Continuing Education Course #026
Timber Pier Design

1. In the example pier section shown in Figure 4, if the deck width were 7 feet instead of 5 feet, and the span was 16 feet, and the number of stringers and load conditions were the same as the example, what would be the approximate Uniform Dead Load per lineal foot be on the Center Stringer?

- a. 63.1 lb per lineal foot
- b. 37 lb per lineal foot
- c. 70 lb per lineal foot
- d. 20 lb per lineal foot

2. Assuming a 60 psf live load, what would the approximate combined live and dead load per lineal foot be on the center stringer?

- a. 200# per lineal foot
- b. 220# per lineal foot
- c. 247# per lineal foot
- d. 300# per lineal foot

3. Using the answers from Questions 1 & 2, what would the approximate maximum bending moment be in the center stringer?

- a. 80,640 in lb
- b. 40,320 in lb
- c. 94,850 in lb
- d. None of the above

4. Assuming an allowable unit stress only; and 1200 psi, plus an allowable increase of 25% as a maximum unit stress, what would be the minimum section one should consider for the center stringer?

- a. 3 x 10 timber
- b. 4 x 10 timber
- c. 3 x 12 timber
- d. 4 x 12 timber

5. Assuming a 4 x 12 timber is chosen for the center stringer, and all of the loading conditions from above apply, what the anticipated deflection be at the center of the span?

- a. 0.69 inches
- b. 0.97 inches
- c. 0.35 inches
- d. 1.25 inches

6. Besides the obvious vertical live and dead loads that were just considered in questions 1 to 5 above, what are some of the additional loads that a stringer may be subjected to in its life span.

- a. Wave Uplift
- b. Lateral Load from waves

○ c. Impacts from moored or drifting boats
○ d. All of the above

7. A “Split Cap” refers to:
○ a. Splitting that occurs in wood as it weathers
○ b. Two horizontal timbers placed on either side of a pile, then through bolted forming a clamp type connection
○ c. A fiberglass cap that sits on top of a pile to prevent end rot
○ d. None of the above

8. Dapping of a Pile is useful in pier design & construction because:
○ a. It provides a flatter surface to seat a horizontal timber against
○ b. It provides a seat for a horizontal timber that will help distribute the vertical load to the pile.
○ c. It provides a temporary seat to place the pile on during construction
○ d. All of the above

9. Oversizing bolted connections either by using larger bolts or increasing the number of bolts is a good practice because:
○ a. To compensate for metal loss that will occur over time after galvanizing has weathered away.
○ b. In case the wood portion of the connection is weakened due to weathering of the wood.
○ c. All of the above
○ d. None of the above

10. Usually a split pile cap is oversized in the vertical direction for what reason?
○ a. To reduce current velocities under the pier
○ b. To allow additional space for insertion of bolts
○ c. To catch drifting debris
○ d. To provide better anchorage for mooring cleats

11. While soil conditions dictate desirable pile penetration depths, even in very firm soil conditions, the minimum recommended embedment depth of a pile in ice free waters is:
○ a. 5 feet
○ b. 10 feet
○ c. 15 feet
○ d. 20 feet

12. Assuming a boat is tied off to a pier, and the wind is blowing broadside to the boat. Using the dynamic drag equation to determine the wind load of a moored boat, and a wind speed of 60 knots, a wind surface area of a boat’s profile of 200 square feet, and a drag Constant (Co) of 1.0, approximately what horizontal force would be expected from wind loads on the boat?
○ a. 1224 pounds
○ b. 2000 pounds
○ c. 2450 pounds
○ d. 3000 pounds

13. Assuming that a pier is built using a two pile bent spacing of 12 feet, and no X-bracing and the horizontal load for design purposes is 400# per lineal foot of pier length, and the exposed length of pile from the deck above to the bottom is ten feet, and soil conditions are firm enough that we need only neglect the first 3 feet of soil with respect to unsupported pile length; approximately what bending moment is generated in a single pile?
○ a. 748,800 inch pounds
○ b. 374,400 inch pounds
○ c. 187,200 inch pounds
○ d. 93,600 inch pounds

14. Taking the pile load condition from the previous question, and allowing 1500 psi as maximum bending stress (1200 psi x 1.25) what is the minimum pile diameter (at the mud-line) that should be considered?

