National Bridge Inspection Program
Local System Manual

Office of State Aid Road Construction
Mississippi Department of Transportation
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September 2009

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APPENDICES

SECTION 1: ACKNOWLEDGEMENTS AND PREFACE

1.1 ACKNOWLEDGEMENTS

The **Office of State Aid Road Construction** acknowledges and appreciates the contributions of the below listed personnel who participated in the development of this manual:

J. Brooks Miller, Sr.	State Aid Engineer
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Fred Hollis	State Aid Bridge Engineer
C. David Barrett	State Aid Senior Transportation Planner
Jim Maher	State Aid Systems Manager
Rebecca Hayworth	Division Bridge Engineer, FHWA

Thanks are extended to all the individuals and organizations who also contributed to the development and review of the Office of State Aid Road Construction Bridge Inspection Manual, as well as members of the FHWA and State DOT's that provided content and recommendations.

1.2 PREFACE

This manual has been developed to establish policy and to provide guidance for the inspection, load rating and posting of bridges on the Local System of public roads in Mississippi. This Manual describes the organization, administration, and operational procedures of the Office of State Aid Road Construction. It updates and incorporates various policies, and documented and previously undocumented procedures. It is intended for all individuals involved in the vital responsibilities of inspecting the bridges comprising the Local System of Roads.

This Manual compliments established Federal codes, manuals, and guidelines. This Manual does not supercede, nor replace, the applicability of Federal regulations. In the event of a conflict between Federal Regulations and provisions of this Manual, the Federal Guidelines will have precedence.

This Bridge Inspection Manual does not describe procedures for every conceivable situation which may occur. The intention of this Manual is not to eliminate the need for individual engineering judgment and initiative, but rather to provide the users with sufficient information so that their training and experience may be better applied to routine and unusual problems encountered in the performance of inspecting, load rating and posting bridges.

Bridge inspection personnel at all levels of government have the primary responsibility to provide adequate levels of inspection service for structures under their respective jurisdictions, as outlined in the Code of Federal Regulations and as adopted by the AASHTO Subcommittee on Bridges and Structures. Bridge inspection personnel should become familiar with the contents of this Manual and conduct Bridge inspections under their responsible charge within the requirements and recommendations contained herein.

This manual is intended to be a living document; hence, it will be revised periodically to reflect new requirements. It will also be revised to make it more useful to its readers. Any user of this manual may submit recommendations for changes in writing to the Program Manager.

SECTION 2: POLICY DIRECTIVE

2.1 LEGAL ENVIRONMENT

State Aid will continue to coordinate with the many bridge owners of Mississippi as they meet their legal requirements under 23 CFR 650 subpart C. The AASHTO Manual for Bridge Evaluation (MBE) has been incorporated by reference in 23 CFR 650.317(a) & (b). State Aid will endeavor to pursue a policy of not placing additional burdensome requirements on bridge owners. Nothing in these procedures is intended to prevent a bridge owner from electing to comply with the requirements of 23 CFR 650 without the assistance of State Aid. In that event State Aid will have no responsibility to provide funds for that compliance.

2.2 INSPECTION ORGANIZATION

It is required by 23 CFR 650.307(a) that "Each state transportation department must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the State's boundaries except bridges owned by Federal Agencies".

Mississippi government entities have been organized such that MDOT owns and maintains the State Designated Highway System. Public roads, highways and routes not identified in the State Designated Highway system or owned by Federal Agencies comprise the Local System. The legislature has charged State Aid with administration of the various financial assistance programs which assist the owners of the Local System, and consequently the administration of the Bridge Inspection Program required for the Local System. The Local System is generally owned and maintained by Counties, Municipalities, and others. State Aid's relationship with respect to local governments is with the County Board of Supervisors acting through its County Engineer.

Therefore, to meet this Obligation State Aid has adopted the following policy to wit:

1. State Aid does not own nor maintain any bridge in the state, and State Aid does not inspect any bridges.

2. In accordance with 23 CFR 650.307(d) & (c), The County Boards of Supervisors shall either inspect or cause to be inspected all bridges located on the Local System within their respective jurisdiction.

3. All tasks related to the creation, retention, and/or maintenance of Bridge inspection documents, records, files, reports, characteristic list, descriptions, identifications, plans of inspections, and Quality Control shall be the responsibility of the County Board of Supervisors through its County Engineer.

4. The bridge owners will be responsible for repairing, maintaining, developing plans of action and countermeasures, monitoring deficiencies, and addressing critical findings.

5. State Aid will exercise oversight function to each of the counties' NBIS bridge inspection programs. State Aid will collect NBI inspection data from each of the counties, compile and forward that data to MDOT. Each county will maintain its own bridge inspection records. State Aid will perform an annual Quality Assurance Reviews. FHWA may accompany State Aid for a joint review.

6. Any county, city or other bridge owner that fails to meet the requirements of 23 CFR 650 Subpart C, will be taken out of compliance and subject to loss of funding until such time as they return to compliance.

SECTION 3: BRIDGE RECORDS

3.1 REQUIREMENTS:

23 CFR 650.313(d) requires that the bridge owner prepare and maintain bridge inspection files. These Bridge Records are the property of the bridge owner. Bridge Records are to be kept by the bridge owner for the life of the structure. Bridge Records shall be stored in a single location and be organized in a way to allow clear interpretation and easy navigation by the owner and inspector as well as State Aid and FHWA. There may be portions of the complete Bridge Record which are not physical in nature but rather are of an electronic nature. Electronic data may be stored at an alternate location, but this data must be easily accessible at the location of the primary bridge records.

As built bridge plans administered through the State Aid are stored electronically on a file server and are accessible as part of the Bridge Record. The County Engineer may have any additional plans available scanned and placed on the file server and/or paper copies placed in the physical Bridge Record.

3.2 LOCATION AND ACCESSIBILITY

The County Engineer's office shall be the primary depository for the complete physical Bridge Record for the local system. The County Engineer will hold these records in safe keeping on behalf of the bridge owner, and will assure that they are accessible by the County Engineer's staff. In the event that the Board employs a new County Engineer, the Bridge Records will be transferred to the newly designated County Engineer as the agent of the Board and bridge owner.

Bridge Records must be up-to-date and available for review at the County Engineer's office during normal business hours.

3.3 REQUIRED CONTENTS

The MBE section 2.2, 2.3, 2.4, and 2.5, pages 5-9 provides the County Engineer with a list of items that should be included in the Bridge Record when available. 23 CFR 650.313(d), (e), (f), & (h) list additional required data. Each Bridge Record must contain the following:

1. All current and past bridge inspection reports including SI&A data, photographs, channel cross sections, inspector's notes, and supporting information.

2. Notation of any action taken to address the findings of the inspection.

3. All available relevant records including accident records, current traffic counts, flood records, posting records, and all relevant documented correspondence.

4. Relevant maintenance, repair, and inspection data to allow assessment of current bridge condition.

5. All available construction records including bridge plans. (These will be considered part of the bridge record and although maintained at the SAO, they will be readily available to inspectors upon request.)

6. For Fracture Critical Bridges**:**

    a. A Fracture Critical Inspection Plan containing:
        1. The location of Fracture Critical Members
        2. The fracture critical inspection frequency (NBI Item 92A).
        3. Specific fracture critical inspection procedures.

    b. Fracture Critical Inspection forms completed during all fracture critical inspections. See Appendix F for forms.

    c. Description of its appearance and condition.

7. For Bridges with Underwater Components:

    a. Underwater Inspection Reports.

    b. An Underwater Inspection Plan containing:
        1. The location of underwater elements (bent number).
        2. A description of the underwater elements.
        3. The underwater inspection frequency (NBI Item 92B).
        4. Specific underwater inspection procedures.

8. For Scour Critical bridges:

    a. A Plan of Action.
    b. Documented monitoring in accordance with the plan.

9. For Complex Bridges:

    a. Identify any specialized inspection procedures.
    b. Identify additional inspector training and experience required to inspect complex bridges.

10. For bridges with Critical Findings:

    a. Completed Critical Finding(s) Form (Appendix F) indicating the date and reason for recommendations with supporting documentation (pictures, sketches, etc.)
    b. Documentation of any repairs or closures made including dates, pictures and any relevant details.
    c. Documentation of notification of Bridge Owner and any compliance notifications from FHWA, the Office of State Aid, MDOT, etc.

SECTION 4: QUALIFICATIONS OF PERSONNEL

The Board of Supervisors of each county is responsible for conducting its bridge inspection in accordance with 23 CFR 650 subpart C. The various Boards generally accomplish these duties through their agent the County Engineer. It is essential that the County Engineer select personnel who meet or exceed the qualifications listed in 23 CFR 650.309.

Qualifications of personnel will be verified by furnishing copies of qualifying documents to State Aid for approval or a ruling of qualifications in accordance with Questions and Answers (Q 309-3, Special Cases) as published on the FHWA's Bridge Technology website. State Aid will forward to FHWA, and the written response from the FHWA Division Office will be forwarded to the County Engineer. The County Engineer will then place the ruling/approval in the County's Quality Control File. The contents of this file will be available for review by FHWA / State Aid during the annual Quality Assurance Review.

To request a copy of your NHI transcript contact the NHI Registrar at NHIRegistrar@fhwa.dot.gov, www.nhi.fhwa.dot.gov/training or 703-235-0500. Transcripts for courses taken prior to January 1, 2004, are not available.

4.1 Bridge Inspectors/Team Leaders

A Team Leader is an individual in charge of an inspection team responsible for planning, preparing, and performing field inspection of the bridge.

A separate qualifications form, found in Appendix D, should be completed for the team leader of the inspection team. Supporting documents will be attached to the form and filed in the county's quality control file. A copy of the form will be forwarded to State Aid and kept in the state aid quality control file.

To maintain these qualifications, the TEAM LEADER must complete the three day refresher course once each five years.

Other bridge inspection team members should have qualifications as outlined in subsection 4.4.1 of the MBE.

The Inspection Team Leader is responsible for planning, preparing and performing the field inspection of a bridge. Please note, in accordance with 23 CFR 650.313(b) and the MBE, section 4.4.3, the county must "provide at least one TEAM LEADER, who meets the minimum qualifications stated in 23 CFR 650.309, at the bridge at all times during each ... inspection."

4.2 Program Manager

The Program Manager is the individual in charge of the program that has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The program manager provides overall leadership and is available to inspection team leaders to provide guidance. The Program Manager for the Bridge Inspection Program will be designated by State Aid.

The State Aid Program Manager will complete a qualification form and attach supporting documents. This form will be forwarded to the FHWA Division Office for review and written approval. The documents will then be retained in the State Aid Quality Control File as documentation. This data will be available for review by the FHWA Division Office as part of their Annual Program Review.

4.3 Load Rating Engineer

The Load Rating Engineer is the subject matter expert for the load rating portion of the Bridge Inspection Program. The Load Rating Engineer is designated by State Aid and is responsible to the Assistant State Aid Engineer. Minimum qualifications for the position are to be a licensed Professional Engineer. Experience in structural analysis and design is desired.

A qualification form for the Load Rating Engineer will be submitted to the FHWA Division Office for review and concurrence. The document will be maintained in the State Aid Quality Control File as documentation and will be available for review.

4.4 County Quality Control Manager

Each County will have a person responsible for assuring that the quality of the Bridge Records is maintained at or above a specified level. It is important that this person have a thorough knowledge of the program and its requirements**.** The minimum qualifications for this position are to be a graduate engineer or to have five (5) years of experience in bridge inspection or construction, knowledge of all aspects of the bridge inspection program, and completion of the NHI Bridge Inspector Training three day refresher course.

SECTION 5: BRIDGE INSPECTION PROCEDURES

Each County shall ascertain their needs in order that each bridge in that county receives thorough routine Inspections. Inspections shall be performed in accordance with the guidelines published in the MBE with a minimum of one qualified inspector who must meet the NBIS definition of a Team Leader (see Appendix B). All inspections are usually performed in teams for safety purposes and to provide assistance in the inspection procedure.

5.1 ELEMENTS OF THE INSPECTION

Plan: The bridge owner will plan inspections so that all structures are inspected within the prescribed inspection frequencies. For individual structures, plan the inspection to assure that the inspection is done timely and those unique structural characteristics and any special problems of individual bridges are considered. Identify the Team Leader and any other team members. Locate the supporting data necessary for the inspection such as prior inspection reports, as built plans, etc. Identify and make available equipment necessary for the inspection.

Safety Features: The inspection should include a thorough review and evaluation of all safety features such as railings, guardrails and signs, including advance warning and posting signs.

Visual and Hands On Inspection: A complete visual and hands on inspection of the bridge and all of its components shall be performed, noting all defects, irregularities, and damages.

Maintenance: The inspectors should note any needed maintenance such as, clogged deck drains, debris in the stream channel, debris around bearing devices, missing signage, damaged safety features and other items as noted.

Soundings: For bridges over water, soundings (water depths) need to be taken and recorded using a common benchmark so that an historical record can be established. Soundings shall be taken on upstream side of each substructure unit as a minimum. Special note should be taken of observed scour evidence. See Scour Inspection Procedures for sounding goals and methods.

Stencil: The inspectors shall assure that the bridge has the proper bridge number and bridge key if applicable stenciled or otherwise affixed on the structure.

Photographs: Digital photographs are required as part of all inspections. In addition to the standard identification photos, photos should be taken of all major defects, including any evidence of scour. For all bridges, the following standard photos are required, and shall be included as part of the inspection report:

View from both approaches:

Elevation view from both sides of the bridge:

Up stream & down stream showing stream banks for hydraulic structures:

Underneath in both directions of traffic for Overpasses:

All in place signage to include bridge end markers, weight limit postings, etc.

5.2 GOOD INSPECTION PRACTICES:

Good inspection practices include but are not limited to:

1. Inspection teams take copies of inspection files to the field and inspect each bridge.

2. Inspection team completes all condition and appraisal ratings, and reviews other items for correctness before leaving the site.

3. The Team Leader prepares each report. The report is then signed and submitted to the County Engineer.

4. The County Engineer reviews the report for completeness and uniformity, initials to indicate the review, and arranges for the load ratings to be calculated or re-calculated as required.

SECTION 6: INSPECTION FREQUENCY

Reference 23 CFR 650.311 (a, b, c, d) 1

6.1 Routine inspections: Performed on each bridge at regular intervals not to exceed twenty-four (24) months (NBI item 91).

State Aid also requires:

1. Any bridge with a timber structural component rated less than twelve (12) tons will have a twelve (12) month inspection frequency.
2. Any bridge coded D, E, or K in item 41 and Item 66 = “000" will have a twelve (12) month inspection frequency.

6.2 Underwater Inspections (NBI Item 92-B): Performed at intervals not exceed sixty (60) months.

6.3 Fracture Critical Member Inspections (NBI Item 92-A): Performed at intervals not to exceed twenty-four (24) months.

6.4 Damage Inspections: As needed and determined by the bridge owner.

6.5 Fracture Critical and Complex Bridge Inspections: Interval not to exceed twenty-four (24) months. Shorter interval may be required based on performance history, and as determined by the Bridge Owner with State Aid concurrence.

6.6 Special Inspections (NBI Item 92-C): These are inspections scheduled at the discretion of the Owner or the responsible agency and are used to monitor known or suspected deficiencies. The inspection will be of that item only.

State Aid requires:

1. The inspector may call for a twelve (12) month inspection based upon his observations.

2. Any bridge with one condition rating of three (3) or less will have a twelve (12) month inspection frequency of that condition and a normal frequency for a full inspection.

3. Any bridge with two or more condition ratings of four (4) or less will have a twelve (12) month inspection frequency for the conditions rated four (4) or less and a normal frequency for a full inspection.

4. Any Box Bridge or Culvert coded <= 4 in Item 61 or 62 will have a twelve (12) month inspection frequency.

SECTION 7: SCOUR

7.1 IDENTIFICATION

Scour is the erosion of streambed or bank material due to flowing water; often considered as being localized around piers and abutments of bridges. State Aid will perform a Scour Assessments/Analyses for all existing bridges on the Local System, and will continue updating the Scour Assessments of these bridges in accordance with HEC-18, 20, and 23. A full hydraulic design will be performed for newly constructed bridges on the Local System in accordance with 23 CFR Subpart C as part of the design package. This will produce a current list of Scour Susceptible Bridges. A list of Scour Susceptible Bridges in a county will be kept in the County's Quality Control File.

7.2 SCOUR CRITICAL

A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition is deemed to be scour critical. For these bridges, Plans of Action will be developed (POAs) in accordance with FHWA requirements and guidance to mitigate the scour potential. The County Engineer will add contact information and other detailed information. State Aid in cooperation with the County Engineer will complete the Scour Plan of Action for installation of countermeasures and/or monitoring of known deficiencies for each Scour Critical Bridge and submit to the bridge owner. This Scour Plan of Action will be placed into the Bridge Record in accordance with 23CFR650.313 (e) (3). The County Engineer working with the owner shall be responsible for assuring that the POA is fully implemented.

SECTION 8: UNDERWATER INSPECTIONS

8.1 REQUIREMENTS

This is an inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually by wading or probing, generally requiring diving or other appropriate techniques Bridge owners must comply with 23 CFR 650.313(e)(2) concerning underwater inspection requirements.

8.2 METHODOLOGY

Underwater inspections will be conducted using a statewide contract in order to benefit from economies of scale. The participating counties will collectively enter into a contract with an underwater bridge inspection consultant. State Aid will administer the contract on behalf of the counties. The designated inspection frequency for underwater bridge inspections shall be sixty (60) months

(23CFR650.311(b)). This frequency may be reduced at the recommendation of the inspector, and with concurrence of the Program Manager.

The County Engineer will provide State Aid a list of bridges which meet the criteria requiring underwater inspection. The County Engineer will maintain this list in the County's Quality Control File. State Aid will select, contract with an underwater inspection company and administer the statewide contract on behalf of the bridge owners. State Aid will solicit a Statement of Qualifications (SOQ) from interested underwater diving companies. In the SOQ an officer of the company will list the qualifications of each staff member and certify that each meets the minimum qualification for his duties in accordance with 23 CFR 650.309(d). A copy of the successful firm's SOQ will be retained in the State Aid Quality Control File as documentation and made available for review by FHWA Division Office as part of their Annual Program Review.

8.3 DELIVERABLES

A Level I and Level II underwater inspection shall be performed in accordance with the guidelines set forth in the Federal Highway Administration's "Bridge Inspector's Reference Manual" (BIRM) current edition. An individual written Underwater Inspection Procedure for each bridge will be developed with specific information on the bridge substructure elements. Each of these procedures will be distributed to the County Engineer for insertion into the Bridge Record. These Underwater Inspection Procedures will be available for reference during future underwater inspections. State Aid will forward the inspector's final report to the County Engineer. When an underwater inspection is performed, each Bridge Record File shall contain the documents listed in the Bridge Records Section.

SECTION 9: FRACTURE CRITICAL BRIDGES

9.1 DEFINITION

A Fracture Critical Member shall be defined as:

1. Any steel member in tension. AND
2. Consisting of two or less elements. AND
3. Failure of which would be expected to result in collapse of the bridge or a deck panel.

These structures will include but are not limited to:

1. Two-truss systems.
2. Two-girder system (most have floor beams).
3. Steel pier caps.
4. Cross girders (needle beams, the steel cap on false/helper bents).

These types of structures may have fatigue prone details. Refer to the MBE, section 4.10.

