DPD

Director's Rule 20-2006

Applicant:	Page	Supersedes:
City of Seattle Department of Planning and Development	1 of 4	DR 34-96
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Subject: Post-Tensioned Concrete Installation and Special Inspection Requirements	**Code and Section Reference:** Seattle Building Code Chapter 17 and Section 1907	
	Type of Rule: Procedural Requirement	
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Index: Building Code/Technical Requirements	**Approved** (signature on file) **Date** 12/22/06 Diane M. Sugimura, Director, DPD	

Purpose

This rule establishes the requirements for the use of post-tensioned slabs and beams. Sections of the rule detail the requirements for preconstruction meetings; the duties of the general contractor and the special inspectors; technical details for tendon laying, stressing and end cutting, and finish work.

Background

Advantages of a post-tensioned concrete system include up to 40% reduction of concrete, 75% reduction of reinforcing steel, a lower building profile due to reduced member sizes, continuous framing with fewer construction joints, and greater structural integrity. However, problems that reduce structural integrity may occur without adequate oversight. Concrete that is not well consolidated around the anchors may blow-out causing damage to the concrete and resulting in expensive repairs. A reduction in load carrying capacity may occur when a tendon is over-stressed or when excessive shrinkage occurs because the placed concrete was too wet. Other problems unique to a post-tensioned concrete system may occur and for these reasons, DPD requires special inspections in accordance with Seattle Building Code Section 1701.

Rule

1. A preconstruction meeting shall be held prior to placement of any concrete for a post-tensioned member.
   1.1. It is the responsibility of the general contractor to arrange for the meeting. The following parties must attend: (a) general contractor; (b) engineer of record; (c) tendon placement / reinforcing steel placement company; (d) tendon supplier; (e) concrete supplier; (f) concrete placement / finishing company; (g) testing agency; and, (h) DPD.
   1.2. Shop drawings that have been reviewed by the Engineer of Record (EOR) and approved by DPD must be distributed to the meeting attendees prior to the preconstruction meeting.
   1.3. The testing agency shall submit the special inspection checklist that will be used during the project to the engineer of record for approval.
   1.4. It is the responsibility of the contractor to take minutes at the preconstruction meeting.
   1.5. The contractor shall distribute the minutes within seven calendar days from the meeting date to the attendees.

2. At least one full working day prior to the desired inspection, the general contractor shall give the special inspection agency notice that post-tensioning special inspections will be required.

3. There shall be a minimum of 4 hours, or other time period approved at the preconstruction meeting, between the time the special inspector and EOR have approved the placement of post-tensioned tendons and reinforcing steel and the time concrete placement commences.
   3.1. Only minor changes, as deemed by the Special Inspector or DPD, may be made prior to or during the concrete placement. If concrete is being placed while there are still substantial quantities of reinforcing steel or tendons being tied DPD will issue a stop work order.

4. Special inspections for a post-tensioned concrete system will be considered complete after the special inspector has: verified that the tendons have been properly cut off; verified that the ends have been protected; verified that the block-outs have been grouted per plans and specifications; and verified that acceptance has been received from the EOR.

5. Each tendon shipment to the jobsite shall be accompanied by 6' long sample pieces with mill certifications to match sample pieces.
   5.1. The sample tendon pieces shall be transported to the testing agency for possible future testing. Mill certifications must remain with the tendons.
   5.2. The testing agency shall retain the sample pieces with mill certifications until the testing agency issues a Final Letter.
   5.3. After Final Letter is issued for the project, tendon samples may be disposed according to disposal regulations.
   5.4. Original mill certificates or a true copy of the certificates shall be maintained by the testing agency in the project file. The certificates may be purged with the project file.

6. A minimum of two Special Inspectors shall be used during any post-tensioned concrete placement. One is required to remain at the trucks to monitor slumps, while the senior inspector shall remain on the deck monitoring concrete placement.

7. Slumps shall be taken at the end of the chute to determine their acceptance to be placed on the deck. This is required per ASTM C172, which states:

7.1. "Sampling should normally be performed as the concrete is delivered from the mixer to the conveying vehicle used to transport concrete to the forms; however, specifications may require other points of sampling, such as the discharge of a concrete pump."

