOUNDATIONS ON GRANULAR AND CLAY DEPOSITS - TOTAL AND DIFFERENTIAL SETTLEMENT - ALLOWABLE SETTLEMENTS

1. The total settlement of a footing in clay is considered to be consisting of _____ components.
a) One
b) Three
c) Two
d) Four

Answer: b
Explanation: According to Skempton and Bjerrum, the total settlement of a footing in clay may be considered to consist of three components
S = Si + Sc + Ss.

2. The component Sc, used in the total settlement of clay refers to which of the following?
a) Total settlement
b) Consolidation settlement

c) Immediate plastic settlement
d) Settlement due to secondary consolidation of clay

Answer: b
Explanation: The three components used in total settlement of clay are given below:
Sc = consolidation settlement
Si = immediate elastic settlement
Ss = settlement due to secondary consolidation of clay.

3. The immediate settlement can be computed from the expression, based on _____
a) Theory of plasticity
b) Theory of elasticity
c) Terzaghi's analysis
d) Pressure distribution

Answer: b
Explanation: The immediate settlement is the elastic settlement and can be computed from the following expression based on the theory of elasticity,
Si = q B (1-μ2/E s) I w.

4. The influence factor for rigid square footing is _____
a) 0.88
b) 0.82
c) 1.06
d) 1.70

Answer: b
Explanation: As suggested by BIS Code IS: 8009 Part 1, 1976 the value of influence factor Iw for rigid footing is 0.82.

5. The equation for computing immediate settlement "Si = μ0μ1 q B (1-μ2/Es)" was proposed by _____
a) Janbu
b) Bjerrum
c) Kjaernsli
d) All of the mentioned

Answer: d
Explanation: In 1966, Janbu, Bjerrum, and Kjaernsli have proposed the following equation for computing the immediate settlement:
Si = μ0μ1 q B (1-μ2/Es).

6. The value of Es used in the immediate settlement equation, can be found out using _____
a) Triaxial test
b) Compression test
c) Direct shear test
d) Rankine's theory

Answer: a
Explanation: The modulus of elasticity Es used in the equation Si = μ0μ1 q B (1-μ2/Es) is computed from triaxial test data, where Es = (σ1-σ3)/ΔL / L.

7. A combined footing may be rectangular in shape if both the columns carry _____
a) Unequal loads
b) Equal loads
c) No load
d) All of the mentioned

Answer: b
Explanation: The combined footing may be rectangular in shape if both the columns carry equal loads, or may be trapezoidal if they carry unequal loads.

8. The influence factor Iw for rigid rectangular footing with L/B = 1.5 is _____
a) 0.88
b) 0.82
c) 1.70
d) 1.06

Answer: d
Explanation: Iw = influence factor = 1.06 for rigid rectangular footing, with L/B = 1.5 = 1.70 for rigid rectangular footing, with L/B = 5.

TOPIC 2.5 CODAL PROVISION - METHODS OF MINIMIZING TOTAL AND DIFFERENTIAL SETTLEMENTS.

1. The analytical methods used for finding bearing capacity of footing is based on

_____
a) Shear failure
b) Effective pressure
c) Overburden pressure
d) Size of the footing

Answer: a
Explanation: The analytical methods for the determination of bearing capacity of footings are based essentially on shear failure.

2. The effect of settlement on structure depends upon its _____
a) Magnitude and Uniformity
b) Size
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The effect of settlement upon the structure depends on its magnitude, the length of the time over which it takes place, its magnitude and the nature of the structure itself.

3. The vertical downward movement of the base of the structure is called _____
a) Penetration resistance
b) Settlement
c) Effective pressure
d) Shear failure

Answer: b
Explanation: The vertical downward movement of the base of the structure is called settlement and its effect depends upon its magnitude and uniformity etc.

4. The allowable pressure, that should be selected for a maximum settlement is

_____
a) 40 mm
b) 25 mm
c) 30 mm
d) 10 mm

Answer: b
Explanation: It is suggested that allowable pressure should be selected such that maximum settlement of any individual foundation is 25 mm.

5. The maximum allowable settlement for warehouses are _____
a) 25
b) 38
c) 50
d) Less than 0.5

Answer: c
Explanation: The allowable maximum settlement for warehouse type of structure is 50 mm.

6. According to National building code of India, the differential settlement can be kept within limits by _____
a) Suitably designing the foundation
b) Decreasing the total settlements
c) Increasing the allowable pressure.
d) None of the mentioned

Answer: a
Explanation: According to National Building Code of India (SP: 7-1970) the differential settlement shall be kept within limits to which the super-structure can accommodate itself without the distortion, by suitably designing the foundation.

7. For simple spread footing on clayey soil, the differential settlement should not exceed

_____
a) 1/ 400
b) 1/300
c) 1/100
d) 1/3

Answer: b
Explanation: For simple spread footing on clayey soils, the allowable pressure should be such that the differential settlement does not exceed 1/300.

8. According to Polish and Tokar brick masonry will crack, when the unit elongation amounts to _____
a) 0.5
b) 0.005
c) 1.0
d) 0.05

Answer: b
Explanation: According to Polishin and Tokar (1957), brick masonry will crack due to differential settlement when the unit elongation amount to 0.005.

9. The recommendation of American code, for a differential settlement depends upon _____
a) Type of structure and Pattern of loading
b) Settlement depth
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The recommendation of American code are based upon that if the maximum total settlement is kept within a reasonable limit, the differential settlement will only be a fraction depending upon the type of structure and pattern of loading.

10. The rate of differential settlement is defined by which of the following equation?
a) H/L
b) L/H
c) H/H c
d) None of the mentioned

Answer: b
Explanation: The rate of settlement is defined as the slope or the relative settlement between two points divided by the horizontal distance.
Rate of differential settlement = L/H.

UNIT III FOOTINGS AND RAFTS

TOPIC 3.1 TYPES OF ISOLATED FOOTING, COMBINED FOOTING, MAT FOUNDATION - CONTACT PRESSURE AND SETTLEMENT DISTRIBUTION

TOPIC 3.2 PROPORTIONING OF FOUNDATIONS FOR CONVENTIONAL RIGID BEHAVIOUR - MINIMUM THICKNESS FOR RIGID BEHAVIOUR - APPLICATIONS

1. Foundations can be broadly classified under _____
a) Shallow foundation and Deep foundation
b) Pile foundation
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Foundations may be broadly classified under two heads: shallow foundations and deep foundations.

2. A foundation is said to be shallow if its depth is _____ than its width.
a) Equal to and Less than
b) Greater than
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: According to Terzaghi, a foundation is shallow if its depth is equal to

or less than its width. In the case of deep foundations, the depth is equal to or greater than the width.

3. which of the following, is a type of shallow footing?
a) Spread footing
b) Pile foundation
c) Pier foundation
d) Well foundation

Answer: a
Explanation: The shallow foundations are of the following types: spread footing (or simple footing), strap footing, combined footing, and mat footing or raft footing.

4. Which of the below is the most commonly used shallow foundation?
a) Strap footing
b) Spread footing
c) Combined footing
d) Raft footing

Answer: b
Explanation: In spread footing, load is transmitted through an isolated column or wall to the subsoil; hence this is most common type of foundation.

5. The pressure intensity beneath the footing depends upon _____
a) Rigidity of the footing
b) Soil type
c) Condition of soil
d) All of the mentioned

Answer: d
Explanation: Both from observations as well as the analytical studies from elasticity, it is known that the pressure distribution beneath footing is not uniform and it depends on the rigidity of footing, the soil type, and the condition of the soil.

