

## Copy of NCHRP 51-14 Synthesis

### Repair and Maintenance of Post-Tensioned Concrete Bridges

The objective of this synthesis is to gather information on the practices used by bridge owners to repair and maintain post-tensioned (henceforth abbreviated as PT) bridges, both in service and during construction. There are a total of 40 questions, but you may not be required to respond to all questions. Please provide your response by January 23rd, 2020.

1. Please provide the following information for person (or persons) responding to the survey:

Name(s)

Title(s)

Agency

State/Province

Email Address(es)

Phone Number(s)

2. Does your agency have post-tensioned (PT) structures in its bridge inventory?

NO

YES, please specify approximate quantity:

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Your agency does not have PT structures in its inventory

3. Why not? Please check all that apply.

- Lack of familiarity with post-tensioned structures
- Concerns related to quality/durability
- Expense
- Time consuming design/construction
- Other, Please describe:

Questions Related to Post-Tensioning Design and Specifications

4. When were your PT Specifications last updated (approximately)?

Date

MM/DD/YYYY

5. What were the reference documents used for updating? Please specify/explain:

6. What PT specifications are you using? Please check all that apply.

- ASBI/PTI M50
- PTI M55
- In-house/DOT created specifications
- Other, please provide a link:

7. Are your PT specifications very similar to or derived from another state's?

- NO
- YES, Please specify source:

8. What type of PT structures are in your inventory? Please check all that apply.

- Cast-in-place segmental
- Precast segmental
- Cast-in-place, non-segmental
- PT decks
- PT slab bridges
- Box girders
- Pier caps
- Spliced girder
- Other, Please describe:

9. Are your PT structures designed for a specific service life?

- NO
- YES, What is the design service life (number of years)?

10. Do you specify a protection level (PL-1a or PL-1b, PL-2, PL-3 as specified in ASBI/PTI M50) for your PT structures?

- NO
- YES, What is the level specified?

11. What type of PT grout do you specify for initial construction (i.e., "pre-bagged, proprietary", "cement/water")? Please describe:

12. Has your agency initiated repairs on any post-tensioned structures (either during construction or while the structure is in service)?

- NO
- YES

Questions Related to PT Repair

The following questions are intended to collect more specific information on repairs performed to PT structures (such as concrete spalling/damage, strand corrosion, strand/cable relaxation, overhead collision, etc.).

13. On what types of PT structures have you performed repairs? Please check all that apply.

- Cast-in-place segmental
- Precast segmental
- Cast-in-place, non-segmental
- PT decks
- PT slab bridges
- Box girders
- Pier caps
- Spliced girder
- Other, Please describe:

14. Does your agency have standard or commonly-used plans, specifications, procedures or details for PT tendon replacement specifically?

- NO
- YES, Please provide a link:

15. Does your agency have standard or commonly-used plans, specifications, procedures or details for PT repairs?

- NO
- YES, Please provide a link:

16. Who performs repairs? Please check all that apply.

In-house staff

Contractor

Other. Please describe:

17. Has your agency encountered issues requiring repair *during construction*?

NO

YES, Please describe issue and performed repair:

18. Has your agency encountered issues requiring repair *related to corrosion*?

NO

YES, Please describe issue and performed repair:

19. Has your agency performed repairs to PT structures due to *damage by vessel/vehicle impact*?

NO

YES, Please describe issue and performed repair:

20. Has your agency performed *repair/replacement of decks* on PT bridges?

NO

YES, Please describe issue and performed repair:

21. Have your agency performed (or initiated) the following types of maintenance, inspection or repairs related to PT structures? Please check all that apply.

- Member strengthening to address corrosion/impact damage
- Re-grouting of tendons
- During construction
- At a later stage when structure in-service
- NDT-aided inspection of PT system
- Invasive inspection of PT system
- Repair of pour-back (anchor block-out)
- FRP wrapping
- Injection of corrosion inhibitor
- Crack injection
- Repair or replacement of deck on a PT superstructure
- Internal/bonded tendon replacement
- External/unbonded tendon replacement
- Other. Please specify:

Questions Related to Inspection

22. Does your agency have established inspection procedures specific to PT bridges?

- NO
- YES, Please provide a link or location where procedure can be accessed:

23. Have you used any NDT methods for evaluating the post-tensioning system? Please check all that apply, including if used in a research effort.