9.2 INSPECTION PROCEDURES

Refer to the MBE, section 4.2.5, Inspection of Fracture Critical Members, report number FHWA-IP-86-26, pages 20 and 26, and *The Bridge Inspector's Reference Manual*. An inspection plan will be developed in accordance with these references and approved by State Aid for inspecting fracture critical members. The plan will identify the member(s), the frequency of inspection, and the procedures to be used during the inspection. The inspection will consist of as a minimum a detailed, close visual, hands on field inspection of each fracture critical member of a structure.

SECTION 10: COMPLEX BRIDGES

10.1 DEFINITION

A Complex Bridge shall be defined as any special structure listed in the MBE, section 4.9 and any other bridge that requires extraordinary inspection skills. These will include but are not limited to movable bridges, suspension spans, cable-stayed bridges, and prestressed concrete segmental bridges.

10.2 INSPECTION METHODOLOGY

The county's Quality Control File will include a list of all Complex Bridges within the county. Complex bridges will be inspected using a statewide contract in order to benefit from economies of scale. The various counties will collectively enter into a contract with an inspection consultant. State Aid will administer the contract on behalf of the counties. State Aid will solicit a Statement of Qualifications (SOQ) from interested inspection consultants. In the SOQ an officer of the company will list the qualifications of each staff member and certify that each meets the minimum qualification for his duties in accordance with 23 CFR 650.309. A copy of the successful firm's SOQ will be retained in the State Aid Quality Control File as documentation and made available for review by FHWA Division Office as part of their Annual Program Review.

The County Engineer will provide State Aid a list of bridges which meet the criteria for complex bridges. The County Engineer will maintain this list in the County's Quality Control File. State Aid will select, contract with an inspection company and administer the statewide contract on behalf of the bridge owners. All required inspections except Damage Inspections will be performed by the selected inspection consultant. The inspection consultant may be asked to assist with Damage Inspections if requested by the Bridge Owner with concurrence of the State Aid Bridge Engineer.

10.3 DELIVERABLES

An individual written Inspection Procedures for each bridge with specific information on the bridge elements will be developed. Each of these procedures will be distributed to the various County Engineers for insertion into the Bridge Record. These Inspection Procedures will be available for reference during future inspections. State Aid will forward the inspector's final report to the County Engineer. When an inspection is performed, each Bridge Record File shall contain the documents listed in the Bridge Records Section.

SECTION 11: DAMAGE INSPECTIONS

11.1 REQUIREMENTS

Damage Inspections are unscheduled inspections to assess structural damage resulting from environmental factors or human actions. They will be the responsibility of the Bridge Owner and will be necessary immediately following an emergency or other incidents such as traffic collisions, flooding, fire, etc. that could affect the structural integrity of the bridge. For each structure, the Owner will identify a person who will be responsible for damage inspections and who will also serve as the contact for further inspections or remedial actions. The minimum qualifications for this position will be the same as a Team Leader for a bridge inspection team as defined herein. This identification will be placed in the bridge records and updated with each inspection of that structure.

11.2 INSPECTION PROCEDURES

The Damage Inspections will be conducted as routine inspections except the effort will be concentrated on the damaged area(s), and will be reported as a Damage Inspection on an OSARC Standard Bridge Inspection Form. Any condition found to be hazardous or dangerous to the traveling public or which endangers the structure shall be immediately reported to the County Engineer for evaluation. Emergency repairs and/or immediate closure of the bridge must be considered if any of these conditions exist. The County Engineer may consult with the State Aid Bridge Engineer for assistance in evaluating the damage and in recommending a repair. A Report of Critical Findings will be made if the damages reach that level, and the procedures for Posting and Closing described herein will be followed. Should the damage pose an imminent threat to the public or to the structure, the structure will be immediately closed until repairs can be made.

SECTION 12: INSPECTION REPORT PROCEDURES

12.1 REQUIREMENTS

Bridge Inspection Reports shall meet the requirements of section 4.7 of the MBE. All inspection data (SI&A sheet, notes, descriptions, photos, sketches), including defect descriptions, and maintenance needs, shall be included on the OSARC Standard Bridge Report (see appendix F for forms), signed by the Team Leader and submitted to the County Engineer. The County Engineer will review the report for completeness and provide initials as evidence of the review. The County Engineer will determine the follow up actions, if any, that are needed from the report. As a minimum, the NBI record for each structure must be updated in accordance with Section 14 of this document. The inspection report with all of its supporting data becomes part of the Bridge Record.

SECTION 13: LOAD RATING

13.1 METHODOLOGY

Load Rating is the determination of the live load carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection. Responsibility for load rating as other elements of the Bridge Inspection requirements remains with the bridge owner. State Aid with assistance of FHWA has developed **IMPLEMENTATION GUIDELINES FOR LOAD AND RESISTANCE FACTOR RATING (LRFR) OF HIGHWAY BRIDGES** that will result in consistent and reproducible load rating**.** These guidelines are copied in **Appendix G** and are made a part of this manual. Rating of bridges on the Local System will be in accordance with these guidelines.

13.2 STANDARD PLAN BRIDGES

State Aid will develop a Load Rating for structures constructed in accordance with the standard plans made available by State Aid. The Load Rating will be on a span length and roadway width basis, and will be developed in accordance with the guidelines in Appendix G of this manual. These ratings will be available to County Engineers. The County Engineers may select the load ratings for the various spans that comprise a bridge and use the least rating of the various spans as the rating for the structure. Copies of the Load Ratings will be available to the County Engineers for inclusion in the Bridge Records.

The Load Rating furnished by State Aid will be valid only for undamaged structures constructed in strict conformity with the Standard Plans. Damage to the structure either environmental or man made and/or deviation from the standard plans will require a reassessment of the load rating, and that

reassessment will be made by the bridge owner in accordance with Appendix G of this manual.

13.3 PROPOSED CONSTRUCTION

A load rating assessment will be required as part of the design calculations for bridges proposed for construction that are not in accordance with standard plans furnished by State Aid. The load rating assessment will be in the format and software package outlined in the guidelines in Appendix G.

State Aid will maintain the software, BRASS, required in the guidelines and it will be available to County Engineers for use in rating bridges on the Local System. Procedures for using this software are in development and will be added to this manual when completed.

13.4 TIMBER COMPONENTS

Existing bridges with load carrying Timber Components will be rated with a modified version of the method in place at the time this manual is adopted. This modification is in development and will be made available when completed. Newly constructed bridges with timber components will be rated in accordance with the guidelines in Appendix G of this manual.

SECTION 14: DATABASE UPDATES

14.1 REQUIREMENTS

23 CFR 650.315(c) & (d), requires the SI&A data be entered into the state's NBI database within 180 days. Therefore, the Owner shall update the Bridge Data in the State's NBI database within 150 days of one or more of the following events:

1. When a non-routine inspection is performed
2. When modifications are made to an existing bridge that alters previously recorded data.
3. When new bridges are opened to traffic.
4. When changes in load restriction are made.
5. When changes in closure status occur.

The data required for inclusion into the NBI data base is listed in the NBI Coding Guide. Not all data is required from each inspection. After a structure is inventoried and entered into the data base the majority of items will remain unchanged.

14.2 SUBMITTAL DATES

It is further required that this data be submitted to FHWA in April of each year for inclusion in their database. The requirement is for MDOT to submit all data for the state in one submittal. State Aid is required to have the data to MDOT no later than April first of each year.

To provide for an orderly review and compilation of the data from routine inspections for submission to MDOT the following deadlines for County Engineers to submit their data to State Aid is adopted:

1. Counties located North of US Highway 80 and counties that US Highway 80 passes through shall submit their data no later than February first of each year.
2. Counties located South of US Highway 80 shall submit their data no later than February 15th of each year.

Data submission from special, damaged, or other non routine inspections shall be submitted not later than 150 days following the inspection.

SECTION 15: CRITICAL FINDINGS:

15.1 DEFINITION

A Critical Finding is a structural or safety related deficiency that requires immediate follow-up inspection or action. In order to implement the requirements of 23 CFR 650.313(h), follow-up procedures have been adopted for dealing with Load Posting and Physical Closure of bridges after regular scheduled NBIS Bridge Inspections. State Aid's procedure has been developed in consultation with the FHWA Division Administrator, and in accordance with 23 CFR 650.313(c) and the MBE, section 6A.8, pages 6-55.

15.2 PROCEDURE

With receipt of a county's bridge inventory data following regular scheduled inspections, State Aid compiles and loads the bridge inventory data into the Statewide Bridge Inventory Database. After review of data, the following actions are taken by the Office of State Aid:

I. Print Attachments A and/or B for each County as applicable:

(1) A - List of bridges requiring physical closure.
(2) B - List of bridges requiring load posting.

II. Notify each County Board of Supervisors in writing of any bridges

requiring load posting and/or bridges requiring physical closure within 45 days. (Include attachments A and/or B with notification if applicable.)

a. Copy to FHWA
b. Copy to County Engineer

III. Print Attachments A and/or B for City/Towns if any.

a. A - List of bridges requiring physical closure.
b. B - List of bridges requiring load posting

IV. Notify City/Town (Mayor) in writing of bridges requiring load posting and/or bridges requiring physical closure within 45 days. (Include attachments A and/or B with notification if applicable.)

a. Copy to FHWA.
b. Copy to County Board of Supervisors.
c. Copy to County Engineer.

V. Maintain file of Notification letters with attachments if any.

VI. Maintain file for County and/or City/Town responses to State Aid of corrective action and compliance with bridge load posting and physical closures (if any).

VII. State Aid will send a letter of compliance of County/City/Town to FHWA.

VIII. State Aid will send letter of non-compliance and suspension of Federal Aid Highway Funds to County Board of Supervisors for failing to properly Post and/or Close bridges listed in II above.

a. Copy to FHWA.
b. Copy to County Engineer

IX. State Aid will send letter of non-compliance to FHWA for Cities/Towns for failing to properly Post and/or Close bridges listed in IV above.

a. FHWA notifies MDOT on any suspension of funds regarding Cities/Towns.

X. After verification of proper bridge posting and/or closure. State Aid will notify FHWA that a County has complied and Federal Funds are reinstated.

a. Copy to Board of Supervisors
b. Copy to County Engineer

c. Copy to State Aid Transportation Planner
d. Copy to State Aid District Engineer

XI. After verification of proper bridge posting and/or closure, State Aid will notify MDOT that City/Town has complied and is eligible to have their Federal Funds reinstated.

a. Copy to FHWA
b. Copy to State Aid District Engineer
c. Copy to County Engineer

XII. Develop and maintain a log of all actions taken so that immediate access can be obtained of current status.

SECTION 16: QUALITY CONTROL PROGRAM

16.1 POLICY

A Quality Control Program is a set of procedures that are intended to maintain the quality of a bridge inspection and load rating program at or above a specified level. To assure independence, the Quality Control Manager (QC Manager) responsible for verifying the Quality of the inspection process can not be a member of the inspection team. Minimum Qualifications for this position can be found in subsection 4.4 of this Manual.

A Quality Control Program is generally verified by a Quality Assurance Review. In instances where the County Engineer is a part of the inspection team, a more rigorous Quality Assurance Review will be conducted.

16.2 PROCEDURE

A County Quality Control File will be maintained and will contain the documents listed in subsection 16.3 of this section. Documentation to demonstrate that each person involved in the inspection process meets or exceeds the minimum qualification requirements will be developed and incorporated into the QC file.

The QC Manager will routinely review a random sampling of Bridge Inspection Reports during the inspection cycle. This review will include but not necessarily be limited to a check to determine if the required information has been entered correctly using the correct form and in accordance with the FHWA coding guide. Further checks for proper coding conventions, formats, significant digits and correct units have been used is encouraged. The size of the sample will be dependent on the results obtained, but a sufficient number will be checked to gauge the quality of the reports. Notes from this review sampling will include the

reviewer, the structures reviewed and the data checked. The notes will be placed in the QC file.

Annually, Bridge Records will be selected for evaluation and a follow-up on site inspection by the QC Manager and assisted by the Inspection Team Leader. The Quality Control and/or Quality Assurance Review forms in Appendix E will be used for this evaluation. The number of bridges selected for this evaluation and follow up inspection will be 5% of the county inventory or a minimum of five bridges. This will include verification of the condition ratings for NBI items 58, 59, 60, 61, 62, load rating calculations. Posting and/or closing decisions and all other inspection data. Notes will be made as to accuracy of the data. These notes will be dated, signed, and placed into the county's Quality Control File.

16.3 FILE CONTENTS

The Quality Control File will contain the following documents:

1. Qualification of Personnel Form, the County Engineer's certification and documentation of experience for each person and position involved in the NBIS program.
2. Quality Control Manager's Inspection Data Verification Notes.
3. List of Bridges with Fracture Critical Members (FCM's).
4. List of Bridges Requiring Underwater Inspections.
5. List of Bridges that are Scour Critical..
6. List of Complex Bridges.
7. List of Current Bridges with Critical Findings.
8. List of Current Bridges recommended for Load Posting.
9. Other items as needed.
10. Completed set of Quality Control Review Forms as provided in the Appendix E.

SECTION 17: QUALITY ASSURANCE PROGRAM

17.1 POLICY

The Quality Assurance Program is the use of sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program. State Aid will select several counties for an onsite Quality Assurance Review. The Quality Assurance Review will be conducted by Representatives of State Aid and may include representatives of FHWA for a joint review.

17.2 PROCEDURE

Prior to visiting the County Engineer's office, State Aid will select 4 to 8 bridges for review. Included in the selected bridges should be at least one bridge, when available, with Fracture Critical Members, one that requires Underwater Inspection and one that is Scour Critical. A bridge that is Complex in nature and a bridge that has had a Critical Finding or is Posted and/or Closed may also be selected. State Aid will conduct the review as follows:

FIELD REVIEW

State Aid will travel to the selected bridge sites and perform an on site review. This review will verify that the data in the Bridge Record is complete and accurate. The review will include posting and/or closing decisions if applicable. The review will specifically verify the accuracy of NBI Items 36, 58, 59, 60, 61, 62, 71 and 72.

OFFICE REVIEW

Verify the County Engineer has a copy of 23 CFR 650 subpart C as a reference.

Verify the County Engineer has a copy of the MBE (Current Edition)

Verify that the County Engineer has a current copy of OSARC Bridge Inspection Manual.

Review the county Quality Control File for the following documents and lists:

1. Qualification of Personnel Form, the County Engineer's certification and documentation of experience for each person and position involved in the NBIS program.
2. Quality Control Manager's Inspection Data Verification Notes.
3. List of Bridges with Fracture Critical Members (FCM's).
4. List of Bridges Requiring Underwater Inspections.
5. List of Bridges that are Scour Critical.
6. List of Complex Bridges.
7. List of Current Bridges with Critical Findings.
8. List of Current Bridges recommended for Load Posting.
9. Other items as needed.
10. Completed set of Quality Control Review Forms as provided in the Appendix E.

For the selected bridges, review the county Bridge Record files for the following documents:

1. Bridge inspection reports, SI&A (electronic or paper).
2. Notation of any action taken to address the findings of the inspection.
3. Historical records (for example, previous SI&A data).
4. As built plans (electronic or paper).
5. Correspondence and documentation of communications concerning posting, closure or repair.
6. Load Rating calculations.

When an error or lack of data is identified, additional records of the same type may be reviewed to determine if the issue is systemic.

Discuss findings of the field review with the County Engineer and the Inspector(s), and recommend corrective actions if needed.

Follow up inspection may be scheduled to assess the resolution of recommended actions or findings.

APPENDIX - A

National Bridge Inspection Standards

Subpart C—National Bridge Inspection Standards

Source: 69 FR 74436, Dec. 14, 2004, unless otherwise noted.

§ 650.301 Purpose.

This subpart sets the national standards for the proper safety inspection and evaluation of all highway bridges in accordance with 23 U.S.C. 151.

§ 650.303 Applicability.

The National Bridge Inspection Standards (NBIS) in this subpart apply to all structures defined as highway bridges located on all public roads.

§ 650.305 Definitions.

Terms used in this subpart are defined as follows:

American Association of State Highway and Transportation Officials (AASHTO) Manual. "Manual for Condition Evaluation of Bridges," second edition, published by the American Association of State Highway and Transportation Officials (incorporated by reference, *see* §650.317).

Bridge. A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between under copings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

Bridge inspection experience. Active participation in bridge inspections in accordance with the NBIS, in either a field inspection, supervisory, or management role. A combination of bridge design, bridge maintenance, bridge construction and bridge inspection experience, with the predominant amount in bridge inspection, is acceptable.

Bridge inspection refresher training. The National Highway Institute "Bridge Inspection Refresher Training Course"[1] or other State, local, or federally developed instruction aimed to improve quality of inspections, introduce new techniques, and maintain the consistency of the inspection program.

[1] The National Highway Institute training may be found at the following URL: *http://www.nhi.fhwa.dot.gov./*

Bridge Inspector's Reference Manual (BIRM). A comprehensive FHWA manual on programs, procedures and techniques for inspecting and evaluating a variety of in-

service highway bridges. This manual may be purchased from the U.S. Government Printing Office, Washington, DC 20402 and from National Technical Information Service, Springfield, Virginia 22161, and is available at the following URL: *http://www.fhwa.dot.gov/bridge/bripub.htm.*

Complex bridge . Movable, suspension, cable stayed, and other bridges with unusual characteristics.

Comprehensive bridge inspection training. Training that covers all aspects of bridge inspection and enables inspectors to relate conditions observed on a bridge to established criteria (see the Bridge Inspector's Reference Manual for the recommended material to be covered in a comprehensive training course).

Critical finding. A structural or safety related deficiency that requires immediate follow-up inspection or action.

Damage inspection. This is an unscheduled inspection to assess structural damage resulting from environmental factors or human actions.

Fracture critical member (FCM). A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.

Fracture critical member inspection. A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation.

Hands-on. Inspection within arms length of the component. Inspection uses visual techniques that may be supplemented by nondestructive testing.

Highway. The term “highway” is defined in 23 U.S.C. 101(a)(11).

In-depth inspection. A close-up, inspection of one or more members above or below the water level to identify any deficiencies not readily detectable using routine inspection procedures; hands-on inspection may be necessary at some locations.

Initial inspection. The first inspection of a bridge as it becomes a part of the bridge file to provide all Structure Inventory and Appraisal (SI&A) data and other relevant data and to determine baseline structural conditions.

Legal load. The maximum legal load for each vehicle configuration permitted by law for the State in which the bridge is located.

Load rating. The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection.

National Institute for Certification in Engineering Technologies (NICET). The NICET provides nationally applicable voluntary certification programs covering several broad

engineering technology fields and a number of specialized subfields. For information on the NICET program certification contact: National Institute for Certification in Engineering Technologies, 1420 King Street, Alexandria, VA 22314–2794.

Operating rating. The maximum permissible live load to which the structure may be subjected for the load configuration used in the rating.

Professional engineer (PE). An individual, who has fulfilled education and experience requirements and passed rigorous exams that, under State licensure laws, permits them to offer engineering services directly to the public. Engineering licensure laws vary from State to State, but, in general, to become a PE an individual must be a graduate of an engineering program accredited by the Accreditation Board for Engineering and Technology, pass the Fundamentals of Engineering exam, gain four years of experience working under a PE, and pass the Principles of Practice of Engineering exam.

Program manager. The individual in charge of the program, that has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The program manager provides overall leadership and is available to inspection team leaders to provide guidance.

Public road. The term “public road” is defined in 23 U.S.C. 101(a)(27).

Quality assurance (QA). The use of sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program.

Quality control (QC). Procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level.

Routine inspection. Regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of the bridge, to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.

Routine permit load. A live load, which has a gross weight, axle weight or distance between axles not conforming with State statutes for legally configured vehicles, authorized for unlimited trips over an extended period of time to move alongside other heavy vehicles on a regular basis.

