

ORIGINATION FORM

THE INFORMATION BELOW IS TO BE PROVIDED BY THE ORIGINATOR

Specification: 462

Subject: Post-Tensioning

Origination date: 14 June 2010

Originator: Rodney Chamberlain

Office/Phone: Structures Design Office (850) 414-4276

Problem statement: Currently, the local zone reinforcement sizing is part of the approved PT system and is approved by passing the Special Anchorage Device Acceptance Test in the AASHTO LRFD Bridge Construction Specifications. The current process does not give the designer the flexibility of taking other beneficial circumstances into account by designing the local zone reinforcement on a project-specific basis. Any change to the approved local zone reinforcement proposed by the designer or the Contractor's Specialty Engineer is treated as a substitution and requires additional testing.

Proposed solution: This change proposes to make local zone reinforcement for post-tensioning system anchorages a project-specific design. The post-tensioning system supplier will be responsible for the design of the local zone reinforcement. This would be a zero cost change that would relieve the Department of any liability associated with approving local zone reinforcement in post-tensioning system approvals. This change could be implemented immediately, possibly as a Supplemental Agreement on construction contracts that have already been executed.

Information source: Charles Boyd, Robert Robertson

Recommended Usage Note: For use on all projects utilizing post-tensioning systems with anchorages requiring local zone reinforcement.

Estimated fiscal impact, if implemented: None

Implementation of these changes, if and when approved, will begin with the January 2011 letting.



Florida Department of Transportation

CHARLIE CRIST
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STEPHANIE KOPELOUSOS
SECRETARY

MEMORANDUM

DATE: July 6, 2010
TO: Specification Review Distribution List
FROM: Rudy Powell, Jr., P.E., State Specifications Engineer
SUBJECT: Proposed Specification: 4620101 Post Tensioning.

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

This change was proposed by Rodney Chamberlain to make local zone reinforcement for post-tensioning system anchorages a project-specific design. The post-tensioning system supplier will be responsible for the design of the local zone reinforcement.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or to my attention via e-mail at ST986RP or rudy.powell@dot.state.fl.us. Comments received after **August 2, 2010** may not be considered. Your input is encouraged.

RP/cah
Attachment

POST-TENSIONING.
(REV 6-2115-10)

SUBARTICLE 462-1.1 (of the Supplemental Specifications) is deleted and the following substituted:

462-1.1 Description: Furnish and install all post-tensioning systems and any other pertinent items necessary for the particular prestressing system used, including but not limited to ducts, anchorage assemblies and local zone reinforcement. Both temporary and permanent post-tensioning shall comply with the requirements of this Section. Furnish all components of a post-tensioning system, including steel pipes, from a single supplier. Prestressing steel *and local zone reinforcement* can be obtained from any supplier.

Install prestressing steel, which may be strands or bars, through ducts in the concrete. Stress to a predetermined load and anchor directly against the hardened concrete. Grout ducts to fill all voids and install protection at end anchorages.

Submit shop and working drawings and manuals in accordance with this Specification and Section 5. The ~~Contractor's~~ Specialty Engineer shall produce, sign and seal all shop drawings related to post-tensioning.

ARTICLE 462-2 (of the Supplemental Specifications) is deleted and the following substituted:

462-2 Certification of Post-Tensioning Systems.

Use only post-tensioning systems that are approved by the State Structures Design Office and that are shown on the State Structures Design Office's Approved Post Tensioning Systems List website. Manufacturers seeking evaluation of their post-tensioning systems must submit test results to the Structures Design Office and include certified test reports from an independent laboratory audited by AASHTO Materials Reference Laboratory (AMRL) which shows the post-tensioning system meets all the requirements specified herein. Manufacturers must also submit fully detailed drawings showing all components of their post-tensioning systems for posting on the State Structures Design Office's Approved Post Tensioning Systems List website. Test plastic components in a certified independent laboratory accredited through the laboratory accreditation program of the Geosynthetic Accreditation Institute (GAI) or the American Association for Laboratory Accreditation (A2LA). Certification of test reports may be performed by an independent laboratory located outside the U.S., if the independent laboratory is approved by the State Materials Office.