6. Once the pressure distribution is known _____ in the reinforced concrete footing can be calculated.
a) Bending moment and Shear force
b) Bearing pressure
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Knowing the pressure distribution is known, the bending moment and shear force can be calculated, and the thickness of the structural member of the member can be calculated using properties of reinforced concrete.

7. In conventional design, allowable bearing capacity should be taken smaller than which of the following value?
a) Safe bearing capacity and Allowable bearing pressure
b) The pressure intensities beneath the footing
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: In conventional design, the allowable bearing capacity should be taken as the smaller of the following two values: i) the safe bearing capacity based on ultimate capacity, and ii) the allowable bearing pressure on tolerable settlement.

8. In cohesive soil, the pressure distribution beneath the footing is _____
a) Linear
b) Non linear
c) Zero
d) None of the mentioned

Answer: a
Explanation: When a footing rests on cohesive soil, the edge stresses may be very large, but the pressure distribution may be considered to be linear.

9. When do strap footings are used in foundation?
a) To transfer load of an isolated column
b) Distance between the columns are long

c) Two column loads are unequal
d) All of the mentioned

Answer: b
Explanation: A strap footing may be used where the distance between the columns is so great that the combined trapezoidal footing becomes quite narrow, with a high bending moment.

10. When two column loads are unequal, which of the possible footing can be provided?
a) Strap footing
b) Raft footing
c) Trapezoidal combined footing
d) Mat footing

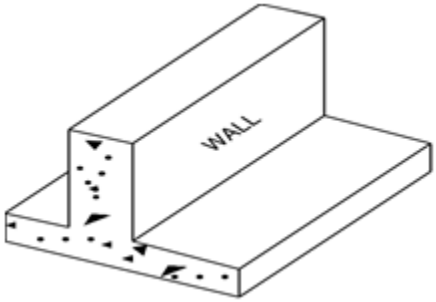
Answer: c
Explanation: When the two columns load are unequal, with the outer column carrying a heavier load, and when there is space limitation beyond the outer column, a trapezoidal footing is provided.

TOPIC 3.3 COMPENSATED FOUNDATION - CODAL PROVISION

1. How many types of foundations are there based on depth?
a) 3
b) 4
c) 5
d) 2

Answer: d
Explanation: The 2 types are shallow and deep foundations. Shallow foundation transfers the load to very near earth. Deep foundations are used for high rise buildings to bear heavy loads.

2. The figure below represents:



a) Isolated footing
b) Wall footing
c) Strap footing
d) Mat foundation

Answer: b
Explanation: Wall footing or strip footing is a continuous strip of concrete that serves to spread weight of load bearing wall.

3. _____ footing is used in load bearing masonry construction.
a) Isolated
b) Strap
c) Strip
d) Pile

Answer: c
Explanation: The strip footing bears a whole load of an entire wall. It is a continuous footing that runs below the wall.

4. How many types of combined footing are possible?
a) 2
b) 3
c) 4
d) 5

Answer: a
Explanation: Combined footing is provided when 2 columns are very close by. They can be rectangular or trapezoidal in section.

5. CPRF stands for:
a) Combined Plain Round Foundation
b) Connected Pile Round Foundation
c) Combined Pile Raft Foundation
d) Corrosion Proof Raft Foundation

Answer: c
Explanation: CPRF uses the combination of pile and raft foundation as the name suggests. It is used as a foundation for high rise buildings. It is more powerful, strong, load bearing, safe than raft or pile when used.

6. Micropiles find its main application in retaining walls.
a) True
b) False

Answer: b
Explanation: Micropiles are used for under pinning. They are used in highways, bridges and transmission tower projects. Sheet piles are extensively used in retaining walls.

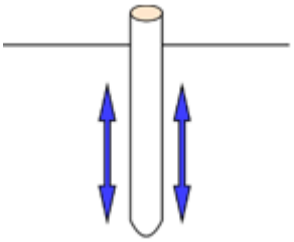
7. Steining is a component of which of the below type of foundation?
a) Pile
b) Strap
c) Isolated
d) Well

Answer: d
Explanation: Well foundation is a type of deep foundation. It is shaped like a well. The well is dug, filled with sand/concrete. Steining is the wall provided to the well and it is built over a wedge shaped portion, called well curb.

8. Pier foundation is also called:
a) Caisson
b) Box
c) Bridge
d) Girder

Answer: a
Explanation: Caisson foundation is often used in the construction of bridge piers, hence it is also called pier foundation. Caisson can be floated to the site and sunk to the required position. It is used under water also.

9. The figure below represents _____ piles.



a) Load bearing
b) End bearing
c) Friction
d) Sheet

Answer: c
Explanation: Friction piles are usually used in construction to provide underground support to structures. They work on static friction developed between soil surface and the pile.

10. Which of the below is not a preliminary consideration for building a foundation?
a) Bearing capacity of soil
b) Ground water condition
c) Settlement control
d) Soil organisms

Answer: d
Explanation: Bearing capacity of soil, ground water conditions and settlement control are all very important parameters to be considered while selecting the right foundation. Every soil contains organisms, foundation should be able to withstand their activities.

11. Machine foundation is subjected to:
a) Static loads
b) Wind loads
c) Static and dynamic loads
d) Dynamic loads

Answer: c
Explanation: Machine foundation is used in industries, workshops, where there is machinery under use. The static load includes a dead load of the machine and dynamic load (the working load). It should be able to withstand both these loads.

UNIT IV PILE FOUNDATION

TOPIC 4.1 TYPES OF PILES AND THEIR FUNCTIONS - FACTORS INFLUENCING THE SELECTION OF PILE

1. The art of driving piles into the ground was first established by _____
a) Greeks
b) Romans
c) Philippians
d) None of the mentioned

Answer: b
Explanation: The art of driving was first well-established in Roman times and the details of such foundation were recorded by Vitruvius in 59 A.D.

2. Based on the function, piles can be classified into _____ types.
a) 4
b) 6
c) 8
d) 3

Answer: c
Explanation: Based on the function or the use, piles may be classified as 1) end bearing piles 2) friction piles 3) compaction piles 4) tension pile 5) anchor pile 6) fender pile 7) batter pile 8) sheet pile.

3. Which of the following piles is used to compact loose granular soil?
a) Friction piles
b) End bearing piles
c) Compaction piles
d) Tension piles

Answer: c
Explanation: Compaction piles are used to compact loose granular soil, thus increasing their bearing capacity.

4. Sheet piles are commonly used as _____ in hydraulic structure.
a) Bulk heads
b) Bearing stratum
c) Boulders
d) Composite piles

Answer: a
Explanation: Sheet piles are commonly used as bulkheads, or as an impervious cutoff to reduce seepage and uplift under the hydraulic structure.

5. The piles that are used for protecting structures from ships and floating object is _____
a) Anchor piles
b) Fender piles
c) Compaction piles
d) Batter piles

Answer: c
Explanation: Fender piles and dolphins are used to protect waterfront structures against the impact of ships or other floating objects.

6. Modern pile driving method was first invented by _____
a) Romans
b) Nasmyth
c) Terzaghi
d) Vitruvious

Answer: b
Explanation: Modern pile driving started with the first steam pile drivers, invented by Nasmyth in 1845.

