Continuing Education Course #115
Mechanically Stabilized Earth Structures
Part 1

1. Who said *"The ancients have stolen all our best ideas"*?
- a. Einstein
- b. Rankine
- c. Mark Twain
- d. Coulomb

2. In ancient structures built in 2,500 BC, what form of reinforcement was used?
- a. geogrid
- b. geotextiles
- c. reed mats
- d. bronze

3. When was the first modern use of MSE structures documented?
- a. 1490's
- b. 1850's
- c. 1950's
- d. 1990's

4. Who rediscovered the technique of reinforcing soil?
- a. Schmertmann
- b. Vidal
- c. Leshchinsky
- d. Holtz & Kovacs

5. Inextensible reinforcement deforms considerably less than the surrounding soil.
- a. False
- b. True

6. Extensible reinforcement deforms as much as the surrounding soil.
- a. False
- b. True

7. In what year was the first MSE wall constructed in the USA?
- a. 1968
- b. 1972
- c. 1980
- d. 1984

8. What two methodologies are used to design MSE structures?

- ○ a. AASHTO & LRFD
- ○ b. LRFD & British Standard
- ○ c. AASHTO & Tie Back Wedge
- ○ d. AASHTO-NCMA

9. The AASHTO method requires a minimum design length of:
- ○ a. L=0.7H
- ○ b. Various lengths
- ○ c. L=0.6H
- ○ d. none of the above

10. The NCMA method can be used for complex MSE walls:
- ○ a. sometimes
- ○ b. never
- ○ c. only for strip loads
- ○ d. only for tiered walls

11. Which design method can address complex structures with tiered geometry and/or strip loads?
- ○ a. AASHTO
- ○ b. NCMA
- ○ c. Tie Back Wedge
- ○ d. none of the above

12. What is the minimum design life of a MSE structure?
- ○ a. 10-years
- ○ b. 25-years
- ○ c. 50-years
- ○ d. 75-years

13. What is the estimated failure rate of MSE walls?
- ○ a. 0.1%
- ○ b. 4.6%
- ○ c. 6.4%
- ○ d. 7.0%

14. What two software programs are considered the industry standard for designing MSE walls.
- ○ a. MiraWall & KeyWall
- ○ b. MSEW & SrWall
- ○ c. StrataWall & RisiWall
- ○ d. ABWalls & TensWall

15. Why should program MSEW be used for design as apposed to SrWall or other manufacturer software?
- ○ a. MSEW addresses public sector and private sector design methods
- ○ b. MSEW can address complex geometry and loading conditions
- ○ c. Paradoxical results can be easily realized when comparing designs from FHWA and NCMA methods
- ○ d. all of the above

16. The active earth pressure coefficient, K_a based on NCMA can be much less than K_a based on FHWA?
- ○ a. True
- ○ b. False

17. Since geotechnical engineers typically base the recommended active earth pressure coefficient, K_a on Rankine the wall engineer should use FHWA criteria.

- a. True
- b. False

18. The main components of a MSE wall system are considered to be:

- a. Geosynthetic Reinforcement
- b. Segmental Blocks
- c. Soil, Leveling Pad and Drainage
- d. all of the above

19. What are the two primary reinforcements used in MSE block walls and slopes?

- a. Reed Mats and Tree Branches
- b. Geogrid and Geotextiles
- c. Steel Mats and Steel Strips
- d. B and C

20. How many reinforcement products are readily available to be used in a MSE structure?

- a. 3
- b. 5
- c. 7
- d. >10

21. To determine a reinforcements Long Term Design Strength LTDS the ultimate strength of the reinforcement, T_{ult} is divided by what reduction factors?

- a. Creep, RF_{cr}
- b. Durability, RF_d
- c. Installation Damage, RF_{id}
- d. all of the above

22. How many segmental block systems are readily available to be used in a MSE structure?

- a. 3
- b. 5
- c. 7
- d. >10

23. Which is better, a mechanical or frictional block system?

- a. mechanical
- b. frictional
- c. does not matter
- d. neither

24. Blanket drains are required…..

- a. never
- b. when ground-water is close to the MSE wall foundation
- c. sometimes
- d. always

25. Blanket and chimney drains are required…..

○ a. never
○ b. when ground-water is close to the MSE wall foundation
○ c. when ground-water rises above the MSE wall foundation
○ d. sometimes

