

Reliability of Visual Inspection for Highway Bridges, Volume II: Appendices

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Research, Development, and Technology
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6300 Georgetown Pike
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FOREWORD

Since the implementation of the National Bridge Inspection Program in 1971, State Departments of Transportation have invested significant resources to evaluate the condition of their bridges. These inspections are primarily conducted within the context of the National Bridge Inspection Standards that require reporting of bridge condition in a standardized format. This standardized format uses a uniform set of condition ratings to describe the condition of a bridge. Key elements of the inspection include the condition ratings for the deck, superstructure, and substructure of the bridge. The assignment of condition ratings to elements of the bridge is used to measure bridge performance at the national level, to forecast future funding needs, to determine the distribution of funds between States, and to evaluate if a particular bridge renovation project qualifies for Federal assistance. Obviously, the accuracy of the condition ratings is important to ensure that FHWA programs for funding bridge construction and renovation are equitable and meet the goal of reducing the number of deficient bridges.

The accuracy and reliability of the inspection process that results in condition ratings for Highway Bridges has not been researched previously. This report documents the findings of the first comprehensive study of the inspection process since the adoption of the National Bridge Inspection Standards. The study provides overall measures of the reliability and accuracy of bridge inspection, identifies factors that may influence the inspection results, and determines what procedural differences exist between various State inspection programs. This report will be of interest to bridge engineers, designers, and inspectors who are involved with the inspection of our Nation's highway bridges.



T. Paul Teng, P.E.
Director, Office of Infrastructure
Research and Development

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16. Abstract Visual Inspection is the predominant nondestructive evaluation technique used in bridge inspections. However, since implementation of the National Bridge Inspection Standards in 1971, a comprehensive study of the reliability of Visual Inspection as it relates to highway bridge inspections has not been conducted. The goals of the study include: providing overall measures of the accuracy and reliability of Routine and In-Depth Visual Inspections, studying the influence of several key factors that affect Routine and In-Depth Inspections, and studying the differences between State inspection procedures and reports. Ten inspection tasks were performed at seven test bridges using State bridge inspectors. The sample of participating inspectors included 49 inspectors from 25 State agencies. Inspectors were provided with common information, instruction, and tools. Inspector characteristics were measured through self-report questionnaires, interviews, and direct measurements. Routine Inspections were completed with significant variability, and the Condition Ratings assigned varied over a range of up to five different ratings. It is predicted that only 68 percent of the Condition Ratings will vary within one rating point of the average, and 95 percent will vary within two points. Factors that appeared to correlate with Routine Inspection results include Fear of Traffic; Visual Acuity and Color Vision; Light Intensity; Inspector Rushed Level; and perceptions of Maintenance, Complexity, and Accessibility. In-Depth Inspections using Visual Inspection alone are not likely to detect or identify the specific types of defects for which the inspection is prescribed, and may not reveal deficiencies beyond those that could be noted during a Routine Inspection. The overall thoroughness with which inspectors completed one of the In-Depth tasks tended to have an impact on the likelihood of an inspector detecting weld crack indications. Other factors that may be related to In-Depth Inspection accuracy include: time to complete inspection, comfort with access equipment and heights, structure complexity and accessibility, viewing of welds, flashlight use, and number of annual inspections performed. The State procedural and reporting tasks indicated that most States follow similar procedural and reporting criteria. Several inconsistencies were noted with the use of the element-level inspection systems, but it is not known if these variations are the result of State practices or inspector use. Deck delamination surveys were found to have significant variability, with only a few teams performing a delamination survey as part of the Routine Inspection. This volume is the second in a series of two. The other volume in the series is: FHWA-RD-01-020, Volume I: Final Report					
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APPENDIX A. STATE, COUNTY, AND CONTRACTOR SURVEY FORMS

**States Survey
Nondestructive Evaluation (NDE)/Visual Inspection**

**Funded by the
Federal Highway Administration**

Please answer all questions in this voluntary survey to the best of your ability. Note that some questions may require you to respond as if you were responsible for your state's bridge inspection unit. If you wish to comment further on any question(s) or qualify your answer, feel free to include additional sheets or use the margins. Upon completion of the study, participants will receive a draft of compiled responses.