7. The precast concrete piles are generally used for a maximum design load of about _____
a) 50 tonnes
b) 100 tonnes

c) 75 tonnes
d) 80 tonnes

Answer: d
Explanation: The precast concrete piles are generally used for a maximum design load of about 80 tonnes, except for large pre-stressed piles.

8. Cast-in-situ piles may be classified in to _____ classes.
a) Three
b) Eight
c) Two
d) Four

Answer: c
Explanation: Cast-in-situ piles can be classified in to two classes: driven piles(cased or uncased) and bored piles(pressure piles, pedestal piles and under reamed piles).

9. Which of the following piles is a cast-in-situ type of concrete pile?
a) Under-reamed pile
b) Raymond standard pile
c) Pressure pile
d) Anchor pile

Answer: b
Explanation: Raymond standard pile and Raymond step-taper pile are the common types of cast-in-situ piles.

10. Composite piles are suitable for _____
a) Maximum design load
b) Project above the water table
c) Compacting the soil
d) Protect water front structures

Answer: b
Explanation: Composite piles are suitable where the upper part of a file is to project above the water table. Such a pile consists of a lower portion of untreated timber and the upper portion of concrete.

11. Piles are commonly driven in to ground by means of special device called _____
a) Pile driver and Hammer
b) Driller
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Piles are commonly driven by means of hammer supported by a crane or by a special device known as pile drivers.

12. The types of hammer used for driving piles are _____
a) Drop hammer
b) Diesel hammer
c) Vibratory hammer
d) All of the mentioned

Answer: d
Explanation: Hammer of the following types: i) drop hammer ii) single acting hammer iii) double acting hammer iv) diesel hammer v)vibratory hammer.

13. If a hammer is raised by steam and allowed to fall by gravity on top of the pile, it is called as_____
a) Diesel hammer
b) Vibratory hammer
c) Single acting hammer
d) Drop hammer

Answer: c
Explanation: If a hammer is raised by steam, compressed air or internal combustion, but is allowed to fall by gravity alone, it is called as single acting hammer. The energy of such hammer is equal to the weight of the ram times the height of the fall.

14. Single acting hammers provide an advantage in _____ type of soil.
a) Compact soil and Hard soil
b) Light weight soil
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Single acting hammers are advantageous when driving heavy piles in compact or hard piles.

TOPIC 4.2 CARRYING CAPACITY OF SINGLE PILE IN GRANULAR AND COHESIVE SOIL - STATIC FORMULA - DYNAMIC FORMULAE (ENGINEERING NEWS AND HILEYS)

1. The maximum load which can be carried by a pile is defined as its _____
a) Ultimate load carrying capacity
b) Ultimate bearing resistance
c) Ultimate bearing capacity
d) All of the mentioned

Answer: d
Explanation: The ultimate load carrying capacity, or ultimate bearing resistance or ultimate bearing capacity Q up is defined as the maximum load which can be carried by a pile and at which the pile continues to sink without further increase of load.

2. The allowable load which the pile can carry safely is determined on the basis of _____
a) Factor of safety
b) Load test
c) Stability of the pile foundation
d) All of the mentioned

Answer: c
Explanation: The allowable load Qa is the safe load which the pile can carry safely and is determined on the basis of: i) overall stability of the pile-foundation ii) the permissible settlement iii) ultimate bearing resistance divided by factor of safety.

3. The load carrying capacity of a pile can be determined by which of the following methods?
a) Dynamic formulae
b) Static formulae
c) Plate load test
d) All of the mentioned

Answer: d
Explanation: The load carrying capacity of a pile can be determined by the following methods: i) Penetration tests ii) Dynamic formulae iii) Static formulae iv) Plate load test.

4. Which of the following are some of the commonly used dynamic formula?
a) Engineers News formula and Hiley's formula
b) Static formula
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The Engineers News formula as proposed by Wellington and Hiley's formula given by the original expression of Hiley are the commonly used dynamic formula.

5. When a pile hammer hits the pile, the total driving energy is equal to _____
a) Weight of hammer times the height of drop
b) Weight of the ram time times the height of the stroke
c) Sum of the impact of the ram
d) Sum of the impact of ram plus the energy delivered by explosion

Answer: a
Explanation: When a pile hammer hits the pile, the total driving energy is equal to the weight of hammer the height of drop or stroke.

6. Dynamic formulae are best suited for _____ type of soil.
a) Fine grained soil
b) Coarse grained soil

c) Cohesive soil
d) None of the mentioned

Answer: b
Explanation: Dynamic formulae are best suited to coarse grained soils for which the shear strength is independent of rate of loading.

7. Dynamic formula does not indicate about _____
a) Temporary change in soil structure and Future settlement
b) Allowable load
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: A disadvantage of a dynamic formula is that it gives no indication about the reduced bearing future settlement or temporary changes in soil structure.

8. The dynamic formula is valueless for which of the following type of soil?
a) Loose sand
b) Saturated soil
c) Clay soil
d) Compacted soil

Answer: c
Explanation: For clays, the dynamic formulae are valueless because the skin friction developed in clay during driving is very much less than which occurs after a period of time.

9. In dynamic formulae what are the energy losses, that is not accounted?
a) Energy Loss due to vibration and Energy loss due to heat
b) Frictional loss
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: In dynamic formulae, the energy loss due to vibrations, heat and damage to dolly or packaging are not taken into account.

10. The greater objection to any of the pile driving formulae is _____
a) Uncertainty in relation between dynamic and static resistance
b) Shear strength of the soil
c) Uncertainty in the allowable pressure
d) None of the mentioned

Answer: a
Explanation: The greater objection to any of the pile driving formulae is the uncertainty about the relationship between the dynamic and static resistance to soil.

11. The static formula is based on the assumption that the ultimate bearing capacity Qup is equal to _____
a) Rf + Qa
b) Rf + Rp
c) As + Ap
d) Q up / F

Answer: b
Explanation: The static formulae are based on the assumption that the ultimate bearing capacity Qup of a pile is the sum of the total ultimate skin friction Rf and total ultimate point or end bearing resistance Rp:
Qup = Rf + Rp.

TOPIC 4.3 CAPACITY FROM INSITU TESTS (SPT AND SCPT) - NEGATIVE SKIN FRICTION

1. The two commonly used penetration tests are _____
a) Standard penetration test
b) Cone penetration test
c) All of the mentioned
d) None of the mentioned

Answer: c
Explanation: According to Indian standard, the two commonly used penetration tests are

static cone penetration test and standard penetration test.

2. The values derived from penetration tests can be used for finding _____
a) Depth of hard stratum and Strength of soil
b) Soil saturation
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The penetration test are useful for general exploration of erratic soil profiles, for finding depth to bed rock or hard stratum, and to have an approximation indication of the strength and other properties of soils.

3. The observed value of N in static cone penetration test is corrected by _____
a) Overburden and Dilatancy /submergence
b) Effective pressure
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The N-value for cohesion less soil shall be corrected for overburden and the values N0 obtained after overburden correction is corrected further for dilatancy.

4. Correction for increasing effective overburden pressure have been proposed by _____
a) Gibbs and Holtz
b) Peck
c) Thornburn
d) All of the mentioned

Answer: d
Explanation: For a constant density index, the N value increase with increasing effective overburden pressure for which correction have been proposed by Gibbs and Holtz, peck, Thornburn, Whitman and others.

5. The split tube used in static cone penetration test, is commonly known as _____
a) Split spoon sampler
b) Split tube sampler
c) Tube sampler
d) All of the mentioned

Answer: a
Explanation: The split tube sampler, used in a test for standard penetration is commonly known as split spoon sampler resting on the bottom of the bore hole which is allowed to sink under its own weight.

