



State of North Carolina
Department of Transportation
Field Support

Structures Management Unit
Inspection Manual

- (1) **PURPOSE:** The Field Support - Structures Management Unit Inspection Manual has been developed to provide general guidance to Structures Management Unit personnel regarding inspection policy and procedures. The objectives of this manual are to promote efficiency in both design efforts and the transfer of information, as well as to ensure uniformity in contract plan presentation.
- (2) **MANUAL CONTENT:** This manual consists of the following four chapters. These consist of an Introduction, Inspection, Analysis, and SI&A.
- (3) **REFERENCE SYSTEM:** A reference system within each chapter is maintained such that the chapter number precedes a section number. The text of each volume is paginated per chapter at the bottom of the page. Figures, where applicable, are presented separately and are referenced via similar designations.
- (4) **REVISIONS:** This manual is designed as an active document. As new research, products, and procedures evolve, such advances may be periodically incorporated into the body of the manual. To maintain the manual's integrity and continuity, revisions should be immediately appended to the manual as they are distributed.

A master copy of this document, including all revisions, deletions, and additions will be maintained by the Policy Development Group of the Structures Management Unit.

CONTENTS

Chapter 1

1.1 Overview..... 1-1

1.2 National Bridge Inspection Standards 1-1

1.3 References..... 1-1

1.4 Funding 1-2

1.5 Quality Control Procedures..... 1-4

1.6 Quality Assurance Procedures 1-5

DRAFT

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

The North Carolina Department of Transportation (NCDOT) Structures Management Unit (SMU) is responsible for the inspection, load capacity analysis, inventory, and administration of maintenance policies and procedures for structures on the State Highway System, which includes but is not limited to bridges, reinforced box culverts, and pipe 54" and larger in diameter. The Federal Highway Administration (FHWA) has established bridge inspection procedures and rating guidelines in an attempt to create uniformity and consistency nationwide and to ensure both older and newer bridge types are properly monitored. The deterioration of existing structures and the escalating cost of replacement make it imperative that older, existing bridges be properly documented and analyzed in order to be kept open and safe for the travelling public. The NCDOT SMU Inspection Manual outlines the inspection, analysis and inventory responsibilities and serves as a guideline for SMU personnel and Private Engineering Firms (PEF'S) when policy and procedures need to be addressed.

1.2 NATIONAL BRIDGE INSPECTION STANDARDS

The National Bridge Inspection Standards (NBIS) are Federal regulations establishing requirements for:

- Bridge Inspection Organization
- Qualifications of Personnel
- Inspection Frequency
- Inspection Procedures
- Maintenance of Bridge Inventory

1.3 REFERENCES

The latest editions of the following manuals shall govern the safety inspection of bridges, unless otherwise stated within this manual:

- 1) AASHTO Manual for Bridge Evaluation (MBE).
- 2) AASHTO LRFD Bridge Design Specifications.
- 3) AASHTO Standard Specifications for Highway Bridges.
- 4) Manual on Uniform Traffic Control Devices with North Carolina Supplement.

- 5) Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.
- 6) Bridge Inspector's Reference Manual (BIRM).
- 7) Culvert Inspection Manual.
- 8) Inspection of Fracture Critical Bridge Members.
- 9) AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual
- 10) AASHTO Manual for Bridge Element Inspection.

1.4 FUNDING

Inspection costs of NBI structures are eligible for reimbursement from Federal Highway Bridge Program (HBP) funds. The inspection funding is taken from HBP funds and placed in a statewide funding source (B-9999). The Federal reimbursement is limited to 80% of the eligible costs; this also includes the inspection of municipal bridges. Municipal bridge funding and inspection requirements are covered in Chapter 2 of the Inspection Manual.

The Federal Funding Unit of the NCDOT Fiscal Department is responsible for establishing the WBS (Work Breakdown Structure) number and funding for the project. The WBS number tracks project expenditures and the amount funded is based on the recommendation from the Project Manager.

To be eligible for federal funds, the bridges must be NBI bridges on public roads and not supported by tolls. Questions on eligibility of individual bridges are forwarded to the State Structures Engineer who will in turn forward the request to the FHWA Division Bridge Engineer for resolution. NBIS activities that are eligible for federal reimbursement are as follows:

- Field inspections, underwater inspections, inspection reports, bridge analysis and load rating, inventory data update, scour assessments, recommendations for repairs and improvements, testing, etc.
- Department Quality Assurance/Quality Control (QA/QC) efforts.
- Inspection administration activities including: scheduling, inspection management, etc.
- Bridge Management System activities including data entry, analysis, etc.

INTRODUCTION

- Support services for NBIS inspections include: Maintenance and Protection of Traffic (equipment rental and labor), temporary access platforms for inspection, access equipment, etc.
- Initial inventories of bridges on public roads.

Reimbursement agreements for bridge inspections between NCDOT and municipalities or other bridge owners are to be reviewed with the above guidelines in mind. Design of repairs and the construction of repairs are NOT eligible for Federal NBIS inspection monies.

The following is criteria established in a memo from the FHWA and the North Carolina Office of the State Auditor outlining the guidelines that must be followed when charging to Federal construction projects.

All NBIS structures requiring inspection are charged to Federal WBS 33842.3.1. The remaining structures are similarly grouped and charged accordingly.

33842.3.1	NBIS Program Eligible Bridges, RCBCs, and metal structures greater than 20 feet in span Deck Evaluation/ Inspection including chloride testing Damage Inspections
15B.22.8	Non-NBIS Eligible Bridges Bridges 20 feet and less in span RCBC's and metal structures 20 feet and less in span Pedestrian bridges Clearances and railroads
15B.13.14	Sign Supports and High-Mast Lighting Clearances at sign supports
34633.1.1	Signal Pole/ Strain Pole Inspections
15B.13.13	Non- NBIS Eligible Administrative Time Time, equipment, materials which are not NBIS Program related Time, equipment, materials making repairs for Divisions
36086	Oversize/Overweight Permits
Varies	Weigh Station Charges – Obtain WBS from Equipment Unit

INTRODUCTION

When creating purchase order requisitions, the user must select the appropriate WBS element. For all purchase order requisitions being charged to a federal or grant WBS element, account assignment category H must be selected. The H account assignment requires the Federal Funds Management Area in Fiscal to review the request for compliance and if deemed appropriate approve the purchase requisition as part of the release strategy.

Purchase Requisitions requiring Federal Funds Management approval have a release strategy of A4 and are reviewed on a daily basis. Purchase items that are ineligible for Federal participation will be rejected and returned to the creator of the requisition. When other WBS elements are selected, the Federal Funds Management Area is bypassed in the review and approval process.

1.5 QUALITY CONTROL PROCEDURES

Bridges are vital links in North Carolina's infrastructure. In order to properly invest bridge funds and maintain a safe bridge system, NCDOT SMU uses the following quality control procedures to maintain bridge inspection data:

- All inspection Team Leaders are required to complete the two week National Highway Institute (NHI) course, *Safety Inspection of In-Service Bridges*, prior to being hired, and are required to successfully complete the three day refresher course every five years.
- Assistant Inspectors are encouraged to complete the two week National Highway Institute (NHI) course, *Safety Inspection of In-Service Bridges*, within one year after being hired.
- Routine inspections are performed at regular intervals not to exceed 24-months.
- Inspectors are instructed in the use of snoopers cranes so that they can better inspect, photograph, and record data on each bridge component.
- Inspections are scheduled one month in advance and monthly compliance reports are compiled to keep inspections on schedule. To assist with time constraints for the in-house inspectors when the number of inspections is too large, Private Engineer Firms (PEFs) are selected to perform inspections. PEFs are retained with open-ended contracts and are available for use during the entire two year cycle.
- The Area, Underwater and Special Team supervisors review all of the inspection reports submitted in their areas and enter them in the Wearable Inspection and Grading Information Network System (WIGINS) for processing. WIGINS is an

electronic data capture system that provides a method of entering bridge inspection data while in the field.

- The State Bridge Inspection Superintendent reviews, at random, approximately 180 reports statewide per two year cycle.
- The Analysis Group also reviews inspection reports. Feedback is provided to the Area Supervisor based on the observations made during analysis. Statewide comparisons are discussed with supervisory personnel concerning problems from different areas.
- The Structure Inventory and Appraisal (SI&A) group implements the following quality control measures:
 1. An Inventory and Appraisal Technician reviews the latest inspection report for element changes and records these in the working record in the WIGINS database.
 2. The working record is reviewed by a senior level technician who flags reporting errors and checks for data missed by the technician. The records are then sent to the group supervisor for final review and approval.
 3. The Inventory and Appraisal Supervisor approves the structure record in the WIGINS database and creates a PDF copy of the inspection report, which is stored in WIGINS – BridgeDocs.

Every effort is made to hire experienced and properly trained staff and PEF's in all areas of the inspection program.

PEFs are responsible for their own internal quality control. SMU observes two PEF inspection teams per year and approves all PEF inspection reports.

1.6 QUALITY ASSURANCE PROCEDURES

The following quality assurance measures are used by NCDOT SMU to ensure the quality of bridge inspection data.

Concerning field inspections, the Area Supervisors make independent checks of completed inspections performed by their inspection teams at regular intervals; a minimum of one team per month. Each team is assessed a minimum of one time each quarter. The results of these checks are recorded and sent to the Business Systems Analyst and stored in a database. Feedback and discussion sessions are held to insure that inspection grades are correct.

INTRODUCTION

The Bridge Inspection Superintendent performs an independent check of each inspection team at least once during each inspection cycle on a statewide basis. He checks one bridge for each team during a two-year cycle. The results of his checks are recorded and compared with the inspection team's numbers and appropriate discussion and feedback sessions are held.

To ensure that inspection standards are applied equally statewide, quarterly meetings are held with the various groups involved with the inspection process. During these meetings, discussions are held regarding inspection related problems in the different areas and these problems are shared statewide.

Having an independent analysis performed for each bridge every cycle enhances the quality of bridge analysis. The Analysis Group procedures ensure that a different analyst performs each new analysis.

SI&A's quality assurance procedures involve the following: The inventory and appraisal group supervisor is responsible for reviewing at least 10% of the structure records to assure that the inventory process is being followed by his squad members. This includes the review of the reports for one county each week. Additionally, an error checking program is run which targets error prone items.

Additional review takes place with FHWA North Carolina Division Structural Engineer. Regularly scheduled meetings are held to discuss a variety of bridge inspection topics and several bridge inspections are reviewed once a year during the NBIS review with FHWA Division staff and SMU staff. The follow up/closeout session usually involves an in-depth discussion of the bridges reviewed. Observation of actual inspections and a review of the results are sometimes a part of this review. Follow-up discussion sessions are usually held the next day.

Private engineering firms are responsible for providing their own internal quality assurance. SMU does quality assurance on the two PEF teams that are visited.