Any questions regarding this survey should be addressed to Mr. Dennis Rolander at the NDE Validation Center at (703) 285-1133. Return the completed questionnaire by **January 29, 1998** by faxing to (703) 285-1175 or mailing to:

NDE Validation Center – HNR-20
State of the Practice Survey NDE/Visual Inspection
6300 Georgetown Pike
McLean, VA 22101-2296
ATTN: Dennis Rolander

Questionnaire completed by: _____
Position/Title: _____
Address: _____
City/State/Zip: _____
Phone No.: _____ Fax No.: _____
Email Address: _____

Section 1 – Composition of Bridge Inspection Team for Visual Inspection

1. Are your bridge inspections completed by Department of Transportation (DOT) staff or by outside Contractors? (*circle one*)

Only DOT staff

Only Contractors

Both DOT staff and Contractors

2. If the answer to Question 1 is "Both DOT staff and Contractors," in what situations are Contractors utilized? (*mark all that apply*)

- ____ Routine inspections
____ Fracture critical inspections
____ Advanced NDE techniques
____ Complex structures
____ Structures with complex traffic control situations
____ Underwater inspections
____ Other (*please describe below*)

3. For the following hypothetical bridge, how many people would make-up a field inspection team (excluding traffic control personnel), and how much time (in man-hours) would be budgeted?
 Twenty-year old, two-span bridge carrying two-lane road (medium ADT) over a small creek, maximum height above the creek is 20 ft.
Superstructure: Steel, four-girder superstructure (rolled shapes); welded flange cover plates; concrete deck.
Substructure: Concrete abutments, a single three-column concrete pier (with pier cap) out of the normal watercourse.
- People: _____
 Man-hours: _____
4. What are the minimum, maximum, and typical numbers of personnel that would make up a bridge inspection team (excluding traffic control personnel)?
- Minimum: _____
 Maximum: _____
 Typical: _____
5. Estimate the percentage of bridge inspections completed with a registered Professional Engineer (PE) **on-site?** (*circle one*)
- 0-20% 21-40% 41-60% 61-80% 81-100%
6. When a PE is included as part of the on-site inspection team, what conditions would dictate his/her presence?
- _____
- _____
7. Please indicate the average number of years of experience in bridge inspection at each of the following positions. (*circle the appropriate responses*)
- Team Leader:
- 0-5 years & PE 5-10 years More than 10 years
- Other team members:
- 0-5 years 5-10 years More than 10 years

Section 2 – Impact of Administrative Requirements on Visual Inspection

1. If additional resources were made available for bridge inspection, please indicate how you might allocate those additional resources (for example, increased time per inspection, increased use of NDE methods, increased use of bridge inventory management software, etc.)?
- _____
- _____
- _____
2. Approximately how many bridge inspectors are in your bridge inspection unit?
- 1-5 6-10 11-15 16-20 21-25 26-30 31-40 41-50 More than 50

3. What type of training do you require of bridge inspectors? *(mark all that apply)*
- Team leaders:
- | | |
|---|---|
| ☐ Associate's Degree CE Technology | ☐ Bridge Inspector's Training Course |
| ☐ Bachelor's Degree CE | ☐ Fracture Critical Inspection Course |
| ☐ Stream Stability Course | ☐ Other Training Courses <i>(please specify)</i> |
-
-
- Other team members:
- | | |
|---|---|
| ☐ Associate's Degree CE Technology | ☐ Bridge Inspector's Training Course |
| ☐ Bachelor's Degree CE | ☐ Fracture Critical Inspection Course |
| ☐ Stream Stability Course | ☐ Other Training Courses <i>(please specify)</i> |
-
-
4. Could you suggest any changes in administrative or inspection procedure or policy that may improve inspection performance? Explain.
-
-
-
5. Do you test the vision of inspectors (with corrective lenses if necessary)? Yes No
6. For a given bridge, are copies of previous inspection reports made available to the inspectors prior to arriving at the bridge site? *(circle one)* Yes No
7. Are inspectors permitted to use copies of previous inspection reports at the bridge site? *(circle one)*
Yes No
8. Who determines the order of field inspection tasks? *(Mark the most appropriate response)*
☐ "Management" provides a checklist to the on-site team to organize the inspection process.
☐ Individual inspectors on-site set the inspection process.
9. Approximately how many bridges are inspected by your organization **each year**? _____
10. What measures do you have in place to assure quality inspections?
-
-
-
-
11. Please describe any recent accomplishments of your bridge inspection program. (For example, an innovative inspector training program, successful implementation of new NDE technologies, identification of potentially life-threatening conditions, etc.).
-
-
-
-

