AMBASSADOR BRIDGE

2007 ANNUAL INSPECTION REPORT

1.0 INTRODUCTION

The Ambassador Bridge is an International crossing over the Detroit River between Detroit, Michigan, and Windsor, Ontario, Canada (see Location Map on Page 11). The bridge is owned, operated and maintained through a joint partnership of the Detroit International Bridge Company (DIBC) and the Canadian Transit Company (CTC).

The original design drawings and specifications of the bridge were prepared by the McClintic-Marshall Company of Pittsburgh, Pennsylvania, who also acted as the General Contractor. The Company requested the approval of their plans, specifications and construction performance by the consulting firm of Modjeski and Chase of New York City. The Ambassador Bridge was opened to traffic on November 15, 1929, after a two-year construction period.

The Ambassador Bridge is a suspension bridge. The suspended main span has a parallel wire main cable that was placed by aerial spinning. The backstays are unloaded. The two sections of the bridge located under the backstays from the main towers to their respective anchorages consist of deck truss spans, with an additional deck truss span located over Fort Street on the U. S. approach. The remaining spans are plate girder spans.

This report includes the findings of the 2007 Annual Inspection of the main span, the U.S. approach and the Canadian approach. Maintenance and repair recommendations are listed at the end of the report, and updated expansion joint and rocker lean measurements are included for reference in Appendix A.

Modjeski and Masters, Inc. would like to thank the maintenance employees of the DIBC and the CTC for their help and assistance during the inspection.

2.0 EXECUTIVE SUMMARY

The Ambassador Bridge is in overall fair condition. The Bridge Company has established repair/rehabilitation and maintenance "Packages" to be performed on specific bridge components to address the deficiencies and/or issues as discussed in the annual bridge inspection reports. The specific packages are listed on Pages 22 and 23. Two significant repair packages (Package #5 and Package #10) were completed near the end of 2007. Package #5 consisted of Interim Structural Steel Repairs that either reinforced members deteriorated due to corrosion and/or cracks or strengthened members in generally good condition to provide increased load capacity. With completion of repair Package #5, all bridge members have a minimum acceptable rating factor of greater than 1.00 at the operating level under both HS20 and Ambassador Bridge legal truck loading except for several main span stringers that were not included in the repair package at the time of development. Those members that were repaired or reinforced and members strengthened include the following:

- Main span stringers with end deficiencies (38 supplemental stringers were installed adjacent to the original stringers).
- Main span floorbeams (additional web plates were installed at six floorbeams).
- U. S. and Canadian approach truss and girder span joists (67 joist ends were reinforced with channels).
- Canadian approach girders (seven girder ends were reinforced with web plates)
- U. S. and Canadian approach truss span floorbeam trusses (truss vertical members were strengthened to increase the original load capacity).

Package #10 consisted of a Main Cable Investigation and Suspender Rope Replacement Contract. The main cable investigation included unwrapping and wedging the cable to inspect the interior wires at four locations on both the east and west cables. A cable band was removed on the east cable for the investigation. Saddle covers atop the towers were removed to view the cable wires and a few cable strands were wedged in the northwest and southeast anchorage chambers. The tension in cable band bolts was measured where possible adjacent to the wedged panel locations. As part of the main cable work, repairs were made to areas of the wrapping wire with broken wires, gaps between wires and areas or overlapped wires and to hand rope stanchion connections. The findings of the main cable investigation indicated the interior wires are overall in very good condition. The complete results of the cable investigation are included in a separate report.

Forty-seven pairs of suspender ropes (33 on the east cable and 14 on the west cable) were replaced as part of the contract. Previous investigations including laboratory testing and inspections revealed severe corrosion and broken wires at the

rope socket connections and at the cable bands. The deterioration of the shorter ropes at the cable bands was found to be more severe than for the longer ropes and the deterioration at the socket connections was more severe on the east ropes due to more contact over time from debris and deicing materials than on the west side of the bridge which is protected by the sidewalk. Laboratory destructive strength testing of more deteriorated shorter ropes removed from the east side of the bridge in 2003 revealed a minimum factor of safety of 2.5. Based on these findings, all the shorter ropes on both sides of the bridge were replaced as were selected longer ropes mainly on the east side. The new galvanized ropes are not painted, except at the floorbeam connections.

There are several additional structural components or systems that should receive priority attention to improve or maintain the overall condition of the bridge. Other items require maintenance work of a continuing nature to be performed annually. All reported deficiencies should be monitored annually for change and the possible need to implement interim repair measures. The major inspection findings and concerns of the bridge components are as follows:

- The paint coating on the outer surface of the main cables is weathered and thin with isolated separation of the coating. Circumferential cracks exist in the coating, specifically on the backstays below the roadway. Repaint the cables and cable bands. Replace missing and deteriorated caulking at all anchorage cable hoods to ensure a near watertight condition.

- The primary structural metalwork of the suspended main span, truss spans and girder spans is in fair to good condition; however, several repairs are recommended for these and other components. The majority of the structural steel section loss reported throughout the bridge has been arrested by the blast cleaning and painting, completed in 2001.