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CONTENTS

Chapter 2.....	1
Inspections	1
2.1 Overview.....	1
2.2 Bridge Inspector Duties and Qualifications.....	1
2.2.1 State Program Manager.....	1
2.2.2 Bridge Inspection Superintendent.....	1
2.2.3 Bridge Inspection Area Supervisors	2
2.2.4 Topside Team Leader	2
2.2.5 Topside Assistant Inspector	3
2.2.6 Underwater Inspection Supervisor.....	3
2.2.7 Underwater Inspection Team Leader.....	4
2.2.8 Underwater Inspection Assistant	5
2.2.9 Special Inspection Supervisor.....	5
2.2.10 Special Inspection Team Leader.....	6
2.2.11 Special Inspection Assistant	7
2.3 Bridge Inspection Safety.....	7
2.4 WIGINS	8
2.4.1 Introduction.....	8
2.4.2 Benefits	8
2.4.3 WIGINS Equipment.....	8
2.5 Types of Inspections	9
2.5.1 Initial Inspections.....	9
2.5.2 Routine Inspections.....	9
2.5.3 Underwater Inspections	9
2.5.4 Fracture Critical Inspections	10
2.5.5 In-Depth Inspections.....	10
2.5.6 Special Inspections.....	10
2.5.7 Damage Inspections	10
2.5.8 Bridge Maintenance Supervisor Inspections	11
2.6 Frequency of Inspections	11
2.6.1 Routine Inspections.....	11
2.6.2 Underwater Inspections	11
2.6.3 Fracture Critical Member Inspections	11
2.6.4 Damage Inspection.....	12
2.6.5 In-Depth/Special Inspections	12
2.6.5.1 Movable Span and Machinery Inspections	12
2.6.6 Other Inspection Types	12
2.6.6.1 Temporary Bridge Inspections.....	12
2.6.6.2 Cantilever Sign Inspections	12
2.6.6.3 Overhead Span Type Sign Support Inspections.....	13

2.6.6.4	High-Mast Lighting Structure Inspections.....	13
2.6.6.5	Deck Evaluations and Other Special Testing.....	13
2.6.6.6	Bridge Maintenance Supervisor Inspections	13
2.7	Inspection Practices	13
2.7.1	Common Inspection Practices.....	13
2.7.2	Underwater Inspections	14
2.7.3	Special Inspections.....	14
2.8	Complex Bridges	15
2.8.1	Fracture Critical	15
2.8.1.1	Steel Trusses	15
2.8.1.2	Pin and Hanger Bridges	16
2.8.1.3	Ferry Ramps.....	17
2.8.2	Movable	17
2.8.3	Segmental Boxes.....	18
2.9	Ancillary Structures	18
2.9.1	High-Mast Lighting	18
2.9.2	Overhead and Cantilever Sign Inspection.....	19
2.10	Non-State Owned Bridges and Structures	21
2.11	Federal Government Bridges	21
2.12	Municipal Bridges.....	22
2.12.1	Use of Private Engineering Firms.....	22
2.12.2	How the Program Proceeds.....	22
2.12.3	Plan Copy Requirement	23
2.12.4	Municipal Notification of Planned Inspections	23
2.12.5	Municipal Priority Maintenance Procedures	23
2.12.6	Municipal Sign Notice Procedure.....	23
2.12.7	When the Reports Come in from the Field.....	24
2.13	Bridges Over Railroads.....	24
2.14	Snooper Inspections	24
2.15	Priority Maintenance Notices	25
2.15.1	Procedures for Inspectors.....	25
2.15.2	Office Priority Maintenance Procedures.....	25
2.16	Hurricane Emergency Response Procedures	25
2.16.1	Safety	30
2.16.2	Pre-Event Planning	30
2.16.3	Communications	30
2.16.4	Staging Area.....	30
2.16.5	Procedures.....	31
2.17	Inundated Bridge Policy	31
2.18	Bridge Closing Procedure	32
2.19	Reporting.....	32

CHAPTER 2

Inspections

2.1 OVERVIEW

The Structures Management Unit is responsible for the inspection and administration of maintenance policies and procedures for all structures on the State Highway System, including all bridges, all reinforced box culverts, and all pipes 54" and larger in diameter.

2.2 BRIDGE INSPECTOR DUTIES AND QUALIFICATIONS

2.2.1 State Program Manager

The State Program Manager is ultimately responsible for all aspects of the Bridge Inspection Program. Tasks include defining organizational roles and responsibilities as well as ensuring compliance to FHWA and NCDOT requirements. This position requires either a registered professional engineer or ten-years of bridge inspection experience. The State Program Manager must have successfully completed FHWA approved comprehensive bridge inspection training and will complete bridge inspection refresher training within each 60 month period.

2.2.2 Bridge Inspection Superintendent

The Bridge Inspection Superintendent administers and manages the statewide program for inspection of all structures. The Superintendent oversees and supervises the inspection of bridges, high-mast lighting, culverts, large pipes, overhead signs, tunnels and overhead structural walkways. Tasks include reviewing, evaluating and approving inspection reports concerning written descriptions, condition grading of all items, determining if structures can safely carry traffic, and performing inspection quality control procedures. The Superintendent oversees inspections of the most complex or critical structures for maintenance needs and is responsible for the supervision of the five Bridge Inspection Supervisors, the overall evaluation of the inspection programs, development of new inspection procedures, evaluation of new testing equipment, and establishing inspection priorities in accordance with Federal and State goals as to type and number of inspections.

The Bridge Inspection Superintendent must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,
- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience

- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

The Bridge Inspection Superintendent must have successfully completed FHWA approved comprehensive bridge inspection training and shall complete bridge inspection refresher training within each 60 month period.

2.2.3 Bridge Inspection Area Supervisors

Bridge Inspection Area Supervisors coordinate and direct a topside team's inspection of bridges, culverts, pipes, overhead walkways, high-mast lighting and sign supports within a major geographical area of the State. The Supervisor manages several bridge inspection teams and may participate in the inspection of structures within their assigned area. Supervisory duties involve ensuring proper techniques are used in the inspection of structural components and proper documentation is developed. Documentation includes sketches of problem areas, proper photographs, required measurements, recording of data, recommended maintenance, and preparation of inspection reports that furnish a complete technical document of the structure condition. The Supervisor also reviews inspection reports for accuracy and completeness, coordinates inspections that require special equipment, and coordinates with Division personnel for help with traffic control where needed. The Supervisor manages all operations to ensure they are conducted in a safe manner and tracks the progress of inspections to ensure all inspection schedules are met. This work requires travel to various locations to evaluate the technical progress of all teams and to troubleshoot activities as needed.

Each Bridge Inspection Area Supervisor must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,
- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience
- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

Bridge Inspection Area Supervisors must have successfully completed FHWA approved comprehensive bridge inspection training and shall complete bridge inspection refresher training within each 60 month period.

2.2.4 Topside Team Leader

Topside Team Leaders perform advanced level inspection and scheduling on a bridge inspection team in a large geographical area. Team Leaders makes determinations on whether to close a severely defective structure and write, review and revise detailed structure inspection reports documenting findings to be used in an evaluation program to determine the structural integrity, safety and recommended maintenance needs of state

highway structures. A Team Leader must ensure that all data necessary to complete an inspection package is obtained; train new inspectors; schedule, plan and determine the team's activities in conformance with bridge priorities; and select the most appropriate inspection techniques and equipment. Each Team Leader works under the limited supervision of a Bridge Inspection Supervisor and work is reviewed and evaluated upon completion for accuracy of inspections and adherence to safety procedures.

Each Team Leader must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,
- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience
- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

Team Leaders must have successfully completed FHWA approved comprehensive bridge inspection training and shall complete bridge inspection refresher training within each 60 month period.

2.2.5 Topside Assistant Inspector

Topside Assistant Inspectors perform inspection work as part of a bridge inspection team in a large geographical area. This includes assisting the team leader in conducting inspections of structures such as bridges, culverts, large pipes, tunnels and overhead structural walkways to detect evidence of deterioration and/or damage due to natural or accidental causes. The Assistant Inspector will take precise measurements of bridges and other structures to detect any movement or distortion and write detailed structure inspection reports documenting all findings used in an evaluation program to determine the structural integrity, safety and recommended maintenance needs of state highway structures. Employees work is reviewed in progress and upon completion for accuracy of inspections and adherence to safety procedures. An Assistant Inspector has no specific qualifications mandated by FHWA; however, Assistant Inspectors are encouraged to successfully complete FHWA approved comprehensive bridge inspection training within the first year of holding this position.

2.2.6 Underwater Inspection Supervisor

The Underwater Inspection Supervisor coordinates and directs a statewide program of underwater inspections, including full underwater inspections and supplemental inspections. The Supervisor manages the work of multiple underwater inspection bridge teams that work statewide. Supervisory duties involve ensuring proper techniques are used during inspections and proper documentation is developed. Documentation includes

sketches, proper photographs, required measurements, recording of data, recommended maintenance, and preparation of inspection reports that furnish a complete technical document of the underwater structure condition. The Supervisor also reviews inspection reports for accuracy and completeness and coordinates inspections that require special equipment. The Supervisor manages all operations to ensure they are conducted in a safe manner and tracks the progress of inspections to ensure all inspection schedules are met. This work requires travel to various locations to evaluate the technical progress of all teams and to troubleshoot activities as needed.

Each Underwater Inspection Supervisor must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,
- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience
- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

Underwater Inspection Supervisors must have successfully completed FHWA approved comprehensive bridge inspection training or FHWA approved underwater bridge inspection diver training and shall complete bridge inspection refresher training within each 60 month period.

2.2.7 Underwater Inspection Team Leader

This position is an advanced level inspector and schedules work as a team leader on an underwater bridge safety inspection team in a large geographical area. Employee makes determinations on whether to close a severely defective structure and write, review and revise detailed structure inspection reports documenting findings to be used in an evaluation program to determine the structural integrity, safety and recommended maintenance needs of state highway structures. Employee ensures that all data necessary to complete an inspection package is obtained; train new inspectors; schedule, plan and determine the team's activities in conformance with bridge priorities, and select the most appropriate inspection techniques and equipment. The Team Leader will use inspections to detect evidence of deterioration and/or damage due to natural or accidental causes and may perform maintenance and/or repair work on structures. Employee works under the limited supervision of the Underwater Inspection Supervisor and work is reviewed and evaluated upon completion for accuracy of inspections and adherence to safety procedures.

Each Underwater Team Leader must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,

- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience
- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

Underwater Team Leaders must have successfully completed FHWA approved comprehensive bridge inspection training or FHWA approved underwater bridge inspection diver training and shall complete bridge inspection refresher training within each 60 month period.

2.2.8 Underwater Inspection Assistant

This position is an underwater inspector on an underwater bridge safety inspection team in a large geographical area. Employees assist the team leader in conducting inspections to detect evidence of deterioration and/or damage due to natural or accidental causes and perform maintenance and/or repair work on structures. Employees take measurements of Piles, Columns, Walls, Channel Alignment, Scour, Etc. and write detailed structure inspection reports; documenting all findings used in an evaluation program to determine the structural integrity, safety and recommended maintenance needs of state highway structures. Employee's work is performed under the technical supervision of a team leader and is reviewed in progress and upon completion for accuracy of inspections and adherence to safety procedures.

Underwater Inspection Assistants are encouraged to successfully complete FHWA approved comprehensive bridge inspection training or FHWA approved underwater bridge inspection diver training within the first year of holding this position.

