CHAPTER 2

QUALITY CONTROL & QUALITY ASSURANCE

2.01 Purpose

The National Bridge Inspection Standards (NBIS) require each state to assure systematic Quality Control (QC) and Quality Assurance (QA) procedures are being used to maintain a high degree of accuracy and consistency in the inspection program. Precise data is vital, as the bridge inspection process is the foundation of the entire bridge management system. Information obtained during the inspection is utilized in determining required preservation activities such as maintenance and repairs, prioritizing rehabilitation and replacements, allocating resources, load rating, and evaluating any design improvements for new bridges. Besides ensuring public safety, the inspection process is important as it impacts future programming and funding appropriations. QC and QA both work effectively to provide continuous improvements to the inspection process, enhance safety, identify efficiencies, and improve statewide alignment.

2.02 Comparison of QC & QA

It is important that all parties involved in the MDOT bridge inspection program recognize the difference between QC and QA. QC is an internal check to verify that accurate data is collected by qualified individuals and to immediately address any safety deficiencies identified. QA is performed independently by the Bridge Program Manager to assure that QC measures are effective and for the overall development of the bridge inspection program.

The NBIS define QC as procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level. The QC system is designed to utilize general methods and standardized procedures to verify accurate data acquisition, calculations, coding, and reporting through:

- Annually reviewing each inspection team leader and load rating engineer
- Analyzing a composite sample of bridge inspections or load ratings with internal staff
- A routine comprehensive verification for data integrity and accuracy
- The identification of errors and omissions that require reevaluation of bridge elements
- Recording deficiencies discovered throughout the process to eliminate future occurrences

The NBIS define QA as 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. The QA review is initiated to confirm the effectiveness of the entire bridge inspection program by:

- Reviewing each agency approximately every 7 years
- Examining a random sample of bridge inspections
- Verifying that QC procedures are being properly instituted

- Categorizing any lapses during the inspection or load rating process
- Reporting the findings to each inspector, load rating engineer, and their employer

2.03 Responsibilities

QC procedures are developed by the organization employing the team leader. It is the bridge owner's responsibility to verify that the QC procedures for each team leader are being adhered to on an annual basis. The FHWA provides a summary of the information that should be provided in QC procedures:

1. Define and document QC roles and responsibilities.
2. Document qualifications required for Team Leaders.
3. Document process for tracking how qualifications are met, including:
    a. Years and type of experience.
    b. Training completed.
    c. Certifications/registrations.
4. Document required refresher training, including:
    a. NHI training courses, other specialized training courses, and/or periodic meetings.
    b. Define refresher training content, frequency, and method of delivery.
5. Document special skills, training, and equipment needs for specific types of inspections.
6. Document procedures for review and validation of inspection reports and data.
7. Document procedures for identification and resolution of data errors, omissions and/or changes.

The bridge owner should maintain a copy of the QC procedures in a separate bridge file in accordance with Chapter 4.

All bridge owners are required to ensure that QC is performed for each team leader they employ. In addition, all consultants are required to ensure that QC is performed for each team leader they employ.

The Bridge Program Manager is responsible for ensuring QA reviews are completed. The QA reviews may be conducted directly by MDOT staff or by a qualified consultant.

2.04 Quality Control Requirements

Each organization is required to maintain QC procedures in a separate bridge file that are to be utilized on an annual basis or more often if deficiencies in the inspection process are regularly identified. If systemic errors or omissions are discovered, then additional QC efforts must be undertaken. Such additional work may require re-inspection of all bridges completed by the individual not meeting credential requirements of the NBIS, re-inspection of all structures with errors, or additional follow up QC efforts to ensure an individual inspector has corrected procedures found unsatisfactory.

QC reviews are to be completed by a qualified team leader that did not perform the original bridge inspection being reviewed. Although the majority of QC reviews for MDOT owned bridges are performed by other internal inspection staff, those who do not have an inspection team large enough may allow

another agency to perform the QC process for them. This action is especially helpful as it allows local agencies to partner with one another and share ideas for improved quality. Local agencies must retain a letter or other signed statement in the QC file that substantiates the completion of QC reviews for each inspection team leader that performed services on their inventory.

Each employer must complete QC file reviews on at least 5 percent of the inspections performed by each individual team leader per year. Further action will occur with conducted field reviews on at least 50 percent of the files selected. The employer completing the QC must have a method to document that the QC procedures are being followed. If the QC procedures cannot be verified or deficiencies are discovered during the QA process, the QC file review should be increased to 10 percent until the next review.