Section 3 – Current and Future Use of NDE Techniques

1. Do you have any American Society for Nondestructive Testing (ASNT) Level III Inspectors on staff?
(circle one)

Yes No

If so, what method(s) are they certified for? (check all those that apply)

☐ Acoustic Emission (AE)
☐ Electromagnetic Testing (ET)
☐ Leak Testing (LT)
☐ Liquid Penetrant Testing (PT)
☐ Magnetic Particle Testing (MT)
☐ Neutron Radiographic Testing (NRT)
☐ Radiographic Testing (RT)
☐ Thermal/Infrared Testing (TIR)
☐ Ultrasonic Testing (UT)
☐ Vibration Analysis Testing (VA)
☐ Visual Testing (VT)

If applicable, are these ASNT Level III Inspectors routinely used in field situations? (circle one)

Yes No

2. Mark any certifications which the typical Bridge Inspection Team Member may hold. (Mark all that apply. Note that NICET refers to the National Institute for Certification In Engineering Technologies (NICET) Bridge Safety Inspection.)

Team Leader

☐ PE License
☐ ASNT Level I
☐ ASNT Level II
☐ ASNT Level III
☐ NICET Level I
☐ NICET Level II
☐ NICET Level III
☐ NICET Level IV
☐ Other _____

Other Team Members

☐ PE License
☐ ASNT Level I
☐ ASNT Level II
☐ ASNT Level III
☐ NICET Level I
☐ NICET Level II
☐ NICET Level III
☐ NICET Level IV
☐ Other _____

3. What NDE techniques are currently utilized on bridges under your jurisdiction? (mark all that apply)

Steel:

Acoustic Emission
Liquid Penetrant
Thermal/Infrared
Visual Inspection

Eddy Current
Magnetic Particle
Ultrasonic
Other _____

Other Electromagnetic Testing
Radiography
Vibration Analysis

Concrete:

Acoustic Emission
Mechanical Sounding (chain drag)
Rebound Hammer
Ultrasonics (Impact Echo)
Other _____

Cover Meters/Pachometers
Radar
Thermal/Infrared
Vibration Analysis

Electrical Potential Measurements
Radiography
Ultrasonics (Pulse Velocity)
Visual Inspection

Timber:

Acoustic Emission
Radiography
Other _____

Mechanical Sounding
Stress Wave Analysis

Moisture Meter
Visual Inspection

Other Materials:

Material/Technique

- 1)
2)
3)

4. Of these NDE techniques, which method do you use most often for each material?

Steel: _____

Concrete: _____

Timber: _____

Other Materials: _____

5. Have you stopped using any NDE techniques due to unreliable performance or for any other reason? If so, which techniques and why?

6. What general area of NDE applications would you like to see more research into? (*mark one*)

___ Concrete decks

___ Concrete superstructure

___ Steel superstructure

___ Prestressed concrete superstructure

___ Timber decks/timber substructure

In conjunction with the development of the Federal Highway Administration's new NDE Validation Center, we plan to ask bridge inspection teams to participate in various visual inspection benchmark tests. The information gathered during these "hands-on" benchmark tests will provide bridge inspectors with valuable information about the factors affecting the reliability of visual inspection. The goal of this survey and the follow-up visual inspection tests is to help the bridge inspection community to perform more reliable bridge inspections. **Would you be willing to participate in the "hands-on" study?**

Thank you for your time in completing this questionnaire. Your answers will allow the NDE Validation Center team to focus their efforts in the areas that will benefit the bridge inspection community the most.