2.2.9 Special Inspection Supervisor

The Special Inspections Supervisor coordinates and directs a statewide program of special bridge safety inspections, including routine and supplemental inspections, damage inspections, bridge machinery, sign supports and inspections utilizing non-destructive ultrasonic testing methods. The Supervisor manages the work of multiple special inspection bridge teams that work statewide. Supervisory duties involve ensuring proper techniques are used in the inspection of structural components and proper documentation is developed. Documentation includes sketches of problem areas, proper photographs, required measurements, recording of data, recommended maintenance, and preparation of inspection reports that furnish a complete technical document of the structure condition. The Supervisor also reviews inspection reports for accuracy and completeness, coordinates inspections that require special equipment, and coordinates with Division personnel for help with traffic control where needed. The Supervisor manages all operations to ensure they are conducted in a safe manner and tracks the progress of inspections to ensure all inspection schedules are met. This work requires travel to various locations to evaluate the technical progress of all teams and to troubleshoot activities as needed.

Each Special Inspection Supervisor must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,
- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience
- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

Special Inspection Supervisors must have successfully completed FHWA approved comprehensive bridge inspection training and shall complete bridge inspection refresher training within each 60 month period.

2.2.10 Special Inspection Team Leader

A Special Inspection Team Leader performs advanced level inspection and scheduling as a team leader on a bridge inspection team statewide. Writing, reviewing, and revising detailed structure inspection reports that document findings to be used in an evaluation program for the structural integrity, safety, and recommended maintenance needs of state highway structures are the primary tasks. The Special Inspection Team Leaders will also make determinations on whether to close a severely defective structure; ensure that all data necessary to complete an inspection package is obtained; train new inspectors; schedule, plan and determine the team's activities in conformance with bridge priorities; and select the most appropriate inspection techniques and equipment. Employees work under the limited supervision of a Special Inspection Supervisor and work is reviewed and evaluated upon completion for accuracy of inspections and adherence to safety procedures.

The Special Inspection Team Leaders must have an in-depth knowledge of movable bridges, fracture critical bridges, trusses, overhead sign structures, high-mast lighting, performing deck evaluations, and have ultrasonic level II certification. Each Special Inspection Team Leader must have at least one of the following to qualify:

- PE registration
- Five years of bridge inspection experience
- NICET Level III or IV Bridge Safety Inspector certification,
- Bachelor degree in engineering from ABET accredited college or university, a passing score on the Fundamentals of Engineering Exam, and two years of bridge inspection experience
- Associate Degree in engineering from ABET accredited college or university and four years of bridge inspection experience

Special Inspection Team Leaders must have successfully completed FHWA approved comprehensive bridge inspection training and shall complete bridge inspection refresher training within each 60 month period.

2.2.11 Special Inspection Assistant

A Special Inspection Assistant performs inspection work as part of a bridge inspection team statewide. Employees assist the team leader in conducting inspections of structures including movable bridges, fracture critical bridges, trusses, overhead signs structures and high-mast lighting, and performing deck evaluations to detect evidence of deterioration and/or damage due to natural or accidental causes. Employees take precise measurements of bridges and other structures to detect any movement or distortion and write detailed structure inspection reports documenting all findings used in an evaluation program to determine the structural integrity, safety and recommended maintenance needs of state highway structures. Employees work is reviewed in progress and upon completion for accuracy of inspections and adherence to safety procedures. Special Inspection Assistants must be able to obtain Ultrasonic level I certification. A Special Inspection Assistant has no specific qualifications mandated by FHWA; however, Inspection Assistants are encouraged to successfully complete FHWA approved comprehensive bridge inspection training within the first year of holding this position.

2.3 BRIDGE INSPECTION SAFETY

Safety is planned into every bridge inspection. The team leader and members discuss the sites that will be visited, the work to be done during the day and the equipment to be used.

The most hazardous condition at any bridge site is vehicular traffic. All work zones are to follow the guidelines in the Work Zone Safety guidelines published by ITRE. All Bridge inspection vehicles have been fitted with flashing lights, and inspection crews wear ANSI approved high visibility vests to warn the traveling public that they are on the right of way.

During work at the site, the inspection crew will be exposed to many other hazards as well. The most common hazards are slips and trips and falls from a ladder or elevated work platform. The walk area around a bridge has small unseen holes or roots which can twist an ankle or cause a fall to the ground. The ground is often wet or has unstable rock that must be walked carefully over. Employees are encouraged to wear high top boots with good traction. Ladders are used to access areas and must be placed so as to remain stable. Snoopers and bucket trucks are often used to inspect the underside of the bridge. Inspectors are provided with special vest with a built in fall arrest harness and lanyard to wear anytime the height is above six feet.

If an incident occurs that results in a personal injury; the other crew member must be able to provide first aid. All inspectors are required to attend a first aid and CPR class every two years. The inspectors must also follow a route plan so if they don't call in the area supervisor can locate them.

NCDOT has developed written Workplace Safety Manual Safe Operating Procedures (SOP) to provide guidance to the bridge inspector on the proper personal protective equipment to wear and site hazards to be aware of during inspections.

SOP 11 B-45 Inspection of Existing Bridges

SOP 11 B-46 Inspection of New Bridges

SOP 11B-86 Underwater Inspection and Maintenance

2.4 WIGINS

2.4.1 Introduction

WIGINS stands for Wearable Inspection and Grading Information Network System. It is named in memory of Lin Wiggins, initial project sponsor and colleague. WIGINS application provides NCDOT with the ability to capture bridge inspection and inventory data. The purpose of the WIGINS application is to provide a method of automating the entry of bridge inspection data in the field with an emphasis on safety, mobility, and efficiency.

2.4.2 Benefits

There are an estimated 18,000 structures (bridges and culverts) statewide, which are inspected by eighteen topside teams, four underwater teams and three special inspection teams. The manual method of bridge inspection/reporting was very time-consuming. It involved taking notes and photos in the field and then returning to the office to type the report. With the automated process, the time spent on bridge inspections and reporting is significantly reduced.

Bridge inspection involves a lot of mobility; therefore, the devices are designed to be portable. Also, data entry is expedited with the aid of handwriting, which can be customized for each user. There is also a function that allows the user to create a custom version of shorthand with the shortcut tool. While performing a bridge inspection, multiple WIGINS Units can be used to enter data; the information can then be synchronized to the Team Lead unit before compiling the report.

Once a bridge has been inspected through the WIGINS application, the data from the inspection can be retrieved to provide a basis for the next inspection. Existing data can be used as a template for the next inspection.

2.4.3 WIGINS Equipment

The type of hardware used to run the WIGINS application is the Tablet PC, a lightweight, portable device that can be held like a clipboard.

2.5 TYPES OF INSPECTIONS

2.5.1 Initial Inspections

An initial inspection is the first inspection of a new or existing structure once it becomes part of the state's bridge inventory. Reconstructed structures may also require an initial inspection to document changes to the structure's type, location, or size. The initial inspection is a hands-on inspection done to verify the safety and document the baseline condition of a structure before it is put to use. Many different types of documentation are put into the bridge files, including photographs, drawings, scour analysis, foundation information, etc. The type of structure, size, design, and location may require traffic control or special access equipment to be used.

2.5.2 Routine Inspections

Routine inspections document the existing physical and functional conditions of the structure. The inspection report for these bridges includes photographs, maintenance needs, and recommendations for major improvements. Load capacity analyses are made after each routine inspection. Routine inspections function to document sufficient field observations, measurements, and load ratings needed to determine:

- The condition of the structure.
- Changes from previously recorded conditions.
- The need to establish or revise a weight restriction.
- Improvement or maintenance needs.
- Existing problems.
- Any inventory changes from the previous inspection.

During a routine inspection, all elements of a structure require a hands-on inspection. Routine inspections are conducted from the bridge deck, ground and/or water level, and ladders, etc.; and, as in an initial inspection, the type of structure, size, design, and location will determine if the inspection may require traffic control or special access equipment to be used.

2.5.3 Underwater Inspections

Underwater inspections are visual and/or tactile inspections of bridges, box culverts and pipes conducted below the water level or above water if topside inspectors are unable to access structural components due to water levels. Teams will detect any and all structural deficiencies and/or undermining of substructure (scour) using various and diverse diving apparatus. The inspection may include removal of marine growth, documentation of structural deficiencies and section loss, documented evidence of fungal/marine attack and marine bores infestation, and other relevant findings. An underwater inspection may include the inspection of cofferdams, concrete seals and bridge removal sites as requested by Construction Units to insure compliance with contracted work with DOT specifications.

2.5.4 Fracture Critical Inspections

Fracture Critical inspections require an in-depth, visual, hands-on inspection, performed by topside, underwater or special inspectors. These inspections are performed only on certain types of structures, which include two girder, truss, suspension spans, pin and hanger, cross-girder and pier caps systems. These types of systems are all considered to have Fracture Critical Members. A fracture critical member is a steel member in tension, or with a tension element, whose failure would likely cause a portion of or the entire structure to collapse. (Reference: 23CFR 650.305)

2.5.5 In-Depth Inspections

An in-depth inspection is a close-up, hands-on inspection of one or more structural elements and a close visual inspection of all members above or below water level to identify any deficiencies not detected by routine inspections. An in-depth inspection may be limited to certain elements, span groups, or structural units. It does not need to involve the entire structure, although in some cases it does include all elements of a structure. For large structures, the inspection may be broken into different sections so that the inspection can be performed at different times. For smaller structures, the in-depth inspection may be done during a routine inspection. In-depth inspections function to collect and document data needed to determine the physical condition of a bridge. These inspections are usually scheduled based on the size, complexity, and condition of the structure. These factors will again determine if special equipment or traffic control will be needed during the inspection process. Personnel, such as special or underwater inspectors, may be required to do these in-depth inspections. Fracture Critical Member inspections shall be in-depth inspections. In-depth inspections are classified as Supplemental inspections or Fracture Critical inspections in the WIGINS system.

2.5.6 Special Inspections

Special inspections are done to examine structures or portions of structures with previous, known, or suspected deficiencies. These inspections are not usually thorough enough to meet NBIS requirements for a routine inspection. The nature, severity, and extent of the known deficiency, along with age, traffic, and maintenance history are all taken into account when determining the frequency and scope of the inspection. Special inspections are classified as Supplemental inspections in the WIGINS system.

2.5.7 Damage Inspections

Damage inspections are performed following extreme weather-related events, vandalism, and vehicular or marine traffic accidents involving a structure. When major damage has occurred, the inspectors will need to evaluate the damaged or failed element, determine section loss, take measurements for misalignment of members, and check for loss of foundation support. This type of inspection determines the nature, severity, and extent of

the structural damage for use in designing repairs. Further, it determines the immediate need to place an emergency weight restriction or closure for vehicular traffic. The documentation taken during a damage inspection may be able to be used to recover the cost of needed repairs or reconstruction from involved parties.

2.5.8 Bridge Maintenance Supervisor Inspections

Bridge Maintenance Supervisor inspections are visual inspections performed on structures including bridges, culverts, and pipe 54" and larger in diameter. The Bridge Maintenance Supervisors in each division are responsible for these inspections. Supervisors are only responsible for the structures in their set counties. If the supervisor sees anything that warrants a more in-depth inspection and/or repair, they will contact the appropriate individuals. During the inspection, the Supervisor fills out the Bridge Inspection Control Sheets form which is then sent to SI&A for processing.

2.6 FREQUENCY OF INSPECTIONS

2.6.1 Routine Inspections

Routine Inspections occur on a 24 month cycle for all bridges.

