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Continuing Education Course #230
Precast Segmental Bridge Construction
Part 3 - Stressing and Grouting

1. Precast Concrete Segmental Bridges are gaining popularity with owners because they offer benefits like:
- ○ a. Reduced costs, reduced construction time, reduced environmental impacts, and reduced steel requirements
- ○ b. Reduced costs, reduced rideability, reduced environmental impacts, and reduced maintenance of traffic
- ○ c. Reduced costs, reduced construction time, reduced concrete strengths, and reduced maintenance of traffic
- ○ d. Reduced construction time, reduced costs, reduced environmental impacts, and reduced maintenance of traffic

2. Which factor is not a benefit of a designer's choice for choosing Precast Bridge Structures?
- ○ a. Adaptability for different modes of transportation
- ○ b. Easily modified deck geometry for future widening
- ○ c. Higher durability with less maintenance
- ○ d. Factory like construction allows better quality control measures

3. Why are elongations measured on the post tensioning strands after stressing?
- ○ a. Because if the steel stretches it is considered a failure and must be replaced
- ○ b. It is measured to make sure the wedges don't slip and they retain the loaded energy
- ○ c. It is a way to make sure the correct size and number of strand were placed in the anchorage
- ○ d. It is a way to ensure the stresses occurred over the entire length of the strand because a shortened elongation will mean the strand is pinched somewhere along its length.

4. Cantilever Tendons are?
- ○ a. Longitudinal post tensioning in top slabs of balanced cantilever segments
- ○ b. Longitudinal post tensioning in the bottom slabs of balanced cantilever segments
- ○ c. Longitudinal post tensioning outside of flanges or webs, usually runs through segment box interior
- ○ d. Post tensioning found in the flanges or webs of segments

5. Continuity Tendons are?
- ○ a. Longitudinal post tensioning in top slabs of balanced cantilever segments
- ○ b. Longitudinal post tensioning in the bottom slabs of balanced cantilever segments
- ○ c. Longitudinal post tensioning outside of flanges or webs, usually runs through segment box interior
- ○ d. Post tensioning found in the flanges or webs of segments

6. External Tendons are?
- ○ a. Longitudinal post tensioning in top slabs of balanced cantilever segments
- ○ b. Longitudinal post tensioning in the bottom slabs of balanced cantilever segments
- ○ c. Longitudinal post tensioning outside of flanges or webs, usually runs through segment box interior
- ○ d. Post tensioning found in the flanges or webs of segments

7. Internal Tendons are?

- a. Longitudinal post tensioning in top slabs of balanced cantilever segments
- b. Longitudinal post tensioning in the bottom slabs of balanced cantilever segments
- c. Longitudinal post tensioning outside of flanges or webs, usually runs through segment box interior
- d. Post tensioning found in the flanges or webs of segments

8. Ductwork piping can be flat or round, corrugated or smooth, and made from what material?
- a. HDPE
- b. PVC
- c. Steel
- d. all of the above

9. Stressing Platforms are specialized equipment used to:
- a. Safely transport, protect, and facilitate installation of tensioning strands and prefabricated tendon bundles.
- b. Hold exterior ductwork to the proper height and alignment.
- c. Provide access and support for material installation and equipment use.
- d. Gauge the pressure in the hydraulic jacks at a known stressing level

10. Common Long term losses in tension are?
- a. Creep Loss
- b. Friction Loss
- c. Seating Loss
- d. Elastic Shortening

11. Tests used to confirm design assumptions for tension losses within the post-tension system are?
- a. Friction test
- b. Fluidity test
- c. Lift-off test
- d. Both A & C

12. An agency that offers specifications & personnel certifications for segmental Bridge Post-Tension Grouting is?
- a. ACI (American Concrete Institute)
- b. GTU (Grouting Technician Union)
- c. PTI (Post Tensioning Institute)
- d. SBA (Segmental Bridge Association)

13. Prior to grouting the tendons in the ductwork, the ducts should be cleaned by:
- a. Swab the interior by running a wet rag through the ductwork
- b. Blow-out all tendons with oil-free compressed air
- c. Flush the ducts with distilled water
- d. Nothing should be needed because it is a closed system that prevents contaminants

14. Three daily tests used to document the grout properties are?
- a. Fluidity Test, Mud Balance Test, Elongation Measurements
- b. Mud Balance Test, Grout Cube Compressive Strength Tests, Elongation Measurements
- c. Mud Balance Test, Grout Cube Compressive Strength Tests, Lift-off Tests
- d. Fluidity Test, Mud Balance Test, Grout Cube Compressive Strength Tests

15. To ensure all air voids in the duct are filled with grout, the direction of grout is:
- a. The grouting direction should proceed from the stressing dead end connection toward the live end connection
- b. The grouting direction should proceed from the highest point and flow downhill to the lowest point

○ c. The grouting direction should proceed from the lowest point and push uphill to the highest point
○ d. The grouting direction should proceed from the stressing live end connection toward the dead end connection

16. Prior to grouting, ductwork should be leak tested by:
○ a. Pressurizing ductwork to 10 psi and measuring pressure loss over 5 minutes
○ b. Pressurizing ductwork to 10 psi and measuring pressure loss over 10 minutes
○ c. Pressurizing ductwork to 5 psi and measuring pressure loss over 5 minutes
○ d. Pressurizing ductwork to 5 psi and measuring pressure loss over 10 minutes

17. To inspect behind the anchor block to make sure the grout has flowed completely around the anchor, the inspector can:
○ a. Remove the plastic cap after the grout has hardened and make sure the metal is encased
○ b. Insert a borescope into the inspection port of the bearing plate
○ c. Perform a Swiss Hammer test on the hardened concrete
○ d. Check the fluidity test results for acceptable flow rates.

18. The procedure used to repair voids in the grouted ductwork is?
○ a. Epoxy Grouting
○ b. Injection Grouting
○ c. Pressure Grouting
○ d. Vacuum Grouting

19. In addition to Hardhats, safety galsses, and work boots, recommended PPE for grouting operations include?
○ a. Tyvek Suits
○ b. Dust Masks
○ c. Rubber Gloves
○ d. All of the above

20. With span by span construction, when is it acceptable to sacrifice the safety of an operation for added production?
○ a. If the schedule critical path shows negative float
○ b. If the budgeted costs show losses for a particular item
○ c. If the project inspectors aren't available during a planned activity
○ d. It is never acceptable to sacrifice safety for production!