Scour. Erosion of streambed or bank material due to flowing water; often considered as being localized around piers and abutments of bridges.

Scour critical bridge. A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.

Special inspection. An inspection scheduled at the discretion of the bridge owner, used to monitor a particular known or suspected deficiency.

State transportation department. The term “State transportation department” is defined in 23 U.S.C. 101(a)(34).

Team leader. Individual in charge of an inspection team responsible for planning, preparing, and performing field inspection of the bridge.

Underwater diver bridge inspection training. Training that covers all aspects of underwater bridge inspection and enables inspectors to relate the conditions of underwater bridge elements to established criteria (see the Bridge Inspector's Reference Manual section on underwater inspection for the recommended material to be covered in an underwater diver bridge inspection training course).

Underwater inspection. Inspection of 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.

§ 650.307 Bridge inspection organization.

(a) Each State transportation department must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the State's boundaries, except for bridges that are owned by Federal agencies.

(b) Federal agencies must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the respective agency responsibility or jurisdiction.

(c) Each State transportation department or Federal agency must include a bridge inspection organization that is responsible for the following:

(1) Statewide or Federal agency wide bridge inspection policies and procedures, quality assurance and quality control, and preparation and maintenance of a bridge inventory.

(2) Bridge inspections, reports, load ratings and other requirements of these standards.

(d) Functions identified in paragraphs (c)(1) and (2) of this section may be delegated, but such delegation does not relieve the State transportation department or Federal agency of any of its responsibilities under this subpart.

(e) The State transportation department or Federal agency bridge inspection organization must have a program manager with the qualifications defined in

§650.309(a), who has been delegated responsibility for paragraphs (c)(1) and (2) of this section.

§ 650.309 Qualifications of personnel.

(a) A program manager must, at a minimum:

(1) Be a registered professional engineer, or have ten years bridge inspection experience; and

(2) Successfully complete a Federal Highway Administration (FHWA) approved comprehensive bridge inspection training course.

(b) There are five ways to qualify as a team leader. A team leader must, at a minimum:

(1) Have the qualifications specified in paragraph (a) of this section; or

(2) Have five years bridge inspection experience and have successfully completed an FHWA approved comprehensive bridge inspection training course; or

(3) Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET) and have successfully completed an FHWA approved comprehensive bridge inspection training course, or

(4) Have all of the following:

(i) A bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology;

(ii) Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination;

(iii) Two years of bridge inspection experience; and

(iv) Successfully completed an FHWA approved comprehensive bridge inspection training course, or

(5) Have all of the following:

(i) An associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology;

(ii) Four years of bridge inspection experience; and

(iii) Successfully completed an FHWA approved comprehensive bridge inspection training course.

(c) The individual charged with the overall responsibility for load rating bridges must be a registered professional engineer.

(d) An underwater bridge inspection diver must complete an FHWA approved comprehensive bridge inspection training course or other FHWA approved underwater diver bridge inspection training course.

§ 650.311 Inspection frequency.

(a) *Routine inspections.* (1) Inspect each bridge at regular intervals not to exceed twenty-four months.

(2) Certain bridges require inspection at less than twenty-four-month intervals. Establish criteria to determine the level and frequency to which these bridges are inspected considering such factors as age, traffic characteristics, and known deficiencies.

(3) Certain bridges may be inspected at greater than twenty-four month intervals, not to exceed forty-eight-months, with written FHWA approval. This may be appropriate when past inspection findings and analysis justifies the increased inspection interval.

(b) *Underwater inspections.* (1) Inspect underwater structural elements at regular intervals not to exceed sixty months.

(2) Certain underwater structural elements require inspection at less than sixty-month intervals. Establish criteria to determine the level and frequency to which these members are inspected considering such factors as construction material, environment, age, scour characteristics, condition rating from past inspections and known deficiencies.

(3) Certain underwater structural elements may be inspected at greater than sixty-month intervals, not to exceed seventy-two months, with written FHWA approval. This may be appropriate when past inspection findings and analysis justifies the increased inspection interval.

(c) *Fracture critical member (FCM) inspections.* (1) Inspect FCMs at intervals not to exceed twenty-four months.

(2) Certain FCMs require inspection at less than twenty-four-month intervals. Establish criteria to determine the level and frequency to which these members are

inspected considering such factors as age, traffic characteristics, and known deficiencies.

(d) Damage, in-depth, and special inspections. Establish criteria to determine the level and frequency of these inspections.

§ 650.313 Inspection procedures.

(a) Inspect each bridge in accordance with the inspection procedures in the AASHTO Manual (incorporated by reference, *see* §650.317).

(b) Provide at least one team leader, who meets the minimum qualifications stated in §650.309, at the bridge at all times during each initial, routine, in-depth, fracture critical member and underwater inspection.

(c) Rate each bridge as to its safe load-carrying capacity in accordance with the AASHTO Manual (incorporated by reference, *see* §650.317). Post or restrict the bridge in accordance with the AASHTO Manual or in accordance with State law, when the maximum unrestricted legal loads or State routine permit loads exceed that allowed under the operating rating or equivalent rating factor.

(d) Prepare bridge files as described in the AASHTO Manual (incorporated by reference, *see* §650.317). Maintain reports on the results of bridge inspections together with notations of any action taken to address the findings of such inspections. Maintain relevant maintenance and inspection data to allow assessment of current bridge condition. Record the findings and results of bridge inspections on standard State or Federal agency forms.

(e) Identify bridges with FCMs, bridges requiring underwater inspection, and bridges that are scour critical.

(1) Bridges with fracture critical members. In the inspection records, identify the location of FCMs and describe the FCM inspection frequency and procedures. Inspect FCMs according to these procedures.

(2) Bridges requiring underwater inspections. Identify the location of underwater elements and include a description of the underwater elements, the inspection frequency and the procedures in the inspection records for each bridge requiring underwater inspection. Inspect those elements requiring underwater inspections according to these procedures.

(3) Bridges that are scour critical. Prepare a plan of action to monitor known and potential deficiencies and to address critical findings. Monitor bridges that are scour critical in accordance with the plan.

(f) *Complex bridges.* Identify specialized inspection procedures, and additional inspector training and experience required to inspect complex bridges. Inspect complex bridges according to those procedures.

(g) *Quality control and quality assurance.* Assure systematic quality control (QC) and quality assurance (QA) procedures are used to maintain a high degree of accuracy and consistency in the inspection program. Include periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations.

(h) *Follow-up on critical findings.* Establish a statewide or Federal agency wide procedure to assure that critical findings are addressed in a timely manner. Periodically notify the FHWA of the actions taken to resolve or monitor critical findings.

§ 650.315 Inventory.

(a) Each State or Federal agency must prepare and maintain an inventory of all bridges subject to the NBIS. Certain Structure Inventory and Appraisal (SI&A) data must be collected and retained by the State or Federal agency for collection by the FHWA as requested. A tabulation of this data is contained in the SI&A sheet distributed by the FHWA as part of the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges," (December 1995) together with subsequent interim changes or the most recent version. Report the data using FHWA established procedures as outlined in the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges."

(b) For routine, in-depth, fracture critical member, underwater, damage and special inspections enter the SI&A data into the State or Federal agency inventory within 90 days of the date of inspection for State or Federal agency bridges and within 180 days of the date of inspection for all other bridges.

(c) For existing bridge modifications that alter previously recorded data and for new bridges, enter the SI&A data into the State or Federal agency inventory within 90 days after the completion of the work for State or Federal agency bridges and within 180 days after the completion of the work for all other bridges.

(d) For changes in load restriction or closure status, enter the SI&A data into the State or Federal agency inventory within 90 days after the change in status of the structure for State or Federal agency bridges and within 180 days after the change in status of the structure for all other bridges.

§ 650.317 Reference manuals.

(a) The materials listed in this subpart are incorporated by reference in the corresponding sections noted. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51.

These materials are incorporated as they exist on the date of the approval, and notice of any change in these documents will be published in the Federal Register. The materials are available for purchase at the address listed below, and are available for inspection at the National Archives and Records Administration (NARA). These materials may also be reviewed at the Department of Transportation Library, 400 Seventh Street, SW., Washington, DC, in Room 2200. For information on the availability of these materials at NARA call (202) 741–6030, or go to the following URL: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. In the event there is a conflict between the standards in this subpart and any of these materials, the standards in this subpart will apply.

(b) The following materials are available for purchase from the American Association of State Highway and Transportation Officials, Suite 249, 444 N. Capitol Street, NW, Washington, DC 20001. The materials may also be ordered via the AASHTO bookstore located at the following URL: *http://www.aashto.org/aashto/home.nsf/FrontPage.*

(1) The Manual for Condition Evaluation of Bridges, 1994, second edition, as amended by the 1995, 1996, 1998, and 2000 interim revisions, AASHTO, incorporation by reference approved for §§650.305 and 650.313.

(2) 2001 Interim Revision to the Manual for Condition Evaluation of Bridges, AASHTO, incorporation by reference approved for §§650.305 and 650.313.

(3) 2003 Interim Revision to the Manual for Condition Evaluation of Bridges, AASHTO, incorporation by reference approved for §§650.305 and 650.313.

APPENDIX - B

Sample Underwater Inspection Procedures

UNDERWATER INSPECTION PROCEDURES

PURPOSE

To inspect and appraise the underwater portion of bridges that can not be inspected visually at low water by wading or probing, generally requiring diving or other appropriate techniques

PROCEDURE

Perform all work in accordance with these guidelines and the following references:

1. National Bridge Inspection Standards (NBIS).
2. AASHTO Manual for Bridge Evaluation,
3. BIRM Current Edition
4. FHWA Technical Advisory: "Evaluating Scour at Bridges", T 5140.23 and its updates.
5. FHWA Technical Advisory: "Revisions to the National Bridge Inspection Standards (NBIS)", T 5140.21 and its updates.
6. *Underwater Inspection of Bridges,* DOT Report Number FHWA –DP-80-1
7. *Evaluating Scour at Bridges, Fourth Edition.* Publication number FHWA NHI 01-001.

FIELD INSPECTION

Structure Inspection

1. Inspect the portions subjected to being submerged for damage, cracking, settlement, steel corrosion, deteriorated and scoured concrete, deteriorated pointing, broken and/or dislodged stones in masonry structures, deterioration and/or damage to piling, insect damage or wood decay, etc.

2. Provide special attention to determine the uniformity of bearing of footings and surrounding foundation materials and the lateral stability and soil support to the pile foundations, the effect or potential effect of scour, and also the soundness or effectiveness of any previous repairs.

3. Sound all timber and probe with a heavy duty 6 inch (min.) blade ice pick or awl.

4. Identify limits of past scour protection.

Streambed Inspection

1. Inspect the streambed in the area of the substructure unit as to type of material, evidence of scour, condition of existing scour protection, debris, etc.

Obtain elevations relative to a fixed permanent reference point marker to provide for accurate plotting of streambed contours and/or streambed profiles in the areas suspect of scour.

2. Provide stream bottom data on a minimum five (5) foot grid around each pier to extend beyond the scour hole but in no case less than twenty five (25) feet beyond the footing area. Estimate flow velocities and direction of flow relative to the foundation structure. Note all turbulence and unusual flow conditions.

3. Obtain channel cross-sections at the bridge and two bridge lengths upstream and downstream. For bridge lengths greater than 100', obtain channel cross sections at 200' upstream and downstream. Significant features directly observable but beyond 200' from the bridge should be included. Do not create new cross-sections, if existing cross-sections can be utilized. Mark any changes on the existing cross-sections from the bridge inspection file.

The cross section at the fascia must include the following:

a. Top-of-bank to top-of-bank channel section at upstream face of the bridge.
b. Geometry of principal bridge openings up to the anticipated high water evaluation.
c. Foundation units.
d. Stream bed materials and boring information.
e. Roadway profile in the vicinity of the bridge.
f. Discernible scour holes.
g. Structural countermeasures at the bridge.
h. Discernible high-water marks at the bridge.
I. Stream level at the upstream side of the bridge at time of inspection.
j. Reference marks on the bridge.
k. The upstream and downstream sections may be sounded from a surveyed water surface evaluation. Obtain sounding by using a continuous reading strip chart Fathometer unless water conditions preclude use of a boat, in which case sounding poles or lead lines may be utilized.

Reference Point Marker

Place a permanent marker if one does not exist already (drill hole, nonferrous PK nail) on each abutment/pier (elevation/datum) that correlates to the report findings and which may be used in future underwater investigations and/or rehabilitation work. Provide one such marker per bridge at a convenient location. Show this reference bench mark on the plan.

Verification of Field Conditions for the Observed Scour Assessment

At the substructure units being inspected, verify and update the field conditions recorded in the most recent Observed Scour Assessment Report.
In the “UNDER THE BRIDGE” section of the Assessment, review data applicable to the substructure units being inspected. Mark all changes in red ink without erasing or obliterating original information. If previous information is valid, note each data item as such with a checkmark or the words “No change”. Update the Plan Sketch and Channel Cross Section at the Bridge accordingly. Record the date of the underwater inspection and inspection leader on each page.

This update of the Scour Assessment Plan and Cross Section is not in lieu of and does not satisfy the Underwater Inspection Report requirements for drawings and sketches required in other sections of these procedures.

DRAWINGS

Prepare sufficient drawings to document the condition of the substructure units and stream.

INSPECTION REPORT

Report Requirements

Provide written report using explicit terminology and language covering the factors relevant to the condition of the substructure, such as:

1. Detail general condition as revealed by the field inspection; past, present and potential flooding conditions, if relevant; history of repairs; and all other features which may affect the service life of the substructure.

2. Provide detailed descriptions of the inspection. Such details shall be referenced and shown on the drawings. Sketches should be such that aggradations and degradation of material around piers can be readily identified during subsequent inspections.

3. Compare channel cross-sections with those obtained in previous inspections and significant stream changes shall be identified.

4. Provide recommendations as to: need for minor repairs; need for major repairs; scheduling of repairs; anticipated useful life of the substructure; recommended intervals for future inspections; and any other recommendations which may be pertinent to the perpetual safety of the structure, such as scour computations and substructure analysis.
5. When repairs are recommended, estimate quantities and cost of the repairs. Prioritize these repairs.

6. Highlight critical deficiencies and/or other important findings on separate sheet(s).

7. Sign and seal the report by a Professional Engineer

REPORTING CRITICAL DEFICIENCIES TO OWNER

Contact owner and State Aid Bridge Engineer immediately if conditions exists that pose an imminent threat to the structure or to public safety. Telephone conversations and notes/sketches sent by facsimile or e-mail may be required.

Submission of Reports

1. Draft Report:
   Submit one (1) draft copy of the inspection report to the Program Manager within four weeks of completion of each field inspection for review and comments.

2. Final Report:
   Submit the original and two copies of each final report within four weeks after receipt of review/comments of the draft copy.

3. Submission Schedule:
   Space submissions at frequent intervals to facilitate review.

QUALIFICATIONS OF PERSONNEL

A. The Engineer in charge of inspection and preparation of the inspection report must possess the following minimum qualifications:

   1. Be a Professional Engineer.
   2. Have a minimum of five years experience in underwater inspection assignments in responsible capacity.

B. The diver(s) who will perform the underwater inspection shall meet the qualification as a bridge inspector in accordance with the NBIS requirements and be a certified diver, with at least two years experience in underwater bridge inspection.

C. A Professional Engineer shall be on site either in the boat or as diver during the inspections.

SAFETY OF PERSONNEL

Safety is of utmost importance. Take all necessary precautions for the safeguard of all personnel involved in this project.

APPENDIX C

SCOUR PLAN OF ACTION FORM

Rev. 08-13-2009

BRIDGE SCOUR PLAN OF ACTION

Office of State Aid Road Construction

STRUCTURE NUMBER: **SA3300000000008**
BRIDGE OWNER: **COUNTY HIGHWAY AGENCY**
ROAD NAME: **CLAUDE BOOTH ROAD**
CROSSING: **BOUIE CREEK**
LOCATION: **SEC 3 T 6N R17W**

COUNTY: **JEFFERSON DAVIS**
LATITUDE: **N 31* 30' 53.00"**
LONGITUDE: **W 089* 41' 41.00"**

========== TYPE OF SUPERSTRUCTURE ==========

MAIN SPAN: **CONCRETE SLAB**

APPR. SPAN: **NOT APPLICABLE**

========== TYPE OF SUBSTRUCTURE ==========

ABUTMENTS: _____

BENTS: _____

PIERS: _____

========== SCOUR EVALUATION ==========

Bridge is scour critical; bridge foundations determined to be unstable for calculated scour conditions

(This text to be replaced with coding text from Item 113.)

========== INSPECTION PROCEDURES ==========

What initiated the Call-out Inspection?

[ ] NWS Flood or Flash Flood Warnings for County and/or Waterway

[ ] MDOT or Local Maintenance Personnel

[ ] MHP or Local Law Enforcement Personnel

[ ] Other _____

Things to check on a bridge during floods:

[ ] - Span movement - horizontally as well as vertically
1. Check displacement / deflection along curb line, both bridge rails and outer edge of bridge deck.
2. Check for plumb of piers or bents

[ ] - Check embankment erosion
[ ] - Check for drift build-up on piers or bents
[ ] - Check pier exposure, if possible, and compare to previous inspection
[ ] - Review the latest bridge inspection report versus current field conditions

If Closure is recommended:

[ ] - Stay at bridge with vehicle pulled across road until bridge is secured and properly closed by County or City Maintenance Personnel. Use Barricade Tape, traffic cones and/or traffic flares as temporary measures to warn motorists to stay off the bridge until such time as the bridge may be properly closed and barricaded.

[ ] - Contact: (1) City or County Road maintenance Official
(2) Mississippi Highway patrol and/or local law enforcement Officers as appropriate
(3) County Engineer
(4) OSARC Bridge Engineer

[ ] - The Bridge should remain closed until the water recedes and a daylight visual inspection is made by a certified bridge inspection team.
[ ] - The bridge inspection team will work with the local road maintenance officials in establishing a detour route. Any bridge on the selected detour route shall be checked prior to signing the detour route.
[ ] - The bridge can be re-opened only after a certified bridge inspection team checks the substructure units and they are determined to be structurally stable.

Contact Personnel:	**Telephone Number:**
County or Local Road Manager	(601) 123-4567
County or Local Law Enforcement	(601) 123-4567
County Engineer	(601) 123-4567

[ ] - Summarize and submit findings from the inspection to the county engineer. The report shall include the date and time of the inspection, a brief summary of findings and as appropriate, photographs of the bridge and stream channel measurements. If significant scouring has occurred, the report shall also be copied to the Office of State Aid Road Construction.

Suggested List of Equipment to conduct the Inspection:

Latest Bridge Inspection Report
Scour POA Report with the above Checklist
Bridge Design Plans, if available
Tape measure with weight
Plumb bob
Range pole
A 1000 foot roll of yellow polyethylene Barricade Tape printed with the following message:
SAFETY HAZARD KEEP AWAY
A barricade tape dispenser with serrated cutter
A roll of Duct Tape
Traffic Cones - minimum of four (4)
Traffic Safety Flares - Minimum of four (4) or set of electronic warning flashers
Cell Phone

APPENDIX - D

QUALIFICATIONS OF PERSONNEL FORMS

QUALIFICATIONS OF PERSONNEL
STATE AID BRIDGE INSPECTION PROGRAM MANAGER
FOR THE LOCAL SYSTEM ROUTES
STATEWIDE

APPLICANT:

Reference: 23 CFR 650.309(a)

Attach supporting certificates and documentation giving dates and location of experience.

(a)(1) Be a registered professional engineer.
Provide registration number:_____ State:

OR

Have ten years bridge inspection experience.

