

EXHIBIT C

CONSULTING ENGINEER'S REPORT ON PHYSICAL CONDITION OF BRIDGES



CHARLESTON WV | EDWARDSVILLE IL | MECHANICSBURG PA | MOORESTOWN NJ | NEW ORLEANS LA | PHILADELPHIA PA | Poughkeepsie NY | ST LOUIS MO

August 16, 2011

Mr. Joseph Ruggiero, Executive Director
New York State Bridge Authority
P.O. 1010
Highland, NY 12528

ATTN: W. J. Moreau, Chief Engineer

RE: JN 3085.07
CONSULTING ENGINEER'S REPORT ON
PHYSICAL CONDITION OF BRIDGES

Dear Mr. Ruggiero:

Modjeski and Masters has prepared this report on the physical condition of the bridges operated by the New York State Bridge Authority (NYSBA) to serve as documentation related to the future financial needs for the Authority's Bridges.

DESCRIPTION OF SYSTEM BRIDGES

The Authority operates six vehicular major bridge structures at five sites along the Hudson River and is also responsible for the structural maintenance of the Walkway Over the Hudson Pedestrian Bridge.

The oldest of the crossings is the Bear Mountain Bridge, opened in 1924, a suspension bridge with a 38-foot wide roadway and a main span length of 1632 feet. The bridge was constructed by a private corporation and acquired by the Authority in 1940. The original roadway deck was replaced and the floor system modernized in 1976 and 1977.

The Mid-Hudson Bridge, a suspension bridge with a main span of 1,495 feet, was opened in 1930. The original roadway deck was replaced in 1987 and 1988 with a new 31-foot wide deck which is operated as a three lane roadway during peak traffic periods. The mile-long four-lane divided highway approach on the west side of the bridge was completed in 1967. The structure-supported approach roadway on the Poughkeepsie end of the bridge was widened to its present four lane configuration in several stages from the 1940s to the 1990s.



The Rip Van Winkle Bridge is a 4,978 foot cantilever through truss and deck truss bridge with an 800-foot main span. Opened in 1935, the bridge has benefitted from several projects to extend the useful life of its deck and improve roadway lighting. In 1992, a deck replacement project increased the roadway width to its present 34 feet with a 6-foot sidewalk on the south side of the bridge.

The Kingston-Rhinecliff Bridge, opened in 1957, is a continuous truss bridge with an overall length of 7,793 feet and two main channel spans of 800 feet each. In 2002, a deck replacement project increased the roadway width from 36 feet to 40 feet.

The North Span of the Newburgh-Beacon Bridge complex was opened in 1963. It is 7,789 feet long overall with a 1,000-foot main channel cantilever truss span. Originally designed to accommodate two 15-foot traffic lanes, the bridge was the object of a major reconstruction beginning in 1980 and was reopened in 1984 with a 39-foot 5-inch wide roadway accommodating three lanes of westbound traffic.

The South Span at Newburgh-Beacon, opened in 1980, is 7,801 feet long overall, slightly longer than the North Span. The newer bridge has a 53-foot 5-inch wide roadway accommodating three lanes of eastbound traffic and a 12-foot wide shoulder, serving as a breakdown lane. The South Span also carries a separate 8-foot wide pedestrian walkway and bicycle path.

In 2010 the Poughkeepsie Railway Bridges, now designated the Walkway over the Hudson, was placed under the ownership of the New York State Bridge Authority. This bridge was originally opened to rail traffic in 1888, was modified in 1923 to increase load capacity, closed to rail traffic in 1974 after being damaged by fire, and converted to a pedestrian walkway in 2009-2010. The bridge presently carries only pedestrians on a concrete deck 25 feet wide with a 21'-7" clear walkway.

ANNUAL INSPECTION PROCEDURE, ADDITIONAL PROCEDURES & IMPLEMENTATION

The Authority regularly contracts with independent firms of civil and structural engineers to provide various inspection, investigation, design and construction supervision services.