- Visual methods
- Magnetic methods (i.e., magnetic flux leakage)
- Mechanical wave propagation and vibration methods (i.e., acoustic emission, impact echo, ultrasonic)
- Electromagnetic wave propagation (i.e., infrared thermography, impulse radar, ground penetrating radar)
- Direct measurement of tendon force (i.e. gages on strands)
- Radiation methods (i.e., x-ray diffraction, radiography)
- Electrochemical techniques (i.e., half-cell potential)
- Other, or not sure how to classify. Please describe:

Questions Related to Construction

**These questions pertain to PT construction. They are intended to identify trends between construction methods and later issues in PT structures.**

24. Please select install certifications/qualifications required by your agency for PT installers. Please check all that apply.

- ASBI grouting certification
- PTI Level 1 installer
- PTI Level 2 installer
- Other, please describe:

25. Please describe your QA/QC procedures during construction. For example, inspections prior to casting, stressing elongation checks, pre-duct fill pressure/vacuum checks, post-duct fill grout quality checks, certification of (e.g. ASBI-certified) PT inspectors, mud balance, or flow meter? Please provide a link, if possible.

26. Does your agency have grout storage requirements?

- NO
- YES, Please specify guiding document, provide link, or describe:

27. Who conducts QA? Please check all that apply.

- Contractor
- In-house
- Consultant inspection (CEI)
- Other, please specify:

28. Who conducts QC? Please check all that apply.

Contractor

In-house

Consultant inspection (CEI)

Other, please specify:

Construction Detailing

The next several questions pertain to construction *details*.

29. Please identify any preferred or “best practice” construction *details*. (Details which perform as intended and are worthy of note.) Please provide a link, if possible.

30. Have you encountered problematic PT construction details?

YES

NO

Construction Detailing - follow-up

**You have indicated that some construction details may be problematic.**

31. Please identify construction details that are problematic. Check all that apply, to the best of your knowledge.

- Anchorage pour-back details
- Mid-tendon vents
- Inspection ports
- Duct placement
- Duct splicing
- Heat-shrink sleeves
- Confinement reinforcement
- Segment mating during erection
- Match-cast joints
- Precast quality
- Deck drainage details
- Other. Please describe:

Construction methods and techniques

32. Have you encountered problematic *construction techniques/methods*?

YES

NO

Construction Methods - Follow-up

You have indicated that some *construction methods* may be problematic.

33. Please identify *construction methods* that are problematic. Please check all that apply.

- Air (pressure) test
- Vacuum test
- Deck-level vent removal/permanent vent cap placement
- Permanent grout cap placement
- Grouting/filler procedures
- Vacuum grouting
- Preparing anchorage area for block-out pour
- Other. Please specify.

PT Materials

34. Have you found encountered issues with any of the materials used in PT construction?

YES

NO

PT Materials - Follow-up

You have indicated that some *PT materials* may be problematic.

35. Please identify *materials* which have been problematic. Please check all that apply.

- Grout filler material
- Flexible filler material (non-cementitious, wax, grease, etc.)
- Prestressing steel
- Elastomeric coatings
- Epoxy grouts
- Pour-back materials
- Other, please specify:

## Cast-in-Place Bridges

The following three questions are specific to cast-in-place bridges.

36. What specific problems with deterioration of CIP post-tensioned bridges have you encountered?

37. How have you rectified these issues?

38. Have you replaced a deck on CIP post-tensioned box girder or segmental concrete bridge?

- NO
- YES, Please describe how it was performed:

Case Studies

**A goal of this NCHRP Synthesis is to investigate specific repair cases through follow-up interviews.**

39. If you know of a particular PT repair for consideration as a case study, please provide some general information (for example: bridge name, location, issue type):

40. Please provide contact information for a follow-up phone call.

**Name**

**Email Address**

**Phone Number**