AND

(a)(2) Successfully complete a Federal Highway Administration (FHWA) approved comprehensive bridge inspection training course. The two week FHWA-NHI-130055 course, “Safety Inspection of In-Service Bridges”.

Attach a copy of the certificate.

The undersigned persons do certify that the attached information is true and correct and that the said applicant is fully qualified for this position per 23 CFR 650.309(a).

Applicant Signature: _____ Date: _____

State Aid Concurrence: _____ Date: _____

FHWA Concurrence: _____ Date: _____

QUALIFICATIONS OF PERSONNEL - BRIDGE INSPECTION TEAM LEADER

(*A separate form must be completed for each county in which the applicant intends to work.*)

APPLICANT: _____ COUNTY: _____

There are five ways to qualify as a Team Leader. Please indicate below which way qualifies the applicant as a team leader. Attach supporting certificates and documentation giving dates and location of experience.

_____ 1. **23 CFR 650.309(b)(1)**

Have the qualifications specified for a program manager in 23CFR650.309(a)(1) & (2). Be a registered professional engineer, or have 10 years bridge inspection experience; and

Have successfully completed an FHWA approved comprehensive bridge inspection training course. The two week FHWA-NHI-130055 course.

_____ 2. **23 CFR 650.309(b)(2)**

Have five years bridge inspection experience; and

Have successfully completed an FHWA approved comprehensive bridge inspection training course. The two week FHWA-NHI-130055 course.

_____ 3. **23 CFR 650.309(b)(3)**

Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET); and

Have successfully completed an FHWA approved comprehensive bridge inspection training course. The two week FHWA-NHI-130055 course.

_____ 4. **23 CFR 650.309(b)(4)**

Have all of the following:

(I). A bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology; and

(II). Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination; and

(III). Two years of bridge inspection experience; and

(IV). Successfully completed an FHWA approved comprehensive bridge inspection training course. The two week FHWA-NHI-130055 course.

_____ 5. **23 CFR 650.309(b)(5)**

Have all of the following:

(I). An associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology; and

(II). Four years of bridge inspection experience; and

(III). Successfully completed an FHWA approved comprehensive bridge inspection training course. The two week FHWA-NHI-130055 course.

I, the County Engineer, for _____ County do certify that the attached information is true and correct and that the said applicant is fully qualified for this position per 23 CFR 650.309.

County Engineer (PRINT): _____

Signature: _____ Date:_____

QUALIFICATIONS OF PERSONNEL
STATE AID BRIDGE INSPECTION LOAD RATING ENGINEER
FOR THE LOCAL SYSTEM ROUTES
STATEWIDE

APPLICANT: _____

Reference: 23 CFR 650.309(a)

Attach supporting certificates and documentation giving dates and location of experience.

(a)(1) Be a registered professional engineer.
Provide registration number:_____ State:

Attach a copy of the certificate.

The undersigned persons do certify that the attached information is true and correct and that the said applicant is fully qualified for this position per 23 CFR 650.309(a).

Applicant Signature: _____ Date: _____

State Aid Concurrence: _____ Date: _____

FHWA Concurrence: _____ Date: _____

QUALIFICATIONS OF PERSONNEL
COUNTY QUALITY CONTROL MANAGER
FOR THE LOCAL SYSTEM ROUTES
STATEWIDE

APPLICANT: _____

Attach supporting certificates and documentation giving dates and location of experience.

(a)(1) Be a graduate engineer.
Provide University attended and degree received:

OR

Five (5) years of experience in bridge inspection or construction and knowledge of all aspects of the bridge inspection program.

AND

(a)(2) Successfully complete a Federal Highway Administration (FHWA) approved comprehensive bridge inspection three (3) day refresher course.

Attach a copy of the certificate.

The undersigned persons do certify that the attached information is true and correct and that the said applicant is fully qualified for this position per 23 CFR 650.309(a).

Applicant Signature: _____ Date: _____

State Aid Concurrence: _____ Date: _____

APPENDIX - E

QUALITY CONTROL
AND
QUALITY ASSURANCE
FORMS

QUALITY CONTROL
and/or
QUALITY ASSURANCE REVIEW

County: _____ Date: _____

Reviewer: _____

Does the County Engineer's office have the following?

YES	NO	
___	___	State Aid Bridge Inspection Manual, current edition.
___	___	"AASHTO Manual for Bridge Evaluation", current edition
___	___	"Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges", December, 1995, Report No. FHWA-PD-96-001.
___	___	"Bridge Inspector's Reference Manual", FHWA-NHI-03-001, December, 2006.

Review the County Quality Control File for the following documents.

YES	NO	
___	___	Is a Quality Control File established for this specific county?
		Approved Qualification Forms for:
___	___	County Quality Control Manager
___	___	County Load Rater
___	___	County Team Leader(s)

Comments: _____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

This portion of the QC/QA Procedure will be in effect for:
1) Two girder and floor beam bridges, and
2)* Following completion of the statewide In-Depth Inspection contract.

Review the County Quality Control File for the following:

YES	NO	
____	____	Current list of FRACTURE **CRITICAL** Bridges.

Select candidates from the list and verify that Bridge Records contain the following:

Bridge # _____

____	____	A.	The fracture critical inspection frequency (NBI item 92A).
____	____	B.*	A sketch showing the location of each Fracture Critical Member.
____	____	C.*	Fracture Critical Sheet
____	____	D.*	A description of Fracture Critical Member inspection procedure.
____	____	E.*	Drawing of fatigue prone details and their inspection procedure.
____	____	F.	Bridge inspection reports, (SI&A data, electronic or paper).
____	____	G.	Notation of any action taken to address the inspection findings.
____	____	H.	Historical records (previous SI&A data, electronic or paper).
____	____	I.	As built plans (electronic or paper).
____	____	J.	Correspondence and documentation of communications concerning load posting, closure or repair.
____	____	K.	Load Rating calculations.

Bridge # _____

____	____	A.	The fracture critical inspection frequency (NBI item 92A).
____	____	B.*	A sketch showing the location of each Fracture Critical Member.
____	____	C.*	Fracture Critical Sheet
____	____	D.*	A description of Fracture Critical Member inspection procedure.
____	____	E.*	Drawing of fatigue prone details and their inspection procedure.
____	____	F.	Bridge inspection reports, (SI&A data, electronic or paper).
____	____	G.	Notation of any action taken to address the inspection findings.
____	____	H.	Historical records (previous SI&A data, electronic or paper).
____	____	I.	As built plans (electronic or paper).
____	____	J.	Correspondence and documentation of communications concerning load posting, closure or repair.
____	____	K.	Load Rating calculations.

This portion of the QC/QA Procedure will take effect with completion of the underwater inspection cycle in FY-2010.

Review the County Quality Control File for the following:

YES NO

____ ____ **LIST OF BRIDGES REQUIRING UNDERWATER INSPECTIONS**.

Select candidates from the list and verify that the Bridge Records contain the following:

For Bridge # _____

____ ____ A. Underwater Inspection Reports.
____ ____ B. The location of underwater elements (bent number).
____ ____ C. Description of the underwater elements.
____ ____ D. The underwater inspection frequency (NBI Item 92B).
____ ____ E. The inspection procedures for each underwater bridge.
____ ____ F. Bridge inspection reports, (SI&A data, electronic or paper).
____ ____ G. Notation of any action taken to address the inspection findings.
____ ____ H. Historical records (previous SI&A data, electronic or paper).
____ ____ I. As built plans (electronic or paper).
____ ____ J. Correspondence and documentation of communications concerning load posting, closure or repair.
____ ____ K. Load Rating calculations.

When an error or lack of data is identified, additional records of this type will be reviewed to determine if the issue is systemic.

This portion of the QC/QA Procedure will take effect following completion of the statewide scour evaluation program and adoption of a Plan of Action for each scour critical bridge by the Bridge Owners.

Review the County Quality Control File for the following:

YES	NO	
____	____	Current list of **SCOUR CRITICAL** Bridges.

Select candidates from the list and verify that Bridge Records contain the following:

For Bridge # _____

____	____	A.	Scour Critical Plan of Action
____	____	B.	Documentation of monitoring in accordance with the plan.
____	____	C.	Bridge inspection reports, (SI&A data, electronic or paper).
____	____	D.	Notation of any action taken to address the inspection findings.
____	____	E.	Historical records (previous SI&A data, electronic or paper).
____	____	F.	As built plans (electronic or paper).
____	____	G.	Correspondence and documentation of communications concerning load posting, closure or repair.
____	____	H.	Load Rating calculations.

When an error or lack of data is identified, additional records of this type will be reviewed to determine if the issue is systemic.

This portion of the QC/QA Procedure will take effect following completion of the statewide In-Depth Inspection contract.

Review the County Quality Control File for the following:

YES NO

____ ____ Current list of **COMPLEX** Bridges.

Select candidates from the list and verify that Bridge Records contain the following:

For Bridge # _____

____ ____ A. Any specialized inspection procedures.

____ ____ B. Any additional inspector training and experience required to inspect these bridges.

____ ____ C. Document these procedures were followed for each inspection.

____ ____ D. Drawing of fatigue prone details and their inspection procedure.

____ ____ E. Bridge inspection reports, (SI&A data, electronic or paper).

____ ____ F. Notation of any action taken to address the inspection findings.

____ ____ G. Historical records (previous SI&A data, electronic or paper).

____ ____ H. As built plans (electronic or paper).

____ ____ I. Correspondence and documentation of communications concerning load posting, closure or repair.

____ ____ J. Load Rating calculations.

When an error or lack of data is identified, additional records of this type will be reviewed to determine if the issue is systemic.

Review the County Quality Control File for the following:

YES NO

____ ____ Current list of Bridges with **CRITICAL FINDINGS**.

Select candidates from the list and verify that Bridge Records contain the following:

For Bridge # _____

____ ____ A. Critical Finding Report.

____ ____ B. Bridge Owner's response.

____ ____ C. Bridge Owner's Plan of Action.

____ ____ D. Actions taken/repairs made by bridge owner to address findings.

____ ____ E. Bridge inspection reports, (SI&A data, electronic or paper).

____ ____ F. Notation of any action taken to address the inspection findings.

____ ____ G. Historical records (previous SI&A data, electronic or paper).

____ ____ H. As built plans (electronic or paper).

____ ____ I. Correspondence and documentation of communications concerning load posting, closure or repair including correspondence related to compliance.

____ ____ J. Load Rating calculations.

For Bridge # _____

____ ____ A. Critical Finding Report.
____ ____ B. Bridge Owner's response.
____ ____ C. Bridge Owner's Plan of Action.
____ ____ D. Actions taken/repairs made by bridge owner to address findings.
____ ____ E. Bridge inspection reports, (SI&A data, electronic or paper).
____ ____ F. Notation of any action taken to address the inspection findings.
____ ____ G. Historical records (previous SI&A data, electronic or paper).
____ ____ H. As built plans (electronic or paper).
____ ____ I. Correspondence and documentation of communications concerning load posting, closure or repair including correspondence related to compliance.
____ ____ J. Load Rating calculations.

For Bridge # _____

____ ____ A. Critical Finding Report.
____ ____ B. Bridge Owner's response.
____ ____ C. Bridge Owner's Plan of Action.
____ ____ D. Actions taken/repairs made by bridge owner to address findings.
____ ____ E. Bridge inspection reports, (SI&A data, electronic or paper).
____ ____ F. Notation of any action taken to address the inspection findings.
____ ____ G. Historical records (previous SI&A data, electronic or paper).
____ ____ H. As built plans (electronic or paper).
____ ____ I. Correspondence and documentation of communications concerning load posting, closure or repair including correspondence related to compliance.
____ ____ J. Load Rating calculations.

When an error or lack of data is identified, additional records of this type will be reviewed to determine if the issue is systemic.

Review the County Quality Control File for the following list and select sites for field visit. At the site make digital photographs to document condition of signs and barriers. When problems are identified, the FHWA Division Office will be contacted by phone for further instructions. The investigation may be expanded as instructed by FHWA. Document and report all findings.

YES NO

___ ___ Current list of Bridges Requiring **LOAD POSTING** and do not have signs in place during the inspection.

___ ___ Current list of bridges which have posting signs in place but are NOT currently recommended for posting by the County Engineer. Has the Supervisor specifically placed this sign here for a purpose? Or, has it been accidentally left in place after a repair and/or bridge replacement? Document the status for each one. If a sign is up it is legally posted and limits the weight of all vehicles. This can cause problems for routing county school busses.

___ ___ Current list of Bridges which have posting signs in place at a lower weight limit than that recommended by the county engineer. This can cause problems for routing county school busses.

For Bridge # _____

___ ___ A. Are signs now in place at both approaches?
___ ___ B. Do both signs now have the correct load limit?
___ ___ C. Do the signs now conform to the current State Aid and MUTCD requirements?

For Bridge # _____

___ ___ A. Are signs now in place at both approaches?
___ ___ B. Do both signs now have the correct load limit?
___ ___ C. Do the signs now conform to the current State Aid and MUTCD requirements?

For Bridge # _____

___ ___ A. Are signs now in place at both approaches?
___ ___ B. Do both signs now have the correct load limit?
___ ___ C. Do the signs now conform to the current State Aid and MUTCD requirements?

When an error or lack of data is identified, additional records of this type may be reviewed to determine if the issue is systemic.

Review the County Quality Control File for the following list and select sites for field visit.

YES NO
____ ____ Current list of Bridges **RECOMMENDED TO BE CLOSED**.

At the site make digital photographs to document condition of signs and barriers. When problems are identified, the FHWA Division Office will be contacted by phone for further guidance. The investigation may be expanded as instructed by FHWA. Document and report all findings.

An adequate Type III Sign Barricade must be:

1. Permanent & unmovable (firmly affixed to the ground).
2. Extend across the entire roadway.
3. Located immediately adjacent to the Structurally Sound Barrier.
3. Red & white striped (orange is for a temporary construction zone).

An adequate Structurally Sound Barrier must be:

1. Permanent & unmovable (firmly affixed to the ground).
2. Extend across the entire roadway
3. Located immediately adjacent to the end span of the bridge.
4. Capable of stopping a moving vehicle. Examples include:
    A. Earthen berm impact attenuator.
    B. Concrete Jersey Barrier Rail (attached to the ground).
    C. Removal of the approach roadway ramp.
    D. Removal of the bridge deck (with other barrier).
    E. Removal of at least on span of the bridge (with another barrier).
    F. Trench cut across the roadway (with another barrier).

For Bridge # __________
____ ____ A. Adequate Type III sign barricade.
____ ____ B. Bridge Closed sign in place on top of the Type III sign barricade.
____ ____ C. Adequate Structurally Sound Barrier in place.
____ ____ D. Evidence that vehicles have passed around or over the Barrier.

For Bridge # __________
____ ____ A. Adequate Type III sign barricade.
____ ____ B. Bridge Closed sign in place on top of the Type III sign barricade.
____ ____ C. Adequate Structurally Sound Barrier in place.
____ ____ D. Evidence that vehicles have passed around or over the Barrier.

For Bridge # __________
____ ____ A. Adequate Type III sign barricade.
____ ____ B. Bridge Closed sign in place on top of the Type III sign barricade.
____ ____ C. Adequate Structurally Sound Barrier in place.
____ ____ D. Evidence that vehicles have passed around or over the Barrier.

When an error or lack of data is identified, additional records of this type will be reviewed to determine if the issue is systemic.

APPENDIX F

INSPECTION FORMS

INTERIM

OSARC STANDARD BRIDGE INSPECTION FORM

COUNTY_____

STRUCTURE NUMBER: _____ INSPECTION DATE: _____

GENERAL INFORMATION:

Inspection Type: Initial: ____ Routine____ In-Depth___ Damage____ Special___
Facility Carried (7): _____
Feature Intersected (6): _____
Location (9): _____
Last Inspection Date _____ Inspection Freq (91): _____ mo

FRACTURE CRITICAL: Yes___ No___
FRACTURE CRITICAL MEMBER: _____
TEMPORARY STRUCTURE: Yes____ No___ _____

BRIDGE ENDS:
Bridge Open/Posted/Closed (41): _____
Posting Signs: Required: Yes___ No___ In Place: Yes____ No_____

		Comments **(G=good, F=fair, P=poor, C=Critical)**
Bridge Rail	(36a): ___	G____ F____ P____ C____
Rail Transitions	(36b): ___	G____ F____ P____ C____
Approach G'Rail	(36c): ___	G____ F____ P____ C____
Guard Rail Ends	(36d): ___	G____ F____ P____ C____

Bridge Ends General Comments:
_____
_____
_____

DECK DESCRIPTIVE CONDITIONS
(G=good; F=fair; P=poor; C=critical)

Joints: G___F___P___C____ _____
Drains: G___F___P___C____ _____
Rail: G___F___P___C____ _____
Sidewalks: G___F___P___C____ _____
Live Load Deflection/
Vibration: Light: ____ Moderate: ____ Severe_____ _____
Debris Accumulation: Light: ____ Moderate: ____ Severe_____ _____
Overall Structural: G___F___P___C____ _____
Surface Roughness Rating: 1(Poor) ____ 2(Average) ____ 3(Smooth) ____

NBI Deck Condition (58) _____
Deck General Comments:
_____
_____
_____

SUPERSTRUCTURE DESCRIPTIVE CONDITIONS:
(**G=good; F=fair; P=poor; C=critical)**

Girders: G___F___P___C___ _____
Diaphragms: G___F___P___C___ _____
Stringers: G___F___P___C___ _____
Floor Beams: G___F___P___C___ _____
Sway Bracing: G___F___P___C___ _____
Hinge Pins/
Hangers: G___F___P___C___ _____
Paint: G___F___P___C___ _____
Cap/Girder Debris: Light ____ Moderate ____ Severe ____ _____
Collision Damage: Yes ____ No ____ _____
Have Flood Waters Reached Superstructure? Yes ____No ____ _____

NBI Superstructure Rating (59): ___ _____

General Superstructure Comments: _____
_____
_____
_____
_____
_____
_____

SUBSTRUCTURE DESCRIPTIVE CONDITIONS:
(**G=good; F=fair; P=poor; C=critical)**

ABUTMENTS

Bearings G___F___P___C___ _____
Cap G___F___P___C___ _____
Piling/Foundations G___F___P___C___ _____
Pile Type(s) _____
Back Wall G___F___P___C___ _____
Wing walls G___F___P___C___ _____
Embankment G___F___P___C___ _____
Slope Protection G___F___P___C___ _____
Scour Light____ Moderate ____ Severe ____ _____

INTERMEDIATE BENTS

Bearings G___F___P___C___ _____
Cap G___F___P___C___ _____
Columns/Piles G___F___P___C___ _____
Pile Type(s) _____
Footings G___F___P___C___ _____
Web Walls G___F___P___C___ _____
Bracing G___F___P___C___ _____
Scour Light____ Moderate ____ Severe ____ _____

Underwater Inspection Required (92B): ___- _____
NBI Substructure Rating (60): ___- _____

General Substructure Comments:

_____
_____
_____
_____
_____
_____
_____

SCOUR / WATERWAY APPRAISAL

Scour Critical Bridge (113): _____ Scour Indicator _____
Scour Countermeasures in Place: Yes ___ No ___
Debris/Drift: Upstream: _____ Site: _____ Downstream: _____
Overall Channel Condition: _____
Indications that High Waters Overtop Structure and/or Approach Roadway:
Yes____ No _____ Rarely ____ Frequently_____ Unknown_____
Waterway Adequacy (71):_____ Route Functional Classification (26):___
NBI Channel/Channel Protection Rating (61):_____

General Waterway/Scour Comments:

