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 Responsibilities

It is the bridge owner's responsibility to verify the organization's QC procedures are being adhered to. The bridge owner will maintain a copy of the QC procedures in the bridge file. If a bridge owner secures a consultant to perform bridge inspections for their agency, then the consultant is also expected to perform the associated QC verifications. The bridge program manager is responsible for ensuring QA reviews are complete. The QA reviews may be conducted directly by MDOT staff or under the direction of a qualified consultant.

2.03 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 by an agency to verify that accurate data is collected by qualified individuals and to immediately address any deficiencies identified. QA is performed independently by the bridge program manager to assure that QC measures are effective and for 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

2.04 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 or load rating processes are regularly identified. MDOT defines QC as a system of routine technical activities to measure and control the quality of the inventory data as it is being developed. 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 individuals 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 or load rating engineer 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 and load rating engineer that performed services on their inventory.

Each agency must complete QC file reviews on at least 5 percent of the inspections and load ratings performed by each individual per year. Further action will occur with conducted field reviews on at least 50 percent of the files selected. The agency completing the QC must have a method to document that QC procedures are being followed. If QC procedures cannot be verified or deficiencies are discovered during the QA process the QC file review will 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, load rating engineer, 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 coding is accurate
- The inspection interval conforms to MDOT *Guidelines for Bridge Inspection Frequencies*
- Comments provided support the condition rating
- Work recommendations are inclusive
- Elements, condition states, and quantities are accurate
- Requests For Action have been submitted (when required)
- Load rating calculations are based according to current conditions
- Channel cross-section measurements were recorded and filed
- Scour Plan of Action information is accurate
- Critical findings were reported to the bridge program manager
- Photographs and a log 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

2.05 Quality Assurance Requirements

The bridge program manager will schedule QA reviews for each bridge and review the results with the agency to improve the overall quality of the bridge inspection program. MDOT defines QA as a planned system of procedures to verify that the data quality objectives were effective and achieved during the QC process. Each agency who has been subject to a QA review on a bridge inspection program operation will receive a report of the QA findings for their work and contributions to the program. The reports are for the participants' information and their employers will also receive copies of them. Participants and their employees should review the QA finding reports and use them to improve their internal processes. The reports will be treated as confidential amongst each agency, but the findings will be provided to the FHWA. 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 shall 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. In order to proceed with corrective action the reports should follow a consistent format. 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, 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
- That any anticipated effects from scour were included in the calculations
- If the data has been accurately recorded in MiB^{RIDG}E using the load rating assumptions and summary sheets.

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. In the event that any information is omitted it must be documented in the QA report. If the file contains any of the following it will be evaluated and included during the QA review process:

- Initial Inspection report
- Bridge Diving Inspection reports
- Fracture Critical Inspection reports

- Fatigue Sensitive Inspection reports
- Other Special Inspection reports
- Damage Inspection reports
- Scoping reports
- Request For Action forms
- Plans and/or sketches
- Correspondence
- Maintenance records
- Photographs
- Scour evaluation
- Scour Plan of Action
- Channel cross sections

The field review will include verifying applicable Structure Inventory & Appraisal items are accurately coded. The field review should confirm the condition ratings and comments provided on the inspection reports. In the event that 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.