Chapter 8 Electrical and Mechanical

8-1 General

The National Bridge Inspection Standards (NBIS)/National Tunnel Inspection Standards (NTIS), 23 CFR 650, requires that complex bridges and tunnels have specialized inspection procedures, and additional inspector training. These structures have numerous mechanical and electrical systems requiring inspection, troubleshooting, repair, and rehabilitation. This chapter serves as a guideline to illustrate inspection and reporting procedure as followed by the Complex Bridge and Tunnel section of the Bridge Preservation Office.

8-1.1 *References*

Inspection staff may refer to the following:

- AASHTO *LRFD Movable Highway Bridge Design Specifications*, 2023
- AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual*, 2024
- AASHTO *Standard Specifications for Movable Highway Bridges*, 1988
- FHWA *Bridge Inspector's Manual for Movable Bridges* IP 77-10
- *Emergency Operations Manual* M 54-11
- Blue Ribbon Commission, Resolution No. 398
- FHWA *Tunnel Operations, Maintenance, Inspection and Evaluation* (TOMIE) *Manual*, 2015
- FHWA *Specifications for the National Tunnel Inventory*, 2015

8-1.2 *Definitions*

Some definitions for use with this chapter are as follows:

Complex Bridge – Complex bridges are defined in the NBIS as movable, suspension, cable stayed, and other bridges with unusual characteristics.

Complex bridges in Washington are referred to as "Complex Feature" bridges where discussed in other chapters of this manual.

Complex Tunnel – Complex tunnels are defined in this manual as tunnels characterized by advanced or unique structural elements or functional systems.

National Bridge Inspection Standards (NBIS) – Title 23 Code of Federal Regulations 650 Part C defines the NBIS regulations, and establishes requirements for inspection procedures, interval of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a state bridge inventory. The NBIS apply to all structures defined as bridges located on all public roads.

National Tunnel Inspection Standards (NTIS) – Title 23 Code of Federal Regulations 650 Subpart E defines the NTIS regulations, and establishes requirements for inspection procedures, interval of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a state tunnel inventory. The NTIS apply to all structures defined as highway tunnels located on all public roads.

See Section 1-1.1 for additional definitions used in this manual.

8-2 Description of Complex Bridges and Tunnels

In accordance with the description of the Bridge Inspection Organization offered in Section 1-2, a bridge inspection program/tunnel inspection program as required by the NBIS and NTIS has been constructed to ensure safe and reliable operation of electrical/mechanical systems present on the bridges and tunnels listed in Appendix 8-E.

The Complex Bridge and Tunnel section is staffed by individuals, specialized in electrical or mechanical engineering, who have defined roles and responsibilities. Their roles and qualifications are as follows:

8-2.1 *Delegated Program Manager (DPM)*

A delegated program manager assumes some functions for the statewide program manager for the selected subset of structures under their direct control. To qualify as a delegated program manager, the individual must meet, at a minimum, the requirements as follows:

1. The individual in charge of the organizational unit that has been delegated the responsibilities for bridge inspection, reporting, and inventory shall possess the following minimum qualifications:
   a. Be a registered professional engineer in the State of Washington; or
   b. Have a minimum of 10 years' experience in complex bridge or tunnel inspection assignments in a responsible capacity.

Note: Although DPMs perform functions for the bridge inspection organization, overall responsibility for NBIS compliance still resides with the Statewide Program Manager.

8-2.2 *Electrical/Mechanical Complex Bridge Lead Inspector (CBLI)*

A CBLI is in charge of inspections and is responsible for planning, preparing, performing the field inspection of bridges/tunnels, and reporting observations/findings. The CBLI also makes repair recommendations and is responsible for initiating the critical damage procedures including full bridge or tunnel closure if deemed necessary. To qualify as a CBLI, the individual must meet, at a minimum, the requirements as follows:

(a) An individual in charge of an inspection team shall possess the following minimum qualifications:
   (1) Be a registered professional engineer in the State of Washington.
   (2) Have a minimum of 4 years' experience in complex bridge or tunnel inspection.

A continued certification of complex bridge inspection personnel has been developed in order to ensure that all program managers and CBLIs are kept up to date with the latest practices and technology in the areas of complex bridge and tunnel inspections. The continued certification of complex bridge inspection personnel is detailed in Appendix 8-D.

8-3 Inspections

Several different types of inspections are in place to adhere to the requirements of the NBIS and NTIS. This section identifies and describes the inspection types and reporting procedures used for mechanical and electrical inspections by the Bridge Preservation Office (BPO).

8-3.1 *Routine Inspections*

Regularly scheduled comprehensive safety and operational reliability inspections encompassing all mechanical/electrical elements of the structures listed in Appendix 8-E. Routine inspections are performed by a licensed professional engineer to evaluate safety as well as whether the electrical and mechanical systems are performing as designed, identify any changes from initial or previously recorded conditions, and ensure that electrical and mechanical components of structures pertaining to the Complex Bridge and Tunnels section continue to satisfy present service requirements.

1. **Interval** – Routine electrical and mechanical inspections are conducted at a maximum of every 24 months as required by NBIS, Section §650.311 and NTIS, Section §650.511. Every complex bridge is inspected annually as suggested by AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual* Chapter 2.3 and required by the *Transportation Structures Preservation Manual*, Bridge Inventory and Inspection Rules.
2. **Inspecting Methodology** – Critical electrical and mechanical components are visually and operationally inspected. Non-destructive testing methods adhering to guidelines established by the AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual* Chapter 2, are used in evaluation of bridge components as well. Following these procedures throughout routine inspections helps ensure the safety and operational reliability of the mechanical and electrical systems by providing a thorough and comprehensive inspection.
3. **Inspection Report** – A routine inspection report (RIR) shall be prepared at the completion of each routine inspection to record the inspection findings, provide a narrative description of conditions at the site, and note any changes in the coding information. The CBLI shall record and submit the findings of the routine inspection into BridgeWorks as follows:
    a. At the conclusion of the routine inspection, confirm the Numerical Rating Condition (NRC), Appendix 8-C, coding for the various elements and make any changes necessary. Complete the narrative portion corresponding to any condition rating change describing the existing condition of its respective element. For tunnels, the FHWA *Specifications for the National Tunnel Inventory* is used as a guideline for rating tunnel specific elements which are submitted to the NTI by the following process:
        - Tunnels with mechanical and/or electrical elements are entered into Bridgeworks by the CBLIs via the corresponding RIR. The same table is attached to both reports in cases where a structure has both mechanical and electrical elements. Condition states and quantities are the same in both RIRs when a tunnel has both mechanical and electrical elements.
        - Every NTI table included in a RIR contains a complete set of Mechanical, Electrical, Fire/Life Safety/Security Systems and Signs NTI elements with quantities other than zero for applicable elements to the structure.
        - All applicable electrical and mechanical elements are then combined with the structural elements from the structural inspection for submittal to the NTI. These elements are always pulled from the NTI table of the Electrical RIR. See Chapter 9 for inspection responsibilities between the structural and mechanical/electrical inspectors.

b. Enter onto the inspection report: CBLI initials, CBLI identification number, date of inspection, total number of crew hours at the site, average bridge openings per month since last inspection, average marine traffic bridge openings per month since last inspection, average maintenance bridge openings per month since last inspection, and the number of inspection bridge openings.

c. Prepare a list of elements in need of repair and recommend the type of repair that should be done. A photo of repair areas should be taken with each type of recommended repair. Assign each repair a priority level. Text describing each repair should appear in the relevant element description. Deficiency photos are to be referenced in the column alongside the element description as well as the repair.

8-3.2 *Blue Ribbon Inspections*

Shall be unannounced random inspections intended to assess the reliability of the mechanical and electrical systems, identify needed preventative maintenance activities and develop the scope of required rehabilitation projects on the floating bridges. Blue ribbon inspections and the corresponding reports are completed by consultants considered to be experts in their field, managed by CBLIs, in accordance with Resolution No. 398. When blue ribbon electrical and mechanical inspections are performed, they are used in conjunction with the routine inspection for that structure.

1. **Interval** – Due to permissions granted by the Bridge and Structures Engineer in 1994, blue ribbon inspections shall be conducted unannounced at least once every two years. This augmentation to the original annual inspection schedule recommended by Resolution No. 398 is provided in the memo in Appendix 8-A.
2. **Inspection Methodology** –Blue ribbon inspections consist of visual and operational inspection of the electrical and mechanical systems. Disassembly of electrical and mechanical components for closer inspection is also conducted throughout these inspections to gather a higher level of detail than is typical in the routine inspections. Non-destructive testing methods adhering to guidelines established by the AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual* Chapter 2, are used in evaluation of bridge components as well. Following these procedures throughout blue ribbon inspections helps ensure the safety and operational reliability of the mechanical and electrical systems by providing a thorough and comprehensive inspection.
3. **Reporting** – After completion of a blue ribbon inspection a RIR is to be entered into BridgeWorks in the same fashion as outlined in Section 8-3.1.3. In addition to this RIR another inspection report is to be generated by a consulting engineer. Consultant reports are detailed reports to be formatted as dictated by the document provided in Appendix 8-B. These reports include identified deficiencies, recommended actions to correct deficiencies, and cost estimates to complete recommended rehabilitation items. The DPM will coordinate the implementation of the recommended repairs and rehabilitation items with the Region maintenance staff.