Test and include typical local zone reinforcement in the system drawings that are submitted for system approval. Final design and details of local zone reinforcement are project specific and are the responsibility of the post tensioning system supplier. The typical local zone reinforcement shown on the approved system drawings or project specific reinforcement may be used. Design project specific local zone reinforcement for the same ~~maximum~~ number of strands used for the design of the approved system. ~~that the system was originally designed and approved for.~~ Do not design project specific local zone reinforcement for a reduced system capacity. Submit signed and sealed details of the local zone reinforcement to the Engineer for review and approval.

If any component of the post-tensioning system is modified or replaced, *excluding local zone reinforcement*, the appropriate component test and entire system test, if *applicable* needed, must be ~~repeated~~ tested in accordance with the requirements herein and an updated application made to the Structures Design Office containing the test reports and revised system drawings. Before attempting to change post-tensioning system components contact the State Structures Design Office for direction.

Ensure that all components of a system are stamped with the suppliers name, trademark model number and size corresponding to catalog designation. Post-tensioning systems consist of an assembly of components for various sizes of strand or bars assembled and pressure tested. Post-tensioning systems will have to be developed and tested both internal (corrugated duct) and external (smooth duct) applications for each of the following:

Department standard tendon sizes for designing and detailing consist of 0.6 inch diameter strand in anchorages containing 4, 7, 12, 15, 19 and 27 strands; standard bar sizes from 5/8 to 1 3/4 inch diameter. Systems using alternate anchorage sizes and/or strands utilizing 1/2 inch strand and providing equivalent force to these standard sizes may be submitted for approval.

Prior to installing any post-tensioning hardware, furnish the Engineer with a certification from the PT supplier that the PT system chosen for the project meets the requirements of Section 462 and is a Department approved PT system along with a list of the system components and drawings.

ARTICLE 462-3 (of the Supplemental Specifications) is deleted and the following substituted:

462-3 Definitions.

Anchorage Assembly: An assembly of various hardware components which secures a tendon at its ends after it has been stressed and; imparts the tendon force into the concrete.

Anticipated Set: The wedge set assumed to occur in the design calculation of the post-tensioning forces at the time of load transfer.

Bar: Post-tensioning bars are high strength steel bars, normally available from 5/8 to 1 3/4 inch diameter and usually threaded with very coarse thread.

Bearing Plate: Any hardware that transfers the tendon force directly into a structure or the ground.

Bleed: The autogenous flow of mixing water within or its emergence from, newly placed grout, caused by the settlement of the solid materials within the mass.

Coupler: A device used to transfer the prestressing force from one partial length prestressing tendon to another. (Strand couplers are not permitted.)

Duct: Material forming a conduit to accommodate prestressing steel installation and provide an annular space for the grout which protects the prestressing steel.

Family of Systems: Group of post-tensioning tendon assemblies of various sizes which use common anchorage devices and design. All components within the family of systems shall be furnished by a single supplier and shall have a common design with varying sizes.

Fluidity: A measure of time, expressed in seconds necessary for a stated quantity of grout to pass through the orifice of a flow cone.

Grout: A mixture of cementitious materials and water with or without mineral additives or admixtures, proportioned to produce a pumpable consistency without segregation of the constituents, when injected into the duct to fill the space around the prestressing steel.

Grout Cap: A device that contains the grout and forms a protective cover sealing the post-tensioning steel at the anchorage.

Inlet: Tubing or duct used for injection of the grout into the duct.

Local Zone Reinforcement: Reinforcement confining the volume of concrete immediately ahead of and surrounding the anchorage device.

Outlet: Tubing or duct to allow the escape of air, water, grout and bleed water from the duct.

Post-tensioning: A method of prestressing where tensioning of the tendons occurs after the concrete has reached a specified strength.

Prestressing Steel: The steel element of a post-tensioning tendon, which is elongated and anchored to provide the necessary permanent prestressing force.

Post-Tensioning Scheme or Layout: The pattern, size and locations of post-tensioning tendons provided by the Designer on the Contract Plans.

Post-tensioning System: An assembly of specific models of hardware, including but not limited to anchorage assembly, local zone reinforcement, wedge plate, wedges, inlet, outlet, couplers, duct, duct connections and grout cap, used to construct a tendon of a particular size and type. The entire assembly must meet the system pressure testing requirement. Internal and external systems are considered independent of one another.

