Structural Inspection Report

Glebe Road Overpass

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IEPC ENGINEERING SERVICES

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I. Introduction

1. IEPC have been appointed by the Ministry of Public Works, Government of Bermuda under the framework agreement to carry out a visual structural inspection of the Glebe Road Overpass.

2. A visual non-intrusive inspection of the overpass was carried out from a MEWP as shown in Photograph 1 in Appendix A on the 29th August 2023.

3. This report summarizes the observations during this inspection and provides recommendations and next steps.

4. Project Stakeholders
   a) Ministry of Public Works, Government of Bermuda - the "Client"
   b) iEPC Limited - the "Engineer"

II. Existing Staircase

A. Site Location

1. The Glebe Road overpass connects Glebe Road to the north and south of Palmetto Road.

B. Existing Structure

1. The overpass has a span of approximately 40 feet and is approximately 32 feet wide.

2. The existing overpass is a steel girder bridge, with the bottom flange encased in 6 inch-deep prestressed concrete. There are 7no. girders spanning the length of the bridge, with an approximate depth of 20.5 inches. The bridge deck is reinforced concrete, which spans between the girders spaced at approximately 5 feet 4 inches. The depth of the concrete deck is unknown.

3. The original girders appear to have been galvanized. The specification and thickness of the original galvanizing is unknown.

III. Observations

A. General

1. The overall condition of the bridge is fair.

2. The following sections provide a detailed summary of each structural element inspected. Refer to Figure 1 for the bridge notation reference.

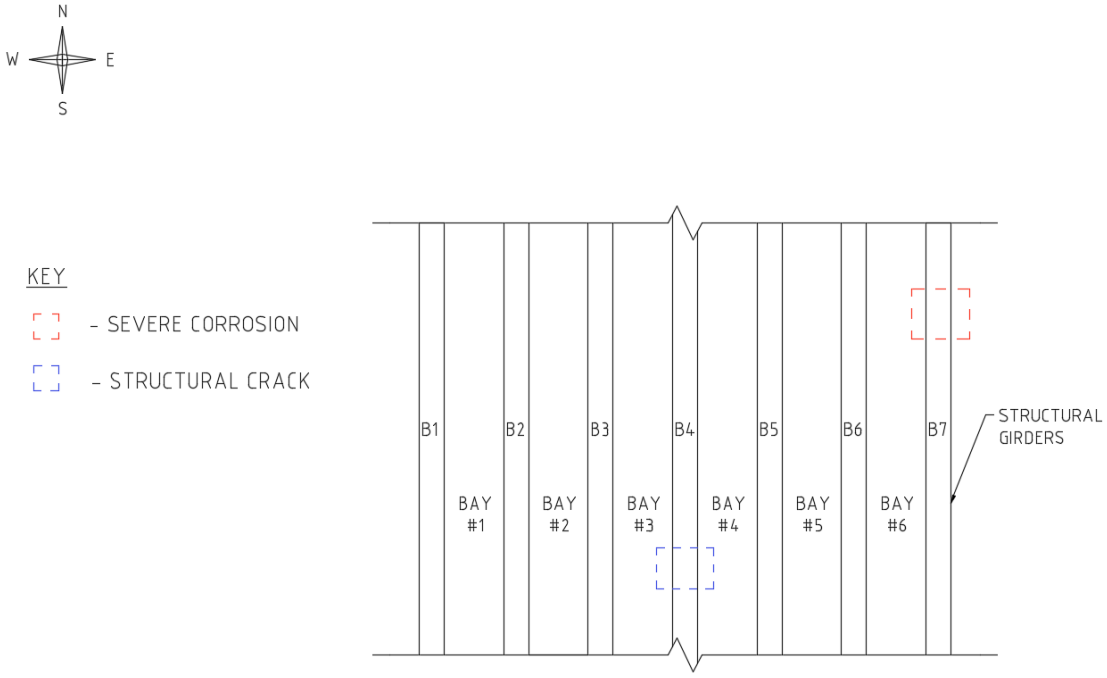

Figure 1- Bridge notation reference

B. Girders/Beams

1. B1
    a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
    b. There is one location where holes have been drilled through the web. There is severe corrosion around the perimeter of the bottom two holes, as shown in Photograph 4 in Appendix A.
    c. The prestressed concrete flange appears to be in good condition. An example of this is shown in Photograph 5 and 6 in Appendix A.
2. B2
    a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
    b. The prestressed concrete flange appears to be in good condition. An example of this is shown in Photograph 5 and 6 in Appendix A.
3. B3

a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
b. The prestressed concrete flange appears to be in good condition. An example of this is shown in Photograph 5 and 6 in Appendix A.

4. B4
    a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
    b. There is a significant crack along a small section of the prestressed concrete flange as shown in Photograph 7 and 8 in Appendix A. The approximate location of the crack is identified in Figure 1.
5. B5
    a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
    b. The prestressed concrete flange appears to be in good condition. An example of this is shown in Photograph 5 and 6 in Appendix A.
6. B6
    a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
    b. The prestressed concrete flange appears to be in good condition. An example of this is shown in Photograph 5 and 6 in Appendix A.
7. B7
    a. A significant proportion of the galvanizing system has failed, with corrosion of the steel surface visible. An example of this is shown in Photograph 2 and 3 in Appendix A.
    b. There are two areas where there appears to be pitting corrosion, as shown in Photograph 9 and 10 in Appendix A. The approximate location of the corrosion is shown in Figure 1.
    c. The prestressed concrete flange appears to be in good condition. An example of this is shown in Photograph 5 and 6 in Appendix A.