Routine Inspections less than 24 months will be determined on a case by case basis when a condition rating of 3 or less exists for one of the following: Deck (58), Substructure (59), Superstructure (60) or Culvert (62). Consideration will be given to the presence of temporary repairs.

2.6.2 Underwater Inspections

Underwater Inspections occur on a 48 month cycle for all bridges over water with structural members underwater that cannot be evaluated during a routine above water inspection.

Underwater Inspections less than 48 months will be determined on a case by case basis when one of the following criteria is met:

1. Condition rating of 3 or less for underwater substructure items, culverts or pipes.
2. Bridge with Item 113 is coded with a U and a POA Code of R, S or Z.

2.6.3 Fracture Critical Member Inspections

Fracture Critical Member Inspections occur on a 24 month cycle.

Fracture Critical Member Inspections less than 24 months will be determined on a case by case basis when one of the following criteria is met:

1. Fracture critical member has a condition rating of 4 or less.
2. Fracture critical member type is nationally recognized to be problematic.
3. Trusses are made of wrought iron.
4. Bridge contains pins and straps.

5. Vertical clearance under or on the bridge is less than:

- 16'-6" for interstates, freeways or arterials.
- 15'-0" for local roads, collector roads or streets.
- 23'-0" for bridges over railroads.

2.6.4 Damage Inspection

Damage Inspection occurs immediately after traffic control measures are in place and access to the damaged area is provided. Damaged concrete structures are typically inspected by topside personnel and damaged steel structures are inspected by Special Inspections personnel. Findings are forwarded to the County Bridge Maintenance Supervisor, or the SMU Area Preservation and Repair Squad Leader for development of engineered repair details, if necessary. The frequency of follow-up inspections is determined on a case by case basis and is dependent upon ADT, ADTT or severity of damage.

2.6.5 In-Depth/Special Inspections

2.6.5.1 Movable Span and Machinery Inspections

Movable Span and Machinery Inspections occur on a 24 month cycle.

Movable Span and Machinery Inspections less than 24 months will be determined on a case by case basis. Consideration will be given to age of structure, significant increases in openings and critical importance factors such as detour length and evacuation route.

2.6.6 Other Inspection Types

2.6.6.1 Temporary Bridge Inspections

Once vehicular traffic is allowed on a temporary bridge utilizing modular panels, routine inspection by the manufacturer is required. The first inspection of the structure occurs 1 month after opening the temporary bridge to vehicular traffic. Subsequent inspections are performed every 6 months; however, when ADTT exceeds 2000, inspection of the temporary bridge occurs every 3 months. An inspection report provided by the Department is completed and submitted by the manufacturer within 3 days of each inspection. Any items documented in the report indicating safety or stability issues with the structure are reported immediately. All repairs are performed by the contractor and approved by the Department's engineer.

2.6.6.2 Cantilever Sign Inspections

For Cantilever Sign Inspections, vertical and horizontal clearances are measured on a 24 month cycle. A complete inspection with condition rating grades occurs on a 48 month cycle.

2.6.6.3 Overhead Span Type Sign Support Inspections

For Overhead Span Type Sign Support Inspections, vertical and horizontal clearances are measured on a 24 month cycle. A complete inspection with condition rating grades occurs on a 96 month cycle.

2.6.6.4 High-Mast Lighting Structure Inspections

High-Mast Lighting Structure Inspections occur on a 60 month cycle.

2.6.6.5 Deck Evaluations and Other Special Testing

Deck Evaluations and Other Special Testing are completed upon request. Requests may come from various agencies within and outside the DOT. Requests are scheduled based on priority.

2.6.6.6 Bridge Maintenance Supervisor Inspections

The Bridge Maintenance Supervisor Inspections occur on a 12 month cycle. Results of these inspections are reported to SI&A on Inspection Control sheets.

2.7 INSPECTION PRACTICES

2.7.1 Common Inspection Practices

Teams thoroughly inspect each structure (bridges, pipes, culverts) for deterioration and/or signs of distress to ensure bridge safety.

During an inspection, the inspection team is responsible for measuring and/or verifying all of the structures dimensions such as clear roadway, span lengths, beam sizes, etc. The inspection team is responsible for documenting any damage or deterioration to all of the deck, superstructure, and substructure. Any deterioration found should be dimensioned, documented, and photographed in the inspection report. Loss of section to steel members should also include a remaining section dimension after all rust is removed. The bridge inspector records all maintenance with a repair need greater than routine maintenance as priority maintenance in the WIGINS system. The central office personnel evaluate each of these notices and determine if they are Critical Findings, Priority Maintenance or Routine Maintenance.

A streambed profile is also compiled during the inspection. This is done by measuring the structure and taking soundings (measurements) at intervals. This is input into the WIGINS system as these soundings are taken and the system creates the drawing, which shows the water surface and streambed in relation to a defined point on the structure. After this is completed, the structure is graded with a grade being issued for each specific element. Grades are determined using the *BIRM* and the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridges*.

After the field inspection is completed and the team returns to the office, the Team Leader synchronizes their WIGINS computer to the State server, which downloads the report to the Bridge Inspection Supervisor for approval.

2.7.2 Underwater Inspections

Underwater Inspections involve the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water by wading or probing, generally requiring diving or other appropriate techniques. These inspections may also include the entire structure if access is not ideal for a topside team. Ferry ramps are an example of a structure which are inspected solely by an underwater inspection team.

For bridges that require both a topside team and an underwater team, the topside team must record the components and elevations that they cease their inspection on. The underwater team will then identify their starting locations and include a description of the underwater elements. Bridges that are scour critical require a plan of action to monitor known and potential deficiencies and to address findings. Monitor bridges that are scour critical in accordance with this plan.

All underwater inspections follow OSHA Standards for Commercial Diving Operations and the NCDOT Safety Policy and Procedures Manual.

2.7.3 Special Inspections

Teams thoroughly inspect assigned structures (bridges, overhead signs, and high mast lights) for deterioration and/or signs of distress to ensure bridge safety.

During an inspection, the inspection team is responsible for measuring and/or verifying all of the structures dimensions such as clear roadway, span lengths, beam sizes, etc. In the case of high mast lights a dimension should be given to any roadway within the fall radius of the light. The inspection team is responsible for documenting any damage or deterioration to all structure members. Any deterioration found should be dimensioned, documented, and photographed in the inspection report. Loss of section to steel members should also include a remaining section dimension after all rust is removed. The special inspector records all maintenance with a repair need greater than routine maintenance as priority maintenance in the WIGINS system. The central office personnel evaluate each of these notices and determine if they are Critical Findings, Priority Maintenance or Routine Maintenance.

If applicable, a streambed profile is also compiled during the inspection. This is done by measuring the structure and taking soundings (measurements) at intervals. This is input into the WIGINS system as these soundings are taken and the system creates the drawing, which shows the water surface and streambed in relation to a defined point on the structure. After this is completed, the structure is graded with a grade being issued for each specific set of

members. Grades are determined using the *BIRM* and the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridges*.

For machinery bridges, the inspector shall follow all methods prescribed in the “Movable Bridge Inspection, Evaluation, and Maintenance Manual”. Exceptions.....

For overhead sign structures, the inspector is responsible for documenting any damage or deterioration to all structure members. This involves climbing the structure, using approved safety methods, in order to check tightness of bolts, welded connection, sign connection, etc. of the structure. A UT reading is also taken on all anchor bolts with the length documented in the inspection report.

For high mast light structures, the inspector is responsible for documenting any damage or deterioration to all structure members. Thickness readings are taken at two locations around the base of the pole and remaining section is documented in the report. UT readings are also taken on all anchor bolts with the length documented in the inspection report. After the field inspection is completed and the team returns to the office, the Team Leader synchronizes their WIGINS computer to the State server, which downloads the report to the Bridge Inspection Supervisor for approval.

2.8 COMPLEX BRIDGES

2.8.1 Fracture Critical

A fracture critical structure is any structure with a steel member in tension, or with a tension element, whose failure would likely cause a portion of or the entire bridge to collapse due to a lack of redundant load path.

2.8.1.1 Steel Trusses

Steel trusses are classified as fracture critical structures. Trusses with bolted or riveted connections may be done by topside inspectors, however, trusses with pin and I-bar connections require special monitoring and non-destructive testing on critical members which are done by Special Inspections. Trusses with pin and I-bar connections may have three inspection reports on the same structure. A Routine Inspection report is performed by a topside inspection team on the approach spans. A Supplemental Inspection report and an Ultrasonic Test report that lists all the readings for that particular truss is performed by a Special Inspection team on the truss and connections

Trusses are classified as a through, pony or deck truss. Once the type of truss has been established inspection can begin. Special equipment such as bucket trucks, boatswain chairs, climbing harness, and ultrasonic testing equipment may be required for this type of inspection.

Using the example of a through truss, determine the bridge orientation, such as south to north. Beginning on the south end the first lower pin is L0 on the east or west side. The second pin would be referred to as L1. The first upper pin would be referred to as U1 and the second would be U2 and so on. With reference to location of pins and forged bars, always begin where you are and where you are going, such as LOL1 at L0 eastside. This reads the exact location of where the inspector is and what he is trying to report.

All pins on the truss must have ultrasonic testing to check for fatigue cracks and measure the pin lengths. All forged bars must also have ultrasonic testing to check for fatigue cracks, measure pin length readings, forging and thickness of the bar fashioned around the pins.

A forging is two pieces of metal that have been forged together into a single piece doubling in thickness; these critical members can be measured. X is the distance from the top to the forging. Y is the length of the forging that can be read, and Z is the distance all the way through both bars from top to bottom after they come together. This data is recorded in the Ultrasonic test report and submitted in addition to the Routine or Supplemental Inspection report.

Taking a reading of forged bars:

A is the thickness of the metal at the top around the pin. B is the thickness of the metal at the front of the bar. C is the thickness of the metal at the bottom of the bar. Some areas may be pitted and have section loss. If, for example, there was section loss and pitting on the bottom at the C location, it may be necessary to move back along the bar and take a C prime measurement. If the area is pitted or has section loss it must be documented and sometimes illustrated in the report. Inspections from previous cycles are always included in the reports and taken to the bridge during new inspections. This is reference material to locations and opportunities to see what the recorded data was last time or in previous years. This helps with determining deterioration.

All fracture critical members are graded and are listed on the report pages for reference.

Under clearance heights must be gathered and documented for height tolerances over the roadway along with cross sections that are included in the normal routine inspections.

2.8.1.2 Pin and Hanger Bridges

Pin and hanger assemblies are devices put in bridges to permit expansion movement and rotation. Modern design techniques enable multi-span bridges to be designed without hinges. The problems with pin and hanger details far outweigh any advantages of placing expansion joints away from substructure units. A bridge span has a cantilever arm usually coming off an interior bent cap. This arm has pins inserted in the top of the cantilever arm and bottom of the suspended girder. Hanger straps are then placed on the outside and inside

of the connection. These pins along with the hangers carry the load for the suspended beams.

NCDOT has two pin and hanger bridges. Federal guidelines advise the inspection of these structures, at the maximum, every two years. Ultrasonic testing has to be done on the pin and hanger assemblies at that time. The readings are taken for length of the pin, fatigue cracks, section loss, wear grooves or anything out of the ordinary in the pin or hangers.

Special equipment is needed to perform inspections on these structures. A snooper truck, hydro-lift, or hydro-platform, and ultrasonic machine are among these tools. All other aspects of the structure are standard. These items were detailed in the topside inspection section of this manual.