_____
_____
_____

INSPECTION TEAM SUMMARY:

_____
_____
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_____

Team Leader: _____ Signature: _____
Date: _____

OSARC STANDARD BRIDGE INSPECTION FORM
COUNTY_____
STRUCTURE NUMBER_____ INSPECTION DATE: _____

GENERAL INFORMATION:

Inspection Type: Initial: ____ Routine ____ In-Depth ____ Damage ____ Special ____
Bridge ID: _____
Facility Carried (7): _____
Feature Intersected (6): _____
Location (9): _____
Last Inspection Date: _____ Inspection Freq (91):_____ mo
Time:_____ Weather: _____
Team Members: _____

FRACTURE CRITICAL: Yes___ No___
FRACTURE CRITICAL MEMBER _____
TEMPORARY STRUCTURE: Yes___ No ___; _____

BRIDGE ENDS:

SIGNING:

Bridge Open/Posted/Closed (41): _____
Posting Signs Required: Yes___ No___ In Place: Yes____ No_____

Posted Weight Limits:	Required	In Place
H Truck (Tons)	_____	Yes___ No___
HS Long (Tons)	_____	Yes___ No___
HS Short (Tons)	_____	Yes___ No___
Tandem (lbs)	_____	Yes___ No___

Bridge End Markers Required: Yes___ No___ In Place: Yes___ No ___

TRAFFIC SAFETY FEATURES
(G=good, F=fair, P=poor, C=critical)
Comments

Bridge Rail (36a)	____	G___F___P___C___	_____
Rail Transitions (36b):	____	G___F___P___C___	_____
Approach G'Rail (36c)	____	G___F___P___C___	_____
Guard Rail Ends (36d)	____	G___F___P___C___	_____

Approach Roadway Alignment (72): _____

Bridge Ends General Comments:
_____
_____
_____
_____

DECK

GEOMETRY

Appr. Rdwy. Width (32): _____ m_____ Median (33): _____
Deck Rdwy. Width (c to c) (51): _____ m_____ Flare (35): _____
Deck Width (out to out) (52): _____ m_____ Skew (34): _____
Deck Geometry (68): _____ No. of Lanes: On (28a): ___ Under (28b):___
Curb/Sidewalk Width: Left (50a): _____ m _____ Right (50b): _____ m _____
Min. Vert. Clear Over Bridge Rdwy (53): ____ m_____
Min. Vert. Clear – Inv Rt. (10): _____ m___Min Horiz – Inv Rt. (47):____ m ____
Bypass Length (19): _____km. Parallel Structure (101): _____
Type of Service On (42a): _____ Under (42b): _____

DESCRIPTIVE CONDITIONS
(G=good, F=fair, P=poor, C=critical)

Joints: G___F___P___C___ _____
Drains: G___F___P___C___ _____
Rail: G___F___P___C___ _____
Sidewalks: G___F___P___C___ _____
Live Load Deflection/
Vibration: Light _____ Moderate _____ Severe _____ _____
Debris Accumulation: Light _____ Moderate _____ Severe _____ _____
Overall Structural: G___F___P___C___ _____
Surface Roughness Rating: 1 (Poor) ____ 2 (Average) ____ 3 (Smooth) ____

NBI Deck Condition (58) _____

Deck General Comments:
_____
_____
_____
_____
_____
_____
_____

SUPERSTRUCTURE

GEOMETRY

Structure Length (49): _____ m
Main Span Unit:
Material Type (43a):_____
Design Type (43b): _____
Spans in Main Unit (45):_____

Max Span Length (48):_____ m
Approach Span Unit:
Material Type (44a):_____
Design Type (44b): _____
Spans in Appr (46):_____

Min Vert Underclear (54b):____ m___

Ref Feature (54a): _____
Ref Feature (55a):_____

Min Horiz Underclear
Left (56): _____ m _____
Right (55b):_____ m _____

Under Clear. Rating (69): _____

DESCRIPTIVE CONDITIONS:
(**G=good; F=fair; P=poor; C=Critical)**

Girders: G___F___P___C ___ _____
Diaphragms: G___F___P___C ___ _____
Stringers: G___F___P___C ___ _____
Floor Beams: G___F___P___C ___ _____
Sway Bracing: G___F___P___C ___ _____
Hinge Pins/
Hangers: G___F___P___C ___ _____
Paint: G___F___P___C ___ _____
Cap/Girder Debris: Light____ Moderate ____ Severe ____ _____
Collision Damage: Yes _____ No _____ _____
Have Flood Waters Reached Superstructure? Yes _____ No _____

NBI Superstructure Rating (59): ___ _____

General Superstructure Comments:

_____
_____
_____
_____
_____
_____

SUBSTRUCTURE

Navigation Control (38): _____ Nav. Vert. Clear (39): ___ m_____
Nav. Horz. Clear (40): ____ m _____ Pier Protection (111): _____

DESCRIPTIVE CONDITIONS
(G=good; F=fair; P=poor; C=Critical)

ABUTMENTS

Bearings:	G___F___P___C ___ _____
Cap:	G___F___P___C ___ _____
Piling/Foundation:	G___F___P___C ___ _____
Back Wall:	G___F___P___C ___ _____
Wing Walls:	G___F___P___C ___ _____
Embankment:	G___F___P___C ___ _____
Slope Protection:	G___F___P___C ___ _____
Scour:	Light ___ Moderate ___ Severe ___ _____
Pile Type(s):	_____

INTERMEDIATE BENTS

Bearings:	G___F___P___C ___ _____
Cap:	G___F___P___C ___ _____
Columns/Piles:	G___F___P___C ___ _____
Footings:	G___F___P___C ___ _____
Web Walls:	G___F___P___C ___ _____
Bracing:	G___F___P___C ___ _____
Scour:	Light ___ Moderate ___ Severe ___ _____
Pile Type(s):	_____

High Water Mark: Yes____ No_____

Underwater Inspection Required (92b): ___- _____
NBI Substructure Rating (60): ___-_____

General Substructure Comments:
_____
_____
_____
_____
_____
_____

SCOUR / WATERWAY APPRAISAL

Scour Critical Bridge (113): _____ Scour Indicator: _____
Unknown Foundation: _____
Scour Countermeasures in Place: Yes ___ No ___
If Yes, Condition: _____
Streambed Material: _____ Has Channel Shifted: Yes___ No ___
Stream Velocity: Dry___ Low ___ Medium ____ High _____
Overall Channel Condition: _____
Bank Erosion: Upstream: _____ Site: _____ Downstream: _____
Bank Vegetation: _____
Debris/Drift: Upstream: _____ Site: _____ Downstream: _____
Bank Protection: _____
Sediment and/or Gravel Accumulation: _____
Streambed Aggradations: Yes __ No ___ Streambed Degradation: Yes___ No___
Realignment of Channel: Yes ___ No ___ Unknown ___
Obstructions in the Waterway: _____
Abutment(s) Encroach in Channel: Yes___ No ___
Indications of Scour: Yes ___ No ___
If Yes, Location and Description: _____
Indications that High Waters Overtop Structure and/or Approach Roadway:
Yes____ No _____ Rarely ____ Frequently_____ Unknown_____
Waterway Adequacy (71) _____
Route Functional Classification (see NBI item 26) _____

NBI Channel/Channel Protection Rating (61): _____

General Scour/Waterway Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

INSPECTION TEAM SUMMARY

Team Leader: _____ Signature: _____
Date: _____

OSARC STANDARD TRUSS INSPECTION FORM
COUNTY_____
STRUCTURE NUMBER_____ INSPECTION DATE: _____

GENERAL INFORMATION:

Inspection Type: Initial ____ Routine____ In-Depth _____ Damage ____ Special ____
Bridge ID: _____
Facility Carried (7): _____
Feature Intersected (6): _____
Location (9): _____
Last Inspection Date: _____ Inspection Freq (91):_____ mo
Time:_____ Weather: _____
Team Members: _____

FRACTURE CRITICAL: Yes___ No___
FRACTURE CRITICAL MEMBER:_____
TEMPORARY STRUCTURE: Yes____ No___ _____

BRIDGE ENDS:

SIGNING:

Bridge Open/Posted/Closed (41): _____
Posting Signs Required: Yes___ No___ In Place: Yes____ No_____

Posted Weight Limits:	Required	In Place
H Truck (Tons)	_____	Yes___ No___
HS Long (Tons)	_____	Yes___ No___
HS Short (Tons)	_____	Yes___ No___
Tandem (lbs)	_____	Yes___ No___

Bridge End Markers Required: Yes___ No___ In Place: Yes___ No ___

TRAFFIC SAFETY FEATURES

(G=good. F=fair, P=poor, C=critical)		Comments
Bridge Rail (36a):	____	G___F___P___C___ _____
Rail Transitions (36b):	____	G___F___P___C___ _____
Approach G'Rail (36c):	____	G___F___P___C___ _____
Guard Rail Ends (36d):	____	G___F___P___C___ _____

Approach Roadway Alignment (72):_____

Bridge Ends General Comments:
_____
_____
_____

DECK

GEOMETRY

Appr Rdwy Width (32): _____ m _____ Median (33):_____
Deck Rdwy Width (c to c) (51):_____ m_____ Flare (35): _____
Deck Width (out to out) (52) _____ m_____ Skew (34) _____
Deck Geometry (68):_____ No. of Lanes: On (28a): ___ Under (28b):___
Curb/Sidewalk Width: Left (50a):_____ m _____ Right (50b):_____ ft _____
Min Vert Clear Over Bridge Rdwy (53):____ m_____
Min Vert Clear – Inv Rt. (10):____ m___ Min Horiz – Inv Rt. (47):____ m ____
Bypass Length (19):_____km. Parallel Structure (101): _____
Type of Service On (42a): _____ Under (42b): _____

DESCRIPTIVE CONDITIONS
(G=good, F=fair, P=poor, C=critical)

Joints: G___F___P___C___ _____
Drains: G___F___P___C___ _____
Rail: G___F___P___C___ _____
Sidewalks: G___F___P___C___ _____
Live Load Deflection/
Vibration: Light ____ Moderate _____ Severe _____
Debris Accumulation: Light ____ Moderate _____ Severe _____
Overall Structural: G___F___P___C___ _____
Surface Roughness Rating: 1(Poor) ____ 2 (Average) ____ 3 (Smooth) ____

NBI Deck Condition (58) _____

Deck General Comments:

_____
_____
_____
_____
_____
_____
_____

SUPERSTRUCTURE – NONE TRUSS PORTION

GEOMETRY

Structure Length (49):_____ m Max Span Length (48): _____m

Main Span Unit
Material Type (43a):_____
Design Type (43b): _____
Spans in Main Unit (45): _____

Approach Span Unit
Material Type (44a): _____
Design Type (44b): _____
Spans in Appr (46 _____

Min Vert Underclear (54b):_____ m____ Ref Feature (54a): _____
Ref Feature (55a): _____

Min Horiz Underclear
Left (56): _____ m_____ Right (55b):_____ m _____

Under Clear. Rating (69): _____

DESCRIPTIVE CONDITIONS:
(**G=good; F=fair; P=poor; C=Critical)**

Girders: G___F___P___C ___ _____
Diaphragms: G___F___P___C ___ _____
Stringers: G___F___P___C ___ _____
Floor Beams: G___F___P___C ___ _____
Sway Bracing: G___F___P___C ___ _____
Hinge Pins/
Hangers: G___F___P___C ___ _____
Paint: G___F___P___C ___ _____
Cap/Girder Debris: Light _____ Moderate _____ Severe _____
Collision Damage: Yes _____No _____
Have Flood Waters Reached Superstructure? Yes _____No _____

NBI Superstructure Rating (59): ___ _____

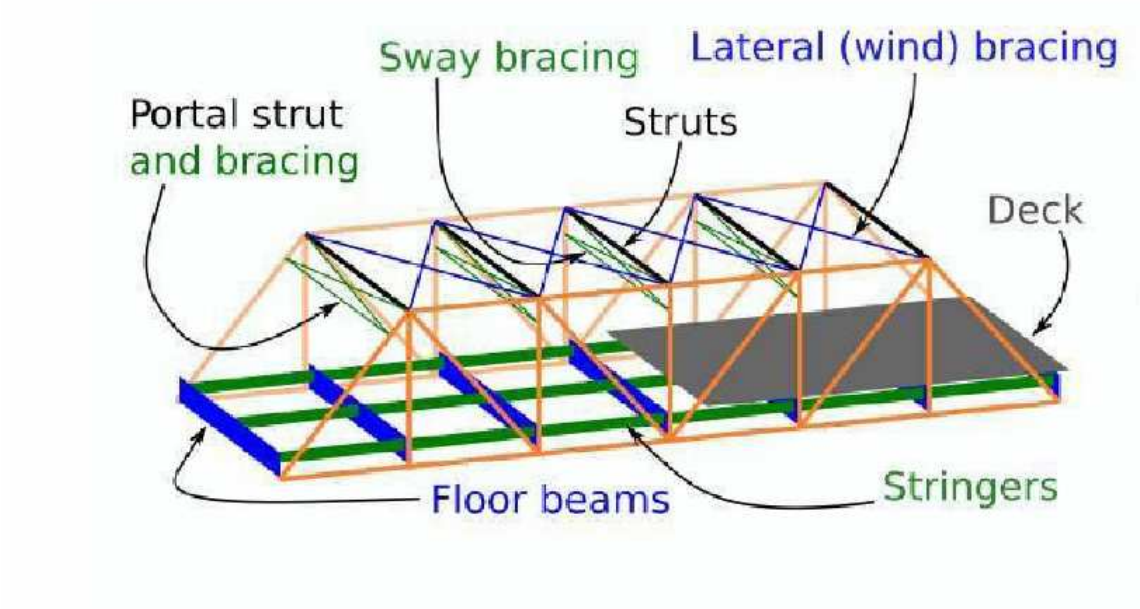
General Superstructure Comments:

_____
_____
_____
_____
_____

OSARC STANDARD TRUSS INSPECTION FORM

Structure Number:_____ Inspection Date:_____

TRUSS



DESCRIPTIVE CONDITIONS:
(**G=good; F=fair; P=poor; C=Critical)**

End Posts:	G___F___P___C___	_____
Portals:	G___F___P___C___	_____
Chords- Top:	G___F___P___C___	_____
Chords – Bottom:	G___F___P___C___	_____
Verticals:	G___F___P___C___	_____
Diagonals:	G___F___P___C___	_____
Sway Bracing:	G___F___P___C___	_____
Top Lateral Struts:	G___F___P___C___	_____
Top Lateral "X" Bracing:	G___F___P___C___	_____
Bottom Laterals:	G___F___P___C___	_____

General Truss Comments:

_____
_____
_____
_____
_____
_____

SUBSTRUCTURE

Navigation Control (38): _____ Nav. Vert. Clear (39): ___ m_____
Nav. Horz. Clear (40): ____ m _____ Pier Protection (111): _____

DESCRIPTIVE CONDITIONS
G=good; F=fair; P=poor; C=Critical)

ABUTMENTS

Bearings:	G___F___P___C ___ _____
Cap:	G___F___P___C ___ _____
Piling/Foundation:	G___F___P___C ___ _____
Back Wall:	G___F___P___C ___ _____
Wing Walls:	G___F___P___C ___ _____
Embankment:	G___F___P___C ___ _____
Slope Protection:	G___F___P___C ___ _____
Scour:	Light ____ Moderate _____ Severe _____
Pile Type(s):	_____

INTERMEDIATE BENTS

Bearings:	G___F___P___C ___ _____
Caps:	G___F___P___C ___ _____
Columns/Piles:	G___F___P___C ___ _____
Footings:	G___F___P___C ___ _____
Web Walls:	G___F___P___C ___ _____
Bracing:	G___F___P___C ___ _____
Scour:	Light ____ Moderate _____ Severe _____
Pile Type(s):	_____

High Water Mark: Yes____ No_____

Underwater Inspection Required (92b): ___- _____
NBI Substructure Rating (60): ___-_____

General Substructure Comments:
_____
_____
_____
_____
_____
_____
_____
_____

SCOUR / WATERWAY APPRAISAL

Scour Critical Bridge (113): _____ Scour Indicator: _____
Unknown Foundation: _____
Scour Countermeasures in Place: Yes ___ No ___
If Yes, Condition: _____
Streambed Material: _____ Has Channel Shifted: Yes___ No ___
Stream Velocity: Dry___ Low ___ Medium ____ High _____
Overall Channel Condition: _____
Bank Erosion: Upstream: _____ Site: _____ Downstream: _____
Bank Vegetation: _____
Debris/Drift: Upstream: _____ Site: _____ Downstream: _____
Bank Protection: _____
Sediment and/or Gravel Accumulation: _____
Streambed Aggradations: Yes __ No ___ Streambed Degradation: Yes___ No___
Realignment of Channel: Yes ___ No ___ Unknown ___
Obstructions in the Waterway: _____
Abutment(s) Encroach in Channel: Yes___ No ___
Indications of Scour: Yes ___ No ___
If Yes, Location and Description: _____
Indications that High Waters Overtop Structure and/or Approach Roadway:
Yes___ No ___ Rarely ___ Frequently___ Unknown ___
Waterway Adequacy (71): _____
Route Functional Classification (see NBI item 26): _____

NBI Channel/ Channel Protection Rating (61): _____

General Scour/Waterway Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

INSPECTION TEAM SUMMARY

Team Leader: _____ Signature: _____
Date: _____

OSARC STANDARD BOX BRIDGE INSPECTION FORM
COUNTY_____
STRUCTURE NUMBER_____ INSPECTION DATE: _____

GENERAL INFORMATION:

Inspection Type: Initial ____ Routine____ In-Depth____ Damage____ Special_____
Bridge ID: _____
Facility Carried (7): _____
Feature Intersected (6): _____
Location (9): _____
Last Inspection Date: _____ Inspection Freq (91):_____ mo
Time: _____ Weather: _____
Team Members: _____
FRACTURE CRITICAL: Yes___ No___
FRACTURE CRITICAL MEMBER: _____
TEMPORARY STRUCTURE: Yes___ No ___ _____

SIGNING

Bridge Open/Posted/Closed (41): _____

Posting Signs Required: Yes___ No___ In Place: Yes____ No_____

Posted Weight Limits:	Required	In Place
H Truck (Tons)	_____	Yes___ No__
HS Long (Tons)	_____	Yes___ No___
HS Short (Tons)	_____	Yes___ No___
Tandem (lbs)	_____	Yes___ No___

Bridge End Markers Required: Yes___ No___ In Place: Yes___ No ___
Other: Required: Yes ___ No ___ In Place: Yes ___ No ___

TRAFFIC SAFETY FEATURES
(G=good, F=fair, P=poor, C=critical)
Comments

Bridge Rail (36a):	____	G___F___P___C___	_____
Rail Transitions (36b):	____	G___F___P___C___	_____
Approach G'Rail (36c):	____	G___F___P___C___	_____
Guard Rail Ends (36d):	____	G___F___P___C___	_____
Appr Roadway Condition:		G___F___P___C___	_____

Approach Roadway Alignment (72): _____

OSARC STANDARD BOX BRIDGE INSPECTION FORM

Structure Number:_____ Inspection Date:_____

GEOMETRY

Appr Rdwy Width (32): _____ m Median (33):____ m Skew (34): _____
Flare (35): ____ Min Vert Clear-Inv Route (10): _____ m ____
Min Horz. Clear – Inv Route (47): ____ m____ Bypass Length (19): ____ km____
Number of Lanes On (28a): ___ Parallel Structure (101): _____
Main Span Material (43a): _____ Main Span Design (43b): _____
Spans in Main unit (45):___ Str. Length (49): ___m Max Span Length (48): __m
Fill Height:____ m Barrel Length:____ m Cell Height:____m Cell Width:____ m
If Applicable**:**
Deck Width (c to c) (51): ___ m Deck Width (out to out) (52):_____ m
Curb/Sidewalk Left (50a):___ m Curb/Sidewalk Right (50b): _____m
Deck Geometry (68): _____