6. The total blow required for the second and third 15 cm of penetration in standard penetration test is taken as _____
a) Seating drive
b) Penetration resistance
c) Overburden pressure
d) Dilatancy/submergence

Answer: a
Explanation: In standard penetration test, the first 15 cm of drive may be considered to be a seating drive. The total blows required for the second and third 15 cm of penetration is termed as the penetration resistance N.

7. The expression for C n as given by Lio and Whitman is _____
a) $C_n = \sqrt{(\sigma')}$
b) $C_n = \sqrt{(100/\sigma')}$
c) $C_n = 0.77\log_{10}(2000/\sigma')$
d) None of the mentioned

Answer: b
Explanation: In 1986, Lio and Whitman gave the following expression for
Normalizing factor C n:
$C_n = \sqrt{(100/\sigma')}$.

8. The cone test is useful in determining the bearing capacity of _____
a) Cohesion less soil and Fine sand
b) Clay soil
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The cone test is considered very useful in determining the bearing capacity of pits in cohesion less soils, particularly in fine sands of varying density.

9. The cone resistance qc, for sandy silt type of soil is _____
a) 3.5
b) 6
c) 2
d) 5

Answer: c
Explanation: For silts, sandy silts, slightly cohesive silt sand mixture type of soil, the cone resistance q c is 2.

TOPIC 4.4 UPLIFT CAPACITYGROUP CAPACITY BY DIFFERENT METHODS (FELD'S RULE, CONVERSE - LABARRA FORMULA AND BLOCK FAILURE CRITERION)

1. The efficiency of pile group depends upon _____
a) Characteristic of pile and Spacing of pile
b) Bearing capacity of soil
c) All of the mentioned
d) None of the mentioned

Answer: a
Explanation: The efficiency of pile group depends upon the following factors: Characteristics of pile (i.e. length, diameter, material etc.), spacing of pile, total number of piles in a row and number of rows etc.

2. Which of the following formulae can be used for determining the efficiency of pile group?
a) Dynamic formulae
b) Static formulae
c) Feld's formulae
d) Hiley's formulae

Answer: c
Explanation: Converse Labarre formulae, Seiler-kenney formulae, Feld's rule are some of the common formulae available for determining the efficiency of pile group.

3. In which of the following rule, the value of each pile is reduced by one-sixteenth?
a) Converse Labarre formulae
b) Feld's formulae
c) Seiler-Keeney formulae
d) All of the mentioned

Answer: b
Explanation: According to Feld's rule, the value of each pile is reduced by one-sixteenth on account of the effect of the nearest pile in each diagonal or straight row of which the pile in question is a member.

4. The bearing capacity of a single pile in clay is mainly due to _____
a) Friction
b) Shear strength of soil
c) Allowable load
d) Ultimate load

Answer: a
Explanation: The bearing capacity of single pile in clay is mainly due to friction, and the friction and the point bearing resistance may be negligible.

5. The downward drag acting on a pile due to the movement of the surrounding is called _____
a) Skin friction
b) Negative skin friction
c) Frictional force
d) None of the mentioned

Answer: b
Explanation: Negative skin friction is downward drag acting on a pile due to the downward movement of the surrounding compressible soil relative to the pile.

6. The area of the pile group along the failure surface is equal to _____
a) Perimeter × Area of cross section
b) Breadth × Length
c) Perimeter × Length
d) Perimeter/area of cross section

Answer: c
Explanation: The area of the pile group, along failure surface is approximately equal to the perimeter P of the pile group multiplied by the length L of the pile.

7. The pile spacing of each pile is taken as _____ diameter of the pile.
a) Four
b) Five
c) Three
d) Ten

Answer: c
Explanation: A spacing of three times the diameter of piles is commonly selected as trial spacing between the piles and checked against the criterion that the resistance Qs obtained.

8. The settlement of a group of friction piles can be computed on the assumption that _____
a) Clay is incompressible
b) Pile below the lower level is ignored
c) Bearing resistance is zero
d) None of the mentioned

Answer: a
Explanation: As a rough approximation, the settlement of a group of friction piles can be computed on the assumptions that the clay contained between the top of piles is incompressible.

9. The equation used for determining the bearing capacity of a group of friction piles is _____
a) Qup = Rf + Rp
b) Qug = n Qup . ηg
c) Qug = n Qup / ηg
d) None of the mentioned

Answer: b
Explanation: A method of estimating the bearing capacity of a group of friction piles is to multiply the quantity nQup by a reduction factor called the efficiency of pile group. Qug = n Qup . ηg.

TOPIC 4.5 SETTLEMENT OF PILE GROUPS - INTERPRETATION OF PILE LOAD TEST (ROUTINE TEST ONLY), UNDER REAMED PILES

1. The pile load test should be performed on _____
a) Working pile
b) Test pile
c) All of the mentioned
d) None of the mentioned

Answer: c
Explanation: The pile load test can be performed on a working pile which forms the foundation of the structure or on a test pile.

2. A Factor of safety that should be adopted for finding an allowable load for a pile is _____
a) 2.5 and 3
b) 4
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The IS code recommends that for working out allowable load, a minimum factor of safety 2.5 or 3 should be used.

3. For pile in cohesive soil _____ is neglected for individual pile action.
a) Frictional resistance
b) Surface area of pile

c) Shear strength of soil
d) All of the mentioned

Answer: b
Explanation: For the pile in cohesive soil, point bearing is generally neglected for individual pile action, since it is negligible as compared to frictional resistance.

4. The allowable load for the pile is given by _____ equation.
a) Qa = Qup/ F
b) Qa = Qup× F
c) Qa = WH /F(S+C)
d) Qa = WH /6(S+2.5)

Answer: a
Explanation: The allowable load Qp for a pile is given by dividing the ultimate bearing capacity Qup by a suitable factor of safety F. Qa = Qup/ F.

5. The separation of Q at any stage of loading into Rp and Rf in cyclic test is based on experimental value found out by_____
a) Hailey
b) A.F. Van Weele
c) A.M. Wellington
d) MacArthur

Answer: b
Explanation: The separation of Q at any stage of loading into Rp and Rf in cyclic test is based on experimental found value of A.F. Van Weele (1957) that the load on the pile toes (1957) that the load on the pile toe (i.e. RP) increases linearly with the elastic compression of the soil.

6. The test which can be used for separating load carried by the pile is _____
a) Cyclic load test
b) Pile load test
c) Penetration test
d) All of the mentioned

Answer: a
Explanation: The cyclic load test is particularly useful in separating the load carried by the pile into the skin friction and point bearing resistance.

7. The result of Dutch cone penetration test can be applied to determine _____
a) Ultimate skin fraction
b) Total ultimate point
c) Ultimate bearing capacity
d) None of the mentioned

Answer: c
Explanation: The result of Dutch cone penetration test can be applied with sufficient accuracy to determine the ultimate bearing capacity of piles in cohesion soils.

8. The elastic compression Δ L of a pile can be calculated by the expression based on _____
a) Terzaghi's theory
b) Hooke's law
c) Meyerhof's theory
d) Hiley's formula

Answer: b
Explanation: The elastic compression Δ L of the pile corresponding to any load Q (= Rf + Rp) can be calculated from the following expression based on Hooke's law,
Δ L = (Q – Rf/2) L / AE.