Once the inspection has been completed, it is entered into the WIGINS mobile inspection report, and can be signed as grading complete and forwarded on through the inspection process.

2.8.1.3 Ferry Ramps

Ferry Ramps have fracture critical components as part of their structure. Do to access challenges, all parts of a Ferry Ramp are inspected by an underwater inspection team.

2.8.2 Movable

Movable bridges, such as swing, lift, or bascule spans, are those that open and close to increase the navigational clearance. These structures require special monitoring and non-destructive testing on critical members. They may be classified as fracture critical depending on the type of structure. For multi-span bridges that contain a movable span, the Special Inspections teams perform the inspection on the movable span and the operating machinery, classified as a machinery inspection. In general, the topside inspection teams are responsible for performing routine inspections on the approach spans in accordance with the procedures in Section 2.5.2.

Machinery inspection reports are somewhat like fracture critical reports. They have special items graded that other bridges do not have. Previous inspection reports should be taken along on current inspections for reference. These reports have detailed drawings and readings from past cycles. They can be cross-examined at the time of inspection for loss or wear of movable items.

Trunnions are the pivot point of the spans. The span rotates up and down over these points much like a fulcrum. The lift span has the weight on one side and is counter balanced in the back to pivot on the trunnion. The anchor bolts have ultrasonic testing each cycle to verify bolt length. The trunnions also have ultrasonic testing for cracks and problem areas.

Trunnion alignment is determined by measuring and recording tooth wear and backlash on the pinion and rack gear sets and by observing grease patterns.

Diagrams of gears for lifting machinery, locks, trunnions, bearings, buffers, and brakes are included in these reports. Each of these items are examined and graded accordingly. Calipers, flashlights, scrappers, and all other types of specialty tools are used for such inspections. The diagrams were drawn from the plans when the bridge was new and in pristine working order. The measurements over the years may have declined or worn in but still may have satisfactory tolerances. These diagrams and charts must be used for calculations to determine the condition of all these items in present day working order.

Once the inspection has been completed it is entered into the WIGINS mobile inspection report. It can be signed as grading complete and forwarded on through the inspection process. There are many different types of movable span bridges within NCDOT, all having different and unique properties.

2.8.3 Segmental Boxes

For post-tensioned segmental box bridges, special attention should be paid to the profile of the roadway surface. This can be accomplished by sighting along the top of the rail, or by providing an annual survey of the bridge profile. For long bridges utilizing post-tensioned segmental boxes, survey of the profile are done twice per year. The results are to be compared against previous surveys in order to establish a normal range of movement. If subsequent surveys show movement outside of the allowable range, such that there is cause for concern, an in depth inspection of the affected areas should be scheduled to determine if localized issues with the units exist.

2.9 ANCILLARY STRUCTURES

2.9.1 High-Mast Lighting

High-Mast light structures are pole mounted light clusters normally 80 to 120 ft. tall. They are located at featured interchanges and along NC highway or interstate medians. Federal Highway guidelines advise these structures are to be inspected every 5 years. They also state anything that is suspended over the highway or has the potential to fall into the road must be inspected.

Basic guidelines for High-Mast Light inspections are as follows: Locate the high-mast light at featured intersections or along roadways from a known point, include milepost if applicable and list quadrants at intersections. For example: Intersection of I-40 west bound and SR 1008 south west quad. Initial inspection will document the position of the structure on a site map and show the distance from all roadways. Determine the height of structure and note any obstructions around pole within the known range, such as power lines, roadways, buildings, etc. Determine how many sections and lights make up the structure.

Start inspection. Standard forms for high-mast light have items listed for grades and descriptions. These forms should be used to gather the information and ensure everything is included. Inspect base seam welds anchor bolts base plate and footing. Ultrasonic testing of the anchor bolts is required to check for cracks and determine bolt lengths.

Approach the pole at the access door, which is located at the 6:00 position. Lay the pole out as if looking at the face of a clock. Mark the pole at 6:00, 7:30, 9:00, 10:30, 12:00, 1:30, 3:00, and 4:30. The marks should be located 3" above the base plate and again at 54" above the base plate.

Since many high-mast light poles are double walled at the bottom, calibrate the thickness meter on a known thickness before taking reading on the pole. The access door can be used since it is of the same material as the pole and the thickness can be easily verified. This will also allow for notation of the velocity reading of the steel. Inside the access door is the best place to locate the manufacturer.

With this information, readings can be taken. Readings around the pole are taken in a clockwise manner. The readings should be consistent around the pole. If not, the inspector should look for signs of section loss or other problems with the pole.

High-Mast lights have slip joints or sections depending on construction materials. These joints have also been known to have problems in the past. Binoculars are used to check these areas and if necessary a high ranger bucket truck from traffic services. Check the pole for plumb or leaning. Always note the direction of lean. The other main place for problems to occur is the seam weld at the base where the pole and base plate are welded together. Moisture and section loss often occur in these areas.

2.9.2 Overhead and Cantilever Sign Inspection

Overhead and Cantilever signs are structures suspended over highways used as information directional aides. Some have self-supporting frames and others are attached to larger structures such as bridges. Federal Highway guidelines advise the inspection of these structures for their potential to fall into the roadway. An overhead is a complete structure with vertical supports on each end. A cantilever is a structure with one fixed vertical support responsible for carrying the entire load. Federal guidelines advise the full inspection of overhead signs every eight years and cantilever and tee signs every four years. They also state a clearance is to be done every two years regardless of the class of sign. The under clearances are used for over height permits or the military carrying loads down the highway. They know the heights of the structures for clearance tolerances. When the vertical clearance is proposed to drop below 16' on the Strategic Highway Network (STRAHNET), we (FHWA and NCDOT) have to get approval from the Military Traffic Management Command (MTCM). The name of the MTCM has been changed to Surface

Deployment and Distribution Command, but the contacts are the same. See attached link for how approval requests are performed.

<http://www.fhwa.dot.gov/hep10/nhs/review/strahnetproc.html>

Basic guidelines for full sign inspections are as follows:

1. Locate the structure along roadway or route carried.
2. Distance from last featured intersection and direction of travel.
3. Note the milepost if applicable.
4. Standard photos and GPS are required.
 - a. Directional photos like looking north or overview of structure.
 - b. Photo close up view of what sign reads.
 - c. Photo of base.
 - d. Photo of frame connection to vertical support.
 - e. Back of sign connection.
5. Determine the type of structure. See sign structure type manual.

Begin physical inspection. Measure footing, base plate, anchor bolt, pole or vertical truss, bolt and post spacing. Anchor bolts must have ultrasonic testing for cracks and determining bolt lengths. Once the base measurements are completed the inspector can move to the cross section. All distances are measured from the through lanes of travel. The distance to the base, paved or unstable, guardrail (if present), paved shoulder, through and ramp lanes, and other side if applicable.

The minimum vertical clearance is taken at the closest vertical point from the through lanes to the sign structure. This distance must be on the through lanes of travel. The Maximum Minimum Vertical Clearance is 10 ft. away from the highest vertical point to the sign structure. The MMVC can be located on the shoulder of the road or any location that is paved without a raised median, as long as it is 10 ft. wide at any section. At narrow locations, the measurement could be the same and represented as the MVC and MMVC at the same location.

Once the sign type has been verified the information can be entered into WIGINS. The WIGINS system has inspection reports that list all items to be graded.

Climbing the structure can be difficult. Often bucket trucks are used to gain vertical access and climbing harnesses are required. Inspect the welds of the vertical truss or vertical seam welds of poles on the way up. Check the U-bolts and connections at the sign frame to vertical truss connections. Move along the horizontal arm checking the chord's diagonals laterals welds bolts and nuts and also the I-bars and connections. This is the main area that the sign is connected to the frame. This is the area that usually has the loosest connections. Older signs do not have through bolts from the main panels through the z-bars and have

given problems in the past. Document the percent loss of shear studs on the back of sign panels, and whether the sign has through bolts in each panel. Continue across frame and inspect other side if applicable.

Once all the information has been gathered it can be entered into WIGINS and signed as grading complete.

2.10 NON-STATE OWNED BRIDGES AND STRUCTURES

Inspection teams also perform a limited inspection on some private structures (Pedestrian, Railroad, and privately owned structures over State Roads). These structures have the data pack photos and measurements and the vertical and horizontal clearances measured, noted, and sketched for the roadway beneath. These structures are not graded and full inspections are only completed as they are requested. If a serious condition is observed during inspection, it is photographed, measured, and the appropriate personnel are notified. The FHWA does not fund the inspection process for these structures.

When the Lowes Motor Speedway Bridge fell onto US 29 in 2000, the legislature mandated a one-time inspection of all private structures crossing state maintained roads. They also required we notify the structure owners that we highly recommend they have their structures inspected every two years by NBIS (National Bridge Inspection Standards) qualified inspectors. In addition the legislation required that any new encroachment agreements involving structures over NCDOT roads require an NBIS inspection of these structures on a two year cycle. FHWA also strongly supports and encourages private bridge owners to have their bridges inspected on a regular basis.

Because of the maintenance agreement that NCDOT has with the North Carolina State Park Service, state park bridges are inspected by NCDOT bridge inspection teams in accordance with NBIS.

2.11 FEDERAL GOVERNMENT BRIDGES

Federal Government bridges are those bridges owned by federal governmental agencies. These bridges are not included in the FHWA twenty-four-month cycle. These bridges are inspected on an as needed basis and upon request by the government agency to which they belong. Most of the government bridges are located in government owned parks, military bases and structures, and anything else government owned. The process for inspection of these bridges begins with the government agency contacting the State Bridge Inspection Superintendent. The superintendent then calls the inspection team closest to the bridge. The local team then performs a routine inspection and the completed inspection report is sent to the agency that made the initial request.

2.12 MUNICIPAL BRIDGES

NCDOT/SMU is charged by the FHWA with having all bridges carrying public traffic in the state inspected in accordance with the NBIS Law. This includes bridges that are not owned by the state. Municipal bridges fall into this category. To meet the FHWA requirement, NCDOT/SMU manages a municipal bridge inspection program.

2.12.1 Use of Private Engineering Firms

NCDOT/SMU does not use its in house inspection personnel to perform the NBIS inspections on municipal bridges. Limited service contracts (LSC) for inspections are maintained with and awarded to Private Engineering Firms (PEF's) and renewed on a two-year basis. An orientation kickoff meeting is held before the inspections begin.

2.12.2 How the Program Proceeds

An email request is made to The North Carolina League of Municipalities for a list of the contact information for all the city managers, clerks and directors of public works in North Carolina. Municipal questionnaires are sent to all the contacts. The questionnaire asks that the municipality forward SMU the number and the location of bridges that will need to be inspected. The questionnaire should also include a contact person and contact information for the municipality. The questionnaires list three inspection options, which are listed below.

Option A: Municipal governments may inspect their own bridges with their staff (qualified bridge inspectors), perform all engineering analyses to determine the structural condition of existing bridges and enter necessary data in WIGINS. NCDOT will make provisions for eighty percent of the cost of the inspections and analysis to be paid for by FHWA. The remaining twenty percent of the cost must be provided by the municipality. There are no state funds available for the inspection and analysis of municipally owned bridges.