**Iowa County Survey
Nondestructive Evaluation (NDE)/Visual Inspection**

**Funded by the
Federal Highway Administration**

Please answer all questions in this voluntary survey to the best of your ability. Note that some questions may require you to respond as if you were responsible for your county's bridge inspection unit. If you wish to comment further on any question(s) or qualify your answer, feel free to include additional sheets or use the margins. Upon completion of the study, participants will receive a draft of compiled responses.

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NDE Validation Center – HNR-20
State of the Practice Survey NDE/Visual Inspection
6300 Georgetown Pike
McLean, VA 22101-2296
ATTN: Dennis Rolander

Questionnaire completed by: _____
Position/Title: _____
Address: _____
City/State/Zip: _____
Phone No.: _____ Fax No.: _____
Email Address: _____

Section 1 – Composition of Bridge Inspection Team for Visual Inspection

1. Are your bridge inspections completed by county personnel, state personnel, or by Contractors? (*circle one*)

County Personnel State Personnel Contractors Blend of three

2. If non-county personnel are used for bridge inspections in Question 1, in what situations are they involved? (*mark all that apply*)

- ☐ Routine Inspections
☐ Fracture Critical Member Inspections
☐ Advanced NDE techniques
☐ Complex structures
☐ Structures with complex traffic control situations
☐ Underwater inspections
☐ Other (*please describe below*)

3. For the following hypothetical bridge, how many people would make-up a field inspection team (excluding traffic control personnel), and how much time (in man-hours) would be budgeted?
 Twenty-year old, two-span bridge carrying two-lane road (medium ADT) over a small creek, maximum height above the creek is 20 ft.
Superstructure: Steel, fabricated four-girder superstructure (rolled shapes); welded flange cover plates; concrete deck.
Substructure: Concrete abutments, a single three-column concrete pier (with pier cap) out of the normal watercourse.
- People: _____
 Man-hours: _____
4. What are the minimum, maximum, and typical numbers of personnel that would make up a bridge inspection team (excluding traffic control personnel)?
- Minimum: _____
 Maximum: _____
 Typical: _____
5. Estimate the percentage of bridge inspections completed with a registered Professional Engineer (PE) **on-site?** (*circle one*)
- 0-20% 21-40% 41-60% 61-80% 81-100%
6. When a PE is included as part of the on-site inspection team, what conditions would dictate his/her presence?
- _____
- _____
7. Please indicate the average number of years of experience in bridge inspection at each of the following positions (*circle the appropriate response*).
- Team Leader:
- 0-5 years (& PE) 5-10 years More than 10 years
- Other team members:
- 0-5 years 5-10 years More than 10 years

Section 2 – Impact of Administrative Requirements on Visual Inspection

1. If additional resources were available for bridge inspection, please indicate how you might allocate those additional resources (for example, increased time per inspection, increased use of NDE methods, increased use of bridge inventory management software, etc.)?
- _____
- _____
- _____
2. Approximately how many bridge inspectors are in your bridge inspection unit?
- 1-5 6-10 11-15 16-20 21-25 26-30 31-40 41-50 More than 50