TOPIC 4.6 CAPACITY UNDER COMPRESSION AND UPLIFT - COHESIVE - EXPANSIVE - NON EXPANSIVE - COHESIONLESS SOILS - CODAL PROVISIONS.

1. When the under-reamed pile has only one bulb, it is called _____
a) Multi-under reamed pile
b) Single-under reamed pile
c) Unique-under reamed pile
d) All of the mentioned

Answer: b
Explanation: When the pile has only one bulb, it is known as single-under reamed pile, while the pile with more than one bulb is known as multi-under reamed pile.

2. The diameter of the under-reamed pile is kept equal to _____ times the diameter of pile steam.
a) 4
b) 5
c) 2.5
d) 2

Answer: c
Explanation: Generally the diameter of the under-reamed pile bulb is kept equal to 2.5 times the diameter of pile steam. However, it may vary from 2 to 3 times the stem diameter of pile steam.

3. Under-reamed pile foundation is most suitable for _____ type of condition.
a) Seasonal moisture change
b) Dry conditioned soil
c) Cohesive type of soil
d) All of the mentioned

Answer: a
Explanation: The under-reamed pile foundation find application in widely varying situations in a type of soils where foundation are required to laid on undesirable effect of seasonal moisture change as in expansive soils.

4. The load carrying capacity of a under-reamed pile may be determined by _____
a) Safe load test
b) Penetration test
c) Pile load test
d) Cyclic load test

Answer: a
Explanation: The load carrying capacity of an under-reamed pile may be determined from safe load test, in the absence of actual test.

5. The under-reamed piles are connected by a beam known as _____
a) Capping beam and Grade beam
b) Reamed beam
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The under-reamed piles are connected by a reinforced concrete beam, known as capping beam or grade beam.

6. The maximum spacing of the under-reamed pile should not normally exceed _____
a) 2 meters
b) 2½ meters
c) 1.5 meters
d) 30 centimeters

Answer: b
Explanation: The maximum spacing of the under-reamed pile should not normally exceed 2½ m as to avoid heavy capping beams.

7. Under reamed piles are normally bored _____ piles.
a) Cast-in-situ piles
b) Pre-cast-piles
c) Steel piles
d) Composite piles

Answer: a
Explanation: Under reamed piles are bored cast-in-situ concrete piles having one or more bulbs formed by enlarging the bore hole.

8. The spacing of the piles in under-reamed pile foundation depends on which of the following factor?
a) Nature of the ground and Type of pile
b) Load acting on the pile
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The spacing of the piles shall be considered in relation to the nature of the ground, the types of pile and the manner in which the pile transfers the load to the ground.

9. The grade beams are designed for a maximum bending moment of _____ if the beams are supported.
a) (wL2)/50
b) (wL2)/30
c) (wL2)
d) None of the mentioned

Answer: a
Explanation: The grade design are designed for a maximum bending moment of (wL2)/50 if the beam are supported during the construction, and for a bending moment of (wL2)/30 if the beams are not supported.

10. The details of the depth of beam and reinforcement required for various loading is provided by_____
a) Indian standard code
b) Central Building Research Institute, Roorkee
c) M.I.T system
d) None of the mentioned

Answer: b
Explanation: Design of grade beam, depth of beam and reinforcement required for various loading is provided by Central Building Research Institute, Roorkee.

UNIT V RETAINING WALLS

TOPIC 5.1 PLASTIC EQUILIBRIUM IN SOILS - ACTIVE AND PASSIVE STATES

1. The theory of plasticity pertaining to soils is based on _____
a) Mohr's theory
b) Rankine's method
c) Mohr-coulomb theory
d) None of the mentioned

Answer: a
Explanation: The theory of plasticity pertaining to soils is based on Mohr's theory of rupture.

2. On designing retaining walls it is necessary to take care of _____ exerted by soil mass.
a) Erosion
b) Lateral pressure
c) Surcharge
d) Lateral stress

Answer: b
Explanation: In the designing of retaining walls; sheet piles or other earth-retaining structures, it is necessary to compute the lateral pressure exerted by the retained mass of soil.

3. The material retained or supported by the retaining structure is called _____
a) Surcharge
b) Support wall
c) Back fill
d) All of the mentioned

Answer: c
Explanation: The material retained or supported by the structure is called backfill which may have its top surface horizontal or inclined.

4. The coefficient of earth pressure when the soil is at equilibrium is _____
a) $\sigma v / \sigma h$
b) $\sigma h / \sigma v$
c) $\sigma v \times \sigma h$
d) $\sigma 1 / \sigma 3$

Answer: b
Explanation: When the soil is at elastic equilibrium(i.e. at rest) the ratio of horizontal to vertical stress is called the co-efficient of earth pressure of rest.
σh /σv = K0.

5. The computation of stress in plastic equilibrium is based on _____
a) Theory of plasticity
b) Mohr's theory of rupture
c) Rankine's theory
d) All of the mentioned

Answer: a
Explanation: The theory on which the computation of the stress in a state of plastic equilibrium is based is called the theory of plasticity.

6. The wedge-shaped portion of the backfill tending to move with the wall is called _____
a) Wedge fall
b) Active fall
c) Failure wedge
d) None of the mentioned

Answer: c
Explanation: During the active state, the wall moves away from backfill and a certain portion of the backfill in wedged-shaped tend to move which is called a failure wedge.

7. In active stress, the major principal stress σ1 acting on the wall will be in _____ plane.
a) Vertical
b) Horizontal
c) Inclined
d) Zero

Answer: b
Explanation: In an active state, the major principal stress σ1 is vertical and the minor principal stress σ3 is horizontal.

8. The plastic state of stress was proposed by _____
a) Mohr
b) Rankine
c) Coulomb
d) Darcy

Answer: b
Explanation: The plastic state of stress when the failure is imminent was investigated by Rankine in 1860.

9. The position of the backfill lying above the horizontal plane at the top of wall is called _____
a) Active state
b) Plasticity
c) Surcharge
d) Slip lines

Answer: c
Explanation: The position of the backfill lying above a horizontal plane at the elevation of the top of a wall is called the surcharge, and its inclination to the horizontal is called surcharge angle β.

10. What will be the co-efficient of passive earth pressure, at a depth of 8m in cohesion less soil sand with an angle of internal friction of 30° when the water rises to the ground level?
a) 4
b) 5
c) 3
d) 1

Answer: c
Explanation: Given φ = 30°
Co-efficient of passive earth pressure, Kp = (1 + sin φ) / (1 – sin φ)
Kp = (1 + sin 30)/ (1 – sin 30°)
KP = 3.

TOPIC 5.2 RANKINE'S - THEORY - COHESIONLESS AND COHESIVE SOIL

1. Originally, Rankine's theory of lateral earth pressure can be applied to only _____
a) Cohesion less soil
b) Cohesive soil
c) Fine grained soil
d) Coarse grained soil

Answer: a
Explanation: As originally proposed, Rankine' s theory of lateral pressure is applied to uniform cohesion less soils only. Later, it was extended to include cohesive soil.

2. Rankine's theory of lateral pressure was extended to other soil by _____
a) Resal and Bell
b) Mohr
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The theory of lateral pressure was extended to cohesive, stratified, partially immersed and submerged soil was by Resal in 1910 and by Bell in 1915.

3. Based on the assumptions of Rankine's theory, the soil mass is _____
a) Stratified
b) Submerged
c) Homogeneous
d) All of the mentioned

Answer: c
Explanation: According to the assumption of Rankine's theory, the soil mass is semi-infinite, homogeneous, dry and cohesion less.