DESCRIPTIVE CONDITION

(G=good, F=fair, P=poor, C=critical)

Structural Condition: G___F___P___C___ _____
Sidewalks: G___F___P___C___ _____
Live Load
Deflection/ Vibration: Light _____ Moderate _____ Severe _____
Debris Accumulation: Light _____ Moderate _____ Severe _____
Condition Cell 1: G___F___P___C___ _____
Condition Cell 2: G___F___P___C___ _____
Condition Cell 3: G___F___P___C___ _____
Condition Cell 4: G___F___P___C___ _____
Condition Cell 5: G___F___P___C___ _____
Condition Cell 6: G___F___P___C___ _____
Upstream Apron/Wingwalls: G___F___P___C___ _____
Down Str. Apron/Wingwalls: G___F___P___C___ _____

NBI Culvert Rating (62) ____- _____

General Box Bridge Comments:

_____
_____
_____
_____
_____
_____

SCOUR / WATERWAY APPRAISAL

Scour Critical Bridge (113): _____ Scour Indicator: _____
Unknown Foundation: _____
Scour Countermeasures in Place: Yes ___ No ___
If Yes, Condition: _____
Streambed Material: _____ Has Channel Shifted: Yes__ No __
Stream Velocity: Dry___ Low ___ Medium ____ High _____
Overall Channel Condition: _____
Bank Erosion: Upstream: _____ Site: _____ Downstream: _____
Bank Vegetation: _____
Debris/Drift: Upstream: _____ Site: _____ Downstream: _____
Bank Protection: _____
Sediment and/or Gravel Accumulation: _____
Streambed Aggradations: Yes __ No ___ Streambed Degradation: Yes___ No___
Realignment of Channel: Yes ___ No ___ Unknown ___
Obstructions in the Waterway: _____
Abutment(s) Encroach in Channel: Yes___ No ___
Indications of Scour: Yes ___ No ___
If Yes, Location and Description: _____
Indications that High Waters Overtop Structure and/or Approach Roadway:
Yes____ No _____ Rarely __ Frequently___ Unknown___
Waterway Adequacy (71): _____
Route Functional Classification (see NBI item 26): _____
NBI Channel/ Channel Protection Rating (61): _____

General Scour/Waterway Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

OSARC STANDARD BOX BRIDGE INSPECTION FORM

Structure Number:_____ Inspection Date:_____ page 4 of 4

INSPECTION TEAM SUMMARY

Team Leader: _____ Signature: _____
Date: _____

REPORT OF CRITICAL FINDINGS

DATE: _____

STRUCTURE NUMBER: _____
FEATURE INTERSECTED: _____
ROAD CARRIED: _____
LOCATION: _____
STRUCTURE SIZE AND TYPE: _____
INSPECTOR (Name, Organization, telephone, e-mail): _____

CRITICAL FINDINGS (include sketches, photos, and any other relevant data):

_____
_____
_____
_____
_____
_____
_____

ACTIONS TAKEN:

___BRIDGE CLOSED TIME AND DATE_____
___ SIGNS AND DETOUR IN PLACE

___REPAIRS MADE (include sketches, photos, etc.) _____
_____
_____
_____

OWNER NOTIFIED _____ (Yes) _____(No)

PERSON CONTACTED (Name and Organization, time and date)

_____
_____
_____

OSARC FRACTURE CRITICAL INSPECTION FORM
COUNTY_____
STRUCTURE NUMBER_____ INSPECTION DATE: _____

<u>NOTE:</u> THIS FORM IS REQUIRED AS A SUPPLEMENT TO THE STANDARD INSPECTION FORM FOR FRACTURE CRITICAL INSPECTIONS.

Component (Member Inspected)	General Location (of member)	Specific Location (of member)	Inspection Comments: Report results of inspection at each location. If no defects found, record "OK" to indicate member was inspected.

Inspection Comments: (Report Inspection findings such as types of defects found and their locations)

_____
_____
_____
_____
_____
_____
_____

Recommendations: (Provide repair and inspection recommendations)

_____
_____
_____
_____
_____
_____
_____
_____

OSARC FRACTURE CRITICAL INSPECTION FORM

Structure Number:_____ Inspection Date:_____ page 2 of 2

Use this form to provide a drawing or plan identifying fracture critical and non fracture critical tension members. Use multiple pages if necessary.

Page: _____ of _____

Team Leader: _____ Signature: _____
Date: _____

APPENDIX G

LRFR LOAD RATING IMPLEMENTATION GUIDELINES

MISSISSIPPI DEPARTMENT OF TRANSPORTATION- OFFICE OF STATE AID ROAD CONSTRUCTION

IMPLEMENTATION GUIDELINES FOR LOAD AND RESISTANCE FACTOR RATING (LRFR) OF HIGHWAY BRIDGES

April 24, 2009

Prepared By:

Bala Sivakumar, P.E.
HNTB Corporation, New York

Prepared For:

Federal Highway Administration

Table of Contents

CONTENTS **PAGE**

SECTION 1 INTRODUCTION AND GENERAL OVERVIEW

1.1 INTRODUCTION

Bridge load rating is the determination of the live load carrying capacity of a newly designed or existing bridge. Load ratings are typically determined by analytical methods based on information taken from bridge plans supplemented by information gathered from field inspections or field testing. Knowledge of the capacity of each bridge to carry loads is critical for several reasons, including (but not limited to) the following:

- To determine which structures have substandard load capacities that may require posting or other remedial action.
- To assist in the most effective use of available resources for rehabilitation or replacement.
- To assist in the overload permit review process.
- FHWA requires that bridge load ratings be submitted to them annually. The NBIS (Title 23, Code of Federal Regulations, Section 650.313 (c)), requires that load ratings be in accordance with the latest AASHTO Manual. The results are used in conjunction with other bridge inventory and inspection information to determine the Federal Bridge Sufficiency Rating.

1.2 PURPOSE OF THIS DOCUMENT

This document was developed using the American Association of State Highway Officials **AASHTO 2008** ***Manual for Bridge Evaluation***, hereinafter referred to as the MBE. This document provides guidance to load rating engineers for performing and submitting load rating calculations, posting bridges for load restrictions, and checking overweight permits using the LRFR methodology. The procedures stated in this document are to provide guidelines that will result in consistent and reproducible load rating inputs and deliverables. This document serves as a supplement to the AASHTO MBE and deals primarily with the Office of State Aid Road Construction, hereinafter referred to as STATE AID specific load rating requirements, interpretations, and policy decisions.

1.3 LOAD AND RESISTANCE FACTOR RATING METHODOLOGY

Load and Resistance Factor Rating is consistent with the LRFD Specifications in using a reliability-based limit states philosophy and extends the provisions of the LRFD Specifications to the areas of inspection, load rating, posting and permit rules, fatigue evaluation, and load testing of existing bridges. The LRFR methodology has been developed to provide uniform reliability in bridge load ratings, load postings and permit decisions. The LRFR procedures provide live load factors for load rating that have been calibrated to provide a uniform and acceptable level of reliability.

1.4 GENERAL LOAD RATING EQUATION

The general rating equation in LRFR (MBE Eq. 6A.4.2.1-1) is given as:

$$RF = \frac{\phi_c \, \phi_s \, \phi \, R_n - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_p)(P)}{(\gamma_L)(LL + IM)}$$

In the LRFR Rating Factor equation:

RF = Rating Factor
R_n = Nominal member resistance (as inspected)
ϕ_c = Condition Factor (Section 3.3)
ϕ_s = System Factor (Section 3.3)
ϕ = LRFD Resistance Factor
DC = Dead load effect due to structural components and attachments
DW = Dead load effect due to wearing surface and utilities
P = Permanent loads other than dead loads (secondary prestressing effects, etc.)
LL = Live load effect of the rating vehicle
IM = Dynamic load allowance (Section 3.2)
γ_{DC} = LRFD load factor for structural components and attachments
γ_{DW} = LRFD load factor for wearing surfaces and utilities
γ_p = LRFD load factor for permanent loads other than dead loads
γ_L = Evaluation live load factor for the rating vehicle (Section 3.2)

The load and resistance factors for evaluation are as provided in MBE Section 6 and Sections 3.2 and 3.3 of this document

SECTION 2 GENERAL LOAD RATING REQUIREMENTS

2.1 LOAD RATING REQUIREMENTS

2.1.1 New or Reconstructed Bridges

Load ratings by the LRFR method, for the live load models defined in Section 3.2 of this document, are required for all new and replacement bridges, and for all rehabilitation and repair designs involving a substantial structural alteration.. LRFR Load rating calculations shall be performed as part of the design process and reflect the bridge as-built or as-rehabilitated. Load rating does not include the future wearing surface as a dead load because it is not part of the as-built condition. When ratings are performed in conjunction with the preparation of design drawings, the load rating results shall be shown on the structural drawings following the structural notes for all new, replaced and rehabilitated bridge projects (STATE AID requires a table summarizing the load rating results for HL-93 and/or certain legal loads and standard permit loads be shown on the bridge plans). Also, the Load Rating Summary Sheet (see Pgs 26 & 27) and the electronic input file for use in future re-analyses shall be created by the Design Engineer in accordance with the requirements of Section 2.5 of this document, in a format prescribed by State Aid.

2.1.2 Existing Bridges

The load rating engineer shall review the bridge file after each inspection to see if a reanalysis is required. If re-analysis is required, documentation of the re-analysis will be provided in the Bridge Record. A re-rating will be necessary, unless STATE AID concurs that a new analysis is not required, if any of the following have occurred since the last load rating was completed:

- The primary member condition rating has changed to 5 or below.
- Dead load has changed due to resurfacing or other non-structural alterations such as utilities.
- Section properties have changed due to deterioration, rehabilitation, re-decking or other alterations.
- Damage due to vessel or vehicular hits.
- Cracking in primary members.
- Losses at critical connections.
- Significant changes in traffic loadings, traffic volume.
- Specification changes.
- Issuance of overweight permits.
- Bridge is under construction.
- Soil and substructure settlement and slope stability.
- Any condition that an inspector, load rating engineer, or STATE AID determines to require re-rating.

2.2 QUALIFICATIONS AND RESPONSIBILITIES

The engineering expertise necessary to properly evaluate a bridge varies widely with the complexity of the bridge. Evaluation in accordance with this Manual shall be performed and checked by suitably qualified engineers in the type of bridges being load rated. It is expected that load rating engineers using LRFR will have a working knowledge of the LRFD Specifications. Engineers involved in calculating or checking LRFR load ratings should take the NHI LRFR load rating course (Course No 130092) prior to performing load rating in accordance with this document. Load rating analysis is an engineering evaluation that shall be dated, signed and sealed by a licensed professional engineer.

STATE AID has designated a licensed professional engineer to be in charge of the statewide load rating program. All questions relating to the implementation of this document shall be directed to the designated engineer.

A-1 2.3 ELEMENTS TO BE LOAD RATED

Load rating will include analysis of the following items:

- All elements defined as “primary members” as well as stringer-floorbeam, girder-floorbeam connections, and truss connections.
- Capacity of gusset plates and connection elements for non-redundant steel truss bridges
- Other connections of non-redundant systems.
- Timber and metal bridge decks.
- Concrete decks on non-redundant systems.
- Timber and metal piers elements (See Appendix A).
- Integrated hammerhead
- Pile bent elements.

It is not necessary to analyze concrete bridge decks on redundant stringers provided they do not affect the load carrying capacity of the entire bridge.

For slab on girder bridges, both interior and exterior girders shall be load rated.

Recent FHWA Technical Advisory T5140.29, dated January 15, 2008, or subsequent update, recommends that during future recalculations of load capacity on existing non-load path redundant steel bridges, the capacity of gusset plates be checked to reflect changes in condition or dead load, to make permit or posting decisions, or to account for structural modifications or other alterations that result in significant changes in stress levels. Previous load ratings should also be reviewed for bridges which have been subjected to significant changes in stress levels, either temporary or permanent, to ensure that the capacities of gusset plates were adequately considered. Gusset plates and connection elements of existing non-load path redundant steel bridges that have not under gone a load capacity evaluation in the past shall be checked for compliance with Technical Advisory T5140.29.

2.4 ANALYSIS AND TESTING METHODS IN LOAD RATING

Routine load ratings consist of computations made from design plans, as-built drawings, field measurements, and inspection reports based on common analytical methods, such as LRFD distribution

analysis. The rater should review the original design plans as the first source of information for material strengths and stresses. If the material strengths are not explicitly stated on the design plans, STATE AID construction and material specifications applicable at the time of the bridge construction shall be reviewed. This may require investigations into old ASTM or AASHTO Material Specifications active at the time of construction. The MBE also provides guidance and data on bridge types and materials that allows the evaluation of existing bridges without original design specifications.

All bridges shall be rated in accordance with the LRFD load distribution factors.

Higher level load ratings consist of routine computations adjusted for actual material properties as determined from field sampling and tests of the materials. Higher level load ratings may also require the use of refined methods of analysis such as 2-D grillage or 3-D finite element models. Refined methods of analysis are justified where needed to avoid load posting or to ease restrictions on the flow of permitted overweight trucks. Some of the newer more complex structures may have been designed using sophisticated analysis methods. Therefore a sophisticated level of analysis will be required to rate these structures. Refined analysis, material testing, and other field tests will only be accepted when performed by a qualified professional and the cost is borne by the County.

The actual performance of most bridges is more favorable than conventional theory dictates. The safe load capacity for a structure can be determined from full scale non-destructive field load tests, which may be desirable to establish a higher safe load carrying capacity than calculated by analysis. Refer to the MBE Section 8 for information on conducting field load tests and using the results to establish a new or updated load rating. Non-destructive load tests shall be performed by a registered professional engineer and the costs borne by the County.

2.5 ANALYSIS TOOLS

Standard analysis tools applicable to STATE AID bridge inventory can maximize efficiency, provide consistency, and also facilitate future revisions of Load Ratings by different parties. To this end STATE AID has specified BRASS as the acceptable load rating software to be used.

STATE AID will require the use of the BRASS-GIRDER (LRFD) program for load rating of the following bridge types:

- Steel girders and stringers (both composite and non-composite)
- Reinforced concrete deck girders
- Reinforced concrete box girder bridges
- Reinforced concrete slab bridges
- Reinforced concrete rigid frames
- Precast prestressed concrete girders (pre-tensioned)
- Cast-in-place post-tensioned girders
- Precast prestressed concrete slabs (multi-beam decks)
- Precast reinforced concrete beam-slabs

Bridges that cannot be load rated using BRASS, shall be load rated using a software package approved by STATE AID.

2.6 CONCRETE BRIDGES WITH UNKNOWN REINFORCEMENT

There are bridges for which common analytical methods are not adequate to determine a load rating. For bridges where necessary details, such as reinforcement in a concrete bridge, are not available from plans or field measurements, knowledge of the live load used in the original design, the current condition of the structure and live load history may be used to provide a basis for assigning a safe load capacity. A concrete bridge with unknown details need not be posted for restricted loading if it has been carrying normal traffic and shows no distress. In these circumstances, the County Engineer shall document their recommendation that a bridge does not have to be load tested or load rated in the STATE AID load rating summary form. Nondestructive proof load tests can be helpful in establishing the safe load capacity for such structures. Proof load tests shall be performed by a registered professional engineer and the costs borne by the County.

2.7 REPORTING LRFR RATINGS TO THE NBI

For all new load ratings based on the LRFR methodology, the load rating data shall be reported to the NBI as a Rating Factor, for items 63, 64, 65 and 66, using the HL-93 loadings.

2.8 EVALUATION OF CONCRETE BRIDGES FOR SHEAR

MBE Article 6A.5.9 states that in-service concrete bridges that show no visible signs of shear distress need not be checked for shear when rating for the design load or legal loads. STATE AID requires that the shear capacity of all existing reinforced and prestressed concrete bridge members, with the exception of concrete slab bridges, shall be evaluated. However, load postings need not be governed by shear, unless distress is evident.

SECTION 3 LOAD AND RESISTANCE FACTOR RATING GUIDELINES

3.1 DATA COLLECTION FOR LRFR LOAD RATING

3.1.1 Review of Existing Bridge Plans and Documents

As-built plans are contract design plans which have been modified to reflect changes made during construction. As-built plans are used to determine loads, bridge geometry, section and material properties. Shop drawings are also useful sources of information about the bridge. Plans may not exist for some bridges. In these cases complete field measurements will be required. Certain structures or components of structures are built from standard drawings. These standard drawings may have been changed and revised over time. The specific standard drawings used for construction are generally identified in the roadway plans for the project under which the bridge was built. Other appropriate bridge history records, testing reports, repair or rehabilitation plans should be reviewed to determine their impact on the load carrying capacity of the structure.

3.1.2 Bridge Inspection for Load Rating

Bridges being investigated for load capacity must be inspected for condition as per the latest edition of the MBE and the FHWA Bridge Inspector's Reference Manual. Bridge inspections are conducted to determine the physical and functional condition of the bridge; to form the basis for the evaluation and load rating of the bridge, as well as analysis of overload permit applications. The inspector should verify the accuracy of existing plans or sketches in lieu of plans with field measurements. It is especially important to measure and document items that may affect the load capacity, such as dead loads and section deterioration and damage. Only sound material should be considered in determining the nominal resistance of the deteriorated section. Where present, utilities, attachments, depth of fill, and thickness of wearing surface should be field verified at the time of inspection. Wearing surface thicknesses are also highly variable. Multiple measurements at curbs and roadway centerline should be used to determine an average wearing surface thickness. Load factor for wearing surface DW at the strength limit state may be taken as 1.25 where thickness has been field measured.

3.1.3 Assessment of Truck Traffic Conditions at Bridge Site

LRFR live load factors appropriate for use with legal loads and permit loads are defined based upon the Average Daily Truck Traffic (ADTT) available or estimated for the bridge site. FHWA requires an ADTT to be recorded on the Structural Inventory and Appraisal (SI&A) form for all bridges. ADTT may also be estimated from Average Daily Traffic (ADT) data for the site.

3.1.4 Selection of Surface Roughness Rating

LRFD dynamic load allowance of 33% reflects conservative conditions that may prevail under certain distressed approach and bridge deck conditions. For load rating of legal and permit vehicles for bridges with less severe approach and deck surface conditions, the dynamic load allowance (IM) may be decreased based on field observations in accordance with MBE Table C6A.4.4.3-1 (See Section 3.2.6). Inspection should carefully note these and other surface discontinuities in order to benefit from a reduced dynamic load allowance.

To ensure proper and consistent selection of dynamic load allowance values in all load ratings, STATE AID has included a new data item in the Bridge Inspection Forms for documenting the surface roughness of the bridge riding surface, with clear guidelines for inspectors on how to assign a rating for this item. Surface roughness ratings represent the average condition of the riding surface, including the immediate approaches. Surface Roughness is defined as follows:

Table 1 Surface Roughness Rating

Surface Roughness Rating	Description
3 = Smooth	Smooth riding surface at approaches, bridge deck, and expansion joints
2 = Average	Minor surface deviations or depressions
1 = Poor	Significant deviations in riding surface at approaches, bridge deck, and expansion joints

See section 3.2.6 for selecting reduced impact factors for load rating based on surface roughness rating.