3. What type and how much training do you require of bridge inspectors? *(mark all that apply)*
- Team leaders:
- | | |
|---|---|
| ☐ Associate's Degree CE Technology | ☐ Bridge Inspector's Training Course |
| ☐ Bachelor's Degree CE | ☐ Fracture Critical Inspection Course |
| ☐ Stream Stability Course | ☐ Other Training Courses <i>(please specify)</i> |
-
-
- Other team members:
- | | |
|---|---|
| ☐ Associate's Degree CE Technology | ☐ Bridge Inspector's Training Course |
| ☐ Bachelor's Degree CE | ☐ Fracture Critical Inspection Course |
| ☐ Stream Stability Course | ☐ Other Training Courses <i>(please specify)</i> |
-
-
4. Could you suggest any changes in administrative or inspection procedure or policy that may improve inspection performance? Explain.
-
-
-
5. Do you test the vision of the inspectors (with corrective lenses if necessary)? Yes No
6. For a given bridge, are copies of previous inspection reports made available to the inspectors prior to arriving at the bridge site? *(circle one)* Yes No
7. Are inspectors permitted to use copies of previous inspection reports at the bridge site? *(circle one)*
Yes No
8. Who determines the order of field inspection tasks? *(Mark the most appropriate response)*
☐ "Management" provides a checklist to the on-site team to organize the inspection process.
☐ Individual inspectors on-site set the inspection process.
9. Approximately how many bridges are inspected by your organization **each year**? _____
10. What measures do you have in place to assure quality inspections?
-
-
-
-
11. Please describe any recent accomplishments of your bridge inspection program. (For example, an innovative inspector training program, successful implementation of new NDE technologies, identification of potentially life-threatening conditions, etc.).
-
-
-
-

Section 3 – Current and Future Use of NDE Techniques

1. Do you have any American Society for Nondestructive Testing (ASNT) Level III Inspectors on staff?
(circle one)

Yes No

If so, what method(s) are they certified for? (check all those that apply)

☐ Acoustic Emission (AE)
☐ Electromagnetic Testing (ET)
☐ Leak Testing (LT)
☐ Liquid Penetrant Testing (PT)
☐ Magnetic Particle Testing (MT)
☐ Neutron Radiographic Testing (NRT)
☐ Radiographic Testing (RT)
☐ Thermal/Infrared Testing (TIR)
☐ Ultrasonic Testing (UT)
☐ Vibration Analysis Testing (VA)
☐ Visual Testing (VT)

If applicable, are these ASNT Level III Inspectors routinely used in field situations? (circle one)

Yes No

2. Mark any certifications which the typical Bridge Inspection Team Member may hold. (Mark all that apply. Note that NICET refers to the National Institute for Certification in Engineering Technologies (NICET) Bridge Safety Inspection.)

Team Leader

☐ PE License
☐ ASNT Level I
☐ ASNT Level II
☐ ASNT Level III
☐ NICET Level I
☐ NICET Level II
☐ NICET Level III
☐ NICET Level IV
☐ Other _____

Other Team Members

☐ PE License
☐ ASNT Level I
☐ ASNT Level II
☐ ASNT Level III
☐ NICET Level I
☐ NICET Level II
☐ NICET Level III
☐ NICET Level IV
☐ Other _____

3. What NDE techniques are currently utilized on bridges under your jurisdiction? (mark all that apply)

Steel:

Acoustic Emission
Liquid Penetrant
Thermal/Infrared
Visual Inspection

Eddy Current
Magnetic Particle
Ultrasonic
Other _____

Other Electromagnetic Testing
Radiography
Vibration Analysis

Concrete:

Acoustic Emission
Mechanical Sounding (chain drag)
Rebound Hammer
Ultrasonics (Impact Echo)
Other _____

Cover Meters/Pachometers
Radar
Thermal/Infrared
Vibration Analysis

Electrical Potential Measurements
Radiography
Ultrasonics (Pulse Velocity)
Visual Inspection

Timber:

Acoustic Emission
Radiography
Other _____

Mechanical Sounding
Stress Wave Analysis

Moisture Meter
Visual Inspection

Other Materials:

Material/Technique

1)
2)
3)

4. Of these NDE techniques, which method is used most often for each material?

Steel: _____
Concrete: _____
Timber: _____
Other Materials: _____

5. Have you stopped using any NDE techniques due to unreliable performance or any other reason? If so, which techniques and why?

6. What general area of NDE applications would you like to see more research into? (*mark one*)

☐ Concrete decks
☐ Concrete superstructure
☐ Steel superstructure
☐ Prestressed concrete superstructure
☐ Timber decks/timber superstructure

Thank you for your time in completing this questionnaire. Your answers will allow the NDE Validation Center team to focus their efforts in the areas that will benefit the bridge inspection community the most.