4. Which of the following cases for cohesion less backfill in Rankine's theory is considered?
a) Submerged backfill
b) Moist backfill with no surcharge
c) Backfill with sloping surface
d) All of the mentioned

Answer: d
Explanation: In Rankine's theory the following cases of cohesionless backfill are considered
i) Dry or moist backfill with no surcharge
ii) Submerged backfill
iii) Backfill with a sloping surface and inclined back and surcharge.

5. The factor that is responsible for inclination of resultant pressure to the retaining wall is _____
a) Frictional force
b) Surcharge
c) Earth pressure
d) Weight of the wall

Answer: a
Explanation: The retaining walls are constructed of masonry or concrete, due to this the frictional force develops. The existence of the friction makes the resultant pressure inclined to the wall at an angle that approaches the frictional angle between the soil and the wall.

6. If the sand filled behind the retaining wall with saturated water with water, then the possible lateral pressure is _____
a) Lateral pressure due to submerged weight and Lateral pressure due to water
b) Lateral pressure due to retaining wall
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The lateral pressure is made up of two components for wetted soil in back of the retaining wall:
i) Lateral pressure due to submerged weight 'γ' of the soil, and
ii) Lateral pressure due to water.

7. The earth pressure at rest exerted on a retaining structure can be calculated using _____
a) Theory of plasticity
b) Theory of elasticity

c) Mohr's theory of rupture
d) None of the mentioned

Answer: b
Explanation: The earth pressure at rest, exerted on the back of the rigid, unyielding retaining structure, can be calculated using theory of elasticity.

8. The value of K0(coefficient of earth pressure at rest) for loose sand is _____
a) 0.6
b) 0.5
c) 0.4
d) 0.8

Answer: c
Explanation: The value of K0 for different soils is:
i) Loose sand – 0.4
ii) Dense sand – 0.6
iii) Soft clay – 0.6
iv) Hard clay – 0.5.

9. The expression for K0 as given by Jacky is _____
a) K0 = 1 – sin φ
b) K0 = sin φ
c) K0 = 1 – cos φ
d) K0 = 1 + sin φ

Answer: a
Explanation: K0 can be calculated by using the following equation as computed by Jacky in 1944:
K0 = 1 – sin φ.

10. What will be the coefficient of earth pressure at rest for a rigid retaining wall, If the backfill consists of cohesion less soil having φ = 26°?
a) 0.1295
b) 0.6552
c) 0.5616
d) 0.7383

Answer: c
Explanation: Coefficient of earth pressure, K0 can be calculated using Jacky's formula:
Given: φ = 26°
Formula: K0=1 – sin φ
K0 = 1 – sin 26°
K0 = 1 – 0.4383
K0 = 0.561628.

TOPIC 5.3 COULOMB'S - WEDGE THEORY - CONDITION FOR CRITICAL FAILURE PLANE

1. The wedge theory of earth pressure is based on the concept of _____
a) Active earth pressure
b) Sliding wedge
c) Wall friction
d) All of the mentioned

Answer: b
Explanation: The wedge theory of earth pressure is based on the concept of a sliding wedge which is torn off from the rest of the backfill on a movement of the wall.

2. Which of the following is a basic assumption of the wedge theory?
a) The slip surface is plane
b) The backfill is dry
c) The backfill is homogeneous
d) All of the mentioned

Answer: d
Explanation: Based on the assumptions of the wedge theory:
i. The backfill is dry, cohesion less, homogeneous, isotropic, and elastically undeformable.
ii. The slip surface is a plane which passes through the heel of the wall
iii. The sliding wedge itself acts as a rigid body.

3. The force acting on a wedge of soil are _____
a) Frictional force

b) Weight of the wedge and Active thrust
c) None of the mentioned
d) All of the mentioned

Answer: b
Explanation: According to wedge theory, the forces acting on a wedge of soil are its weight W, the reaction R along the plane of sliding and the active thrust against the retaining wall.

4. The active lateral pressure of intact saturated clays is calculated by assuming

_____
a) φ=0 and φc=0
b) φ=90
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The active lateral pressure of intact saturated clays for temporary works or immediately after construction of a retaining wall is calculated by assuming φ=φc=0.

5. The forces acting on the trial wedge which is used for finding Rankine's active earth pressure is _____
a) Weight W of the wedge
b) Resultant force
c) Resultant reaction between wedge and sol
d) All of the mentioned

Answer: d
Explanation: The three forces acting on a trial wedge are: i) the resultant force that exist between the free body and the wall ii) the weight W of the wedge iii) the resultant reaction between the wedges and the rest of the soil along the surface.

6. The Rankine's active earth pressure can also be found out by method of

_____
a) Trial wedges
b) Graphical method
c) Sliding wedge
d) Theoretical calculation

Answer: a
Explanation: The Rankine's active earth pressure (assuming the wall to be smooth) can be found out by method of trial wedges.

7. Based on the assumptions of the wedge theory, pressure distribution is assumed to be

_____
a) Planar
b) Hydrostatic
c) Equal
d) Distributed

Answer: b
Explanation: The assumption is based on that, the total pressure distribution is hydrostatic,i.e., triangular

8. In Coulomb's wedge theory, the angle λ is referred as _____
a) Angle of wall friction
b) Surcharge angle
c) Critical slip angle
d) None of the mentioned

Answer: c
Explanation: In wedge theory, the angle between the slip plane and the ground is called the critical angle λ.

9. The φ-line in wedge theory can also be called as _____
a) Surcharge line
b) Natural slope line and Repose line
c) None of the mentioned
d) All of the mentioned

Answer: b
Explanation: The φ-line shows a plane inclined at an angle φ to the horizontal at which the soil is expected to stay in the absence of any lateral support. The line therefore is called the natural slope line or repose line.

10. In coulomb's wedge theory, the criterion for maximum active pressure is present at

_____

a) Slip-plane
b) Repose line
c) Surcharge line
d) Ground line

Answer: a
Explanation: In 1971, Professor Rebhann presented that the criterion for maximum active pressure is present at the slip–plane of the assumed triangle.

TOPIC 5.4 EARTH PRESSURE ON RETAINING WALLS OF SIMPLE CONFIGURATIONS

1. The principal stress relationship on a failure plane is given by _____
a) $\sigma_1=\sigma_3 \tan^2 \alpha$
b) $\sigma_1=2c \tan\alpha-\sigma_3 \tan^2 \alpha$
c) $\sigma_1=2c \tan\alpha+\sigma_3$
d) $\sigma_1=2c \tan\alpha+\sigma_3 \tan^2 \alpha$

Answer: d
Explanation: The principal stress relationship on a failure plane is given by,
$\sigma_1=2c \tan\alpha+\sigma_3 \tan^2 \alpha$,
Where, σ_1=major principal stress
σ_3=minor principal stress
$\alpha = (45^\circ + \frac{\varphi}{2})$,
φ=angle of internal friction
c=cohesion.

2. The Belli equation of lateral pressure of cohesive soil is _____
a) $p_a=\gamma z\cot^2 \alpha-2c \cot\alpha$
b) $p_a=\gamma z\cot^2 \alpha+2c \cot\alpha$
c) $p_a=-2c \cot\alpha$
d) $p_a=\gamma z\cot^2 \alpha/2c \cot\alpha$

Answer: a
Explanation: Since the principal stress relationship on a failure plane is given by,
$\sigma_1=2c \tan\alpha+\sigma_3 \tan^2 \alpha$,
$\sigma_1=\gamma z$ and $\sigma_3=p_a$,
$\therefore \gamma z=2c \tan\alpha+p_a \tan^2 \alpha$
$\therefore p_a=\gamma z\cot^2 \alpha-2c \cot\alpha$.