- a. 10 inch diameter
- b. 12 inch diameter
- c. 14 inch diameter
- d. None of the above

15. Considering the pile bent in the previous two questions, however the deck to mud-line distance is 12 feet. If the bent were of the configuration shown in Figure 7, and the vertical dimension for the X-bracing was 4 feet (instead of the 5 feet shown), leaving an unsupported height of 8 feet above the "mud line", what would the approximate bending moment in one pile be?

- a. 158,400 inch pounds
- b. 316,800 inch pounds
- c. 475,200 inch pounds
- d. 633600 inch pounds

16. Considering the x-braced pile bent in the previous question, if piles were used that had a net diameter at the mud line of 10 inches, would the resulting unit bending stress be less than 1500 psi?

- a. Yes
- b. No

17. Given a wave that has a significant height (Hs) of 2.5 feet, and a Period (Ts) of 3.5 seconds, and an average water depth of 12 feet at extreme high tide, calculate the Wave Length (Ls) using Formula 20.

- a. 57.3 feet
- b. 28.6 feet
- c. 114.6 feet
- d. None of the above

18. Given a wave length of 50 feet, calculate the "wave number" kp for use in Formula 16.

- a. 0.50
- b. 0.25
- c. 0.126
- d. 0.0628

19. Given a Wave Length (Ls) of 35 feet and a wave number (kp) of 0.18, a water depth (h) of 12 feet, a significant wave height of 2.5 feet; compute "Fo" using Formula 16.

- a. 81.7
- b. 259.4
- c. 77.6
- d. Not enough information

20. Given the same data as presented in the preceding question, assuming a wave barrier penetration depth "w" of 3.0 feet, compute Fmo (the significant force per unit width of wave wall).

- a. 57.6
- b. 26.4
- c. 85.4
- d. 96.8

21. Given the data from the previous two questions, compute Fdesign, using the Goda equation.

- a. 47.4 pounds per lineal foot of wall
- b. 72.68 pounds per lineal foot of wall

- c. 85.4 pounds per lineal foot of wall
- d. 96.9 pounds per lineal foot of wall

22. Assuming the wave wall shown in Figure 14, were configured as follows: EHW elevation +6.6 MLW, Upper Wale +8.0 MLW, Lower Wale elevation +0.0 MLW, Bottom of Wall -3.0 MLW, Water depth at MLW = 5.4 feet, Distance between pile bents 16 feet, and a design wave of 2.5 feet. Compute the approximate wave crest elevation at the EHW tidal condition.

- a. 9.10 MLW
- b. 8.35 MLW
- c. 4.85 MLW
- d. 6.60 MLW

23. Assuming the data from the above question holds, and that the final design wave force is about 251# per lineal foot of wall. Based on the simplified methods laid out in this text, how much pressure per lineal foot of wall would be contained in the upper 6” of the wave contact area with the wall?

- a. 50.2# per lineal foot
- b. 100.4# per lineal foot
- c. 125.5# per lineal foot
- d. 200.8# per lineal foot

24. Considering the information laid out in the previous two questions, what would be the unit pressure per lineal foot of wall for the remaining portion (lower two feet) of the wave?

- a. 25.1# per square foot
- b. 50.2# per square foot
- c. 100.4# per square foot
- d. 80.3# per square foot

25. Considering the information given in the preceding three questions, assuming the wave were to occur at EHW, such that the center of the force from the upper 20% of the wave were to be centered on the upper wale, and the remainder of the unit pressure from the wave would be distributed over the 2.25 feet below the wale. What would be the horizontal force per lineal foot of wall be on the Upper wale?

- a. 200.8# per lineal foot of wale
- b. 243.2# per lineal foot of wale
- c. 125.5# per lineal foot of wale
- d. 100.4# per lineal foot of wale