8-3.3 *In-Depth Inspection*

Shall be a close-up inspection of one, several, or all electrical and mechanical elements to identify any deficiencies not readily detectable using routine inspection procedures. The results of these inspections are used to assess the reliability of mechanical and electrical systems, identify needed preventative maintenance activities, review and correct as-built schematics, review and correct OIM manuals, and develop the scope of required rehabilitation projects. In-depth electrical and mechanical inspections are used in conjunction with the routine inspection. Consultants, specialized in the specific field of interest, are used in conducting these inspections due to constant change in demand of disciplines, equipment, and vendors needed to accomplish the various in-depth inspections. Consulting engineers are managed by CBLIs in the same manner as those used in blue ribbon inspections.

1. **Interval** – An in-depth inspection shall be performed in conjunction with a routine inspection every six years in accordance with the AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual* Chapter 2 Section 2.2.3. An in-depth inspection may also be performed as a follow-up inspection to a routine or blue ribbon inspection to better identify any deficiencies found. The first inspection on a new or rehabilitated structure shall be an in-depth inspection in order to establish a detailed baseline for the structure file.
2. **Inspection Methodology** – In-depth inspections consist of visual and operational inspections of the electrical and mechanical systems. Extensive disassembly of electrical and mechanical components for closer inspection is conducted throughout these inspections to gather a higher level of detail than is typical in blue ribbon and routine inspections. Non-destructive testing methods adhering to guidelines established by the AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual* Chapter 2, are used in evaluation of bridge components as well. Following these procedures throughout in-depth inspections helps ensure the safety and operational reliability of the mechanical and electrical systems by providing a thorough and comprehensive inspection.
3. **Reporting** – After completion of an in-depth inspection an RIR is to be entered into BridgeWorks in the same fashion as outlined in Section 8-3.1.3. In addition to this RIR another inspection report is to be generated by a consulting engineer. Consultant reports are detailed reports to be formatted as dictated by the document provided in Appendix 8-B and 8-G. These reports include identified deficiencies, recommended actions to correct deficiencies, and cost estimates to complete recommended rehabilitation items. The DPM will coordinate the implementation of the recommended repairs and rehabilitation items with the Region maintenance staff.
4. **Specialized Inspections** – Occasionally certain components/systems have their own specialized inspections carried out separately. Examples of components/systems that may require special inspections are trunnion bearings, counterweight ropes, and cathodic protection. Each of these inspections is functionally an in-depth inspection, pertaining only to that component or system, which are conducted and reported as such. This practice is suggested by AASHTO *Movable Bridge Inspection, Evaluation, and Maintenance Manual* Chapter 2 Section 2.2.4.

8-4 Complex Bridge and Tunnel QC/QA Program

The CBLIs review 100% of inspection reports under their responsibility prior to release. The majority of inspections involving the Complex Bridge and Tunnel section only concern one inspection engineer of each discipline. If multiple CBLIs of the same discipline participated in an inspection then that report will be reviewed by both engineers prior to submittal to the DPM.

An effort shall be made to rotate which CBLIs conduct routine inspections on each structure on an annual basis to add variation to the Complex Bridge and Tunnel section's internal QC program.

The DPM reviews 100% of all Complex Bridge and Tunnel reports under his area of responsibility prior to release.

The office review of reports will consist of validation for accuracy and consistency of the following:

- **Inspection Type** – The appropriate inspection types are identified.
- **Inspection Date** – Ensure that bridges are inspected on time.
- **Inspection Interval** – Verify that inspection interval is based on condition or policy (i.e., 12 month interval criteria).
- **Inspection Hours** – Verify that the correct inspection hours are reported based on history of previous report hours, structure type and condition.
- **Organization of Report** – Verify that the report is organized, understandable, uses correct photo and file references that follow office policy.
- **Inspection Resources** – Verify that the appropriate resources needed for safety, access, and adequate inspection are being used.
- **NRC Codes** – Verify that the Numerical Rating Condition codes are supported by inspection report content. Coding information available in Appendix 8-C.
- **Elements** – Verify that the elements are complete and accurate.
- **Repair Recommendations and Priorities** – Verify that appropriate repairs and repair priorities are recommended based on inspection report content.
- **Follow-Up Actions on Significant/Critical Findings** – Ensure deficiencies that require immediate action have had the proper parties notified and are being monitored and/or followed up on.

Utilizing consultants on blue ribbon and in-depth inspections serves to act as QA for the Complex Bridge and Tunnel section. An effort is made to rotate which consultant conducts each blue ribbon or in-depth inspection. This process helps to ensure delivery of a comprehensive and high quality inspection program.

8-5 Tunnel Inspection Duties

Routine inspections of the electrical and mechanical systems present in highway tunnels are to be conducted at a maximum of 24 month intervals. Routine inspections result in an inspection report created and submitted through BridgeWorks. In-depth inspections result in detailed consultant reports that are reviewed by CBLIs in addition to a standard RIR. In-depth inspections of the mechanical and electrical systems are to be conducted at least once every six years on complex tunnels. Maintenance and inspection guidelines for mechanical and electrical systems present in tunnels are outlined in the FHWA *Tunnel Operations, Maintenance, Inspection and Evaluation* (TOMIE) *Manual*.

8-6 Complex Bridge and Tunnel Records

8-6.1 *Operation, Inspection and Maintenance Manuals*

Operation, Inspection, and Maintenance (OIM) Manuals developed by the Bridge Preservation Office as mandated by *Transportation Structures Preservation Manual* M 23-11 exist for nearly all complex bridges in WSDOT's inventory. OIM manuals contain important information relevant to their corresponding structure including but not limited to specific operational procedures, emergency procedures, recommended maintenance scheduling and procedure, as well as inspection procedures. OIM manuals are invaluable for planning of inspection and maintenance activities. They are a source of information recommended by AASHTO *Movable Bridge for Inspection, Evaluations, and Maintenance Manual* Section 2.6.1.1 and AASHTO *LRFD Movable Highway Bridge Design Specifications* Section 1.7.1.1. Critical information needs mentioned in FHWA *Tunnel Operations, Maintenance, Inspection and Evaluation* (TOMIE) *Manual* Sections 2.4 and 3.3 are standard in an OIM manual.

Both of these manuals as well as any as-builts must be periodically updated as structures are rehabilitated and the information contained within them becomes obsolete. Region(s) input is invaluable in the process of creating OIM manuals and correctly identifying operating procedures for each structure. OIM Manuals are developed partially using the Operations and Maintenance (O&M) manuals provided to WSDOT as a result of *Standard Specifications* Section 1-06.5. O&M manuals consist of catalog cuts or shop drawings of each piece of equipment found on its corresponding structure. Contract documents, special provisions, and as-builts are also used in the process of generating the OIM manual.

Master copies of each OIM manual are retained by the BPO and the regions are provided with copies of every manual relevant to their bridges. A complete list of OIM manuals developed by the BPO is included in Appendix 8-F.

8-6.2 *Structure Files*

Every complex bridge and tunnel has its own structure file maintained in accordance with the standards set in Chapter 2 of this manual to satisfy the FHWA. The physical location of structure file documents is indicated in Appendix 2-A "Bridge Preservation Floor Plan." A more detailed explanation of the legend is as follows:

- "B- Movable Bridge Files" refers to project files, signed copies of every bridge inspection report, signed copies of every tunnel inspection report, contract documents, microfilm cards and antiquated pictures from old inspections.
- "F- Letter Files" refers to the movable bridge letter files as well as reports generated by consultants. These reports are the original stamped and signed copies that come as a result of a Blue Ribbon inspection or an In-Depth inspection.

The current Routine and In-Depth inspection databases containing inspection dates and intervals for scheduling purposes are available to view on the Corporate drive. These files are only editable by members of the Complex Bridge and Tunnel section. These databases are available along the following file path on the Corporate drive: \Data\Bridge\Movable. Folders labeled "Routines" and "In-Depth Database" contain the relevant files.

8-7 Bridge Damage/Emergency Responsibilities

As dictated in the WSDOT *Emergency Operations Plan* M 54-11 BPO personnel are provided with emergency responder training. The BPO employs multiple mechanical and electrical engineers with offset schedules such that in the event of an emergency situation involving an electrical or mechanical component failure, personnel will be available to provide technical assistance to the Region(s). Should an emergency situation occur the Region(s) are to contact the BPO at which point technical assistance will be dispatched. After any emergency response situation the CBLI onsite for the incident shall prepare a report to be distributed amongst the BPO and the Region(s) via email. The BPO can always be reached via the emergency response phone at 360-480-4500.

8-8 Plans, Specifications and Estimates

The BPO assists the region with preparation of Plans, Specifications & Estimates documentation for the purpose of special inspections, requiring consultants, as well as rehabilitation activities. In the event electrical and mechanical components need to be acquired through the bidding process, the BPO provides assistance to the region with preparation of the proper documentation. During construction of repairs or rehabilitation of structures the BPO is available to assist the Region(s) and the Project Engineer Office as needed.

8-9 Appendices

Appendix 8-A	BPO Memo for Blue Ribbon Inspection Schedule Alteration
Appendix 8-B	Guideline for Writing Bridge Electrical and Mechanical Inspection Reports
Appendix 8-C	Numerical Rating Condition Description
Appendix 8-D	Continued Certification of Bridge Inspection Personnel
Appendix 8-E	Complex Bridge and Tunnel Inspection List
Appendix 8-F	Operations, Inspection, and *Maintenance Manual* List
Appendix 8-G	Guideline for Writing Tunnel Electrical and Mechanical Inspection Reports

Appendix 8-A BPO Memo for Blue Ribbon Inspection Schedule Alteration

S.F. 80 ROUTING SLIP SF 80 F

DATE 5-28-94

RECEIVED MAY 31 1994 DEPT. OF TRANSPORTATION

TO ORG

ADDRESS

MAIL STOP

FROM MML

MAIL STOP

PHONE

- [ ] For Action
- [ ] For Approval
- [ ] For Signature
- [ ] Per Your Request
- [ ] Read and Return
- [ ] For Your Information
- [ ] Per Our Conversation
- [ ] Read & Route to Files
- [ ] For Your Comments

The random inspection shall include an element of "surprise" and an element of "independence" to and from the regular maintenance folks and their activities. Are we accomplishing this?