Please answer all questions to the best of your ability. Note that some questions may require you to respond as if you were responsible for all bridge inspections done by your company. If you wish to comment further on any question(s) or qualify your answer, feel free to include additional sheets or use the margins. Upon completion of the study, participants will receive a draft of the compiled responses.

Any questions regarding this survey should be addressed to Mr. Dennis Rolander at the NDE Validation Center at (703) 285-1133. Return the completed questionnaire by **January 22, 1998** by faxing to (703) 285-1175 or using the enclosed envelope and mailing to:

NDE Validation Center – HNR-20
State of the Practice Survey NDE/Visual Inspection
6300 Georgetown Pike
McLean, VA 22101-2296
ATTN: Dennis Rolander

Questionnaire completed by: _____
Position/Title: _____
Address: _____

City/State/Zip: _____
Phone No.: _____ Fax No.: _____
Email Address: _____

Section 1 – Composition of Bridge Inspection Team for Visual Inspection

1. What types of bridge inspection services does your company perform? (*mark all that apply*)
 - ___ Routine Inspections
 - ___ Fracture Critical Member Inspections
 - ___ Advanced NDE techniques
 - ___ Complex structures
 - ___ Structures with complex traffic control situations
 - ___ Underwater inspections
 - ___ Other (*please describe below*)

2. For the following hypothetical bridge, how many people would make-up a field inspection team (excluding traffic control personnel), and how much time would be budgeted?

Twenty-year old, two-span bridge carrying two-lane road (medium ADT) over a small creek, maximum height above the creek is 20 ft.

Superstructure: Steel, fabricated four-girder superstructure (rolled shapes); welded flange cover plates; concrete deck.

Substructure: Concrete abutments, a single three-column concrete pier (with pier cap) out of the normal watercourse.

People: _____

Man-hours: _____

3. What are the minimum, maximum, and typical numbers of personnel that would make up a bridge inspection team (excluding traffic control personnel)?

Minimum: _____

Maximum: _____

Typical: _____

4. Estimate the percentage of bridge inspections completed with a registered Professional Engineer (PE) **on-site?** (*circle one*)

0-20%

21-40%

41-60%

61-80%

81-100%

5. When a PE is included as part of the on-site inspection team, what conditions would dictate his/her presence?

6. Please indicate the average number of years of experience in bridge inspection at each of the following positions. (*circle the appropriate response*)

Team Leader:

0-5 years & PE

5-10 years

More than 10 years

Other team members: (*indicate number of inspectors*)

0-5 years

5-10 years

More than 10 years

Section 2 – Impact of Administrative Requirements on Visual Inspection

1. Approximately how many bridge inspectors are in your bridge inspection unit?

1-5 6-10 11-15 16-20 21-25 26-30 31-40 41-50 More than 50

2. Approximately how many bridges are inspected by your organization **each year?** _____

3. What type of training do you require of bridge inspectors? (*mark all that apply*)

Team leaders:

_____ Associate's Degree CE Technology

_____ Bachelor's Degree CE

_____ Stream Stability Course

_____ Bridge Inspector's Training Course

_____ Fracture Critical Inspection Course

_____ Other Training Courses (*please specify*)

Other team members:

_____ Associate's Degree CE Technology

_____ Bachelor's Degree CE

_____ Stream Stability Course

_____ Bridge Inspector's Training Course

_____ Fracture Critical Inspection Course

_____ Other Training Courses (*please specify*)

4. Could you suggest any changes in administrative or inspection procedure or policy that may improve inspection performance? Explain.
- _____
- _____
- _____
5. Do you test the vision of the inspectors (with corrective lenses if necessary)? (*circle one*) Yes No
6. For a given bridge, are copies of previous inspection reports made available to the inspectors prior to arriving at the bridge site? (*circle one*) Yes No
7. Are inspectors permitted to use copies of previous inspection reports at the bridge site? (*circle one*) Yes No
8. Who determines the order of field inspection tasks? (*Mark the most appropriate response*)
 _____ "Management" provides a checklist to the on-site team to organize the inspection process.
 _____ Individual inspectors on-site set the inspection process.
9. What measures do you have in place to assure quality inspections?
- _____
- _____
- _____
- _____