Annual Inspection Procedures

From the late 1950s through 1989, the Authority retained Modjeski and Masters to conduct annual inspections of its bridges. In 1990, 1991, and 1992, the Authority bridges were inspected by three consulting engineering firms with each firm being assigned a different pair of bridges each year. Over the three year period, each firm inspected the entire group of six bridges. The three consultants utilized were Ammann and Whitney; Modjeski and Masters, Inc.; and Parsons Brinkerhoff Quade and Douglas, Inc. Since 1993, Modjeski and Masters, Inc. has performed the annual inspections for all six of the Authority's bridges.

The actual inspections are performed each year by a team of the firm's licensed professional engineers and, where appropriate, experienced engineers under the direction of licensed professional engineers. Presently, all bridges are inspected annually with three bridges receiving a biennial inspection and three bridges receiving a maintenance inspection. The biennial inspection is performed to meet the state and federal requirements while the maintenance inspections are performed to insure the continuation of the present high level of bridge maintenance. For the biennial inspections, the bridges receive hands-on close-up visual inspection of virtually every steel member of the bridges. Special attention is paid to all fracture critical members. Fracture critical members are those steel members whose failure would be expected to result in collapse of the structure. Where it is useful, "snooper" crane trucks and/or underbridge inspection platforms are utilized to provide access for inspections to the bridge floor systems and below deck trusses. Elsewhere, Authority employees rig scaffolding as needed, or the inspectors climb the structural members themselves using "technical access methods" to complete their observations.

The products of these annual inspections include:

- (1) A photographically illustrated narrative report on the condition of each bridge;
- (2) A numerical rating of each component of each vehicular bridge structure consistent with the requirements of the New York State Department of Transportation inspection and reporting manuals and the Federal Highway Administration's National Bridge Inspection Standards. No such numerical rating system exists for pedestrian structures therefore no numerical assignment is made for the components of the Walkway Over the Hudson;
- (3) A checklist of maintenance tasks recommended for implementation by the Authority's in-house maintenance staff; and
- (4) A prioritized listing of extraordinary maintenance, rehabilitation and replacement projects recommended for implementation through the use of outside contractors.

In 1987, the adequacy and effectiveness of the Authority's annual inspection program was evaluated by a joint team of Federal Highway Administration and New York State Department of Transportation officials. They concluded in their evaluation report that the Authority was 100% in compliance with the national standards for frequency of inspection, that the inspections were being carried out by competent and qualified personnel and that "the New York State Bridge Authority should be commended for instituting special in-depth inspections, such as the cable inspection of their suspension bridges, as an indication of their foresight into areas of possible problems." Subsequent FHWA/NYS DOT evaluations have made similar findings.

Additional Procedures

In addition to developing its annual inspection reports, Modjeski and Masters also prepares additional investigation and inspection reports and reviews investigation and inspection reports of other consulting engineering firms retained by the Authority to undertake specific projects. In recent years such additional procedures have included, among others:

- Underwater inspections of each of the Authority's submerged bridge piers, which have been routinely done at three to five year intervals;
- Unwrapping, interior inspection, chemical analysis and fatigue testing of suspension bridge main-cable wires, undertaken at not greater than five year intervals;
- Removal, inspection and testing of suspender ropes;
- Sonar depth plotting and scour monitoring of the river bottom adjacent to the Authority's bridge piers;
- Ship collision studies and associated risk assessments at all bridge crossings with piers in the river;
- Vulnerability Assessment of all NYSBA facilities;
- Seismic analyses of the bridges to identify areas of the structures that do not meet current seismic standards; and
- Truss hanger stress and fatigue analysis.

Finally, Bridge Authority maintenance and engineering personnel are interviewed in connection with both the annual inspections and any additional procedures to collect information on conditions and events observed by them during the course of their work on the bridges.

Implementation

Implementation of the recommended maintenance and rehabilitation and replacement programs is the responsibility of the Authority. After review of the annual inspection reports, the reports of the additional studies and investigations, and the prioritized list of major projects developed by the Authority and reviewed by Modjeski and Masters, the Authority develops both an annual maintenance work plan for its in-house forces and an annual revision of its Five Year Capital Construction and Rehabilitation Program. The current Five Year Program includes work scheduled for the years 2011 through 2016. In addition to the Five Year Program, a long range Capital Construction and Rehabilitation Program extending through the year 2031 has been developed.