Please include me in the random inspections that are coming up. Thanks.

Washington State
Department of Transportation

Memorandum

Date: May 10, 1994

From: O. R. George ORG
Phone: 753-4739

Subject: Proposed Schedule For Floating Bridge Random Inspections

To: M. Myint Lwin
Bridge & Structures - 7340

Random inspections of the four floating bridges are conducted by our office as outlined in the attached June 8, 1993 memorandum from A. H. Walley to S. A. Moon. We propose to delay the mechanical and electrical inspections on the Evergreen Point Bridge (520/8) until 1995 due to the major mechanical and electrical renovations taking place this summer. Inspections by our office during the construction phase would be redundant since the designer, Sverdrup Corporation will be assisting with construction services.

We also propose to conduct the first electrical random inspection on the Lacey V. Murrow Bridge (90/25S) in 1995. This first inspection will be within 2 years of opening the bridge to traffic and will meet the requirements of the June 8, 1993 memorandum. It was determined after the 1992 mechanical inspection of the Third Lake Bridge (90/25N) that mechanical inspections on both of the I-90 floating bridges are not needed due to their lack of mechanical components.

When in-depth mechanical/electrical inspections performed by consultants coincide with the random mechanical/electrical inspections, we will use the in-depth inspections in place of the random inspections. This occurs on the Hood Canal Bridge in 1994 and is denoted on the schedule by an asterisk.

With your approval, we would like to adopt the inspection schedule shown below which allows us to conduct 1 mechanical and 2 electrical inspections per year, rather than 2 mechanical and 4 electrical inspections every other year.

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MAY 12 1994
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BRIDGE & STRUCTURES

DOT 700-008X
Revised 6/92

M. Myint Lwin
May 10, 1994
Page 2

Inspection Schedule

Bridge No.	* Water-Tightness	Electrical	Mechanical
90/25S	Annually	1995, 1997, ...	NA**
90/25N	Annually	1994, 1996, ...	NA**
104/5.1 & 5.2	Annually	1994*, 1996, ...	1994*, 1996, ...
520/8	Annually	1995, 1997, ...	1995, 1997, ...

* In-depth electrical/mechanical inspections by consultants

** Random mechanical inspections not needed, as determined after the 1992 random mechanical inspection on 90/25S.

* Shall include inspection/testing of sensors piping system and pumps.

ORG:jj
MPP/DLS
Attachment

Approval: Myint Lwin Date: 5-28-94
M. MYINT LWIN, P.E.
Bridge and Structures Engineer

Washington State
Department of Transportation

Memorandum

Date: June 8, 1993

From: A. H. Wall
J. F. Conrad

Subject: Floating Bridge
Random Inspections

Thru: E. R. Burch
J. R. Buss

To: S. A. Moon

As directed by the Transportation Commission, random inspections have been conducted on the three state floating bridges. Based on our office's evaluation of the initial inspections, we request your approval of the following proposals on the process to be used in the future:

1. Responsibility for planning and conducting the random inspections should be delegated to the Bridge Office, and clearly defined in Directive D23-11.

2. A report on findings on each inspection should be prepared by the Bridge Office and sent to the Chief Maintenance Engineer for further transmittals to the districts.

3. Annual random inspections should be conducted to verify water-tightness of the bridge pontoons.

   Random inspections focusing on reliability of mechanical and electrical systems of the bridges should be conducted at two year intervals.

The following background is provided to assist in your consideration of the above proposals:

The Report issued on May 2, 1991 by the Blue Ribbon Panel investigating the sinking of the Lacey V. Murrow Bridge included a recommendation for "Independent Random Inspections" of the state's floating bridges. These inspections were to be "in addition to the scheduled major inspections" and were to be conducted by people not responsible for bridge maintenance". Emphasis of the inspections was to be "placed on the water-tightness of the bridge and on the reliability of electrical and mechanical systems.

S. A. Moon
June 8, 1993
Page 2

Transportation Commission Resolution 398 directed the department to "carefully review, analyze and, if feasible incorporate certain recommendations of the Blue Ribbon Panel". The Resolution's "implementing action document" directs us to address random inspections as follows:

> "The Department will hire a consultant or utilize an independent division internal to the Department to provide random inspections on the floating bridges. These inspections are to occur unannounced at least once a year for each bridge and will be an in-depth review of the water-tightness of the structure plus an inspection of the mechanical and electrical component of each bridge. A detailed report will be required."

Copies of pertinent sections of the Blue Ribbon Panel Report and Resolution 398 are attached.

An initial random inspection was conducted on the Hood Canal, Evergreen Point and 3rd Lake Floating Bridges in August and September of 1992. The inspection team consisted of members from the Bridge and Structures and Marine Transportation Offices and from the office of the State's mechanical and electrical consultant; the Sverdrup Corporation. Reports on inspection findings were prepared by the Bridge Office and provided to the districts through the HQ Maintenance Office. Inspection recommendations are now being implemented or considered for implementation by the districts.

A post inspection review of the random inspection process by our offices led to the recommendations in this letter. Responsibilities for these inspections need to be clearly defined in a Department Directive. Also, although a one year interval for random inspection of pontoon watertightness appears to be appropriate, a longer interval is needed between random inspections of the electrical and mechanical systems. The longer interval is needed to provide sufficient time to cost effectively address any problems identified on these complex systems.

AHW/JFC:sf
ORG
Attachments

Approval: S.A. Moon Date: 6-22-93
Deputy Secretary of Transportation

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Appendix 8-B Guideline for Writing Bridge Electrical and Mechanical Inspection Reports

GUIDELINE FOR WRITING BRIDGE ELECTRICAL AND MECHANICAL INSPECTION REPORTS FOR WSDOT

General - Format and fonts used in the electrical and mechanical inspection reports must be the same. The reports shall be written in the past tense. Single side print. The body of the text shall be left-justified. Condition descriptions shall be consistent with the verbiage in the Numerical Rating Condition Description in Appendix B.

See page 5 of 15 for a sample cover page.

The first submittal received by WSDOT shall be an unsigned final report. This submittal shall consist of 2 copies of each report. Unsigned final reports shall be signed and dated by person(s) who conducted internal quality control review. The stamp shall remain unsigned.

The title of the report and the bridge name and bridge number will be indicated exactly as spelled out in the scope of work for the inspection.

A photograph of the general outline of the bridge will appear on the cover of the reports.

The Consultant's Company name will appear under the photograph.

The PE Seal shall be placed below the photograph on the first submittal but not signed. When the final submittal is ready for the PE Seal it shall be placed on the original report and signed by the Consultant. Color copies will then be made of the original report.

The Table of Contents page shall be page number i. Each page of the report will be numbered sequentially and will agree with the page numbers listed in the Table of Contents. Font size shall be No. 12.

See page 6 of 15 for a sample Table of Contents.

The footers for each report page and appendices shall have the bridge name and number on two lines on the bottom left, the page number in the bottom center and the type of inspection and month and year on two lines on the bottom right. The font shall be No. 10.

The font for the report titles and text shall be No. 12. Heading shall be capitalized and bold.

The report shall include the following sections in the order listed:

The Executive Summary should be brief but give a general assessment of the condition of the bridge systems and major conclusions.

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The Purpose and Scope of Inspection should state that the purpose of the inspection is to determine the condition of the bridge equipment and identify any deficiencies. The dates of the inspection and the Consultant's Company name should also be indicated. Reference shall be made to the Scope of Work provided by WSDOT in the inspection request for proposal and it shall be attached to the report in Appendix A.

See page 7 of 15 for a sample of the Executive Summary and the Purpose and Scope of Inspection.

Any deviations from the Scope of Work should be identified with an explanation of why the deviations occurred.

Inspection Methodology should briefly describe the type of inspections, tests or measurements performed. The following text shall be included in the Inspection Methodology: "The ratings in this report are based upon the field conditions. These ratings may be low due to conditions that cannot be repaired or do not require immediate rehabilitation. Listed deficiencies are used to identify repair or rehabilitation items. If a component has a Condensed Mechanical/Electrical Rating of minor or moderate deterioration, there may be no associated deficiency or repair item for that component."

A general description of the bridge is not required. We know where the bridge is, what river it crosses and how it operates.

Inspection Findings shall identify the condition of the systems in the order that they are listed in the Scope of Work. Inspection findings that are not considered repair or rehabilitation items shall be included as observations in paragraph format. All deficiencies shall be identified and reference shall be made to any corresponding photograph. Deficiencies shall be listed in bullet format. Deficiencies that were repaired during the inspection shall be listed in bullet format. The condition statement for each Scope of Work item shall be the last sentence of its respective Inspection Findings section. The photographs shall be the last Appendix in the report except when additional data such as oil sample analysis or other sub-consultant reports are attached. The photos shall be referenced in the body of the report as follows: (See Photo ___ in Appendix ___). Data such as motor currents, insulation resistance, gear tooth measurements, etc. shall be tabulated and included in the Appendices. The tabulated data shall be referenced in the body of the report as follows: (See Table ____ in Appendix ___).