Option B: Municipal governments may employ a qualified PEF to perform the inspection and analysis and enter the necessary data in WIGINS. NCDOT will make provisions for eighty percent of the cost of the inspections and analysis to be paid for by FHWA. The remaining twenty percent of the cost must be provided by the municipality. There are no state funds available for the inspection and analysis of municipally owned bridges.

Option C: Municipal governments may request NCDOT to employ a qualified PEF to perform the inspection and analysis and enter the necessary data in WIGINS. NCDOT will employ and pay a PEF for work performed and will invoice the municipality for twenty percent of the cost upon completion of the work. The remaining eighty percent will be paid for by FHWA.

*Regardless of which option is chosen, NCDOT must approve the inspection team leaders and the inspections must be performed using the WIGINS system.

As completed questionnaires are returned, the municipal bridges are selected based on the new information and the past inspection records. Municipalities that select Options B or C receive an agreement prepared according to their selection. The law requires the approval of these agreements by the appropriate municipal authority.

2.12.3 Plan Copy Requirement

If plans are used to prepare the inspection report, a copy of those plans should be provided to NCDOT SMU. This will allow for verification of the report, as well as ensuring that the bridge inventory is kept current.

2.12.4 Municipal Notification of Planned Inspections

Consultants should notify the municipality well in advance of a planned bridge inspection, to allow them time to notify the public if necessary. If a lane closure is involved, the notice should be two to three weeks in advance.

2.12.5 Municipal Priority Maintenance Procedures

If it is determined that a Priority Maintenance is needed at a particular structure, a Municipal Priority Maintenance Form and cover letter should be sent to the municipal contact person. The cover letter should require the municipality to inform SMU of the anticipated repair date. A copy of this letter, as well as the Priority Maintenance, should then be sent to SMU. Priority Maintenance is analyzed for posting changes and if posting should be reduced, the municipality is notified. This process has a one hundred twenty-day time limit, which can be reduced.

The PEF is required to review the completed municipal inspections with the municipality if the municipality has more than five structures or a Priority Maintenance has been issued.

Priority Maintenance must be made in a timely manner. If repairs are deemed critical, a written response is requested from the municipality detailing the plan of action to accomplish the repairs.

2.12.6 Municipal Sign Notice Procedure

During the municipal inspection process, it may be determined that a structure needs a Regulatory Sign Notice. If this occurs, a Municipal Regulatory Sign Notice and cover letter should be sent to the municipal contact person. The cover letter should require the municipality to inform SMU of the anticipated Sign erection date. A copy of this letter and the Municipal Regulatory Sign Notice should then be forwarded to SMU.

The PEF is required to review completed municipal inspections with the municipality if the municipality has more than five structures or a Municipal Regulatory Sign Notice has been issued.

The required repairs must be made within one hundred twenty days. If the repairs are not made, SMU will notify the municipality again. A written response will be requested from the municipality detailing the plan of action to accomplish the repairs. If one hundred twenty days have passed since the Municipal Regulator Sign Notice was issued and the repairs have not been made, SMU will contact the municipality. A response in writing will be requested from the municipality outlining a plan of action.

2.12.7 When the Reports Come in from the Field

The PEF'S submit the reports as they are completed by syncing their pen tablet with the WIGINS server. These reports are then available for review by the Area Bridge Inspection Supervisor, the State Bridge Inspection Superintendent, and the Bridge Inspection Engineer. If there are any questions, comments, or problems, the report is sent back to the PEF via WIGINS for corrections. The PEF must be notified so that they can receive the report by syncing.

2.13 BRIDGES OVER RAILROADS

NCDOT owned bridges over railroads should follow these guidelines:

The inspection should be made from behind the bents adjacent to the track if possible. If the inspector needs to access the track area, the inspector is to notify the railroad by telephone that the inspection team will access the railroad right of way to inspect the bridge. The inspector should supply the date and the time of the anticipated inspection. When the railroad provides a flagger, they send SMU a bill and the department pays them for the flagger.

The railroad contacts and maps can be found on the NC Rail web site:

<http://www.bytrain.org/>

For bridges over Norfolk Southern Railroad Company's tracks, please follow the terms of the agreement.

2.14 SNOOPER INSPECTIONS

It is up to the Inspector to determine if the snooper vehicle should be used on a bridge. Any bridge with an under-clearance greater than thirty feet would be a candidate for the use of a snooper truck. This includes High Rise (coastal) bridges and bridges over rivers and lakes. Utilizing a snooper truck requires several pre-inspection arrangements including contracting with the aerial device company and ensuring that traffic control is in place

during the inspection. When using a snoopier contractor, the area supervisor makes snoopier requests. The supervisor also notifies the divisions when and where the snoopier is to be used.

2.15 PRIORITY MAINTENANCE NOTICES

2.15.1 Procedures for Inspectors

During the inspection process, if an inspector identifies a structural deficiency that needs to be repaired immediately, a Priority Maintenance Notice is issued. The following procedures are used when submitting a Priority Maintenance Notice:

- A. After synchronization, Priority Maintenance Notices are immediately available to Central SMU personnel to evaluate and determine if the condition is a Critical Finding, a Priority Maintenance need, or a Routine Maintenance need. After the priority is assigned, the notice is available via WIGINS to Division Maintenance personnel.
- B. After the Inspection Report has been synchronized and approved, the entire report is made available to Division Maintenance personnel.
- C. Priority Maintenance conditions should be graded as they exist at the time the inspection is made. No grades should be based on repairs that will be made.
- D. Use sketches and/or digital photos to clarify conditions described in the notice.
- E. When the condition is critical, the structure should be closed to all traffic. A Priority Maintenance Notice should still be submitted even though the structure is closed.

2.15.2 Office Priority Maintenance Procedures

Priority Maintenance Notices are sent to SMU central office personnel via WIGINS for review and priority assignment. The Assistant State Bridge Engineers will usually assign the priority. The three levels of priority are Critical Finding, Priority Maintenance need, or Routine Maintenance need. The following guidelines can be used to make these determinations:

CRITERIA FOR DETERMINING CRITICAL FINDINGS & PRIORITY MAINTENANCE NEEDS

In cases where there is an imminent danger to the traveling public, any perceived risk of (local or global) failure, or closure may be necessary, contact the Bridge Inspection Superintendent (Brian Hedrick – ((336) 596-4692) and/or the Division Bridge Maintenance

Engineer (DBME). The Superintendent will follow up and coordinate immediate actions to address the inspection finding with the DBME.

MISC.:

Critical Finding:

- Missing or illegible weight limit sign.
- Drastic/excessive movement (e.g. sliding or deflection) in a major structural component that poses an imminent danger to the structure.
- Any condition that poses a safety hazard to traffic/public (e.g. broken or loose joint armoring, etc.).

Priority Maintenance:

- Excessive settlement to the approach slab or approach roadway adjacent to or affecting transition on to the structure.
- Any other missing bridge regulatory or warning signs (e.g. delineators, narrow bridge, etc.)

TIMBER:

Critical Finding:

- Holed-thru deck boards, broken deck boards in traffic areas, or deck boards in imminent danger of breaking thru.
- Broken or severely decayed timber joists.
- Mushroomed piles, piles hollowed with less than 1½" shell remaining, or with less than 6" of heartwood remaining.
- Bearing loss/undermining due to scour on timber mud-sill footing (>30% footing bearing area).
- Missing or broken rail posts, rail boards, and blockouts.

Priority Maintenance Need:

- Crushed/broken out nailer boards.
- Extensively decayed and crushing caps, crown strips, or sills.
- Damaged/loose/badly decayed rail posts, rail boards, and blockouts.
- Loose/flopping deck boards.
- Deteriorated or missing asphalt wearing surface that is creating hazard to traffic.
- Split/decayed nailers.
- Decayed or unusual/excessive splits in timber joists.
- Decayed or unusual/excessive splits in caps and sills, but still intact and not subject to extensive crushing.
- Decayed/split piles but not in imminent danger of failure.
- Decayed or missing bulkhead boards with loss of fill.

- Bearing loss/undermining due to scour on timber mud-sill footing (<30% footing bearing area).
- Excessive drift causing excess pressure/scour on bridge substructure.
- Bracing boards for piles missing or not functioning on bents \geq 12' high.

CONCRETE:

Critical Finding:

- Holed-thru concrete deck subject to enlargement by traffic.
- Spalled/cracked columns with rebar section loss and with column subject to failure.
- Loose or spalling concrete in imminent danger of falling onto traffic that could cause extensive damage or injury.
- Bearing loss/undermining due to scour on concrete spread footing ($>$ 30% footing bearing area)
- Spalled concrete cap at girder bearing area that poses an imminent safety concern.
- Deck spalls below the top mat of reinforcing steel, creating a hazard to traffic, or in danger of holing through.

Priority Maintenance Need:

- Spalls with exposed rebar in the top of a concrete deck.
- Spalled prestressed girder with exposed/deteriorating strands.
- Unsound patches with rust staining in prestressed concrete members.
- Spalled reinforced concrete girder with exposed/deteriorating main rebar with section loss and more than one bar affected at same location on girder.
- Spalled concrete cap at girder bearing area resulting in any loss of bearing area.
- Spalled cap with extensive spalls and areas of exposed rebar.
- Spalled/cracked columns with extensive spalls and areas of exposed rebar.
- Bearing loss/undermining due to scour on concrete spread footing (<30% bearing area).
- Deep and wide cracks ($\frac{1}{2}$ " wide)

STEEL:

Critical Finding:

- Beams, girders, or piles with deteriorated areas that are likely to cause failure, or have failed in buckling, crippling, etc.
- Impact damage to steel members that are likely to cause failure, or have failed in buckling, crippling, etc.
- Unmitigated crack in a fracture critical member (FCM) or weld connecting a FCM.
- Any damage to a FCM that causes deformation of the member.

Priority Maintenance Need:

- Beams/girders/steel piles with active corrosion and 25% section loss.

- Secondary members (diaphragms, bracing, etc.) with 25% or more section loss.
- Bolted Field Splice: Missing bolts, active corrosion and 10% section loss.
- Active measurable section loss in the tension zone on FCM's
- Unmitigated crack in a secondary steel member.
- Cracked welds on steel grid deck.

GUARDRAIL:

Critical Finding:

- Connection shoe projecting into traffic.

Priority Maintenance Need:

- Loose or missing connection shoe.
- Impacted approach guardrail or end terminal/treatment in close proximity to the bridge.

HIGH-MAST LIGHTING:

Critical Finding:

- Sections split or buckled.
- Welds cracked at pole/base connection.
- Significant section loss or member buckling.

Priority Maintenance Need:

- Loose nuts.
- Broken/damaged anchor bolt.
- Occasional cracked weld.
- Pack rust between sections.

SIGN STRUCTURES & TRAFFIC SIGNAL/STRAIN POLES:

Critical Finding:

- Sections extensively damaged, split or buckled.
- Broken anchor bolts on backside of cantilevered signs and in foundations.

Priority Maintenance Need:

- More than 10% of shear studs are missing with no through bolts present (each panel).
- Sign panel connectors deteriorated/missing, allowing sign to “flop” in wind.
- Welds cracked at pole/base connection or member/member connections.
- Loose nut(s) on base plate or splice connections.
- Broken/damage anchor bolts.
- Damaged member.