8. Samples taken for strength tests are required to be taken from the end of the hose. However, samples may be taken from the chute if it is deemed unsafe for the Special Inspector to take samples from the end of the hose on the deck. This shall be determined at the pre-construction meeting.

9. Cylinders for determining stressing strengths shall remain on site until the requested break date. They may be transported, in accordance with the standards contained in ASTM C31 Section 11, to the testing lab on the date of the break. The cylinders shall be field cured using one of the following techniques:
   9.1. Cylinders shall be placed within a thermocoupled box, with its own continuous power source, located away from both vehicular and foot traffic, and connected to the deck to prevent movement of the box. There shall be a monitoring device wired between the thermocoupled box and the power source as a loss of power indicator. The indicator shall provide easy visual observation from any location within the project perimeter. The cable shall also be placed in a protective cover and clearly marked in such a way as to prevent disconnection, or
   9.2. Cylinders shall be placed directly on the deck, covered with an insulated 5 sided box (made of a durable material such as wood or plastic), with material placed along the outside bottom in order to seal the box to the deck, and covered in the same fashion as the deck (such as tarps or thermal blankets)
      9.2.1. There shall be no more than 6 cylinders placed within each box in order to prevent overheating cylinders.
      9.2.2. On extremely hot days, when the deck is being protected using fog misters or other water curing methods, the cylinders must also be exposed to the mist or water and not contained within the box.
      9.2.3. If the deck is coated with a curing compound, place the cylinders on the deck after the compound has been placed and cover with the box.

10. During concrete placement, the contractor is required to provide an assistant to the Lead Inspector. This person is to be considered on pour watch and is required to correct any placement issues that the Special Inspector deems necessary. This person shall not be removed from this position until the placement is complete, and is not allowed to perform any other duty until the Special Inspector has released him/her.

11. No water shall be allowed to be added to the concrete unless an 'allowed water per load' indication is on the delivery ticket. At no time shall either the maximum slump or the water-to-cementitious material ratio be exceeded.
   11.1. The ticket shall state 'x gallons allowed.' An indication of '*x* gallons per yard' is not acceptable.
   11.2. The target slump indicated on the approved mix is the target slump achieved at the end of the chute per ASTM C172 (see section 7), even if all of the maximum water allowed has not been used.

12. All items that are to either protrude from the concrete or be embedded in the concrete shall be securely tied in place prior to concrete placement. There shall be no 'wet setting' of any item in the concrete.
   12.1. It is vital that all embedded items be placed prior to concrete placement as there shall be no drilling into the deck after placement.

13. Stressing of the tendons shall not be allowed unless the required stressing strength has been reached. Under no circumstances shall the lab cured cylinders be used to determine that strength.

14. One Special Inspector shall be provided for each ram/ gage combination that will be in use, regardless of the deck size or number of tendons pulled by a second ram/gage.

15. Safety concerns must be addressed during stressing operations. Tendon breaks during stressing may result in serious injury. At no time shall any person be allowed access to the deck during stressing operations who is not directly involved with that stressing operation.

16. All tendons shall be manually measured to within 1/8 of an inch. These measurements shall then be either e-mailed or faxed to the EOR as soon as stressing is complete or by morning of the next working day.

17. If any tendon exceeds the allowable tolerance, stressing shall cease until the EOR and Post-tension supplier is contacted, and a determination of the cause and a corrective action has been approved.

18. The ends of stressed tendons shall be cut off 24 to 48 hours after receiving approval from the EOR to do so.
    - 18.1. If the tendons are considered encapsulated, the grease caps shall be placed on the newly cut tendon ends after they have cooled to the touch.
        - 18.1.1. The pockets shall then be grouted within 10 working days from capping.
    - 18.2. If the tendons are considered non-encapsulated, the pockets shall then be grouted within 24 hours after cutting.
    - 18.3. The Special Inspector shall be present during the cutting of all tendons and capping of newly cut ends.
    - 18.4. The Special Inspector need not be present during the grouting of the pockets, but must document the pockets were grouted prior to final approval of the project.