26. What information is needed to complete a MSE wall design?
○ a. soil properties
○ b. grading information
○ c. block/reinforcement properties
○ d. all of the above

27. Approximately what percentage of a MSE wall is comprised of soil?
○ a. 35%
○ b. 50%
○ c. 98%
○ d. 99%

28. What are the two main soil properties needed for design?
○ a. effective friction angle
○ b. unit weight
○ c. effective cohesion
○ d. A and B

29. A _____ shear test is required when using coarse grained soils.
○ a. quick
○ b. direct
○ c. indirect
○ d. none of the above

30. A _____ shear test is required when using fine grained soils.
○ a. unconsolidated undrained
○ b. consolidated drained
○ c. consolidated undrained
○ d. unconsolidated drained

31. What is the two effective stress strength parameters noted on the CU triaxial test on Page 16?
○ a. Φ'=35.8° and c'=70-psf
○ b. Φ'=27.7° and c'=190-psf
○ c. Φ'=53.0° and c'=720-psf
○ d. none of the above

32. What would the moist unit weight, γ_{moist}, be using the equation on Page 17 at 98% compaction if γ_d=102.1-lb/ft^3 and w_{opt}=14.6%?
○ a. 111.2-lb/ft^3
○ b. 112.3-lb/ft^3
○ c. 113.5-lb/ft^3
○ d. 114.7-lb/ft^3

33. How often should compaction be checked during MSE wall construction?

○ a. whenever the contractor asks for a test
○ b. 2 compaction tests per day
○ c. one test every 100 to 150 linear feet of in-place fill and 2-foot vertically
○ d. none of the above

34. The reinforced zone Liquid Limit LL should be less than?
○ a. 35
○ b. 20
○ c. 15
○ d. 40

35. What is the best type of soil to use in a MSE structure?
○ a. course grained sands/gravel
○ b. fine grained silts/clays
○ c. both a and b
○ d. neither

36. What are the advantages of using coarse grained soils?
○ a. easy to place and compact
○ b. higher friction angle
○ c. less susceptible to creep
○ d. all of the above

37. If the reinforced zone soil classify as silt or clay a _____ engineer should be involved in the design to make sure the soil does not exhibit creep behavior.
○ a. civil
○ b. geotechnical
○ c. MSE wall
○ d. structural

38. What information is required for design with respect to the segmental block units?
○ a. dimension and setback
○ b. weight
○ c. connection and block shear
○ d. all of the above

39. Is it required to choose a specific SRW facing unit and reinforcement for design?
○ a. yes - each SRW and grid combination is unique
○ b. no - all blocks are the same
○ c. yes - only for walls <20-ft
○ d. yes - only for walls >20-ft

40. Connection capacity is determined by _____.
○ a. full scale field tests
○ b. a one point pullout test
○ c. applying several normal loads and tension load to a specific SRW and grid combination
○ d. interpolating a bi-linear from a two point pullout test

41. If K_a=0.333, γ=120-pcf and assume maximum vertical spacing between reinforcement layers of S_v=1.5-ft what would the maximum design test height H_{max} be for a geogrid with LTDS=1,500-lb/ft?

- a. 10-ft
- b. 13-ft
- c. 15-ft
- d. 17-ft

42. Segmental blocks that have a mechanical connection typically have a load-displacement curve that reaches a peak load and then sudden loss of strength, i.e. something breaks.

- a. False
- b. True

43. Segmental blocks that have a frictional connection typically have load-displacement curves that reaches a peak load and then tapers off, i.e. reinforcement pulls out between the block units.

- a. True
- b. False

44. Calculate hinge height for a block with the following properties: W_u = 1.67-ft, H_u = 0.604-ft, ω = 7.125-deg, i_b = 0-deg and γ_u = 140-lb/ft^3?

- a. 7.12-ft
- b. 12.14-ft
- c. 36.63-ft
- d. 13.36-ft

45. Calculate the maximum connection load for a block with the following properties: W_u = 1.67-ft, H_u = 0.604-ft, ω = 7.125-deg, i_b = 0-deg and γ_u = 140-lb/ft^3?

- a. 1,167-lb/ft
- b. 1,586-lb/ft
- c. 1,604-lb/ft
- d. 1,870-lb/ft