Since its inception in 1986 the Authority's Department of Engineering and Maintenance has been



responsible for the condition and proper repair of the bridges. The Chief Engineer is a licensed professional engineer with experience in the inspection, construction and maintenance of large over-water bridges. He oversees a Director of Bridge Maintenance who is responsible for the activities of all Authority maintenance employees and a Director of Contract Maintenance who coordinates the activities of all outside contractors. The Authority employs one bridge maintenance foreman at each bridge and a staff of approximately 48 full-time maintenance workers throughout the bridge system.

These forces are responsible for many maintenance activities which prevent or delay deterioration of the bridges, such as annual washing of the deck support system, lubrication of moving portions of the bridges, spot painting and repainting of portions of the bridges, repairing of roadway deck concrete spalls and deck joints, and minor structural steel repairs and modifications.

The NYSBA has always pursued the policy of maintaining an adequate paint coating on steel bridge members. For many years NYSBA maintenance personnel repainted the bridges. However, with the environmental constraints and associated specialized equipment and expertise required for lead paint removal as well as an increase in general repainting needs, a larger portion of the work has been performed in recent years under contract. Until recently, the practice of the NYSBA was to repaint, under contract, each bridge on a five year cycle. As evidence of the effectiveness of that painting program, as well as other maintenance functions, the calculations made in 1988 and 1992 to set vehicle posting and loading limits did not have any loss of material deducted from steel members due to corrosive deterioration at critical points. However, in order to efficiently manage the current cost and regulatory requests of lead abatement and repainting, the Authority has revised its approach and is now assembling larger paint contracts at less frequent intervals. If this program is continued as planned, the bridges will display more cosmetic deficiencies from time to time, but should not suffer structurally in any significant way.

In addition to the inspection information described herein, the NYSBA has received from Modjeski and Masters load rating reports in 1988 and 1992. Rating analysis calculations were made for the floor system members of all NYSBA structures. This vehicle load capacity information is used by the NYSBA to control weights of vehicles crossing the bridges. The goal of preventing vehicle overloading on the bridges results in reducing maintenance and contract work and may extend the service life of the bridges.

CONDITION OF BRIDGE FACILITIES

Annual inspections were made and reports filed in 2010 on the following NYSBA facilities:

- Bear Mountain Bridge and Approaches
- Newburgh-Beacon North and South Spans With Approaches, including Balmville Road Bridge Over Route I-84 and Route I-84 Bridge Over Route 9W
- Mid-Hudson Bridge and Approaches, including Routes 44/55 Bridge Over Route 9W
- Kingston-Rhinecliff Bridge and Approaches
- Rip Van Winkle Bridge and Approaches
- Walkway Over the Hudson

In the case of the Walkway over the Hudson, an inspection was completed in late 2010 with a report filed in 2011. At the present time, it is anticipated that condition inspections will be completed on a 5 year cycle for this particular bridge.

In the case of the vehicular bridges, the annual inspections were conducted in accordance with New York State Department of Transportation requirements and Federal Highway Administration guidelines. The New York State Inventory and Inspection Forms were updated from the previous year's inspection.

All of the elements of each vehicular bridge are rated. The entire bridge also receives an overall "General Recommendation", which is the Inspector's opinion of what he/she feels is the condition of the bridge as a whole. Important bridge elements such as primary structural members, abutment stems, pier columns, roadway deck, etc., heavily influence the general recommendation. The general recommendation is numerically rated from one to seven. This numerical rating system is described in general terms as follows: 1 signifies "very poor condition"; 2 signifies "poor condition"; 3 signifies "major structural repairs required"; 4 signifies "structural repairs required"; 5 signifies "repairs required"; 6 signifies "minor repairs required"; and 7 signifies "good condition".