3.2 LIVE LOADS AND LOAD FACTORS

3.2.1 Overview of LRFR Load Rating Process for County Bridges

Live loads to be used in the rating of bridges are selected based upon the purpose and intended use of the rating results. Live load models outlined below shall be evaluated for the Strength, Service and Fatigue limit states in accordance with Table 2. Load ratings shall be performed for all of the following live loads:

1) Design load rating is a first-level rating performed for all bridges using the HL-93 loading at the Inventory (Design) and Operating levels.
2) Rate for the state legal loads HS-Short, HS-Long, H-Truck, Concrete Truck, Fig 1
3) Rate for Specialized Hauling Vehicles using the Notional Rating Load (NRL) given in Figure 3. If the NRL RF < 1.0 for a bridge, then rate for the posting vehicles SU4, SU5, SU6, and SU7 given in Figure 4.
4) Rate for Mississippi Annual Permits, given in Fig 5

Table 2 LRFR Limit States

Bridge Type	Limit State	Design	Legal	SHV	Permits
		HL-93	HS-Short, HS-Long, H-Truck, Concrete Truck	NRL, SU4, SU5, SU6, SU7,	
Steel	Strength I	●	●	●	
	Strength II				●
	Service II	●	●	●	●
	Fatigue	●			
Reinforced Concrete	Strength I	●	●	●	
	Strength II				●
	Service I				●
Prestressed Concrete (non-segmental)	Strength I	●	●	●	
	Strength II				●
	Service III	●	●		●
	Service I				●
Timber	Strength I	●	●	●	●

3.2.2 Strength Rating for HL-93 Loading

The design-load rating (or HL-93 rating) assesses the performance of existing bridges utilizing the LRFD HL-93 design loading and design standards with dimensions and properties for the bridge in its present as-inspected condition. It is a measure of the performance of existing bridges to new bridge design standards contained in the LRFD Specifications. The design-load rating produces Inventory and Operating level rating factors for the HL-93 loading. The evaluation live-load factors for the Strength I limit state shall be taken as given in MBE Table MBE 6A.4.3.2.2-1.

Table MBE 6A.4.3.2.2-1 Load Factors for Design Load: γ_L

Evaluation Level	**Load Factor**
Inventory	1.75
Operating	1.35

The dynamic load allowance specified in the LRFD Specifications for new bridge design (LRFD Article 3.6.2) shall apply. For design load rating, regardless of the riding surface condition or the span length, always use 33% for the dynamic load allowance (IM).

The results of the HL-93 rating are to be reporting to the NBI as a Rating Factor.

3.2.3 Strength Rating for Legal Loads

In LRFR, load rating for legal loads determines a single safe load capacity of a bridge. The previously existing distinction of Operating and Inventory level ratings is no longer maintained when load rating for legal loads.

The live load to be used in the LRFR rating for posting considerations for routine commercial traffic should be any of the State legal loads HS-Short, HS-Long, H-Truck, Concrete Truck given in Figure 1. They are representative of routine commercial truck configurations in use in Mississippi, and are used as vehicle models for load rating and for bridge posting purposes.

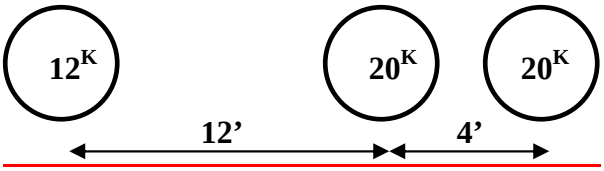
It is unnecessary to place more than one vehicle in a lane for spans up to 200 ft. because the LRFR live load factors provided have been modeled for this possibility (no lane load to be used). For negative moments and for span lengths greater than 200 ft., critical load effects shall be obtained by lane-type legal load models shown in Figure 2.

The evaluation live-load factors for legal loads for the Strength I limit state shall be taken as given in Table MBE 6A.4.4.2.3.1-1.

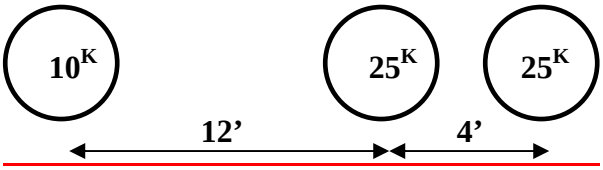
Table MBE 6A.4.4.2.3.1-1 Live-Load Factors, γ_L for Legal Loads

Traffic Volume (One direction)	Load Factor for HS-Short, HS-Long, H-Truck, Concrete Truck
Unknown	1.80
ADTT $\geq$ 5000	1.80
ADTT = 1000	1.65
ADTT $\leq$ 100	1.40

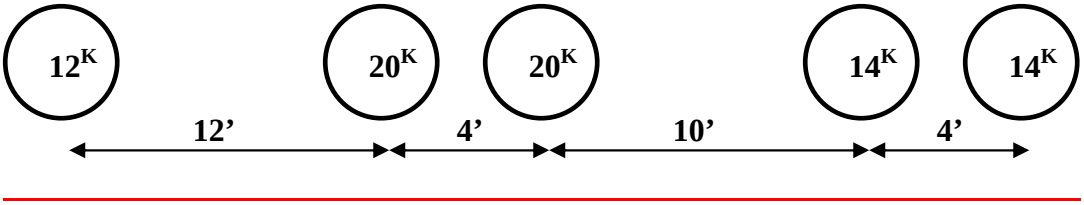
Linear interpolation is permitted for other ADTT



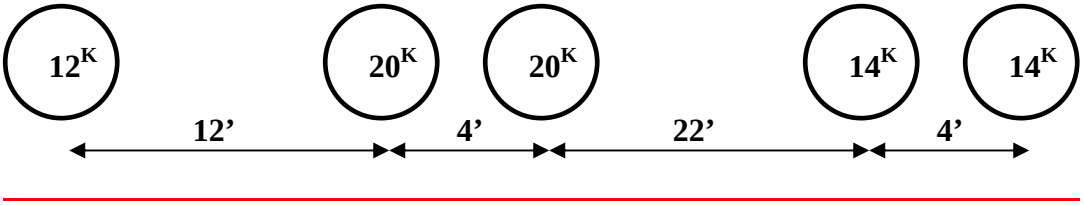
MS H - TRUCK GVW = 52 kips



MS CONCRETE TRUCK GVW = 60 kips



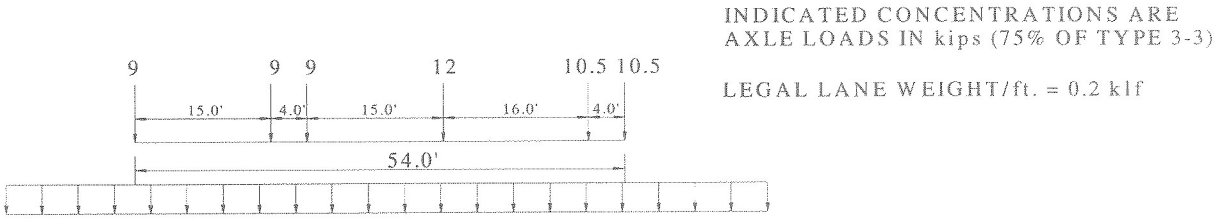
MS HS – SHORT TRUCK GVW = 80 kips



MS HS – LONG TRUCK GVW = 80 kips

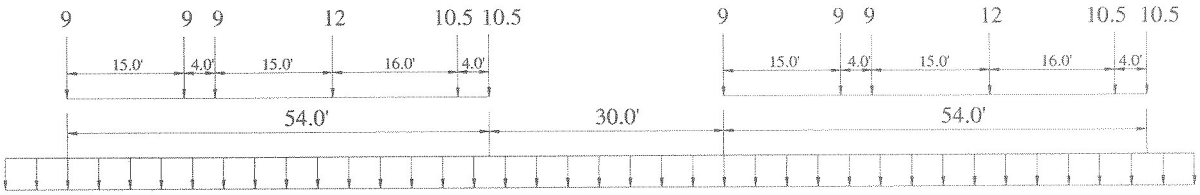
Figure 1. Rating Trucks for Mississippi State Legal Loads

b) Lane-Type Legal Load Model—Apply for spans greater than 200 ft. and all load effects.



MBE APPENDIX A-6A.4, Figure A-6A.4-4

c) Lane-Type Legal Load Model—Apply for negative moment and interior reaction for all span lengths.



MBE APPENDIX A-6A.4, Figure A-6A.4-5

Figure 2. LRFR Legal Lane Load Models

3.2.4 Strength Rating for Specialized Hauling Vehicles

In recent years, the trucking industry has introduced single unit Specialized Hauling Vehicles (SHV) with closely-spaced multiple axles that make it possible for these short wheelbase trucks to carry the maximum load of up to 80,000 lbs and still meet Federal Bridge Formula B and the axle weight limits. Because of the higher load effects of these vehicles, especially on short span bridges, AASHTO has adopted a new rating live load model and four new single unit trucks as legal loads for bridge posting. The four single unit posting trucks SU4, SU5, SU6 and SU7 shown in Figure 4, model the short wheelbase multi-axle SHVs that are becoming increasingly more common in Mississippi.

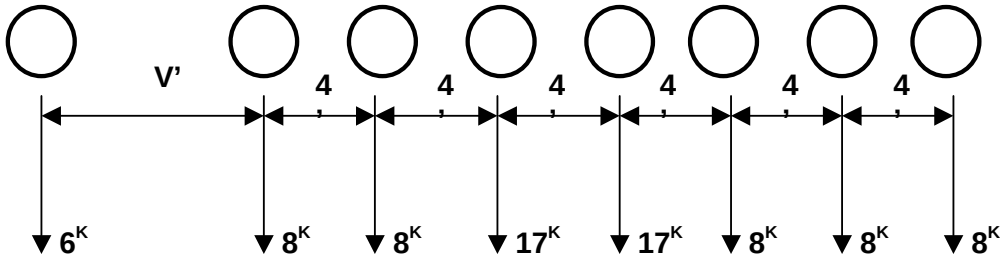
The Notional Rating Load (NRL) shown in Figure 3, represents a single load model for load rating that will envelop the load effects of the worst possible SHV configurations with multiple axles on simple and continuous span bridges. Evaluate bridges for this single load model to verify adequate capacity for all SHV traffic. This step is required only as an analysis convenience. There is no requirement to report the NRL rating to the NBI. Bridges that do not rate for the NRL loading shall be investigated to determine posting needs using the AASHTO single unit posting loads SU4, SU5, SU6, and SU7. LRFD distribution factors are used for the distribution analysis.

The evaluation live-load factors for the NRL and SHV posting loads for the Strength I limit state shall be taken as given in Table MBE 6A.4.4.2.3.2-1.

Table MBE 6A.4.4.2.3.2-1 Live-Load Factors, γ_L for Specialized Hauling Vehicles

Traffic Volume (One direction)	Load Factor for NRL, SU4, SU5, SU6 and SU7
Unknown	1.60
ADTT ≥ 5000	1.60
ADTT = 1000	1.40
ADTT ≤ 100	1.15

Linear interpolation is permitted for other ADTT.



V = VARIABLE DRIVE AXLE SPACING — 6'0" TO 14'-0". SPACING TO BE USED IS THAT WHICH PRODUCES MAXIMUM LOAD EFFECTS.

AXLES THAT DO NOT CONTRIBUTE TO THE MAXIMUM LOAD EFFECT UNDER CONSIDERATION SHALL BE NEGLECTED.

MAXIMUM GVW = 80 KIPS

AXLE GAGE WIDTH = 6'-0"

Figure 3. Notional Rating Load (NRL) for Specialized Hauling Vehicles

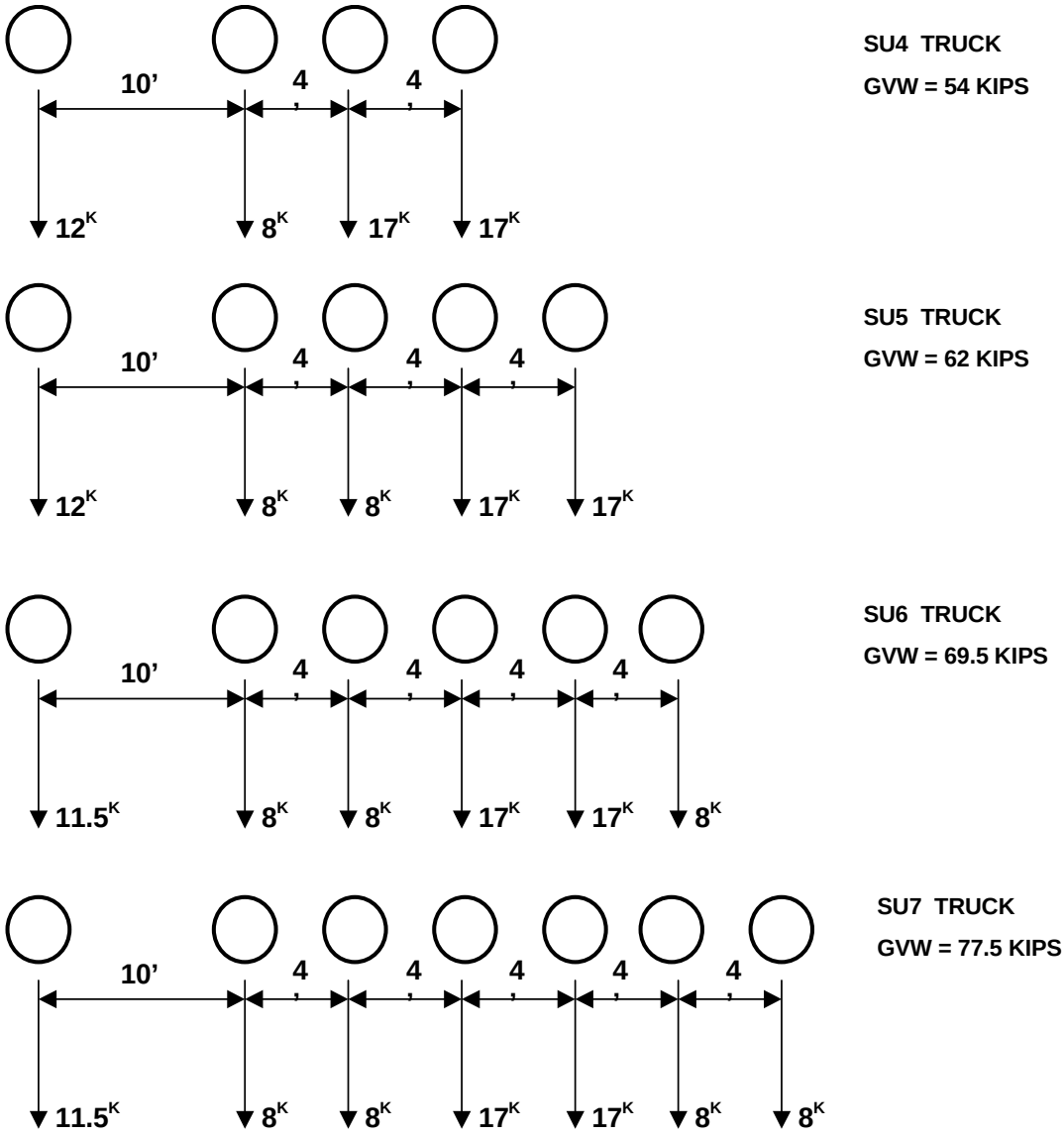


Figure 4. Legal Loads for Posting for Specialized Hauling Vehicles

3.2.5 Strength Rating for Overweight Permits

Single Trip Permits: Permits for single trip movements are issued for one-way or round-trip movement of overweight vehicles. These permits are valid only for the specific date, time, vehicle, and route designated in the permit.

Single trip permit analysis shall be performed for a single lane loading. This is used because these permit loads are infrequent and are likely the only heavy loads on the structure during the crossing. When one-lane LRFD distribution factor is used, the built-in 1.2 multiple-presence factor should be divided out (That is, divide the computed one-lane distribution factor by 1.2 before using in the permit load rating). The permit vehicle shall be placed laterally on the bridge, within the striped lanes, to produce maximum stresses in the critical member under consideration. In special cases the dynamic load allowance may be neglected provided that the maximum vehicle speed can be reduced to 5 MPH prior to crossing the bridge. Also, in some cases, the truck may be escorted across the bridge with no other vehicles allowed on the bridge during the crossing. If this is the case, then the live load factor can be reduced from 1.5 to 1.15 as shown in Table 3.

Annual Permits: Annual (Blanket) permits are issued for the movement of overweight vehicles over a specified route or within a restricted area. Annual permits are usually valid for unlimited trips over a period not to exceed one year. The permit vehicle may mix in the traffic stream and move at normal speeds without any restrictions. Annual permit analysis shall be performed using distribution factors for two or more lanes loading.

The evaluation live-load factors for permits for the Strength II limit state shall be taken as given in Table 3. (Table MBE Table 6A.4.2.2-1):

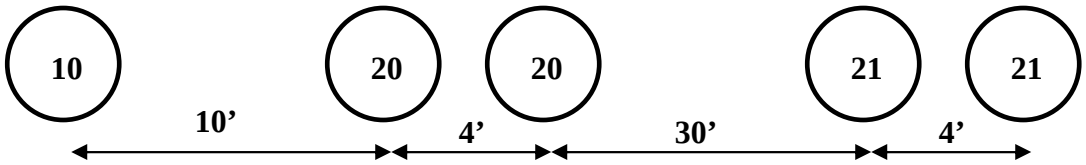
Table 3 Permit Load Factors

Permit Type	Frequency	Loading Condition	DF^a	ADTT (one direction)	Load Factor by Permit Weight[b]	
					Up to 100 kips	≥150 kips
Annual	Unlimited Crossings	Mix with traffic (other vehicles may be on the bridge)	Two or more lanes	>5000	1.80	1.30
				=1000	1.60	1.20
				<100	1.40	1.10
					All Weights	
Special or Limited Crossing	Single-Trip	Escorted with no other vehicles on the bridge	One lane	N/A	1.15	
	Single-Trip	Mix with traffic (other vehicles may be on the bridge)	One lane	>5000	1.50	
				=1000	1.40	
				<100	1.35	
	Multiple-Trips (less than 100 crossings	Mix with traffic (other vehicles may be on the bridge)	One lane	>5000	1.85	
				=1000	1.75	
				<100	1.55	

Note: When one-lane distribution factor is used, the built-in 1.2 multiple presence factor should be divided out. Linear interpolation is permitted for other ADTT

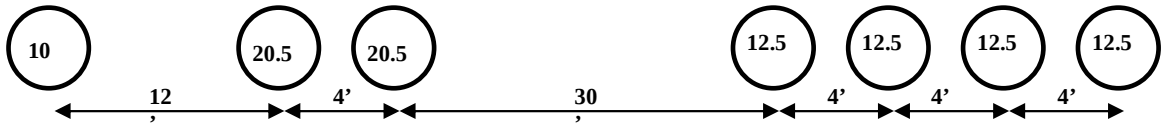
3.2.5.1 Standard Annual (Blanket) Permit Vehicles for Load Rating

Standard permit vehicles represent classes of overweight trucks most frequently used to carry loads requiring an Annual Permit. For any bridge re-rating, the standard annual permit vehicles shown in Figure 5 shall be analyzed as additional live load models. The results will be available for informational and future permit management and operations purposes. For most future permit load investigations, the results of the standard permit vehicles will provide a sound basis for screening the load for bridge safety without the need for a reanalysis. Maximum load effects for these standard annual permits are given in Tables 4. The load effects are enveloped by the HL-93 loading. STATE AID may define additional standard permit vehicles based upon the frequency of such permits and their potential to induce load effects outside the envelope of the other standard permit vehicles.