3. The Belli equation at the ground surface is given by _____
a) $p_a=\gamma z\cot^2 \alpha-2c \cot\alpha$
b) $p_a=\gamma z\cot^2 \alpha+2c \cot\alpha$
c) $p_a=-2c \cot\alpha$
d) $p_a=\gamma z\cot^2 \alpha/2c \cot\alpha$

Answer: c
Explanation: Since the Belli equation of lateral pressure of cohesive soil is given by,
$p_a=\gamma z\cot^2 \alpha-2c \cot\alpha$,
at the ground surface, z=0,
$\therefore p_a=-2c \cot\alpha$.

4. The tension at the top level of retaining wall reduces to zero at a depth _____
a) $z_0 = \frac{q-2c\cot\alpha}{\gamma}$
b) $z_0 = \frac{2c\tan\alpha}{\gamma}$
c) $z_0 = \frac{2\cot\alpha}{\gamma}$
d) $z_0 = \frac{\cot\alpha}{\gamma}$

Answer: b
Explanation: Since the Belli equation of lateral pressure of cohesive soil is given by,
$p_a=\gamma z\cot^2 \alpha-2c \cot\alpha$,
When $p_a=0$,
$\therefore z_0 = \frac{2c\tan\alpha}{\gamma}$

5. The depth at which the tension is zero for cohesive soils with retaining wall in terms K_a is _____
a) $z_0 = \frac{2cK_a}{\gamma}$
b) $z_0 = \frac{2c}{\gamma}\frac{1}{\sqrt{K_a}}$

c) $z_0 = \frac{2cK_a}{\gamma}$
d) $z_0 = \frac{2c}{\gamma}(\frac{1}{K_a})$

Answer: b
Explanation: The tension at the top level of retaining wall reduces to zero at a depth, $z_0 = \frac{2ctan\alpha}{\gamma}$,
Since, $K_a = \frac{1}{tan^2(45^\circ + \frac{\varphi}{2})}$,
$\therefore z_0 = \frac{2c}{\gamma}\frac{1}{\sqrt{K_a}}$.

6. The effect of cohesion in the soil is to

_____
a) reduce pressure intensity
b) increase pressure intensity by 3
c) double the pressure intensity
d) increase pressure intensity by 4

Answer: a
Explanation: Cohesion is the component of shear strength of a rock or soil that is independent of inter-particle friction. Due to the cohesion, the particles of the soil are in close contact by which they distribute the load evenly.

7. For a cohesive soil, the pressure intensity is reduced by a factor of _____
a) 2c cotα
b) 2c tanα
c) 2c sinα
d) 2c cosα

Answer: a
Explanation: The equation of pressure intensity due to cohesion is given by,
$p_a = \gamma z cot^2 \alpha - 2c\ cot\alpha$.
Thus, the effect of cohesion is to reduce the pressure intensity by a factor of " 2c cotα".

8. The total net pressure for a cohesive soil is given by _____
a) $P_a = \frac{1}{2} K_a \gamma H^2 cot^2 \alpha - 2c\ cot\alpha$
b) $P_a = \gamma H^2 - 2c\ cot\alpha$
c) $P_a = K_a \gamma H^2 - 2c\ cot\alpha$
d) $P_a = K_a H^2 - 2c\ cot\alpha$

Answer: a
Explanation: The total net pressure is given by,
$P_a = \int_0^H p_a . dz = \int_0^H (\gamma z cot^2\alpha - 2c cot\alpha) . dz$
$\therefore P_a = \frac{1}{2} K_a \gamma H^2 cot^2 \alpha - 2c\ cot\alpha$.

9. If a tension crack is developed at the top of wall to a depth Z_o in cohesive soils, then the total net pressure is zero for a depth of

_____
a) $2Z_o$
b) $3Z_o$
c) $4Z_o$
d) $5Z_o$

Answer: a
Explanation: A negative pressure develops and because of it, a crack is developed in the soil upto a depth Z_o. The sum of negative pressure and the positive pressure will be compensated at a depth of $2Z_o$. Hence, the total net pressure is zero for a depth of $2Z_o$.

10. The critical height for an unsupported vertical cut in cohesive soil is given by

_____
a) $H_c = \frac{q - 2ccot\alpha}{\gamma}$
b) $H_c = \frac{4ctan\alpha}{\gamma}$
c) $H_c = \frac{4cot\alpha}{\gamma}$
d) $H_c = \frac{cot\alpha}{\gamma}$

Answer: b
Explanation: If a tension crack is developed at the top of wall to a depth Z_o in cohesive soils, then the total net pressure is zero for a depth of $2Z_o$. This means that the soil will be able to stand with a vertical face up to a depth

of $2Z_o$.

∴ The critical height $H_c = \frac{4ctan\alpha}{\gamma}$.

11. For an inclined back and surcharge, if P1, is horizontal pressure and W is weight of soil wedge, then the total pressure is given by

a) $P=P_1+W$

b) $P = \sqrt{P_1^2 + W^2}$

c) $P=(P_1+W)^2$

d) $P=P_1-W$

Answer: b

Explanation: For an inclined back and surcharge, if P1, is horizontal pressure and W is weight of soil wedge, then the total pressure is given by,

$P = \sqrt{P_1^2 + W^2}$,

This is due to the fact that the total pressure P is the resultant of the horizontal pressure and the weight of the wedge.

12. When the top tension portion of the wall in cohesive soil is neglected, the total lateral thrust is given by _____

a) $P_a=\frac{1}{2}K_a\ \gamma H^2\ cot^2\ \alpha$-2c cotα

b) $P_a=\frac{1}{2}K_a\ \gamma H^2\ cot^2\ \alpha$-2c cotα+$\frac{2c^2}{\gamma}$

c) $P_a=\frac{1}{2}K_a\ \gamma H^2\ cot^2\ \alpha$-2c cotα-$\frac{2c^2}{\gamma}$

d) $P_a=K_a\ H^2$-2c cotα

Answer: b

Explanation: When the negative tensile portion is neglected, the total lateral thrust is given by,

$P_a = \int_{z_0}^{H} p_a . dz = \int_{z_0}^{H} (\gamma z cot^2\alpha - 2c cot\alpha) . dz$

substituting for $z_0 = \frac{2ctan\alpha}{\gamma}$,

∴ $P_a=\frac{1}{2}K_a\ \gamma H^2\ cot^2\ \alpha$-2c cotα+$\frac{2c^2}{\gamma}$.

13. If the cohesive backfill carries a surcharge of q per unit area, then the lateral pressure is increased by _____

a) K_a q

b) q

c) K_a

d) K_a/q

Answer: a

Explanation: Since the surcharge is the additional load, when the backfill is horizontal and carries a surcharge q, then the vertical pressure increment will be by q. Due to this, the lateral pressure will increase by K_a q.