EXAMPLES OF COMMON ROUTINE MAINTENANCE NEEDS:**MISC.:**

- Cracked AWS not causing traffic hazard.
- Leaking or damaged expansion joints.
- Clogged deck drains.
- Loose fasteners, but still functioning as intended.
- Debris on bridge deck or cap/bridge seats.
- Drift not causing excess substructure pressure/scour.
- Excess vegetation around bridge area.
- Masonry members out of alignment or with unsound patching.
- Restriction of movement for bearings.
- Minor settlement.
- Minor scour.

TIMBER:

- Decayed/missing bulkhead boards with no loss of fill.
- Decayed timber wingwall system not causing loss of fill or overturning.

CONCRETE:

- Exposed coarse aggregate due to abrasion in concrete deck.
- Cracking/unsound patches/delamination/minor spalls in concrete members.
- Exposed rebar in concrete members without measurable section loss.
- Loose coarse aggregate due to abrasion in concrete members.

STEEL:

- Failed paint system on steel members.
- Gouges in steel flanges that do not warrant a Priority Maintenance or Critical Find.
(These may prompt a call to the DBME).

GUARDRAIL:

- Failed handrail paint system.
- Decayed or damaged wheel guard not presenting danger to vehicles.

2.16 HURRICANE EMERGENCY RESPONSE PROCEDURES

2.16.1 Safety

As with all Department activities, safety must be at the forefront of our pre-event planning and preparation activities. Teams will be briefed on hazards they may encounter and will follow established safety guidelines.

2.16.2 Pre-Event Planning

In the event of an impending storm, Inspection teams should take the necessary precautions to secure their homes, offices, and equipment.

Equipment should be maintained at all times.

Vehicles and boats should be fueled.

Maintain a supply of batteries for cameras, fathometer, and flashlights.

2.16.3 Communications

It is essential that the lines of communications stay open between the SMU Central Office in Raleigh and all Inspection Teams.

With the threat of inclement weather Team Leaders and Area Supervisors will take their cellular phones home with them. Cellular phones should be turned on if home or office service is interrupted.

All bridge inspection and SI&A personnel are considered essential employees.

If you live in the affected area and have to evacuate your family, let us know where you are as soon as you have seen to the safety of your family.

2.16.4 Staging Area

The SMU Central Office in Raleigh will be the initial staging area

Inspection teams from outside the affected area will assemble in Raleigh to receive assignments prior to being deployed to the affected areas.

As soon as the danger has passed and it is safe to proceed, teams will be deployed to the affected areas if needed.

The Area Inspection Supervisor and local inspection teams will be consulted as to the number of teams needed and location of these teams.

All directives to the inspection teams, topside and underwater will come from the SMU Central Office in Raleigh.

Teams will be briefed on what hazards they may encounter, and will follow established safety guidelines. **Remember Safety First.** Watch out for yourself and your team member.

2.16.5 Procedures

Teams will evaluate the condition of the structure.

Run a streambed profile.

Provide detailed information of the damage including written documentation and photographs.

Provide recommendations for repairs.

Close structures that are unsafe.

Notify the SMU Central Office in Raleigh of all closed structures, whether closed due to high water or damage.

Submit all documentation to the SMU Central Office in Raleigh as soon as possible electronically through WIGINS.

If you have any questions do not hesitate to contact the SMU Central Office in Raleigh.

NOTE: If the SMU Central Office in Raleigh is in the affected area and the staging area has to be relocated to the East, it will be at the Nashville Bridge Inspection Office.

If the staging area has to be moved to the West, it will be at the Statesville Bridge Inspection Office.

Addresses and Contact Information will be available upon request or as needed.

2.17 INUNDATED BRIDGE POLICY

This policy was developed so that with the threat of a storm event, we would have a plan in place. The policy involves the three coastal divisions that are most susceptible to hurricane winds and rain.

Each coastal division has been given the listing of the scour susceptibility of all the bridges in their division. From this list, the division personnel can set their priorities concerning how to proceed during and after a storm event. Armed with this information, the bridge maintenance personnel would be the first responders in areas of concern. They would use their familiarity with the bridges to look for signs of problem with the bridge. From these observations, recommendations could be made concerning allowing the bridge to remain open to traffic.

Bridge Inspection personnel are always put on alert when there is an eminent threat of a storm. Division forces have access to their help through the SMU office. Assessments concerning the integrity of an inundated bridge can only be made after the water goes down below the bottom of the caps. It is not possible to determine if the piles are still in place until the water is below the caps.

There is a "Plan of Action" for all bridges that are coded in Item 113 as "3 Scour Critical." All bridges on the scour critical list are looked at as soon as the water goes down by bridge inspection personnel.

2.18 BRIDGE CLOSING PROCEDURE

The following is a review of the procedures expected of Bridge Inspection and Bridge Maintenance personnel when a bridge closing is recommended by Bridge Inspection Personnel. Keep in mind that the Bridge Inspector, before taking any action, is free to discuss the bridge closing with their Area Supervisor, Bridge Maintenance Supervisor or Engineer and Central Bridge Management.

- The Bridge Inspector's first contact will be to notify the Bridge Maintenance Supervisor of the recommended closing. If immediate repairs cannot be made and thus necessitates the bridge closing, it will be the Bridge Maintenance Supervisors responsibility to notify the District or Division and the Bridge Maintenance Superintendent of the closing.
- The Bridge Inspector will notify the Bridge Engineer of the recommended closing and the same procedures as above should be followed.
- When none of the Bridge Maintenance personnel are available, the Bridge Inspector should notify the District or Division office directly after which the Raleigh office should be notified. In all cases, the Raleigh office should be notified.
- It will be the responsibility of the person contacted, Bridge Maintenance Supervisor, clerk or Engineer to see that the bridge closing is entered on the terminal.

2.19 REPORTING

The following documents are examples of those used regularly during the inspection process and make up the Routine Inspection Report.



NC DEPARTMENT OF TRANSPORTATION ATTENTION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

MACHINERY INSPECTION REPORT

INSPECTION TYPE: Machinery Inspection

COUNTY _____ BRIDGE NUMBER _____ INSPECTION CYCLE _____ YRS

ROUTE _____ ACROSS _____ M.P. _____

LOCATION _____

SUPERSTRUCTURE _____

SUBSTRUCTURE _____

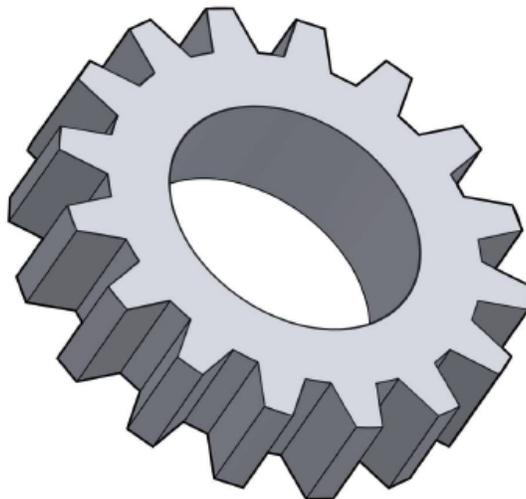
SPANS _____

LONGITUDE _____ LATITUDE _____

INSPECTION DATE _____ PRESENT CONDITION _____

PRESENT POSTING _____ PROPOSED POSTING _____

OTHER SIGNS PRESENT _____



Fracture Critical _____
Temporary Shoring _____
Scour Critical _____
Scour POA _____

SIGN NOTICE ISSUED FOR	NUMBERED REQUIRED
_____ WEIGHT LIMIT	_____
_____ DELINEATORS	_____
_____ NARROW BRIDGE	_____
_____ ONE LANE BRIDGE	_____
_____ LOW CLEARANCE	_____



NC DEPARTMENT OF TRANSPORTATION ATTENTION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

BRIDGE INSPECTION REPORT

INSPECTION TYPE: _____

COUNTY _____ BRIDGE NUMBER _____ INSPECTION CYCLE _____ YRS
ROUTE _____ ACROSS _____ M.P. _____

LOCATION _____

SUPERSTRUCTURE _____

SUBSTRUCTURE _____

SPANS _____

LONGITUDE _____ LATITUDE _____

PRESENT CONDITION _____ INVENTORY RATING _____

INSPECTION DATE _____ OPERATING RATING _____

PRESENT POSTING _____ PROPOSED POSTING _____

COMPUTER UPDATE _____ ANALYSIS DATE _____

POSTING LETTER DATE _____ SUFFICIENCY RATING _____

OTHER SIGNS PRESENT _____

SIGN NOTICE ISSUED FOR	NUMBERED REQUIRED
_____ WEIGHT LIMIT	_____
_____ DELINEATORS	_____
_____ NARROW BRIDGE	_____
_____ ONE LANE BRIDGE	_____
_____ LOW CLEARANCE	_____



NC DEPARTMENT OF TRANSPORTATION ATTENTION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

OVERHEAD SIGN INSPECTION REPORT

INSPECTION TYPE: _____

COUNTY: _____ SIGN NUMBER: _____ INSPECTION CYCLE: ____ YEARS

ROUTE: _____ STRUCTURE TYPE _____ MP _____

LOCATION: _____

DESCRIPTION: _____

LONGITUDE: _____ LATITUDE: _____

PRESENT CONDITION: _____ COMPUTER UPDATE: _____

INSPECTION DATE: _____

INSPECTED BY: _____ SIGNATURE: _____

BRIDGE I & A FORM 1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY (PIPE AND ARCH CULVERTS)

INSPECTION TYPE
BRIDGE NO.

ROUTE

INSPECTION DATE

OVER

ROUTE ORIENTATION

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

1. Structure Conditions		
2. Wingwalls - Retaining Walls		
3. Headwalls, Toewalls, Flumes		
4. Structure Alignment - Settlement		
5. Channel & Channel Protection	a. Waterway	
	b. Alignment	
	c. Scour	
	d. Slope Prot. (Rip-Rap, Dikes, etc.)	
6. Approach Roadway Condition		
7. Estimated Remaining Life		
8. Channel & Channel Protection	Item 61	
9. Culvert & Retaining Walls	Item 62	
10. Waterway Adequacy	Item 71	
11. Approach Roadway Alignment	Item 72	
12. Field Scour Evaluation		
13. Presently Posted		
14. Regulatory Sign Notice Issued		
15. Prompt Action Notice Issued		
16. Total Field Inspection Time		
17. Inspected By		

BRIDGE INSPECTION RECORD FOR OVERHEAD SIGNS		
Inspection Type: Complete Sign Inspection		Inspection Date:
Structure No.:	County:	Mile Post:
Route:		Structure Type:
Location:		
EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)		
INSPECTION ITEM		GRADE
BASE		
1. Pedestal and Vertical Support Anchorage	a. Footing	
	b. Base Plate or Casting	
	c. Anchor Rod Nuts	
	d. Grout Below Base Plate	
	e. Vertical Support Weld to Base Plate	
VERTICAL SUPPORT		
2. Vertical Post	a. Post	
	b. Post Vertical Welds (Seam)	
	c. Post Horizontal Welds (Splice)	
3. Vertical Truss	a. Truss Vertical Members	
	b. Truss Horizontal Members	
	c. Truss Diagonal Members	
	d. Truss Member Welds	
4. Vertical Support Connection to Arm	a. Plates	
	b. Welds	
	c. Bolts	
	d. Nuts	
HORIZONTAL ARM		
5. Horizontal Truss Member Connections	a. Upper Chord Members - Welds	
	b. Upper Chord Members - Bolts & Nuts	
	c. Lower Chord Members - Welds	
	d. Lower Chord Members - Bolts & Nuts	
	e. Vertical Members - Welds	
	f. Diagonal Members - Welds	
	g. Top Lateral Member - Welds	
	h. Bottom Lateral Member - Welds	
	i. Chords	
6. Connection of Sign to Arm		
7. Damper - Distance From Vertical Support		
8. Movement		
9. Equipment Used		
10. Prompt Action Notice Issued		
11. Insp. Man-Hours Required		
12. Traffic Control Required		
13. Inspected By		

BRIDGE I & A FORM I (90)A

BRIDGE INSPECTION RECORD AND SUMMARY (R. C. BOX CULVERTS)

INSPECTION TYPE
BRIDGE NO.