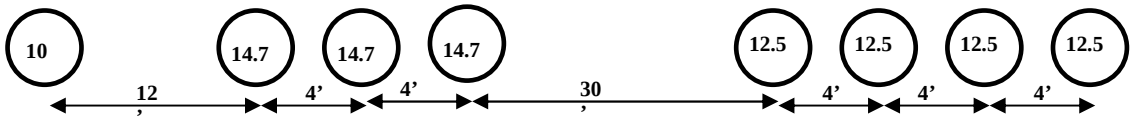


BP-1 GVW = 92 kips

BP-2 GVW = 96 kips



BP-3 GVW = 101 kips



BP-4 GVW = 104 kips

Figure 5. Standard Annual (Blanket) Permit Loads (Normal Travel)

Table 4. Maximum Load Effects for Standard Annual (Blanket) Permits

Simple Span (Ft)		20	40	60	80	100	120	160	200
M(+)	HL-93	**232.0**	**578.0**	**1086.0**	**1668.1**	**2317.3**	**3027.3**	**4642.4**	**6515.1**
	BP-1	170.1	400.2	650.1	1089.4	1541.1	1995.6	2908.7	3824.6
	BP-2	166.1	409.2	664.1	1087.9	1557.2	2030.0	2981.0	3935.6
	BP-3	161.1	409.2	664.1	1074.0	1564.0	2059.0	3056.5	4059.0
	BP-4	166.7	405.2	674.7	1054.6	1562.9	2075.3	3106.2	4141.1
V	HL-93	**54.1**	**67.5**	**79.4**	**88.9**	**97.1**	**104.1**	**118.5**	**132.5**
	BP-1	36.8	43.4	57.5	66.1	71.3	74.8	79.1	81.7
	BP-2	37.6	44.3	55.9	65.9	71.9	75.9	80.9	84.0
	BP-3	37.6	44.3	55.5	66.8	73.7	78.2	83.9	87.3
	BP-4	34.2	44.0	54.8	66.6	74.1	79.1	85.3	89.1

Two Span Continuous (Ft)		20	40	60	80	100	120	160	200
M(+)	HL-93	**187.7**	**466.2**	**860.3**	**1325.1**	**1843.6**	**2407.3**	**3688.1**	**5168.0**
	BP-1	137.8	322.8	530.3	870.7	1228.9	1595.1	2339.4	3091.4
	BP-2	134.5	330.1	539.1	873.0	1242.2	1621.5	2394.7	3177.3
	BP-3	134.5	330.1	539.1	864.7	1247.0	1641.9	2450.2	3270.5
	BP-4	127.5	327.5	546.8	850.6	1237.8	1645.9	2480.5	3327.0
M(-)	HL-93	**155.1**	**392.8**	**803.2**	**1383.6**	**1918.4**	**2492.5**	**3807.7**	**5349.6**
	BP-1	91.1	334.6	481.7	564.7	747.3	946.3	1328.7	1700.0
	BP-2	92.9	343.8	510.2	604.6	764.0	974.0	1376.2	1765.7
	BP-3	92.9	352.9	542.3	650.5	786.0	1009.6	1436.1	1848.1
	BP-4	93.8	350.4	562.0	684.5	787.8	1021.5	1465.6	1893.1
V	HL-93	**54.6**	**74.3**	**88.0**	**98.1**	**107.5**	**116.4**	**133.4**	**149.9**
	BP-1	39.0	47.5	62.0	71.3	76.5	79.7	83.4	85.4
	BP-2	39.9	48.1	60.5	71.5	77.7	81.5	85.9	88.3
	BP-3	39.9	47.8	60.6	72.8	79.8	84.2	89.3	92.1
	BP-4	37.8	48.3	58.9	72.6	80.5	85.4	91.1	94.2

Note: Bold text indicates governing vehicles

3.2.5.2 Single Trip Permit Vehicles for Load Rating

For specific Single Trip permit applications, the actual truck configuration described in the permit shall be the live load used to analyze all pertinent structures. Single Trip Overweight Permit load analysis assumes only one permit load on the bridge, which allows the use of the single-lane distribution. As stated in the footnote of Table 3, when using a single-lane LRFD distribution factor, the 1.2 multiple-presence factor should be divided out from the distribution factor equations. For girder bridges, the interior and exterior girders shall be checked to see which governs. For single trip permit vehicles, it is important to note that the vehicle could traverse the bridge in any lane, making it necessary to investigate whether the exterior girder controls the load rating.

3.2.6 Reduced Dynamic Load Allowance for Rating (Legal and Permit Loads)

For legal and permit vehicles rating, of longitudinal members having spans greater than 40 ft. with less severe approach and deck surface conditions, the Dynamic Load Allowance (IM) may be decreased from the LRFD design value of 33%, as given below in Table 5, for the Strength

and Service limit states. Dynamic load allowance shall be applied to the state legal vehicles and not the lane loads. Regardless of riding surface condition, always use 33% for spans 40 ft or less and for transverse members. Selection of IM shall be in accordance with the requirements of Section 3.1.4 and the Surface Roughness rating noted in the inspection report. State or document what value of IM was used for the load rating in the Load Rating Summary Form. If the permit vehicle proceeds at a crawl speed, no more than 5 miles per hour, then the impact can be assumed to be 0%.

Table 5 Dynamic Load Allowance for Rating: IM.

Riding Surface Rating	IM
3	10%
2	20%
1	33%

3.3 RESISTANCE FACTORS AND RESISTANCE MODIFIERS FOR THE STRENGTH LIMIT STATES

3.3.1 Resistance Factor: ϕ

For Strength Limit States, member capacity is given as:

$$C = \phi_c \ \phi_s \ \phi \ R_n$$

Where:

ϕ_c = Condition Factor

ϕ_s = System Factor

ϕ = LRFD Resistance Factor

Where, the following lower limit shall apply:

$$\phi_c \ \phi_s \geq 0.85$$

Resistance factor φ has the same value for new design and for load rating. Resistance factors, φ, shall be taken as specified in the LRFD Specifications for new construction. A reduction factor based on member condition, Condition Factor ϕ_c, is applied to the resistance of degraded members. An increased reliability index is maintained for deteriorated and non-redundant bridges by using condition and system factors in the load rating equation.

3.3.2 Condition Factor: ϕ_C

The condition factor provides a reduction to account for the increased uncertainty in the resistance of deteriorated members and the likely increased future deterioration of these members during the period between inspection cycles. Current STATE AID policy is to set this factor equal to the values presented in Table MBE 6A.4.2.3-1.

Table MBE 6A.4.2.3-1 Condition Factor: ϕ_c .

Superstructure Condition Rating (SI & A Item 59)	Equivalent Member Structural Condition	ϕ_c
6 or higher	Good or Satisfactory	1.00
5	Fair	0.95
4 or lower	Poor	0.85

The Condition Factor ϕ_c does not account for section loss, but is used in addition to section loss. If section properties are obtained accurately, by actual field measurement of losses rather than by an estimated percentage of losses, the values specified for ϕ_c in Table 6A.4.2.3-1 may be increased by 0.05 ($\phi_c \leq 1.0$). For instance, a concrete member may receive a low condition rating due to heavy cracking and spalling or due to the deterioration of the concrete matrix. Such deterioration of concrete components may not necessarily reduce their calculated flexural resistance. But it is appropriate to apply the reduced condition factor in the LRFR load rating analysis. If there are also losses in the reinforcing steel of this member, they should be measured and accounted for in the load rating. It is appropriate to also apply the reduced condition factor in the LRFR load rating analysis, even when the as-inspected section properties are used in the load rating as this reduction by itself does not fully account for the impaired resistance of the concrete component.

3.3.3 System Factor: ϕ_S

System factors are multipliers applied to the nominal resistance to reflect the level of redundancy of the complete superstructure system. Bridges that are less redundant will have their factor member capacities reduced, and, accordingly, will have lower ratings. The aim of the system factor is to provide reserve capacity for safety of the traveling public. Current STATE AID policy is to use the system factors provided in Table MBE 6A.4.2.4-1 when load rating for Flexural and Axial Effects for steel members and non-segmental concrete members. The system factor is set equal to 1.0 when checking shear. Subsystems that have redundant members should not be penalized if the overall system is non-redundant (i.e. multi stringer deck framing members on a two-girder or truss bridge). System Factor is used with all live load models.

Table MBE 6A.4.2.4-1 System Factor: ϕ_S for Flexural and Axial Effects

Superstructure Type	ϕ_S
Welded Members in Two-Girder/Truss/Arch Bridges	0.85
Riveted Members in Two-Girder/Truss/Arch Bridges	0.90
Multiple Eyebar Members in Truss Bridges	0.90
All Other Girder Bridges and Slab Bridges	1.00
Floorbeams with Spacing >12ft. and Non-Continuous Stringers	0.85
Redundant Stringer Subsystems Between Floorbeams	1.00

Definitions

Floorbeam – A horizontal flexural member located transversely to the bridge alignment.
Stringer – A longitudinal beam supporting the bridge deck.
Girder – A large flexural member, usually built-up, which is the main or primary support for the structure, and which usually receives load from floorbeams, stringers, or in some cases directly from the deck.

3.4 RESISTANCE FACTORS AND RESISTANCE MODIFIERS FOR THE SERVICE LIMIT STATES

For all non-strength limit states, φ =1.0, ϕ_c = 1.0, ϕ_s = 1.0

3.5 SERVICE & FATIGUE LIMIT STATES FOR LOAD RATING

3.5.1 General Overview

Service and fatigue limit states to be evaluated during a load rating analysis shall be as given below in Table 6:

Table 6 LRFR Service and Fatigue Limit States and Load Factors

Bridge Type	Limit State	Dead Load	Dead Load	Design Load		Legal Load	Permit Load
				Inventory	Operating		
		DC	DW	LL	LL	LL	LL
Steel	Service II	1.00	1.00	1.30	1.00	1.30	1.00
	Fatigue	0.00	0.00	0.75	—	—	—
Reinforced Concrete	Service I	1.00	1.00	—	—	—	1.00
Prestressed Concrete (non-segmental)	Service III	1.00	1.00	0.80	—	1.00	1.00
	Service I	1.00	1.00	—	—	—	1.00

3.5.2 Concrete Bridges

- For non-segmental prestressed concrete bridges, LRFR provides a limit state check for cracking of concrete (SERVICE III) by limiting concrete tensile stresses under service loads. SERVICE III check shall be performed during design load, legal load, and permit load ratings of prestressed concrete bridges. No tension stresses are allowed in the precompressed tensile zone when performing the design load check at the Inventory level. The allowable tensile stress precompressed tensile zone for the Operating level design load check, legal load ratings, and permit load ratings shall be $0.19\sqrt{f'_c}$. in KSI units.

- Service I and Service III limit states are mandatory for load rating of segmental concrete box girder bridges (MBE 6A.5.14).

- A new SERVICE I load combination for reinforced concrete components and prestressed concrete components has been introduced in LRFR to check for possible inelastic deformations in the reinforcing steel during heavy permit load crossings (MBE 6A.5.4.2.2.2). This check shall be applied to permit load checks and sets a limiting criterion of $0.9F_y$ in the extreme tension reinforcement. Limiting steel stress to $0.9F_y$ is intended to ensure that there is elastic behavior and that cracks that develop during the

passage of overweight vehicles will close once the vehicle is removed. It also ensures that there is reserve ductility in the member.

3.5.3 Steel Bridges

- Steel structures shall satisfy the overload permanent deflection check under the SERVICE II load combination for design load, legal load and permit load ratings using load factors as given in Table 6. Maximum steel stress is limited to 95% and 80% of the yield stress for composite and non-composite compact girders respectively. During an overweight permit review the actual truck weight is available, so a 1.0 live load factor is specified.

- In situations where fatigue-prone details are present (category C or lower) a Fatigue limit state Rating Factor for infinite fatigue life shall be computed. If directed by STATE AID, bridge details that fail the infinite-life check can be subject to the more complex finite-life fatigue evaluation using evaluation procedures given in the MBE (Section7).

SECTION 4 LRFR LOAD POSTING GUIDELINES

4.1 LOAD POSTING REQUIREMENTS FOR BRIDGES

NBIS regulations (23 CFR Part 650) require the rating of each bridge as to its safe loading capacity in accordance with the AASHTO MBE. If a bridge is not capable of carrying statutory loads, it is posted for a lesser load limit in conformance with the MBE. The decision to load post a bridge will be made by the bridge owner based on an agency's load-posting practice. The LRFR guidelines are provided to assist STATE AID and local bridge owners for establishing posting weight limits. Deviations from these guidelines shall be justified to the satisfaction of STATE AID.

Strength limit state is used for checking the ultimate capacity of structural members and is the primary limit state utilized by STATE AID for determining posting needs. Service and fatigue limit states are utilized to limit stresses, deformations, and cracking under regular service conditions. In LRFR, Service and Fatigue limit state checks are optional in the sense that a posting or permit decision does not have to be dictated by the result. These serviceability checks provide valuable information for the engineer to use in the decision process.

A concrete bridge with unknown details need not be posted for restricted loading if it has been carrying normal traffic and shows no distress (see Section 2.6)..

4.2 RELIABILITY-BASED POSTING

The goal of the LRFR methodology is to maintain target uniform reliabilities in all load ratings and load postings. Unlike past practice, it should be noted that in a reliability-based evaluation the relationship between posting values and rating factors is not proportional. For a posted bridge there is a greater probability of vehicles exceeding the posted limit compared to numbers exceeding the legal limit on an un-posted bridge. The MBE provides guidance on how to translate LRFR rating factors less than 1.0 into posting values that maintain the criteria of uniform reliability, especially for the low-rated bridges. This is achieved through a posting analysis equation, Eq. 6A.8.3-1 and a posting graph given in the MBE that presents posting weights for different vehicle types as a function of LRFR rating factors.

4.3 POSTING ANALYSIS

When for any legal truck the RF is between 0.3 and 1.0, then the following equation should be used to establish the LRFR posting load for that vehicle type:

$$\text{LRFR Posting Load} = \frac{W}{0.7}\left[\left(RF\right) - 0.3\right] \qquad \text{MBE Eq. (6A.8.3-1)}$$

Where:

RF = Legal load rating factor
W = Weight of rating vehicle (Tons)

The Load Rating Engineer shall make a recommendation as to the need for posting and the weight limit for posting should posting be required. When the RF for any legal vehicle type falls below 0.3, then a recommendation should be made to not allow that particular vehicle type on the bridge. Other vehicle types with RF > 0.3 may continue to use the bridge. Posting recommendations shall be added to the Load Rating Summary sheet.

Bridges that are determined not capable of carrying 3 tons shall be closed.

SECTION 5 LOAD RATING DELIVERABLES

5.1 LOAD RATING REPORT

Load rating calculations and documentation shall be incorporated into a comprehensive report to facilitate updating of the information and calculations in the future. The load rating should be completely documented in writing including all background information such as field inspection reports, material and load test data, all supporting computations, and a clear statement of all assumptions used in calculating the load rating and the recommended posting load. Sketches shall be provided to document section losses incorporated in the analysis. Inspection reports, testing reports, and articles referenced as part of the load rating shall be documented. When refined methods of analysis or load testing are used, the load rating report shall include live load distribution factors for all rated members, determined through such methods. For more complex structures where computer models are used in the analysis, the computer models with documentation shall be saved in the bridge file. For new, replaced and rehabilitated bridges designed using LRFD, the LRFR ratings shall be computed at the time of design and shown on the structural drawings following the structural notes.

An electronic version of the load rating report, including the BRASS input data file and any computer models used in the analysis shall be saved in the bridge file.

5.2 LOAD RATING SUMMARY SHEET

After the structure has been load rated, the STATE AID Bridge Load Rating Summary Form shall be completed and utilized as the first sheet for the load rating calculations.

STATE AID Bridge Load Rating Summary **1 of 2**

Bridge Data:		
County:	Structure Number:	Bridge Location:
Feature Intersected:	Year Built:	Inspection Date:
Route:	Design Load:	Deck:
Bridge Posting:	Roadway Width:	Super:
Bridge Type:	Project Number:	Sub:
Bridge Length:		
Standard Plan: (Y/N)		

Bridge Load Rating Summary:

Dead Load Wearing Surface Thickness:	**LRFR Evaluation Factors:** Surface Roughness Rating:
Wearing Surface Type:	Condition Factor:
Non-structural attachments:	System Factor:
	ADTT (one way):

Superstructure/Deck Rating Summary:

Vehicle Type	GVW (Kips)	Rating Factor	Controlling Member	Controlling Load effect	IM	Live Load Distribution factor
HL-93 (INV)	N/A					
HL-93 (OPR)	N/A					
MS H-Truck	52					
Concrete Truck	60					
HS-Short	80					
HS-Long	80					
NRL	80					
SU4	54					
SU5	62					
SU6	69.5					
SU7	77.5					
BP-1	92					
BP-2	96					
BP-3	101					
BP-4	104					

Substructure Rating Summary:

Substructure Rated: (Y/N)

STATE AID Bridge Load Rating Summary **2 of 2**

Vehicle Type	GVW (kips)	Rating Factor	Controlling Member	Controlling Load effect	IM	Live Load Distribution factor
HL-93 (INV)						
HL-93 (OPR)						
Legal load						
Permit load						

Posting Analysis Summary:			**Please Check the following boxes that apply:**
Governing Rating Factor:		☐	Load rating is not governed by deck.
Governing Load Model:		☐	Load rating is not governed by substructure.
Recommended Posting Load:		☐	Connections do not control the load rating.
Single Tonnage	Value =	☐	Exterior girder does not control the load rating.
3 Truck Symbols	Type 3 =	☐	Plans do not exist.
	Type 3S2 =	☐	Re-rating not required based on inspection.
	Type 3-3 =		
QC/QA:			

Stamp

Rated By:	**Remarks/Recommendations**		
Checked By:	Project Number:		
QA By:	Rating Software:	BRASS	Others:
Date Rated:			

5.3 QUALITY CONTROL AND QUALITY ASSURANCE REVIEW OF LOAD RATINGS

Quality control procedures are intended to maintain the quality of the bridge load ratings and are usually performed continuously within the load rating teams/units. When Consultants perform load ratings, the consultant shall have quality control procedures in place to assure the accuracy and completeness of the load ratings. All load rating calculations shall be checked by a qualified engineer other than the load rating engineer. Upon completion, the reviewer shall initial the Summary Sheet.

When computer programs are used, the load rating engineer shall perform necessary independent checks to validate the accuracy of the load rating results generated by the program. The checker should verify all input data, verify that the summary of load capacity information accurately reflects the analysis, and be satisfied with the accuracy and suitability of the computer program.

Quality assurance procedures are used to verify the adequacy of the quality control procedures to meet or exceed the standards established by the agency or the consultant performing the load ratings. Quality assurance procedures are usually performed independent of the load rating teams on a sample of their work. Guidance on quality measures for load rating may be found in MBE Article 1.4.

STATE AID will perform an ongoing QA review to assure compliance.

5.4 QUALITY CONTROL OF LOAD POSTINGS

The owner shall ensure that bridges are posted, where required, in accordance with their load ratings.

REFERENCES:

1. AASHTO *Manual for Bridge Evaluation* 2008

2. FHWA. 2002. *Bridge Inspector's Reference Manual (BIRM)*, Federal Highway Administration, U.S. Department of Transportation, Washington, DC.

3. AASHTO LRFD Bridge Design Specifications, 4th Edition (2007) including all subsequent interim revisions.

4. NCHRP Report 575, *Legal Truck Loads and AASHTO Legal Loads for Posting.*

APPENDIX H

ORGANIZATION CHART

Office of State Aid Road Construction
Organization Chart
For Bridge Inspection Program