  Subsequent to the development of the Interim Structural Steel Repair Contract in 2006, rating analysis and inspections has determined that 12 additional main span stringers warrant repair or reinforcement. These stringers which are identified in Section 8.0 should be repaired as soon as practical. Eleven other stringers should be scheduled for repair in about two years or included in Package #2 if developed at that time.

  Replace the severely deteriorated main span floor system metalwork near both towers (Panel Points 0 and 0'). Replace the finger dams and the finger dam support metalwork and rehabilitate the stiffening truss link assemblies at both towers.

  Replace the deteriorated wind transfer plates in the truss span top chords. Replace/repair deteriorated truss and girder span joists. Replace/repair the deteriorated truss bracing and connection plates adjacent to the bearings at Bents CA6, CC1, CC4 and CC5. Modify the floor system support metalwork on the south side of the roadway joint in Span CC3 to reduce vertical deflection.

The pin joints of the Span 5 rocker bearings at Fort Street, the Span CA5 rocker bearings at Bent CA4, the Spans CA1 and CC1 bearings at the towers and the Span CC6 bearings at the Canadian anchorage are moderately to severely worn and will continue to wear, causing minor changes in elevation of the spans. Continue to monitor the wear in the bearing pins until rehabilitation or replacement of the bearings can be undertaken.

Rehabilitate the truss top chord plate bearings above Bent CA1 for Span CA2 for proper functioning. Loosen hold-down bolts and remove debris from the slotted holes in the bottom flange of the stringers at Bent CA4 and lubricate bearings to allow proper movement. The deck truss rocker bearings are in the expanded position, 1-1/2" to 2" more than normal at the U. S. Tower, and the ends of the top chords and stringers contact or are very close to the tower expansion dam metalwork at high and low temperatures. A plumb survey was performed on the approach Bents CA1 through CA4 and the U. S. tower in 2003 to help determine a cause for the offset of the span metalwork. The survey revealed the approach bents have a very minor lean to the south, while the tower is offset to the north over 1" at roadway level, with respect to the base. The tower position has apparently contributed the greatest extent to the span position.

- There are operational and potential safety problems associated with the inspection and maintenance travelers in the main span. Many of the support rail beams are distorted or misaligned and many of the webs of the beams are cracked or broken at the ends. The support wheels generally bear on the outboard portion of the support rails and contact the rivet heads of the adjacent stiffening truss metalwork at locations. Due to the above conditions the travelers do not move efficiently on the rails. Movement is accompanied by loud binding sounds and skewing of the platform position. The north traveler was not able to be used during this inspection because of the skewed condition. An in-depth mechanical and electrical inspection and evaluation of the traveler system was performed in June 2006. The results of the inspection, including short-term repairs and options for rehabilitation and replacement to provide an efficient, reliable and safe system, are presented in a separate report.

- The condition of the concrete deck of the U. S. and Canadian approach spans has been improved since the 2003 inspection by completing replacement of nearly all of the expansion joints and the expansion joint support joists (Package #1). The deck of the U. S. truss spans is in generally good condition and the deck of the Canadian truss spans is generally in fair condition, except near the bridge towers and other random locations. The deck of the U. S. girder spans is in fair to good condition. The deck of the Canadian girder spans is in fair to poor condition with greater deterioration in the form of potholes in the bituminous overlay, spalled areas, cracking,

corroded stay-in-place forms and vertical movement under certain live load conditions.

- The main span concrete deck is in poor condition and is near the end of its service life. We understand a deck replacement contract (Package #2, Phase 1) is proposed for the main span followed by similar reconstruction in the approach spans (Package #2, Phase 2). Milling and resurfacing of the deck on the entire bridge was performed in the summer of 2005.

- Remedial action is needed on the sidewalk and bridge railings to strengthen against vehicle loading or impact. Current standards are more stringent than the original design criteria. This issue is to be addressed in a separate repair contract. Until repairs are made continue to cover large spalls and holes that develop in the sidewalk concrete. The bridge deck does not presently have a median barrier for separation/protection of the two-way traffic.

- Even though the main span maintenance walkway railing may have met past requirements, they do not meet the current OSHA standards for guardrail systems. The top and mid-height rails consist of 3/4" rods. The top rail is very near the minimum height requirement of 42" plus or minus 3" above the walkway surface; however, there are no intermediate supports between floorbeams. The top rail maybe deflect below a minimum height of 39" under loading. It is not known if the top rail is capable of withstanding, without failure, a force of at least 200 pounds in the outward or downward direction as required in the standard. The mid-rails have intermediate supports, but the height of the rail is lower than 1/2 the height of the top rail above the walkway surface as required by the standard. Modification of the railing system is recommended to comply with the current standards.

A close review of the problem areas associated with this structure has revealed that there should not be any adverse progressive structural affects based on the scope of this inspection.

The Bridge Company should consider a security assessment study for the bridge to primarily identify any existing component vulnerabilities and to develop countermeasures as needed for the vulnerabilities in conjunction with existing security measures.

A load capacity rating based on a proposed rehabilitation design was performed for the entire bridge in 2005 and supplemented with a recently completed as-built rating. The results of ratings are included in a separate report.

The repairs/replacements recommended, along with the maintenance required of the bridge staff, will help improve the safety and serviceability of the structure. The rehabilitation contracts completed in recent years and in future years will ultimately increase the overall condition and service life of the bridge.