The following is a summary of General Recommendations of Bridge Authority facilities from the latest Biennial Inspections:

<u>STRUCTURE</u>	<u>GENERAL RECOMMENDATION</u>
• Bear Mountain Bridge	5
• Newburgh-Beacon Bridge (South Span)	5
• Newburgh-Beacon Bridge (North Span)	5
• Balmville Road Overpass	5
• Interstate 84 over Route 9W Overpass	5
• Mid-Hudson Bridge	5



- Route 9W overpass at Mid-Hudson 6
- Kingston-Rhinecliff Bridge 5
- Rip Van Winkle Bridge 5

An inspection report for each bridge was submitted to the Authority. Maintenance recommendations were abstracted from the reports to serve as checklists for bridge maintenance crews. The Federal Structure Inventory and Appraisal Forms are to be updated for each bridge.

Modjeski and Masters reviews the findings of depth soundings surveys performed each year for all river piers. Findings from underwater diver inspections made in 2007 were reviewed as available. The next Underwater diver inspections are currently scheduled for the summer of 2012.

The findings on the bridge conditions are summarized below, based on the 2010 annual inspection reports. Reference is also made to the recommended 2011-2016 Capital Construction and Rehabilitation Program and the Long range plan through 2031.

Bear Mountain Bridge

The current overall condition of this bridge is good and it requires only minor repair efforts, in addition to the contract repair work detailed below.

A main cable investigation was conducted in 1993-94 by Steinman Boynton Gronquist and Birdsall, Consulting Engineers, to evaluate the cable condition and recommend measures for protecting against deterioration. The cables were completely repainted with an elastic latex based paint in 1993. A contract to rehabilitate and evaluate the entire cable will be performed in the 1999-2000 construction seasons. A periodic cable evaluation was performed in 2007 by Amman and Whitney. In 2003 the main cable southwest backstay was strengthened.

The toll plaza of the bridge was completely rebuilt in 1992 with operational improvements made to the west approach. These improvements resulted in safety improvements to the plaza area operations.

Contract repairs to the bridge piers and underdeck supports were completed in 1992. Additional substructure repairs were carried out in 2000 with strengthening of the east abutment taking place in 2006.

The upper and lower chords of the stiffening truss were repainted in 1992 and the towers were repainted in 1998. A maintenance painting contract was conducted in 2002.

Replacement of the bridge deck asphaltic concrete overlay and deck drainage improvements were performed in 1996. Included in this contract were operational improvements to the east approach to the bridge. An overlay of the existing deck was applied in 2007. By 2021 the bridge will likely require an



entire deck replacement project.

Maintenance facilities at Bear Mountain are very limited. As part of the 1992 toll plaza contract a foundation for a maintenance building was constructed with the actual construction of the building taking place in 2000.

As part of an enhanced security program, security fencing and cameras was added at the bridge in 2003 with additional cameras slated for installation in 2011.

Newburgh-Beacon South Span

The current overall condition of this bridge is good and it should require only minor repair efforts, except for the contract repair work described herein.

Installation of additional safety cables on top truss chords of both the North and South spans was accomplished in 1992.

A painting contract for the main span of this unpainted weathering steel bridge was completed in 1994. Based on the performance of the selected paint system, the remainder of the bridge was repainted in 1998-2000. In-house maintenance painting continues on an as needed basis. Due to the limitation of in-house forces, regularly scheduled maintenance painting by outside contractors will be required in 2017.

A contract to replace the railings alongside the pedestrian walkway was completed in 1996. In addition, a contract to improve the traffic safety barrier on the north side of south span and the north and south side of the north span to comply with national safety standards was completed in 1998.

Underwater pier repairs and substructure repairs were performed in 2003.

A contract to rehabilitate and enhance the capacity of the toll plaza was performed in 2003. In 2007 an overlay was applied to the deck, new modular dams were installed in 2009 and by 2013, the deck of the south span will have to be replaced. This deck replacement, coupled with the new joints that will be included, will alleviate much of the steel corrosion noted in the 2010 inspection.

To enhance the security of the facility, new security fencing was installed in 2003 with additional cameras slated for installation in 2011.

Newburgh-Beacon North Span

The current overall condition of this bridge is good and it requires only minor repair effort, except for the contract repair work described herein.