It is important for every random sample to be representative of the entire bridge inventory and not rely heavily on one structure type or condition. The team leader performing the QC review shall perform a file and field review within 18 months of the previous inspection date for each bridge inspection being examined. All of the following must be verified and documented:

- Team leader and diving inspector credentials meet NBIS requirements
- Inspection report(s) are complete with timely submission
- Condition ratings are in accordance with the MDOT *NBI Rating Guidelines*
- Structure Inventory & Appraisal (SI&A) coding is accurate
- Specifications for the National Bridge Inventory (SNBI) coding is accurate
- The inspection interval conforms to MDOT *Guidelines for Bridge Inspection Frequencies*
- Comments provided support the rating for components in fair or worse condition
- Work recommendations are inclusive
- Elements, condition states, and quantities are accurate
- Requests for Action have been submitted for critical findings
- Load rating analysis incorporates current conditions
- Stream bed cross section information is documented and aligns with the MDOT *Guidelines for Bridge Inspection Frequencies*
- Scour Plan of Action information is accurate
- Photographs were generated for each inspection that included the deck, elevation, and all poor elements
- Bridge file information is organized and complete according to Chapter 4

Annual quality control documentation for file and field reviews must be maintained and provided upon request of bridge owner, MDOT, or FHWA. A spreadsheet should be organized for each team leader that denotes whether a field review was performed with the file review. It is recommended that a checklist be utilized for file reviews to ensure all necessary items are reviewed. The MDOT Bridge Inspection Quality Control Checklist may be used by local agencies and consultants in lieu of developing their own. Field reviews will include verifying that applicable SI&A / SNBI items are coded correctly and confirm that the condition ratings and supporting comments on the inspection reports

are accurate. A copy of the BSIR or CSIR should be marked up to document the recommendations. When possible, the team leader should accompany those performing the QC review to answer questions.

2.05 Quality Assurance Requirements

The Bridge Program Manager or a qualified consultant will schedule QA reviews for each bridge and review the results with the agency to improve the overall quality of the bridge inspection program. Each agency subject to a QA review will receive a report of the QA findings. Bridge owners and their consultants should review the QA findings and utilize them to improve their internal processes. MDOT recommends that each bridge owner store the QA findings in their QC file for use to improve internal performance.

The QA reviews performed by MDOT, or a consultant acting on their behalf, will verify the use of effective QC procedures for each bridge owner and review bridge files for approximately 10 percent of the total network. Further action will occur with conducted field reviews on at least 50 percent of the files selected.

QA is conducted on a random basis so the sample will be representative of the entire inventory. However, the sampling may be augmented for a minimum percentage of each structure type and occasionally for specific attributes. The QA process should begin by evaluating whether:

- A file is being maintained for QC activities, personnel credentials, and each bridge in the inventory
- The inspector entering the reports meets the minimum requirements of a team leader
- The load rating engineer is a licensed professional engineer in Michigan
- The diving inspector has successfully completed an FHWA approved comprehensive bridge inspection or underwater diver bridge inspection training course
- The inspections for the entire inventory were completed on time
- The quantity of inspections performed each day are suitable

A QA report will be generated for each bridge that is reviewed during the process. This will aid the bridge owner as deficiencies are identified for each team leader. Each report should include the following information:

- MDOT region or local agency
- Team leader and organization
- Structure number
- Facility
- Feature
- Location
- Date of BSIR, SI&A / SNBI, work recommendations, and load rating
- Inspection frequency

A review of the load rating should be thorough enough to confirm:

- Whether the load rating is condition based

- If the analysis was performed using the latest version MDOT Bridge Analysis Guide
- The structure type and material grades
- The accuracy of the structural analysis calculations
- The load rating assumptions
- The methods used for analysis
- If a bridge posting is needed
- Whether any in-depth inspection report data was utilized
- If the data has been accurately recorded in MiB^{RIDG}E

The file review should also establish and note if any other inspection reports, forms, or other applicable information is missing prior to proceeding with a field review. If any information is omitted, it should be documented in the QA report. The following will be evaluated and included during the QA review process:

- Initial Inspection report
- Bridge or Culvert Safety Inspection reports
- Underwater Diving Inspection reports
- Fracture Critical Inspection reports
- Fatigue Sensitive Inspection reports
- Other Special Inspection reports
- Damage Inspection reports
- Scoping reports
- Request for Action reports
- Plans and/or sketches
- Correspondence
- Maintenance records
- Photographs
- Scour evaluation
- Scour Plan of Action
- Channel cross sections
- Load Rating documentation

The field review will include verifying applicable SI&A / SNBI items are accurately coded. The field review should confirm the condition ratings and comments provided on the inspection reports. If there are significant discrepancies a brief summary shall be provided to aid the bridge owner. When possible, the team leader should accompany those performing the QA review to answer questions.

The bridge program manager may elect to meet with the agency's inspection staff or management to resolve substantial issues that affect FHWA compliance and initiate deadlines for corrective actions. Examples of deficiencies that warrant a meeting include a lack of reporting critical findings, failure to perform quality control activities, or poorly rated components with vague comments included on the bridge safety inspection report.