Pressure Rating: The estimated maximum pressure that water in a duct or in a duct component can exert continuously with a high degree of certainty that failure of the duct or duct component will not occur (commonly referred to as working pressure).

Set (Also Anchor Set or Wedge Set): Set is the total movement of a point on the strand just behind the anchoring wedges during load transfer from the jack to the permanent anchorages. Set movement is the sum of slippage of the wedges with respect to the anchorage head and the elastic deformation of the anchor components. For bars, set is the total movement of a point on the bar just behind the anchor nut at transfer and is the sum of slippage of the bar and the elastic deformation of the anchorage components.

Strand: An assembly of several high strength steel wires wound together. Strands usually have six outer wires helically wound around a single straight wire of a similar diameter.

Tendon: A single or group of prestressing steel elements and their anchorage assemblies imparting prestress forces to a structural member or the ground. Also, included are ducts, grouting attachments, grout and corrosion protection filler materials or coatings.

Tendon Size: The number of individual strands of a certain strand diameter or the diameter of a bar.

Tendon Type: The relative location of the tendon to the concrete shape, internal or external.

Thixotropic: The property of a material that enables it to stiffen in a short time while at rest, but to acquire a lower viscosity when mechanically agitated.

Wedge Plate: The hardware that holds the wedges of a multi-strand tendon and transfers the tendon force to the anchorage assembly. (Commonly referred to as anchor head)

Wedge: A conically shaped device that anchors the strand in the wedge plate.

SUBARTICLE 462-4.2 (of the Supplemental Specifications) is deleted and the following substituted:

462-4.2 Post-Tensioning System: Use approved post-tensioning systems, of the proper size and type to construct tendons shown on the Contract Documents. Substitution *or*

modification of components of approved post-tensioning systems *excluding local zone reinforcement*, is not permitted. For permanent applications, the use and location of bar couplers is subject to approval by the Engineer. Use only post-tensioning systems that utilize tendons fully encapsulated in anchorages and ducts. Systems which transfer prestress force by bonding the prestress steel strand directly to concrete are not permitted. Embedded anchors for bars are permitted. Systems utilizing formed, ungrouted voids or “Diab~~o~~los” are not permitted. Strand or tendon couplers are not permitted.

SUBARTICLE 462-4.2.1 (of the Supplemental Specifications) is deleted and the following substituted:

462-4.2.1 Post-Tensioning Anchorages: Ensure that the anchorages develop at least 95% of the actual ultimate tensile strength of the prestressing steel, when tested in an unbonded state, without exceeding the anticipated set.

Design anchorages so that the average concrete bearing stress is in compliance with the “AASHTO LRFD Bridge Design Specifications”. Test *anchorages with the typical local zone reinforcement shown in the system drawings*. ~~and p~~ Provide written certification that anchorages meet or exceed the testing requirements in the AASHTO LRFD Bridge Construction Specifications.

Galvanize the embedded body of the anchorage in accordance with ASTM 123. Other components of the anchorage including wedges, wedge plate and local zone reinforcement are not required to be galvanized. Construct the bearing surface and wedge plate from ferrous metal. Equip all anchorages with a permanent grout cap that is vented and bolted to the anchorage.

Provide wedge plates with centering lugs or shoulders to facilitate alignment with the bearing plate.

Cast anchorages with grout outlets suitable for inspection from either the top or front of the anchorage. The grout outlet will serve a dual function of grout outlet and post-grouting inspection access. The geometry of the grout outlets must facilitate being drilled using a 3/8” diameter straight bit to facilitate endoscope inspection directly behind the anchor plate. Anchorages may be fabricated to facilitate both inspection locations or may be two separate anchorages of the same type each providing singular inspection entry locations.

Trumpets associated with anchorages will be made of either ferrous metal or polypropylene plastic material conforming to the requirements stated in 462-4.2.5.5. The thickness of the trumpet at the transition location (choke point) will not be less than the thickness of the duct as established in 462-4.2.5.5. Alternately, the trumpet material may be polyolefin containing antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D 3895 of not less than 20 minutes. Perform OIT test on samples taken from the finished product. Test the remolded finished polyolefin material for stress crack resistance using ASTM F 2136 at an applied stress of 348 psi resulting in a minimum failure time of 3 hours.