A contract to replace inadequate shims, or install new shims where they were non-existent, at bearing diaphragms adjacent to floorbeam cantilever brackets was completed in 1993. Installation of additional safety cables on top truss chords was accomplished in 1992.

A substructure rehabilitation contract for the Route 9W overpass structure was completed in 1992.

In 2001-2002 the first major lead abatement project began on the bridge. An additional lead paint removal projects was performed in 2009-10 with another scheduled in 2012-2013.

By 2019-2020, the bridge will require a new deck. Other contracts in the maintenance program include modular joint replacement, and pier base repairs.

Mid-Hudson Bridge

The current overall condition of the Mid-Hudson Bridge is good and it requires only minor repair work, except for the contract repair work described herein.

A main cable restoration project was completed in 1993, during which an extensive cable condition investigation was conducted. This contract provided for unwrapping and rewrapping the main cables, coating the cable wires with lubricant, and painting the cable wrapping. The objective was to prolong the service life of the cables as much as possible. The most recent cable interior inspection was performed in 2010. A project to replace the cable band bolts was completed in 1996.

The bridge deck wearing surface was replaced in 1993. Because of the traffic volume carried by this bridge, the wearing surface was replaced in 2003 and 2007.

In 1999 the bridge sidewalks and railings were replaced to permit continued use by pedestrians and bicyclists. Construction of an underdeck maintenance traveler system was completed in 1998.

The east approach was extensively rehabilitated by contract work in 1989-91. The west approach received major rehabilitation from two contracts in 1990 and 1991. The toll plaza was enlarged and rehabilitated in 1998 providing additional capacity and facilitating the installation of EZ Pass. The East approach will received major rehabilitation in 2013.

A bridge redecking for the Route 9W overpass was performed in 2000 and major west approach

rehabilitation was performed in 2004. As a result of recent seismic investigations, a major seismic retrofit of the bridge will be required in 2022.

In addition, a contract for performing lead abatement painting of the superstructure was performed in 2001-2002.

An emergency command center was added at the Mid-Hudson Bridge in 2010 to handle system wide emergency coordination. In addition, security fencing and cameras were added in 2003 with additional cameras slated for 2011.

Kingston-Rhinecliff Bridge

The current overall condition of this bridge is good. The bridge requires only minor repair effort, except for the contract repair work described below.

Displaced granite coping stones and deteriorated sealer on the bases of the river piers was completed by contract in 1994.

A contract to rehabilitate the west roadway approach, including the toll plaza area, was completed in 1993. Additional approach repairs were performed in 1997, 2000, 2006 and 2010.

Results of the load rating study of the deck and floor system of this and the other Authority bridges in 1988 and 1992, as well as the general condition of the deck indicate that the deck needed to be replaced. This major work was completed in 2002.

A major lead abatement painting project was completed in 2003. An additional lead abatement program is planned for 2018. Because of the size of the bridge, maintenance painting of the areas once containing lead paint will be required before completion of the lead removal contracts.

As a result of recent seismic evaluations of the bridge, seismic rehabilitation of the structure is planned for 2020.

To enhance security at the facility, security fencing was added in 2003 with video cameras installed in 2010.

Rip Van Winkle Bridge

The current overall condition of this bridge is good and it requires only minor repair efforts, except for the contract repair work described herein.

The roadway deck and sidewalks received an overlay in 2007.

The complete replacement of the reinforced concrete roadway was completed in 1992. The river towers and lower chords of the bridge were repainted using full lead abatement procedures from 1993 to 1995. Lead abatement continued in 2006. Regular maintenance painting will take place prior to the completion of the lead abatement projects.

An investigation and inspection of truss hanger pins was completed in 1996 with all pins found to be in satisfactory condition.

Rehabilitation of the toll plaza area was completed in 2002. In addition, surface drainage and shoulder repairs on the east side of the bridge at the intersection of Route 23 and 9G was performed in 2005.

To enhance security at the facility, security fencing was added in 2003 with video cameras installed in 2010.