See pages 8 and 9 of 15 for a sample of the Inspection Findings section.

Conclusions shall summarize major findings and condition of the structure. The conclusion is intended to be brief. Major findings shall be listed in the order in which they appear in the Scope of Work. The Conclusions and Executive Summary should not be identical.

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Recommendations shall include Emergency Repairs, Maintenance Repairs or Rehabilitation Recommendations. Emergency Repair recommendations which are not addressed during the inspection shall be made in writing within 48 hours of the finding from the Consultant to the Bridge Preservation Engineer. Recommendations for Maintenance Repairs must be within the capabilities of the available maintenance forces. The order of the Maintenance Repairs shall match the order of the deficiencies in the body of the report. Rehabilitation recommendations should be made for conditions which will provide 20+ years of extended service. The order of the rehabilitation recommendations shall match the order of the deficiencies in the body of the report. See page 10 of 15 for an example Recommendations section.

Cost estimates shall be listed for each rehabilitation recommendation in the order that the system appears in the Scope of Work. (Service Entrance; Power Distribution; Motors and Brakes; Control System; Wire and Conduit; etc.) Do not say Electrical and Mechanical Rehabilitation and give a lump sum figure. Beneath the cost estimate a note shall indicate that cost estimates are for material and installation labor (bridge items only). They do not include cost for design engineering, maintenance, traffic control, construction management or administration. See page 10 of 15 for an example cost estimate.

Appendices shall be attached in the following order:

Appendix A – Scope of Work – This should be the Scope of Work document provided by the WSDOT, not a retyped version.

Appendix B – Condensed Mech/Elect Rating Summary
- **B1 Numerical Rating Condition Description (WSDOT provided with Scope of Work)**
- **B2 Condensed Mech/Elect Rating Summary**

Appendices C, D, etc – tabulated data, schematics, tables of measurements etc.

See pages 11 through 13 of 15 for an example of Appendix B.

The last Appendix should be photographs unless there are Co-Consultant documents like oil analysis in which case the photographs are the next to last and the Co-Consultant data is last. There shall be two photographs on each page.

Appendices shall have a cover page with a Table of Contents.

See page 14 of 15 for a sample Appendix Table of Contents
Appendices sheets shall have the same footer as the report but the page number will be prefaced with the letter of the Appendix.

Data sheets and measurement sheets shall be arranged in the order that the subject appears in the Scope of Work.

See page 15 of 15 for a sample photograph page.

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All reports are to be comb bound with clear plastic front covers and black plastic rear covers. The unsigned final report submittal shall consist of 2 copies of each report and an electronic copy of each report. The final submittal shall consist of one bound final report with original photographs which shall be stamped and signed by an Engineer of the appropriate discipline licensed in the State of Washington and six color copies of the report. An electronic copy of the final report in PDF format and an electronic copy of all photographs in jpeg format along with photo logs shall be submitted with the signed final reports on a credit card size USB drive.

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WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION

(TYPE) INSPECTION REPORT
MONTH, YEAR

NAME OF BRIDGE
BRIDGE NO. (W/XYZ)

PREPARED BY
COMPANY NAME
CITY, STATE

THE SEAL OF THE STATE OF WASHINGTON 1889

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wirgrev16

TABLE OF CONTENTS

Name of Bridge i Type of Inspection
Bridge No. Month, Year

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EXECUTIVE SUMMARY

This report documents the condition of the Bridge Name and Bridge Number, electrical (or mechanical) systems as they existed during the In-Depth Electrical (or Mechanical) Inspection performed Month XX through XX, XXXX.

Overall, the electrical(or mechanical) systems exhibited minor deterioration and operated in an acceptable manner during the inspection.

There were no emergency repairs identified during the inspection.

(Items requiring rehabilitation should be documented in paragraph format. Do not just copy the rehabilitation recommendation list, write a summary.)

The electrical(or mechanical depending on report) systems, in general, require maintenance repairs to improve and maintain safety and operational reliability. Maintenance repair items are listed in the Recommendations section of this report. (Do not include the repair list, the reader can reference that if they are interested.)

PURPOSE AND SCOPE OF INSPECTION

The purpose of this inspection was to determine the condition of the electrical(mechanical) systems and identify deficiencies.

The inspection was performed from Month XX through Month XX, 20XX by XXXXX.

The Scope of Work for this inspection was provided by the WSDOT and is attached as Appendix A.

Name of Bridge 1 Type of Inspection
Bridge No. Month, Year

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INSPECTION FINDINGS

POWER DISTRIBUTION
SERVICE ENTRANCE
The 240-vac service entrance equipment was located at the west approach utility pole.

The service entrance equipment was visually inspected and operationally tested. Utility voltages were measured prior to and during operation. The measurements were tabulated (See Table 1 in Appendix C). The measurements were acceptable in all cases.

The following deficiency was noted and repaired during the inspection:

- There was damaged insulation and part of the conductor was exposed for one of the incoming phases. The exposed conductor had additional insulation and heat shrink added to insulate the exposed conductor and prevent further damage.

Based upon the field survey, the service entrance was observed to have minor deterioration.

GROUNDING SYSTEM
The structure had a ground connection embedded in the west pier. The ground resistance and current of the electrical grounding conductor at the west pier were measured and the results tabulated (See Table 2 in Appendix C). The measurements were acceptable in all cases.

The grounding system was visually inspected.

No deficiencies were noted during this inspection.

Based upon the field survey, the grounding system was observed to have minor deterioration.

ELECTRICAL DISTRIBUTION SYSTEM
The electrical distribution equipment was located in the control house and at the top of the east and west towers. The MCC in the control house distributed power to the roadway equipment and to the east and west towers. The east and west towers also had load centers for distributing power to lights, receptacles, and other ancillary equipment.

The electrical distribution equipment was visually inspected and operationally tested.

Infrared testing was performed on the electrical distribution equipment.

No deficiencies were noted during this inspection.

Based upon the field survey, the electrical distribution equipment was observed to have minor deterioration.

MOTOR STARTERS, CONTACTORS AND DISCONNECTS
The motor starters and contactors were located in the motor control centers. The drive motors, synchrotie motors, and thrustor brakes had disconnect switches located within sight of the equipment they isolated. The traffic gates and traffic barriers had disconnect switches located in their enclosures.

The motor starters, contactors, and disconnects were visually inspected and operationally tested.

No deficiencies were noted during this inspection.

Based upon the field survey, the motor starters, contactors, and disconnects were observed to have minor deterioration.

MOTORS AND BRAKES
DRIVE MOTORS AND SYNCHROTIE MOTORS
There were four motors that drove the span, one drive motor and one synchrotie motor in the east tower and one drive motor and one synchrotie motor in the west tower. The motor inspection covers were removed, and the motor interior and brushes were inspected. Insulation resistance measurements were performed on the motors. The measurements were tabulated (See Table 3 in Appendix C). The insulation resistance measurements were acceptable in all cases.

The motor nameplate and current measurements were tabulated (See Table 4 in Appendix C). The current measurements were acceptable in all cases.

The following deficiency was noted and repaired during the inspection:

- Three missing fasteners were replaced on the inspection covers over the motor brushes for the East Drive Motor.

The following deficiencies were noted:

- One motor brush holder was damaged and temporarily repaired with a ziptie in the East Drive Motor (See Photo 1 in Appendix D).
- One motor brush holder was damaged and temporarily repaired with a ziptie in the West Drive Motor (See Photo 2 in Appendix D).

Based upon the field survey and above deficiencies, the drive motors and synchrotie motors were observed to have minor deterioration.

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Bridge No. Month, Year
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RECOMMENDATIONS

EMERGENCY REPAIRS
There were no emergency repairs.

MAINTENANCE REPAIRS

POWER DISTRIBUTION
SERVICE ENTRANCE
1. Sample repair number one.
2. Sample repair number two.

CONTROL SYSTEM
CONTROL DESK
3. Sample repair number three.

MOTORS AND BRAKES
DRIVE MOTORS AND SYNCHROTIE MOTORS
4. Sample repair number four.
5. Sample repair number five.
6. Sample repair number six.

REHABILITATION RECOMMENDATIONS
1. Sample recommendation number one.

COST ESTIMATE

1. Sample recommendation number one. $100,000

The provided cost estimate is for material and installation labor (bridge items only). This cost does not include design engineering, maintenance, traffic control, construction management or administration.