Section 3 – Current and Future Use of NDE Techniques

1. Do you have any American Society for Nondestructive Testing (ASNT) Level III Inspectors on staff? (*circle one*)
 Yes No
- If so, what method(s) are they certified for? (*check all those that apply*)
- _____ Acoustic Emission (AE)
 _____ Electromagnetic Testing (ET)
 _____ Leak Testing (LT)
 _____ Liquid Penetrant Testing (PT)
 _____ Magnetic Particle Testing (MT)
 _____ Neutron Radiographic Testing (NRT)
 _____ Radiographic Testing (RT)
 _____ Thermal/Infrared Testing (TIR)
 _____ Ultrasonic Testing (UT)
 _____ Vibration Analysis Testing (VA)
 _____ Visual Testing (VT)
- If applicable, are these ASNT Level III Inspectors routinely used in field situations? (*circle one*)
 Yes No

2. Mark any certifications which the typical Bridge Inspection Team Member may hold. *(Mark all that apply. Note that NICET refers to the National Institute for Certification in Engineering Technologies (NICET) Bridge Safety Inspection.)*

<u>Team Leader</u>	<u>Other Team Members</u>
_____ PE License	_____ PE License
_____ ASNT Level I	_____ ASNT Level I
_____ ASNT Level II	_____ ASNT Level II
_____ ASNT Level III	_____ ASNT Level III
_____ NICET Level I	_____ NICET Level I
_____ NICET Level II	_____ NICET Level II
_____ NICET Level III	_____ NICET Level III
_____ NICET Level IV	_____ NICET Level IV
_____ Other _____	_____ Other _____

3. What NDE techniques are currently utilized on bridges under your jurisdiction? *(mark all that apply)*

Steel:

Acoustic Emission
Liquid Penetrant
Thermal/Infrared
Visual Inspection

Eddy Current
Magnetic Particle
Ultrasonic
Other _____

Other Electromagnetic Testing
Radiography
Vibration Analysis

Concrete:

Acoustic Emission
Mechanical Sounding (chain drag)
Rebound Hammer
Ultrasonics (Impact Echo)
Other _____

Cover Meters/Pachometers
Radar
Thermal/Infrared
Vibration Analysis

Electrical Potential Measurements
Radiography
Ultrasonics (Pulse Velocity)
Visual Inspection

Timber:

Acoustic Emission
Radiography
Other _____

Mechanical Sounding
Stress Wave Analysis

Moisture Meter
Visual Inspection

Other Materials:

Material/Technique

- 1)
2)
3)

4. Of these NDE techniques, which method is used most often for each material?

Steel: _____
Concrete: _____
Timber: _____
Other Materials: _____

5. Have you stopped using any NDE techniques due to unreliable performance or any other reason? If so, which techniques and why?

6. What general area of NDE applications would you like to see more research into? (*mark one*)
- ☐ Concrete decks
 - ☐ Concrete superstructure
 - ☐ Steel superstructure
 - ☐ Prestressed concrete superstructure
 - ☐ Timber decks/timber superstructure

In conjunction with the development of the Federal Highway Administration's new NDE Validation Center, we plan to ask bridge inspection teams to participate in various visual inspection benchmark tests. The information gathered during these "hands-on" benchmark tests will provide bridge inspectors with valuable information about the factors affecting the reliability of visual inspection. The goal of this survey and the follow-up visual inspection tests is to help the bridge inspection community to perform more reliable bridge inspections. **Would you be willing to participate in the "hands-on" study?**

Thank you for your time in completing this questionnaire. Your answers will allow the NDE Validation Center team to focus their efforts in the areas that will benefit the bridge inspection community the most.

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