Long-Term Outlook for NYSBA Facilities

The NYSBA highway bridges will remain serviceable until they become either geometrically and functionally obsolete, or structurally unsafe. Bridges can potentially become geometrically and functionally obsolete because horizontal and vertical clearances become deficient or because traffic capacity reaches intolerable levels. Bridges can potentially become structurally unsafe because of deterioration, insufficient load-carrying capacity, increases in legal loads, or fatigue in structural steel.

Based on our knowledge of the information available from inspections, investigations and load ratings, our opinion is that NYSBA bridges are all geometrically and functionally serviceable, structurally safe, and maintained to high standards. It is our opinion that the current NYSBA policies of regular inspections, and timely maintenance and rehabilitation work must be continued so that the bridges will remain serviceable. Given the age of the structures, any substantial delays in preventative maintenance may result in rapid deterioration of the facility.

**EVALUATION OF INSPECTION AND MAINTENANCE PROCEDURES
AND THE FIVE YEAR PROGRAM**

Vehicular Bridges

Modjeski and Masters believes that the annual vehicular bridge inspection program conducted by the NYSBA is successful in achieving its goal of obtaining information on bridge conditions. As stated in the Federal report which reviewed NYSBA inspection procedures, the Authority is to be commended for its inspection program with its emphasis on special investigations such as the suspension bridge cable condition. The firm believes that the Authority is benefiting from the application of the latest techniques and state of the art knowledge to its inspections and investigations.

Modjeski and Masters believes that the Authority has an excellent record of response to the annual inspection findings. The maintenance program continually incorporates the inspection findings to the extent that Authority capabilities permit. Whenever maintenance forces cannot perform needed work as defined by the inspection results, this work is scheduled for maintenance or rehabilitation contract work. The Authority has appropriately determined the priority of the contract work in the Five Year Program.

The Authority's in-house maintenance efforts are, in our judgment, well-directed toward the goal of minimizing the need for contract maintenance. These efforts are cost-effective, based on the condition of the bridges that have resulted. The Authority's maintenance and rehabilitation program keeps the Authority's facilities in very good condition and is, in my opinion, among the best in the nation.

The effects of aging, traffic and changing public needs can be expected to result in continued need for repair and rehabilitation. The firm believes that the planning which has produced the Five Year Program is well-conceived. Adherence to the scheduled program will enable the Authority to cope with deterioration and will keep the facilities serviceable.

Walkway Over the Hudson

Though rehabilitated just prior to the Authority's assuming ownership, there are a significant number of repairs that must be performed on the Walkway over the Hudson. A large number of the repairs can be performed using in-house forces but before this can be done significant expenditures must be made for access walkways, platforms and safety lines. At present, an average of just over \$2.6 million per year is programmed for the Walkway Over the Hudson for the next five years. Because of the expenditures necessary for construction access as well as the results of recent lateral loading analyses, we feel that this may be somewhat low, with something more like \$3.0- \$3.5 million per year being required for each year of the next five years. This annual expenditure should decrease over time with something on the order of \$1.5 to \$2.0 million being required each year for years 6 through 10.



Mr. Joseph Ruggiero
Consulting Engineer's Report on
Physical Condition of Bridges

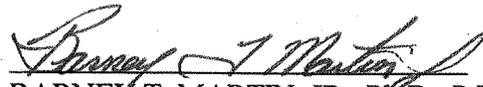
Page 13

Conclusions

With the exception of the amount budgeted for the Walkway over the Hudson, the timing and estimated costs for projects in the Five Year Program, as well as the Long Range Plan, are good estimates of when the projects are needed and how much they can be expected to cost.

Modjeski and Masters therefore believes that the Authority's current operating procedures, with their associated costs for maintenance operations, and the Five Year and Long Range Capital Construction and Rehabilitation Program expenditures will sustain operations at a high standard. The high capital asset value of the Authority's facilities can be expected to be maintained as the service life is extended by Authority policies and operations.

Very truly yours,


BARNEY T. MARTIN, JR., Ph.D., P.E.
President
Modjeski and Masters, Inc.

BTM:btm