Name of Bridge 8 Type of Inspection
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APPENDIX B

CONDENSED ELECTRICAL RATING SUMMARY

NUMERICAL RATING CONDITION DESCRIPTION	
Rating Condition	Description of Condition
1	FAILED CONDITION. Item not operational.
2	POTENTIALLY HAZARDOUS. Deterioration or damage to span drive or stabilizing machinery which could cause movable span to become imminently unstable in any position. Malfunction or deterioration of electrical system which could cause loss of control of the moving span. Deficiency in electrical system design, maintenance, or operational procedure which could cause loss of control of moving span. Inoperable vehicular traffic control device. Also, extreme cases of defects listed under higher rating numbers. Bridge may not be opened to marine traffic. If problem is with stabilizing machinery in the closed position, temporary shoring or support may be necessary to permit safe vehicular traffic over the closed bridge at reduced speed or rating. However, if problem, is with counterweight components of vertical lift bridge stabilizing machinery, bridge may be closed to all traffic until shored or repaired.
3	VERY SERIOUS DETERIORATION. Deterioration or damage to machinery which will not cause imminent instability of a non-redundant span drive but reduces allowable load on drive and may cause future instability if not corrected. Stabilizing machinery damaged, deteriorated, or improperly operated such that movable structure is not properly supported causing structure not to behave as designed and resulting in structural overstress and movements under vehicular traffic that severely affect quality. Severe misalignment of stabilizing machinery, resulting in overload of electrical system and consequent overstress of span drive machinery. Severe interference between moving span and fixed structure due to substructure movements. Deterioration of electrical control system such that many of the safety interlocks are normally by-passed, inconsistent control of moving span, and inoperable or missing traffic control devices. Operation of movable span may be restricted in terms of opening angle, number of openings, and allowable wind velocity. If problem is with stabilizing machinery, shoring may be necessary to permit vehicular traffic.
4	SERIOUS DETERIORATION. Severe wear, deterioration or damage to span drive or stabilizing machinery due to overloading, inadequate maintenance, improper operation, or movement of the structure or substructure. Electrical system malfunctions and numerous safety interlocks are by-passed. Results are inconsistent, noisy, and unreliable operation of the movable span. Improper closure, affecting structural action and vehicular ride quality. Electrical system has archaic components for which replacements are no longer available and open bus panelboards that are considered unsafe nowadays.
5	MODERATE DETERIORATION. Excessive wear, some damage and deterioration of span drive and stabilizing mechanical machinery. Repairs and replacement of some machinery components required. Bearings may need liner adjustment. Machinery may be misaligned due to shifting of structure and substructure but not enough to seriously overload span drive: correctable by adjusting machinery component location using shims, etc. Replacement of corroded machinery fasteners required. Moving span under control but some indicating and safety devices may be inoperable and may be by-passed, and span limit switch may need adjustment.
6	MINOR DETERIORATION. None of the major mechanical machinery components are worn or damaged to the extent that replacement is now required. Some components of the span drive may need to be replaced, such as flex-couplings grids, brake linings, etc. Span stabilizing machinery functioning except that wear may have caused excessive clearances in lock bar guides, etc. Shimming of lock bar guides, replacement of limit switches and adjustments necessary. Machinery needs cleaning, painting, lubrication and adjustment. Electrical system generally functioning as designed. Replacement of some relays, indicating devices and lights may be required. Traffic control devices need repair or maintenance.
7	ALMOST NEW CONDITION. No extensive repairs required. Machinery needs cleaning, painting, lubrication, and adjustment. Electrical systems functioning as designed; may need replacement of indicating lights and minor limit switch adjustment, cleaning of relay contacts and housekeeping in panelboard. Traffic control devices functioning but may need replacement of obstruction lights, object markers, painting of housings, lubrication and adjustment of limit switches.
8	NEW CONDITION. Virtually no repairs required. Mechanical machinery may need cleaning, touch-up painting and lubrication. Electrical system and traffic devices functioning but may need replacement of bulbs and minor housekeeping.
9	NOT APPLICABLE. This device or equipment is not on the structure being inspected.
N/I	NOT INSPECTED. This device or equipment was not included in the inspection.

Name of Bridge B1 Type of Inspection
Bridge No. Month, Year

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Condensed Electrical Rating Summary	
Item	Rating
Power Distribution	
Service Entrance	6
Grounding System	5
Emergency Generator	7
Manual Transfer Switch	6
Electrical Distribution Equipment	7
Motor Starters, Contactors, and Disconnects	6
Hubbell Motor Drive	7
Motors and Brakes	
Span Drive Motors	7
Thrustor Brakes	7
Endlift Motors	6
Traffic Gate Motors	7
Yielding Barrier Motor	6
Control System	
Control Desk	7
Control System	6
Instrumentation and Control Devices	5
Wire, Conduit and Junction Boxes	
Motor and Thrustor Brake Feeders	6
Aerial Cable	6
Droop Cables	6
Conduits and Junction Boxes	6
Traffic Control	
Traffic Signals and Signs	7
Traffic Gates	6
Yielding Barrier	6
Navigation Control	
Navigation Lights	6
Navigation Horn	7
Miscellaneous	
Lighting and Receptacles	6
Public Address System	6
Closed Circuit TV System	5
Overall Rating	6

Name of Bridge B2 Type of Inspection
Bridge No. Month, Year

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APPENDIX D

PHOTOGRAPHS

Name of Bridge Di Type of Inspection
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Photo 1 Control Desk

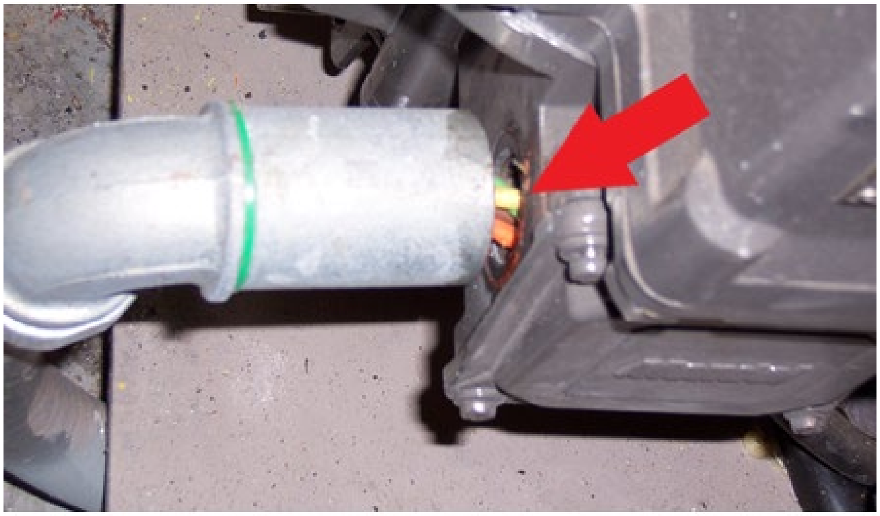

Photo 2 Broken conduit fitting on NE Thrustor Brake

Name of Bridge	D1	Type of Inspection
Bridge No.		Month, Year
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Appendix 8-C Numerical Rating Condition Description

NUMERICAL RATING CONDITION DESCRIPTION	
Rating Condition	Description of Condition
1	FAILED CONDITION. Item not operational.
2	POTENTIALLY HAZARDOUS. Deterioration or damage to span drive or stabilizing machinery which could cause movable span to become imminently unstable in any position. Malfunction or deterioration of electrical system which could cause loss of control of the moving span. Deficiency in electrical system design, maintenance, or operational procedure which could cause loss of control of moving span. Inoperable vehicular traffic control device. Also, extreme cases of defects listed under higher rating numbers. Bridge may not be opened to marine traffic. If problem is with stabilizing machinery in the closed position, temporary shoring or support may be necessary to permit safe vehicular traffic over the closed bridge at reduced speed or rating. However, if problem, is with counterweight components of vertical lift bridge stabilizing machinery, bridge may be closed to all traffic until shored or repaired.
3	VERY SERIOUS DETERIORATION. Deterioration or damage to machinery which will not cause imminent instability of a non-redundant span drive but reduces allowable load on drive and may cause future instability if not corrected. Stabilizing machinery damaged, deteriorated, or improperly operated such that movable structure is not properly supported causing structure not to behave as designed and resulting in structural overstress and movements under vehicular traffic that severely affect quality. Severe misalignment of stabilizing machinery, resulting in overload of electrical system and consequent overstress of span drive machinery. Severe interference between moving span and fixed structure due to substructure movements. Deterioration of electrical control system such that many of the safety interlocks are normally by-passed, inconsistent control of moving span, and inoperable or missing traffic control devices. Operation of movable span may be restricted in terms of opening angle, number of openings, and allowable wind velocity. If problem is with stabilizing machinery, shoring may be necessary to permit vehicular traffic.
4	SERIOUS DETERIORATION. Severe wear, deterioration or damage to span drive or stabilizing machinery due to overloading, inadequate maintenance, improper operation, or movement of the structure or substructure. Electrical system malfunctions and numerous safety interlocks are by-passed. Results are inconsistent, noisy, and unreliable operation of the movable span. Improper closure, affecting structural action and vehicular ride quality. Electrical system has archaic components for which replacements are no longer available and open bus panelboards that are considered unsafe nowadays.
5	MODERATE DETERIORATION. Excessive wear, some damage and deterioration of span drive and stabilizing mechanical machinery. Repairs and replacement of some machinery components required. Bearings may need liner adjustment. Machinery may be misaligned due to shifting of structure and substructure but not enough to seriously overload span drive: correctable by adjusting machinery component location using shims, etc. Replacement of corroded machinery fasteners required. Moving span under control but some indicating and safety devices may be inoperable and may be by-passed, and span limit switch may need adjustment.
6	MINOR DETERIORATION. None of the major mechanical machinery components are worn or damaged to the extent that replacement is now required. Some components of the span drive may need to be replaced, such as flex-couplings grids, brake linings, etc. Span stabilizing machinery functioning except that wear may have caused excessive clearances in lock bar guides, etc. Shimming of lock bar guides, replacement of limit switches and adjustments necessary. Machinery needs cleaning, painting, lubrication and adjustment. Electrical system generally functioning as designed. Replacement of some relays, indicating devices and lights may be required. Traffic control devices need repair or maintenance.
7	ALMOST NEW CONDITION. No extensive repairs required. Machinery needs cleaning, painting, lubrication, and adjustment. Electrical systems functioning as designed; may need replacement of indicating lights and minor limit switch adjustment, cleaning of relay contacts and housekeeping in panelboard. Traffic control devices functioning but may need replacement of obstruction lights, object markers, painting of housings, lubrication and adjustment of limit switches.
8	NEW CONDITION. Virtually no repairs required. Mechanical machinery may need cleaning, touch-up painting and lubrication. Electrical system and traffic devices functioning but may need replacement of bulbs and minor housekeeping.
9	NOT APPLICABLE. This device or equipment is not on the structure being inspected.
N/I	NOT INSPECTED. This device or equipment was not included in the inspection.