14. The lateral pressure for cohesive backfill with surcharge q is _____

a) $p_a=\gamma z cot^2\ \alpha$-2c cotα+$qcot^2\ \alpha$

b) $p_a=\gamma z cot^2\ \alpha$+2c cotα+$cot^2\alpha$

c) p_a=-2c cotα-$cot^2\ \alpha$

d) $p_a=\gamma z cot^2\ \alpha/2c$ cotα

Answer: a

Explanation: When the cohesive backfill carries a surcharge of q per unit area, then the lateral pressure is increased by K_a q. Since,

$K_a=cot^2\alpha$,

∴ $p_a=\gamma z cot^2\ \alpha$-2c cotα+$qcot^2\ \alpha$.

15. For a cohesive backfill with surcharge q, when at depth z_0, p_a=0, then the depth z_0 is

a) $z_0 = \frac{q-2ccot\alpha}{\gamma}$

b) $z_0 = \frac{2ctan\alpha}{\gamma} - \frac{q}{\gamma}$

c) $z_0 = \frac{2cot\alpha}{\gamma} + \frac{q}{\gamma}$

d) $z_0 = \frac{cot\alpha}{\gamma} - \frac{q}{\gamma}$

Answer: b

Explanation: Since the lateral pressure for cohesive backfill with surcharge q is given by,

$p_a=\gamma z cot^2\ \alpha$-2c cotα+$qcot^2\ \alpha$,

when p_a=0,

$\therefore z = z_0 = \frac{2ctan\alpha}{\gamma} - \frac{q}{\gamma}$.

TOPIC 5.5 CULMANN'S GRAPHICAL METHOD

1. Culmann's solution can be conveniently used for _____
a) Various type of surcharge loads
b) Ground surface of any shape
c) Backfill of different densities
d) All of the mentioned

Answer: d
Explanation: Culmann's graphical method can be conveniently used for the ground surface of any shape, for various types of surcharge loads, and for a layered backfill of different densities.

2. Culmann's solution is based on _____ theory.
a) Coulomb's
b) Rebhann's
c) Mohr
d) Rankine's

Answer: a
Explanation: In 1886, Culmann gave a graphical solution to evaluate the active earth pressure by coulomb's theory.

3. Which of the following effect of line load can be taken into account by Culmann's graphical method?
a) Railway track and Long wall of a building
b) Road alignment
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: Culmann's graphical method can be used to take into account the effect of line of load, such as railway track or a long wall of a building etc., running parallel to the retaining wall.

4. Rebhann's graphical method can be used for the location of _____
a) Slip plane and Total active earth pressure
b) Passive earth pressure
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: In 1871, Rebhann presented a graphical method for the location of the slip plane and the total active earth pressure according to Coulomb's wedge theory.

5. Earth pressure for retaining walls, of less than 6m are obtained by _____
a) Analytical method
b) Graphical method
c) Considering approximate value
d) All of the mentioned

Answer: b
Explanation: In practice, earth pressures for retaining walls of less than 6m height are obtained from graphs or tables.

6. All available graphs and tables, used for finding earth pressure is based on _____
a) Rankine's theory
b) Coulomb's theory
c) Culmann's theory
d) Rebhann's graphical method

Answer: a
Explanation: Almost all graphs and tables available in the literature which are used for finding earth pressure are based on Rankine's theory.

7. Which of the following is not one of the criteria, for design of gravity dam?
a) The wall must be safe against sliding
b) The wall must be safe against overturning
c) The wall must be thinner in section
d) No tension should be developed in the wall

Answer: c
Explanation: As the gravity wall resists the

earth lateral pressure by its weight, therefore it should be thicker in section.

8. For the design of gravity dam, the minimum value of F(factor of safety) against sliding should be _____
a) 2.0
b) 1.5
c) 0.5
d) 4.0

Answer: b
Explanation: From the equation F = RV.μ / Rh
The minimum value of factor of safety is found out to be 1.5.

TOPIC 5.6 PRESSURE ON THE WALL DUE TO LINE LOAD - STABILITY ANALYSIS OF RETAINING WALLS - CODAL PROVISIONS

1. The maximum load which can be carried by a pile is defined as its _____
a) Ultimate load carrying capacity
b) Ultimate bearing resistance
c) Ultimate bearing capacity
d) All of the mentioned

Answer: d
Explanation: The ultimate load carrying capacity, or ultimate bearing resistance or ultimate bearing capacity Q up is defined as the maximum load which can be carried by a pile and at which the pile continues to sink without further increase of load.

2. The allowable load which the pile can carry safely is determined on the basis of _____
a) Factor of safety
b) Load test
c) Stability of the pile foundation
d) All of the mentioned

Answer: c
Explanation: The allowable load Qa is the safe load which the pile can carry safely and is determined on the basis of: i) overall stability of the pile-foundation ii) the permissible settlement iii) ultimate bearing resistance divided by factor of safety.

3. The load carrying capacity of a pile can be determined by which of the following methods?
a) Dynamic formulae
b) Static formulae
c) Plate load test
d) All of the mentioned

Answer: d
Explanation: The load carrying capacity of a pile can be determined by the following methods: i) Penetration tests ii) Dynamic formulae iii) Static formulae iv) Plate load test.

4. Which of the following are some of the commonly used dynamic formula?
a) Engineers News formula and Hiley's formula
b) Static formula
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: The Engineers News formula as proposed by Wellington and Hiley's formula given by the original expression of Hiley are the commonly used dynamic formula.

5. When a pile hammer hits the pile, the total driving energy is equal to _____
a) Weight of hammer times the height of drop
b) Weight of the ram time times the height of the stroke
c) Sum of the impact of the ram
d) Sum of the impact of ram plus the energy delivered by explosion

Answer: a
Explanation: When a pile hammer hits the pile, the total driving energy is equal to the weight of hammer the height of drop or stroke.

6. Dynamic formulae are best suited for _____ type of soil.
a) Fine grained soil
b) Coarse grained soil
c) Cohesive soil
d) None of the mentioned

Answer: b
Explanation: Dynamic formulae are best suited to coarse grained soils for which the shear strength is independent of rate of loading.

7. Dynamic formula does not indicate about _____
a) Temporary change in soil structure and Future settlement
b) Allowable load
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: A disadvantage of a dynamic formula is that it gives no indication about the reduced bearing future settlement or temporary changes in soil structure.

8. The dynamic formula is valueless for which of the following type of soil?
a) Loose sand
b) Saturated soil
c) Clay soil
d) Compacted soil

Answer: c
Explanation: For clays, the dynamic formulae are valueless because the skin friction developed in clay during driving is very much less than which occurs after a period of time.

9. In dynamic formulae what are the energy losses, that is not accounted?
a) Energy Loss due to vibration and Energy loss due to heat
b) Frictional loss
c) None of the mentioned
d) All of the mentioned

Answer: a
Explanation: In dynamic formulae, the energy loss due to vibrations, heat and damage to dolly or packaging are not taken into account.

10. The greater objection to any of the pile driving formulae is _____
a) Uncertainty in relation between dynamic and static resistance
b) Shear strength of the soil
c) Uncertainty in the allowable pressure
d) None of the mentioned

Answer: a
Explanation: The greater objection to any of the pile driving formulae is the uncertainty about the relationship between the dynamic and static resistance to soil.

11. The static formula is based on the assumption that the ultimate bearing capacity Qup is equal to _____
a) Rf + Qa
b) Rf + Rp
c) As + Ap
d) Q up / F

Answer: b
Explanation: The static formulae are based on the assumption that the ultimate bearing capacity Qup of a pile is the sum of the total ultimate skin friction Rf and total ultimate point or end bearing resistance Rp:
Qup = Rf + Rp.