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Figure Title

**70-1A Sample Outline of a Construction, Maintenance, and Inspection Manual**

**CHAPTER SEVENTY**

# BRIDGE DESIGN OPERATIONAL INFORMATION

## 70-1.0 MAJOR OR COMPLEX BRIDGE [ADDED JAN. 2008]

### 70-1.01 Major Bridge [Added Jan. 2008]

A Major INDOT Bridge consists of one of the structure types as follows:

1. cable-stayed;
2. moveable;
3. owned by others (i.e., private, DNR, etc.) but inventoried by INDOT;
4. that which includes pin-and-hanger connections;
5. that which includes post-tensioned members or elements;
6. single structure with deck area greater than 25,000 $ft^2$;
7. state-line crossing at Ohio River or Wabash River; or
8. twin structure with combined deck area greater than 50,000 $ft^2$.

### 70-1.02 Complex Bridge [Added Jan. 2008]

A Complex INDOT / County Bridge consists of one of the structure types as follows:

1. cable-stayed;
2. that which includes curved steel beams or girders;
3. moveable;
4. open-spandrel arch;
5. that which includes pin-and-hanger connections;
6. that which includes post-tensioned members or elements;
7. state-line crossing at Ohio River or Wabash River;
8. that which includes steel box girders or pier caps;
9. suspension;
10. thru-truss with four or more main spans; or
11. truss with pin-and-eyebar connections.

## 70-1.03 Construction, Maintenance, and Inspection Manual [Added Jan. 2008]

A Construction, Maintenance, and Inspection Manual may need to be developed or updated for each Major Bridge, or Complex Bridge, when built or if undergoing a major rehabilitation. The lists of existing Major Bridges and Complex Bridges are available from the Planning Division's Office of Technical Services bridge inspection program manager. Such a manual should be developed unless otherwise instructed by the Planning Division's Office of Technical Services bridge inspection program manager, or the Production Management Division's Office of Structural Services manager.

A draft version of the manual should be developed prior to the structure's opening to unrestricted traffic. The manual should include similar information as listed in Figure 70-A1, Sample Outline of a Construction, Maintenance, and Inspection Manual, but tailored to the specific bridge type or complex details. Work on the manual should be started during the early stages of the design of the bridge so that all required items are included and the long-term inspection and maintenance can be considered and incorporated into the design and construction.

A bridge inspection should be conducted by the designer, the project engineer and his or her construction inspectors, the district bridge inspection engineer, and the county bridge engineer if a local-agency project, prior to the structure's opening to unrestricted traffic. The designer should make all of the arrangements for this joint inspection. A draft copy of the manual should be complete and provided for review to each attendee, prior to the inspection. All comments from the inspection along with minutes should be included in the final manual. The initial NBIS inspection should also be incorporated into a final version of the manual.

The Planning Division's Office of Technical Services bridge inspection program manager will approve the final manual as complete. Once finalized, one copy each of the manual should be transmitted to the Planning Division's Office of Technical Services bridge inspection program manager, the INDOT district bridge inspection engineer, and the county bridge engineer if a local-agency project.

**Post-Tensioned Concrete Slab Bridge**

1.0 Bridge Description
- 1.1 Superstructure Slab and Post-Tensioning
- 1.2 Railings
- 1.3 Substructure
- 1.4 Bearings

2.0 Design Records
- 2.1 Superstructure
- 2.2 Substructures
- 2.3 Design Records
- 2.4 Post-Tensioning Shop Drawings

3.0 Construction Records
- 3.1 Falsework Design Calculations
- 3.2 As-Built Plans
- 3.3 Material Records
  - 3.3.1 Concrete compressive strength
  - 3.3.2 Admixtures
  - 3.3.3 Post-Tensioning ducts
  - 3.3.4 Anchorage assemblies
  - 3.3.5 Post-Tensioning strands
  - 3.3.6 Grout
- 3.4 Final Elevation survey
- 3.5 Calculations
  - 3.5.1 Jacking Forces
  - 3.5.2 Elongation
  - 3.5.3 Anchorage Stresses
- 3.6 Grouting Records
- 3.7 Stressing Records
- 3.8 Friction Test

**SAMPLE OUTLINE OF A CONSTRUCTION, MAINTENANCE, AND INSPECTION MANUAL**

**Figure 70-1A**

3.9 Qualifications
3.9.1 Qualification Requirements listed in Contract and Special Provision for Workers
3.9.2 Qualifications of Workers performing the Post-Tensioning and Grouting
3.9.3 Qualifications of Inspectors overseeing the Post-Tensioning and Grouting
4.0 Types and Causes of Distress
4.1 General
4.2 Cracking and Spalling in Concrete
4.3 Corrosion of Reinforcing and Post-Tensioning Steel
4.4 Relaxation of Post-Tensioning Steel
4.5 Post-Tensioning wire breaks
4.6 Creep and Shrinkage
4.7 Voids in Concrete
4.8 Improperly grouted tendons
4.9 Anchorage and Coupler Stresses

5.0 Inspection Requirements and Procedures
5.0.1 Inspection Plan of Action
5.0.2 NDT / Testing Plan of Action
5.0.2.1 What to Test
5.0.2.2 Where to Test
5.0.2.3 How to Access Areas to Test
5.0.2.4 How to Re-cover Areas Tested
5.1 Qualifications of Inspectors and NDT Technicians
5.2 Equipment
5.2.1 Access Equipment
5.2.2 Inspection Equipment
5.2.3 Safety Equipment
5.2.4 Traffic Control and Miscellaneous Equipment
5.3 NBIS Condition Survey
5.4 Elevation Survey
5.5 NDT / Testing
5.5.1 Stresses in Strands
5.5.2 Corrosion Activity
5.5.2.1 Visual Rust Evaluation
5.5.2.2 Corrosion Rate

**SAMPLE OUTLINE OF A CONSTRUCTION, MAINTENANCE, AND INSPECTION MANUAL**

**Figure 70-1A** contd.

5.5.2.3 Corrosion Potential
5.5.2.4 pH of Grout
5.5.2.4.1 At Duct Interface
5.5.2.4.2 At Wire Surface
5.5.2.5 Moisture Content of Grout
5.5.2.6 Chloride Content of Grout
5.5.2.7 Petrographic Examination
5.6 Inspection Checklist
5.7 Schedule
5.7.1 Regular Inspections
5.7.2 In-Depth Inspections
5.7.3 Elevation Surveys
5.7.4 NDT / Testing

6.0 Bridge Load Capacity Ratings
6.1 Initial Load Rating from Design
6.1.1 Inventory and Operating Ratings
6.1.1.1 H-20 Truck
6.1.1.2 HS-20 Truck
6.1.1.3 HL-93 Truck
6.1.1.4 INDOT Group of Permitted Vehicles
6.2 Load Rating based on As-Built Conditions
6.3 Guidelines on when to Re-Load Rate

7.0 Drawings of Details for use during Inspections
[Drawings should show all noted defects as of the date when the bridge was opened to traffic.]

8.0 Maintenance Requirements and Procedures
8.1 Maintenance Plan of Action
8.2 What to Maintain
8.3 How to Maintain
8.4 When to Maintain
8.5 Maintenance Log

**SAMPLE OUTLINE OF A CONSTRUCTION, MAINTENANCE, AND INSPECTION MANUAL**

**Figure 70-1A** contd.