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Appendix 8-D Continued Certification of Complex Bridge Inspection Personnel

A continued certification of complex bridge and tunnel inspection personnel has been established to ensure that all program managers and inspectors are kept up to date with the latest practices and technology in the areas of bridge and tunnel inspections. This continued certification program requires that each Electrical/Mechanical Complex Bridge Lead Inspector (CBLI) and their Delegated Program Manager (DPM) must participate in the following during a 60 month period to maintain certification:

- 30 hours of bridge related continuing education courses and training including WSDOT sponsored bridge training, bridge conferences and other NHI bridge training courses as approved by the delegated program manager.

Continued Certification Course and Training List

The following is a list of courses that are examples of what would qualify in combination to acquire 30 hours of continuing education hours in the designated five-year period. It is the inspector's responsibility to ensure that the information is given to their manager within the necessary timeframes to ensure continued certification.

National Electric Code	16 hours
Grounding and Bonding Training	16 hours
NFPA 70E Arc Flash Electrical Safety	16 hours
Programmable Logic Controller Training	24 hours
AC/DC Motors and Drives Training	16 hours
Cathodic Protection	40 hours
National Fire Alarm and Signaling Code	24 hours
Non-Destructive Testing Training	24 hours
Hydraulics & System Troubleshooting	16 hours
Principles of Bearings and Lubrication	16 hours
Coupling and Shaft Alignment	16 hours
Strain Gage Workshop	40 hours
Pacific NW Bridge Maintenance Conference	16 hours
Pacific NW Bridge Inspection Conference	16 hours
Heavy Movable Structures Conference	16 hours
Western Bridge Engineers' Seminar	16 hours
WSDOT/LTAP – Bridge Condition Inspection Training (BCIT)	72 hours
NHI Bridge Inspection Refresher Training (BCIR)	16 hours
NHI Tunnel Safety Inspection	16 hours
NHI Tunnel Safety Inspection Refresher	16 hours

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Appendix 8-E Complex Bridge and Tunnel Inspection List

The following is a list of complex bridges and tunnels that require electrical and mechanical inspections in accordance with the NBIS and NTIS. The regularly scheduled inspections for each structure are listed along with their interval. Special inspections in addition to those listed may be conducted if deemed necessary.

12/12N – Wishkah River Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

12/12S – Heron Street Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

12/915 – Snake River Clarkston

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)
	Counterweight Rope Inspection (72 months)
	Trunnion Bearing Inspection (72 months)

16/110E – Tacoma Narrows

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

16/110W – Tacoma Narrows

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

90/25N – Homer M. Hadley

Electrical
Routine Inspection (12 months)
Blue Ribbon Inspection (24 months)
Blue Ribbon Cathodic Protection Inspection (24 months)
In-Depth Inspection (72 months)
In-Depth Cathodic Protection Inspection (72 months)

90/25S – Lacey V. Murrow

Electrical
Routine Inspection (12 months)
Blue Ribbon Inspection (24 months)
Blue Ribbon Cathodic Protection Inspection (24 months)
In-Depth Inspection (72 months)
In-Depth Cathodic Protection Inspection (72 months)

99/530E – Duwamish River Br

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)
	Trunnion Bearing Inspection (72 months)

99/530W – Duwamish River Br

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

101/115 – Chehalis River Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

101/125E – Hoquiam River - Riverside

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)
	Counterweight Rope Inspection (72 months)

101/125W – Hoquiam River - Simpson

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

104/5.1 – Hood Canal-W.A. Bugge Bridge W

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
Blue Ribbon Inspection (24 months)	Blue Ribbon Inspection (24 months)
Blue Ribbon CP Inspection (24 months)	In-Depth Inspection (72 months)
In-Depth Inspection (72 months)	
In-Depth CP Inspection (72 months)	

104/5.2 – Hood Canal-W.A. Bugge Br E

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
Blue Ribbon Inspection (24 months)	Blue Ribbon Inspection (24 months)
Blue Ribbon CP Inspection (24 months)	In-Depth Inspection (72 months)
In-Depth Inspection (72 months)	
In-Depth CP Inspection (72 months)	

513/12 – Montlake Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

520/8 – Albert D. Rosellini Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
Blue Ribbon Inspection (24 months)	Blue Ribbon Inspection (24 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

529/10E – Snohomish River Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)
	Counterweight Rope Inspection (72 months)

529/10W – Snohomish River Bridge

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)
	Counterweight Rope Inspection (72 months)

529/20E – Steamboat Slough

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

529/20W – Steamboat Slough

Electrical	Mechanical
Routine Inspection (12 months)	Routine Inspection (12 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

5/549CNC – Wash St Convention Center

Electrical	Mechanical
Routine Inspection (24 months)	Routine Inspection (24 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

90/22LID – Martin Luther King LID

Electrical	Mechanical
Routine Inspection (24 months)	Routine Inspection (24 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

90/24N – Mt Baker Ridge Tunnel

Electrical	Mechanical
Routine Inspection (24 months)	Routine Inspection (24 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

90/24S – Mt Baker Ridge Tunnel

Electrical	Mechanical
Routine Inspection (24 months)	Routine Inspection (24 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

90/26LID – First Hill LID

Electrical	Mechanical
Routine Inspection (24 months)	Routine Inspection (24 months)
In-Depth Inspection (72 months)	In-Depth Inspection (72 months)

99/540 – Alaskan Way Tunnel

Electrical
Routine Inspection (24 months)
In-Depth Inspection (72 months)

Mechanical
Routine Inspection (24 months)
In-Depth Inspection (72 months)

304/9 – Bremerton Tunnel

Electrical
Routine Inspection (24 months)
In-Depth Inspection (72 months)

Mechanical
Routine Inspection (24 months)
In-Depth Inspection (72 months)

The following is a list of tunnels that require electrical and mechanical inspections in accordance with NTIS. All of these tunnels have relatively small electrical and mechanical systems. They all receive routine inspections on a 2 year cycle.

5/546REN – 5th EXP TUNNEL

5/548PN – I-5 Under N Park Plaza

5/548PS – I-5 Under S Park Plaza

5/553R – Express Lanes Tunnel

5/555E-S – E-S Ramp Tunnel

5/555N-W – N-W Ramp Tunnel

5/568S-E – I-5 Over S-E Ramp Tunnel

5/577E-S – Ravenna-S Ramp Tunnel

20/316 – Tunnel

90/16S-E – S-E Ramp Tunnel

90/33E-S – E-S Ramp Tunnel

90/33N-W – N-W Ramp Tunnel

90/55 – SE 35th ST Tunnel Under I-90

90/112.8N – Wildlife Crossing Tunnel

90/563 – Perry St Tunnel Under I-90

97/359ALT – Knapps Hill Tunnel

101/3 – Fort Columbia Tunnel

405/22A – Houser Way Tunnel

405/35N-W – I-90 Over N-W Ramp Tunnel

405/35S-E – I-90 Over S-E Ramp Tunnel

520/9LID – Evergreen Point Road LID

520/11LID – 84th Ave NE Over SR 520

520/12LID – 92nd Ave NE Over SR 520

522/15 – Roosevelt Way Tunnel

525/1S-S – S-E Ramp Tunnel Under S-S Ramp

526/12 – SR 526 Over E-N Ramp Tunnel

526/22E-N – SR 526 Over E-N Ramp Tun

Appendix 8-F Operations, Inspections, and Maintenance Manual List

The following is a tabulated listing of all of the OIM manuals generated by the BPO. They are updated as necessary when rehabilitations of bridge systems occur or major components are changed.

Bridge #	Bridge Name	Manual Date	Revision Date	Document Number
12/12N	Wishkah River	Jun-03	Aug-08	M 23-25
12/12S	Wishkah River - Heron	Jun-03	Dec-07	M 23-19
12/915	Snake River - Clarkston	Jun-96	Feb-16	M 23-26
16/110E	Tacoma Narrows	Jun-95	--	*
90/25N	Homer M. Hadley	Jul-06	Sept-18	*
90/25S	Lacey V. Murrow	Jul-06	--	*
99/530E	Duwamish River	Jun-01	Jun-08	M 23-31
99/530W	Duwamish River	Jun-01	Jun-07	*
101/115	Chehalis River	Oct-99	Aug-16	M 23-23
101/125E	Hoquiam River - Riverside	Jun-97	Mar-13	M 23-22
101/125W	Hoquiam River - Simpson	Jan-12	--	M 23-33
104/5.1 & 5.2	Hood Canal	Jan-15	Feb-16	M 23-12
513/12	Montlake Bridge	Nov-02	Jan-23	M 23-30
520/8	Albert D. Rosellini Bridge	Jun-22	Jan-23	*
529/10E & W	Snohomish River	Mar-01	Jun-07	M 23-21
529/20E & W	Steamboat Slough	Jan-05	--	M 23-28

*Document number not yet assigned.

No OIM manuals have been developed for complex tunnels yet.