C. Bearings

1. The overall condition of the bearings appears to be poor.

2. The bearings appeared to be severely corroded, which has resulted in the concrete upstand detaching from the steel bearing. An example of the corrosion is shown in

Photograph 11 in Appendix A. Video (MOV) files IMG_8404, IMG_8405, IMG_8406 and IMG_8481 showing the extent of the corrosion are included in the data pack issued with this report.

D. Soffit of Bridge Decking

1. The overall condition of the concrete decking appears to be fair, as shown in Photographs 12 and 13.

2. There are localized areas where the concrete has spalled due to corroded reinforcement, with the bottom reinforcement exposed. Examples of this are shown in Photograph 14 and 15 in Appendix A.

3. There are localized areas where the concrete has spalled, but it is still attached to the soffit of the bridge deck. An example of this is shown in Photograph 16 and 17 in Appendix A.

E. Parapet

1. The condition of the parapet appears to be good to fair.

2. There is a horizontal crack within the render along the outside face of the eastern parapet, as shown in Photograph 18 in Appendix A.

IV. Discussion

A. Girder/Beams

1. The original protective coating system has failed, causing the steel beams to corrode. Although the corrosion did not appear to be severe, it is unclear how much of the original steel section remains intact.

2. There are localized areas where holes have been drilled through the web. In some of these locations, the section of steel to the perimeter of the hole has severely corroded. The risk is that as the severity of the corrosion worsens, the holes could potentially merge, to form one larger hole.

3. It is not clear what has caused the crack along the prestressed concrete encasement in beam B4. However, the crack appears to be localized and there are no other defects along the length of the girder to indicate that the crack is affecting the structural capacity of the member.

B. Bearings

1. Due to the space available, it is difficult to get a close inspection of the bearings. They are also not visible on all four sides, therefore it is difficult to provide a comprehensive assessment of their condition. However, based on what is visible, there is significant corrosion of the bearings and localized degradation of the concrete plinths on which the bearings sit.

2. Given the condition of the bearings, it is possible that potential issues could arise in the future. This is a particular risk as there appears to be no protection system in place to prevent or slow the ongoing degradation.

C. Soffit of Bridge Decking

1. The localized areas where the reinforcement is exposed could lead to further corrosion of the reinforcement, which could impact the capacity of the deck.

2. The localized areas where the reinforcement is exposed could lead to further spalling as the adjacent section of reinforcement could corrode. This is a concern as falling debris represents a high risk to vehicles passing beneath the overpass.

3. There are some locations where the concrete has spalled but has not fallen off to expose the reinforcement. This is a concern as the loose debris will at some point fall from the soffit, which represents a high risk to vehicles passing beneath the overpass.

D. Parapet

1. The crack along the eastern face of the parapet appears to be superficial, therefore it does not appear to be a structural issue.

V. Recommendations

A. Girder/Beams

1. The beams should be cleaned of all corrosion and a new protective paint system applied to ensure the durability of the existing structure. The new protective coating should be specified to provide life to first maintenance of minimum 15 years.

2. The thickness of the original metal should be surveyed, and the load capacity of the bridge structure assessed.

3. Further investigation of the crack along the prestressed concrete encasement on beam B4 should be carried out to determine what remedial works may, or may not, be required.

B. Bearings

1. Due to the severe corrosion of the bearings, consideration should be given to full replacement of the bearings.

C. Soffit of Bridge Decking

1. In the localized areas where the concrete has spalled, a concrete repair mortar should be applied to reinstate the soffit of the deck and protect the reinforcement from corrosion.

2. Given the high risk associated with falling debris, it would be prudent to use a rebound hammer to test for areas of the soffit where the concrete is unsound. Any areas of unsound concrete should be broken out, and a concrete repair mortar applied.

I. Appendix A – Photographs

Photograph 1 – Access to the overpass was via a MEWP

Photograph 2 – Example of the failed protective coating

Photograph 3 – Example of the failed protective coating

Photograph 4 – Corrosion of holes through Beam B1

Photograph 5 – Example of prestressed concrete encasement in good condition

Photograph 6 – Example of prestressed concrete encasement in good condition

Photograph 7 – Localized crack in Beam B4 prestressed concrete encasement

Photograph 8 – Localized crack in Beam B4 prestressed concrete encasement

Photograph 9 – Localized evidence of corrosion pitting in Beam B7

Photograph 10 – Localized evidence of corrosion pitting in Beam B7

Photograph 11 – Example of severe corrosion of the bearings

Photograph 12 – Overview of the bridge deck soffit

Photograph 13 – Bridge deck soffit

Photograph 14 – Example of localized spalling to bridge deck soffit

Photograph 15 – Example of localized spalling to bridge deck soffit

Photograph 16 – Example of localized spalling with concrete still attached to soffit

Photograph 17 – Example of localized spalling with concrete still attached to soffit

Photograph 18 – Crack along the eastern parapet