ROUTE

INSPECTION DATE

OVER

ROUTE ORIENTATION

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

1. Top Slab		
2. Bottom Slab		
3. Ext. & Int. Walls		
4. Wingwalls - Retaining Walls		
5. Headwalls, Toewalls, Flumes		
6. Structure Alignment - Settlement		
7. Drainage Systems (On Structure)		
8. Channel & Channel Protection	a. Waterway	
	b. Alignment	
	c. Scour	
	d. Slope Prot. (Rip-Rap, Dikes, etc.)	
9. Approach Roadway Condition		
10. Estimated Remaining Life		
11. Channel & Channel Protection	Item 61	
12. Culvert & Retaining Walls	Item 62	
13. Waterway Adequacy	Item 71	
14. Approach Roadway	Item 72	
15. Field Scour Evaluation		
16. Presently Posted		
17. Regulatory Sign Notice Issued		
18. Prompt Action Notice Issued		
19. Total Field Inspection Time		
20. Inspected By		

BRIDGE INSPECTION RECORD AND SUMMARY

(Supplement Record For Trusses)

Inspection Type:

Inspection Date:

Bridge No.:

County:

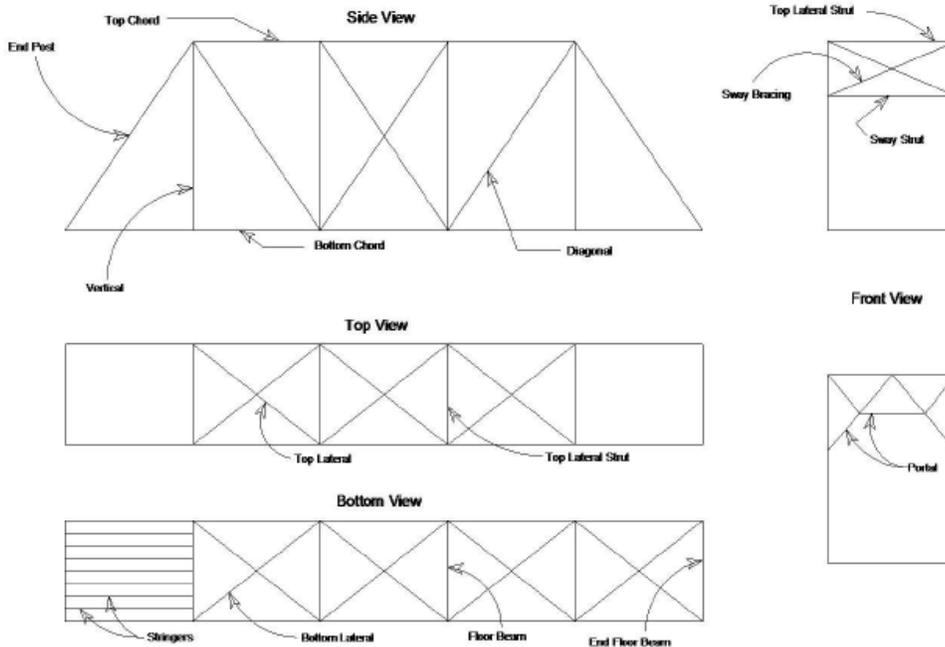
Length:

For Span:

Truss Type:

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

	Inspection Item	Grade
Evaluation For S. I. & A. Item 59	18	Lower Chords & Connections
	19	End Floor Beams & Connections
	20	Intermediate Floor Beams & Connections
	21	Bottom Lateral Struts-Sway Bracing, & Connections
	22	Longitudinal Stringers
	23	Stringer Connections or Bearings
	24	End Post
	25	Verticals
	26	Diagonals & Connections
	27	Portals Struts-Bracing & Connections
	28	Top Chords & Connections
	29	Top Lateral Struts-Sway Bracing & Connections
	30	Top Laterals & Connections
	31	Truss Alignment
32	Bearing Assemblies (include misalignment)	



BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE Run Date:

COUNTY : DIVISION : DISTRICT : STRUCTURE NUMBER : LENGTH :

ROUTE CARRIED : FEATURE INTERSECTED :

LOCATED : BRIDGE NAME : CITY :

FUNC. CLASS : SYST.ON : SYST.UNDER : ADT & YR : RAIL TYPE :
LT RT

BUILT : BY : PROJ : FED.AID PROJ : DESIGN LOAD :

REHAB : BY : PROJ : ALIGNMENT : SKEW : LANES :
ON UNDER

NAVIGATION : VC HC HT. CRN. TO BED : WATER DEPTH :

SUPERSTRUCTURE :

SUBSTRUCTURE :

SPANS :

BEAMS OR GIRDERS :

FLOOR : ENCROACHMENT : DECK (OUT TO OUT) :

CLEAR ROADWAY : BETWEEN RAILS : SIDEWALK OR CURB :
LT RT

VERT.CL.OVER :

INV.RTG. : OPE.RTG. : CONTR.MEMBER : POSTED :
SV TTST DATE

SYSTEM : GREEN LINE ROUTE :

UNDER ROUTES AND CLEARANCES

Span	Route Description	Vertical Clearances		Horizontal Clearances		
		MMVC	MVC	Total	Left	Right

Note: All measurements are in feet.

REMARKS :

NATIONAL BRIDGE INVENTORY----- STRUCTURE INVENTORY AND APPRAISAL		Run Date:
IDENTIFICATION		
(1) STATE NAME -NORTH CAROLINA	BRIDGE	SUFFICIENCY RATING =
(8) STRUCTURE NUMBER(FEDERAL)		STATUS =
(5) INVENTORY ROUTE (ON/UNDER) - ON		
(2) STATE HIGHWAY DEPARTMENT DISTRICT		
(3) COUNTY CODE	(4) PLACE CODE	
(6) FEATURE INTERSECTED -		
(7) FACILITY CARRIED		
(9) LOCATION		
(11) MILEPOINT		
(16) LAT	(17) LONG	
(98) BORDER BRIDGE STATE CODE	PCT SHARE	
(99) BORDER BRIDGE STRUCTURE NO		
CLASSIFICATION		
		(112) NBIS BRIDGE SYSTEM -
		(104) HIGHWAY SYSTEM
		(26) FUNCTIONAL CLASS -
		(100) STRAHNET HIGHWAY -
		(101) PARALLEL STRUCTURE -
		(102) DIRECTION OF TRAFFIC -
		(103) TEMPORARY STRUCTURE -
		(110) DESIGNATED NATIONAL NETWORK -
		(20) TOLL
		(31) MAINTAIN -
		(22) OWNER -
		(37) HISTORICAL SIGNIFICANCE -
STRUCTURE TYPE AND MATERIAL		
(43) STRUCTURE TYPE MAIN:		
TYPE -	CODE	
(44) STRUCTURE TYPE APPR :		
TYPE -	CODE	
(45) NUMBER OF SPANS IN MAIN UNIT		(58) DECK
(46) NUMBER OF APPROACH SPANS		(59) SUPERSTRUCTURE
(107) DECK STRUCTURE TYPE -	CODE	(60) SUBSTRUCTURE
(108) WEARING SURFACE / PROTECTIVE SYSTEM :		(61) CHANNEL & CHANNEL PROTECTION
(A) TYPE OF WEARING SURFACE -	CODE	(62) CULVERTS
(B) TYPE OF MEMBRANE -	CODE	
(C) TYPE OF DECK PROTECTION -	CODE	
CONDITION		
		(31) DESIGN LOAD
		(63) OPERATING RATING METHOD -
		(64) OPERATING RATING -
		(65) INVENTORY RATING METHOD -
		(66) INVENTORY RATING -
		(70) BRIDGE POSTING -
		(41) STRUCTURE OPEN, POSTED ,OR CLOSED DESCRIPTION -
LOAD RATING AND POSTING		
AGE AND SERVICE		
(27) YEAR BUILT		
(106) YEAR RECONSTRUCTED		
(42) TYPE OF SERVICE : ON -		
UNDER -	CODE	
(28) LANES: ON STRUCTURE	UNDER STRUCTURE	
(29) AVERAGE DAILY TRAFFIC		
(30) YEAR OF ADT	(109) TRUCK ADT PCT	
(19) BYPASS OR DETOUR LENGTH		
APPRAISAL		
		(67) STRUCTURAL EVALUATION
		(68) DECK GEOMETRY
		(69) UNDERCLEARANCES, VERTI & HORIZ
		(71) WATERWAY ADEQUACY
		(72) APPROACH ROADWAY ALIGNMENT
		(36) TRAFFIC SAFETY FEATURES
		(113) SCOUR CRITICAL BRIDGES
GEOMETRIC DATA		
(48) LENGTH OF MAXIMUM SPAN		
(49) STRUCTURE LENGTH		
(50) CURB OR SIDEWALK: LEFT	RIGHT	
(51) BRIDGE ROADWAY WIDTH CURB TO CURB		
(52) DECK WIDTH OUT TO OUT		
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS)		
(33) BRIDGE MEDIAN -	CODE	
(34) SKEW	(35) STRUCTURE FLARED	
(10) INVENTORY ROUTE MIN VERT CLEAR		
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR		
(53) MIN VERT CLEAR OVER BRIDGE RDWY		
(54) MIN VERT UNDERCLEAR REF		
(55) MIN LAT UNDERCLEAR RT REF		
(56) MIN LAT UNDERCLEAR LT REF -		
PROPOSED IMPROVEMENTS		
		(75) TYPE OF WORK -
		CODE
		(76) LENGTH OF STRUCTURE IMPROVEMENT
		(94) BRIDGE IMPROVEMENT COST
		(95) ROADWAY IMPROVEMENT COST
		(96) TOTAL PROJECT COST
		(97) YEAR OF IMPROVEMENT COST ESTIMATE
		(114) FUTURE ADT
		(115) YEAR FUTURE ADT
INSPECTIONS		
		(90) INSPECTION DATE
(38) NAVIGATION CONTROL -	CODE	(92) CRITICAL FEATURE INSPECTION :
(111) PIER PROTECTION -	CODE	A) FRACTURE CRIT DETAIL -
(39) NAVIGATION VERTICAL CLEARANCE		B) UNDERWATER INSP -
(116) VERT - LIFT BRIDGE NAV MIN VERT CLEAR		C) OTHER SPECIAL INSP
(40) NAVIGATION HORIZONTAL CLEARANCE		SCOUR
		(93) CFI DATE
		A)
		B)
		C)

DRAFT