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Appendix 8-G Guideline for Writing Tunnel Electrical and Mechanical Inspection Reports

GUIDELINE FOR WRITING TUNNEL ELECTRICAL AND MECHANICAL INSPECTION REPORTS FOR WSDOT

General - Format and fonts used in the electrical and mechanical inspection reports must be the same. The reports shall be written in the past tense. Single side print. The body of the text shall be left-justified. Condition descriptions shall be consistent with the verbiage in the Numerical Rating Condition Description in Appendix B.

See page 5 of 16 for a sample cover page.

The first submittal received by WSDOT shall be an unsigned final report. This submittal shall consist of 2 copies of each report and an electronic copy of both reports. Unsigned final reports shall be signed and dated by person(s) who conducted internal quality control review. The stamp shall remain unsigned.

The title of the report and the tunnel name and tunnel number will be indicated exactly as spelled out in the scope of work for the inspection.

A photograph of the tunnel portal will appear on the cover of the reports.

The Consultant's Company name will appear under the photograph.

The PE Seal shall be placed below the photograph on the first submittal but not signed. When the final submittal is ready for the PE Seal, it shall be placed on the original report and signed by the Consultant. Color copies will then be made of the original report.

The Table of Contents page shall be page number i. Each page of the report will be numbered sequentially and will agree with the page numbers listed in the Table of Contents. Font size shall be No. 12.

See page 6 of 16 for a sample Table of Contents.

The footer for each report page and appendices shall have the tunnel name and number on two lines on the bottom left, the page number in the bottom center and the type of inspection and month and year on two lines on the bottom right. The font shall be No. 10.

The font for the report titles and text shall be No. 12. Heading shall be capitalized and bold.

The report shall include the following sections in the order listed:

The Executive Summary should be brief but give a general assessment of the condition of the tunnel systems and major conclusions.

1 v1.10

The Purpose and Scope of Inspection should state that the purpose of the inspection is to determine the condition of the tunnel equipment and identify any deficiencies. The dates of the inspection and the Consultant's Company name should also be indicated. Reference shall be made to the Scope of Work provided by WSDOT in the inspection request for proposal and it shall be attached to the report in Appendix A.

See page 7 of 16 for a sample of the Executive Summary and the Purpose and Scope of Inspection.

Any deviations from the Scope of Work should be identified with an explanation of why the deviations occurred.

Inspection Methodology should briefly describe the type of inspections, tests or measurements performed. The following text shall be included in the Inspection Methodology: "The ratings in this report are based upon the field conditions. These ratings may be low due to conditions that cannot be repaired or do not require immediate rehabilitation. Listed deficiencies are used to identify repair or rehabilitation items. If a component has a Condensed Mechanical/Electrical Rating of minor or moderate deterioration, there may be no associated deficiency or repair item for that component."

A general description of the tunnel is not required. We know where the tunnel is and how it operates.

Inspection Findings shall identify the condition of the systems in the order that they are listed in the Scope of Work. Inspection findings that are not considered repair or rehabilitation items shall be included as observations in paragraph format. All deficiencies shall be identified and reference shall be made to any corresponding photograph. Deficiencies shall be listed in bullet format. Deficiencies that were repaired during the inspection shall be listed in bullet format. The condition statement for each Scope of Work item shall be the last sentence of its respective Inspection Findings section. The photographs shall be the last Appendix in the report except when additional data such as oil sample analysis or other sub-consultant reports are attached. The photos shall be referenced in the body of the report as follows: (See Photo ___ in Appendix ___). Data such as motor currents, insulation resistance, gear tooth measurements, etc. shall be tabulated and included in the Appendices. The tabulated data shall be referenced in the body of the report as follows: (See Table ____ in Appendix ___).

See pages 8 and 9 of 16 for a sample of the Inspection Findings section.

Conclusions shall summarize major findings and condition of the structure. The conclusion is intended to be brief. Major findings shall be listed in the order in which they appear in the Scope of Work. The Conclusions and Executive Summary should not be identical.

Recommendations shall include Emergency Repairs, Maintenance Repairs or Rehabilitation Recommendations. Emergency Repair recommendations which are not addressed during the inspection shall be made in writing within 48 hours of the finding from the Consultant to the Bridge Preservation Engineer. Recommendations for Maintenance Repairs must be within the capabilities of the available maintenance forces. The order of the Maintenance Repairs shall match the order of the deficiencies in the body of the report. Rehabilitation recommendations should be made for conditions which will provide 20+ years of extended service. The order of the rehabilitation recommendations shall match the order of the deficiencies in the body of the report. See page 10 of 16 for an example Recommendations section.

Cost estimates shall be listed for each rehabilitation recommendation in the order that the system appears in the Scope of Work. (Service Entrance; Power Distribution; Motors and Brakes; Control System; Wire and Conduit; etc.) Do not say Electrical and Mechanical Rehabilitation and give a lump sum figure. Beneath the cost estimate a note shall indicate that cost estimates are for material and installation labor (tunnel items only). They do not include cost for design engineering, maintenance, traffic control, construction management or administration. See page 10 of 16 for an example cost estimate section.

Appendices shall be attached in the following order:

Appendix A – Scope of Work

Appendix B – Combined Mechanical & Electrical NTIS Rating Summary

Tabulated condition state data on FHWA reportable elements relevant to Tunnel Mechanical Systems, Electrical Systems, Fire/Life Safety/Security Systems and Signs as defined in the Specifications for the National Tunnel Inventory.

This table is to be identical in both disciplines' reports. The ratings are based off the coordinated efforts of the mechanical and electrical inspection teams.

See page 11 of 16 for an example of the Combined Mechanical & Electrical NTIS Rating Summary table.

Appendix C – Condensed Mech/Elect Rating Summary

C1 Numerical Rating Condition Description (WSDOT provided with Scope of Work)

C2 Condensed Mech/Elect Rating Summary per Scope of Work item

This rating summary is unique to each discipline based off the Scope of Work.

See pages 12 through 14 of 16 for an example of Appendix C.

Appendix D, E, etc – tabulated data, schematics, tables of measurements etc.

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The last Appendix should be photographs unless there are Co-Consultant documents like oil analysis in which case the photographs are the next to last and the Co-Consultant data is last. There shall be two photographs on each page.

Appendices shall have a cover page with a Table of Contents.

See page 15 of 16 for a sample Appendix Table of Contents
Appendices sheets shall have the same footer as the report but the page number will be prefaced with the letter of the Appendix

Data sheets and measurements sheets shall be arranged in the order that the subject appears in the Scope of Work.

See page 16 of 16 for a sample photograph page.

All reports are to be comb-bound with clear plastic front covers and black plastic rear covers. The unsigned final report submittal shall consist of 2 copies of each report and an electronic copy of both reports. The final submittal shall consist of one bound final report with original photographs which shall be stamped and signed by an Engineer of the appropriate discipline, licensed in the State of Washington, and shall also have a current NTIS tunnel inspection certification. Six stamped and signed color copies of the report shall be included with the final report. An electronic copy of the final report in PDF format and an electronic copy of all photographs in jpeg format, along with photo logs, shall be submitted <u>with the signed final reports</u> on a credit card size USB drive.

WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION

(TYPE) INSPECTION REPORT
MONTH, YEAR

NAME OF TUNNEL
TUNNEL NO. (W/XYZ)

PREPARED BY
COMPANY NAME
CITY, STATE

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report documents the condition of the Tunnel Name and Tunnel Number, electrical (or mechanical) systems as they existed during the In-Depth Electrical (or Mechanical) Inspection performed Month XX through XX, XXXX.

Overall, the electrical(or mechanical) systems exhibited minor deterioration and operated in an acceptable manner during the inspection.

There were no emergency repairs identified during the inspection.

(Items requiring rehabilitation should be documented in paragraph format. Do not just copy the rehabilitation recommendation list, write a summary.)

The electrical(or mechanical depending on report) systems, in general, require maintenance repairs to improve and maintain safety and operational reliability. Maintenance repair items are listed in the Recommendations section of this report. (Do not include the repair list, the reader can reference that if they are interested.)

PURPOSE AND SCOPE OF INSPECTION

The purpose of this inspection was to determine the condition of the electrical(mechanical) systems and identify deficiencies.

The inspection was performed from Month XX through Month XX, 20XX by XXXXX.

The Scope of Work for this inspection was provided by the WSDOT and is attached as Appendix A.

Name of Tunnel 1 Type of Inspection
Tunnel No. Month, Year

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INSPECTION FINDINGS

POWER DISTRIBUTION
SERVICE ENTRANCE
The three phase, 480-vac service entrance equipment was located outside the Puget Sound Naval Shipyard Museum.

The service entrance equipment was visually inspected and operationally tested. Utility voltages were measured under no load and under load at the Motor Control Center. The measurements were tabulated (See Table 1 in Appendix D). The measurements were acceptable in all cases.

No deficiencies were noted during this inspection.

Based upon the field survey, the service entrance was observed to have minor deterioration.

GROUNDING SYSTEM
The grounding system had a ground rod at the incoming service and two no. 1/0 AWG conductors routed to the service panel.

The ground resistance and current were measured at the ground conductor in the Automatic Transfer Switch (ATS) and the measurements were tabulated (See Table 2 in Appendix D). The measurements were acceptable in all cases.

The grounding system was visually inspected.

No deficiencies were noted during this inspection.

Based upon the field survey, the grounding system was observed to have minor deterioration.

EMERGENCY GENERATOR
A generator was located adjacent to the tunnel electrical room.

The generator was visually inspected and operationally tested. Voltage readings were measured under no load and under load at the Motor Control Center. The measurements were tabulated (See Table 1 in Appendix D). The measurements were acceptable in all cases.

No deficiencies were noted during the inspection.

Based upon the field survey, the emergency generator was observed to have minor deterioration.

Name of Tunnel 4 Type of Inspection
Tunnel No. Month, Year
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AUTOMATIC TRANSFER SWITCH
An ATS was in the tunnel electrical room. The ATS was a Kohler Model rated for 800A.

The ATS was visually inspected and operationally tested.

No deficiencies were noted during the inspection.

Based upon the field survey, the automatic transfer switch was observed to have minor deterioration.

ELECTRICAL DISTRIBUTION SYSTEM
The tunnel electrical room had one Motor Control Center (MCC), eight panelboards, two step down transformers and circuit breakers to distribute power to the electrical equipment.

Each transformer's nameplate data and measured surface temperature were tabulated (See Table 3 in Appendix D). All measurements were acceptable and within the nameplate rating.

The electrical distribution equipment was visually inspected and operationally tested.

Infrared testing was performed on the electrical distribution equipment.

The following deficiency was noted and repaired during the inspection:

- Transformer LP-E was not equipped with a nameplate to identify the transformer. A nameplate was generated and installed on the transformer.

The following deficiency was noted:

- Panelboard LP-D was missing a plastic cover for a space in the panelboard that had no circuit breaker. The space was temporary covered with electric tape (See Photo 1 in Appendix E).

Based upon the field survey and above deficiency, the electrical distribution equipment was observed to have minor deterioration.

RECOMMENDATIONS

EMERGENCY REPAIRS
There were no emergency repairs.

MAINTENANCE REPAIRS

POWER DISTRIBUTION
ELECTRICAL DISTRIBUTION SYSTEM
1. Sample repair number one.

MOTORS
SUMP PUMP MOTORS
2. Sample repair number two.

WIRE, CONDUIT AND JUNCTION BOXES
CONDUIT, CABLE TRAY AND JUNCTION BOXES
3. Sample repair number three.
4. Sample repair number four.
5. Sample repair number five.

REHABILITATION RECOMMENDATIONS
1. Sample recommendation number one.

COST ESTIMATE

1. Sample recommendation number one. $100,000

The provided cost estimate is for material and installation labor (tunnel items only). This cost does not include design engineering, maintenance, traffic control, construction management or administration.

COMBINED MECHANICAL & ELECTRICAL NTIS RATING SUMMARY

Element Number	Element Name	Unit	Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4
10200	Ventilation System	each	1	1	0	0	0
10201	Fans	each	6	6	0	0	0
10300	Drainage and Pumping System	each	1	1	0	0	0
10301	Pumps	each	2	2	0	0	0
10400	Emergency Generator System	each	1	1	0	0	0
10475	Flood Gate	each	0	0	0	0	0
10500	Electrical Distribution System	each	1	1	0	0	0
10550	Emergency Distribution System	each	1	1	0	0	0
10600	Tunnel Lighting Systems	each	1	1	0	0	0
10601	Tunnel Lighting Fixtures	each	172	172	0	0	0
10620	Emergency Lighting Systems	each	0	0	0	0	0
10621	Emergency Lighting Fixtures	each	0	0	0	0	0
10650	Fire Detection System	each	1	1	0	0	0
10700	Fire Protection System	each	1	1	0	0	0
10750	Emergency Communications System	each	1	0	0	1	0
10800	Tunnel Operations and Security System	each	1	0	1	0	0
10850	Traffic Sign	each	5	5	0	0	0
10870	Egress Sign	each	0	0	0	0	0
10890	Variable Message Board	each	0	0	0	0	0
10910	Lane Signal	each	6	6	0	0	0
10911	Lane Signal Fixture	each	6	6	0	0	0

Name of Tunnel B1 Type of Inspection
Tunnel No. Month, Year

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APPENDIX C

CONDENSED ELECTRICAL RATING SUMMARY

NUMERICAL RATING CONDITION DESCRIPTION	
Rating Condition	Description of Condition
1	FAILED CONDITION. Item not operational.
2	POTENTIALLY HAZARDOUS. Deterioration or damage to span drive or stabilizing machinery which could cause movable span to become imminently unstable in any position. Malfunction or deterioration of electrical system which could cause loss of control of the moving span. Deficiency in electrical system design, maintenance, or operational procedure which could cause loss of control of moving span. Inoperable vehicular traffic control device. Also, extreme cases of defects listed under higher rating numbers. Bridge may not be opened to marine traffic. If problem is with stabilizing machinery in the closed position, temporary shoring or support may be necessary to permit safe vehicular traffic over the closed bridge at reduced speed or rating. However, if problem, is with counterweight components of vertical lift bridge stabilizing machinery, bridge may be closed to all traffic until shored or repaired.
3	VERY SERIOUS DETERIORATION. Deterioration or damage to machinery which will not cause imminent instability of a non-redundant span drive but reduces allowable load on drive and may cause future instability if not corrected. Stabilizing machinery damaged, deteriorated, or improperly operated such that movable structure is not properly supported causing structure not to behave as designed and resulting in structural overstress and movements under vehicular traffic that severely affect quality. Severe misalignment of stabilizing machinery, resulting in overload of electrical system and consequent overstress of span drive machinery. Severe interference between moving span and fixed structure due to substructure movements. Deterioration of electrical control system such that many of the safety interlocks are normally by-passed, inconsistent control of moving span, and inoperable or missing traffic control devices. Operation of movable span may be restricted in terms of opening angle, number of openings, and allowable wind velocity. If problem is with stabilizing machinery, shoring may be necessary to permit vehicular traffic.
4	SERIOUS DETERIORATION. Severe wear, deterioration or damage to span drive or stabilizing machinery due to overloading, inadequate maintenance, improper operation, or movement of the structure or substructure. Electrical system malfunctions and numerous safety interlocks are by-passed. Results are inconsistent, noisy, and unreliable operation of the movable span. Improper closure, affecting structural action and vehicular ride quality. Electrical system has archaic components for which replacements are no longer available and open bus panelboards that are considered unsafe nowadays.
5	MODERATE DETERIORATION. Excessive wear, some damage and deterioration of span drive and stabilizing mechanical machinery. Repairs and replacement of some machinery components required. Bearings may need liner adjustment. Machinery may be misaligned due to shifting of structure and substructure but not enough to seriously overload span drive: correctable by adjusting machinery component location using shims, etc. Replacement of corroded machinery fasteners required. Moving span under control but some indicating and safety devices may be inoperable and may be by-passed, and span limit switch may need adjustment.
6	MINOR DETERIORATION. None of the major mechanical machinery components are worn or damaged to the extent that replacement is now required. Some components of the span drive may need to be replaced, such as flex-couplings grids, brake linings, etc. Span stabilizing machinery functioning except that wear may have caused excessive clearances in lock bar guides, etc. Shimming of lock bar guides, replacement of limit switches and adjustments necessary. Machinery needs cleaning, painting, lubrication and adjustment. Electrical system generally functioning as designed. Replacement of some relays, indicating devices and lights may be required. Traffic control devices need repair or maintenance.
7	ALMOST NEW CONDITION. No extensive repairs required. Machinery needs cleaning, painting, lubrication, and adjustment. Electrical systems functioning as designed; may need replacement of indicating lights and minor limit switch adjustment, cleaning of relay contacts and housekeeping in panelboard. Traffic control devices functioning but may need replacement of obstruction lights, object markers, painting of housings, lubrication and adjustment of limit switches.
8	NEW CONDITION. Virtually no repairs required. Mechanical machinery may need cleaning, touch-up painting and lubrication. Electrical system and traffic devices functioning but may need replacement of bulbs and minor housekeeping.
9	NOT APPLICABLE. This device or equipment is not on the structure being inspected.
N/I	NOT INSPECTED. This device or equipment was not included in the inspection.

Name of Tunnel C1 Type of Inspection
Tunnel No. Month, Year

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Condensed Electrical Rating Summary	
Item	Rating
Power Distribution	
Incoming Service	6
Grounding System	6
Emergency Generator	6
Automatic Transfer Switch	6
Electrical Distribution Equipment	6
Motor Starters, Contactors, and Disconnects	6
Tunnel Fan Motor Soft Starts	6
Motors	
Tunnel Fan Motors	6
Sump Pump Motors	6
Control System	
Control Consoles	5
Control System	6
Alarm Auto-dialer	6
Sump Pump and Hydrocarbon Detection Controls	6
Uninterruptible Power Supplies	6
Limit Switches, Photo Electrics, Relays, Contactors, Solenoids and other control devices	6
Wire, Conduit and Junction Boxes	
Motor Feeders	6
Power Feeders	6
Conduits, Cable Tray and Junction Boxes	5
Traffic Control	
Traffic Signals, Lane Control Lights and Signs	5
Traffic Detection Loops	6
Fire Detection System and Emergency Service Cabinets	
Fire Detection System	6
Emergency Service Cabinets	6
Miscellaneous	
Lighting and Receptacles	6
Public Address System	3
Closed Circuit TV System	5
Tunnel Lighting	6
Overall Rating	6

Name of Tunnel C2 Type of Inspection
Tunnel No. Month, Year

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APPENDIX E

PHOTOGRAPHS

Name of Tunnel Ei Type of Inspection
Tunnel No. Month, Year

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Photo 1 Exhaust Fan Shaft – paint peeling and blistering (typical)

Photo 2 Standpipe Labels – non-compliant with ANSI/ASME A13.1

Name of Tunnel E1 Type of Inspection
Tunnel No. Month, Year

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