JOHNSON STREET BRIDGE

CONDITION REPORT

PREPARED FOR

CITY OF VICTORIA

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APPENDICES

1.0 TERMS OF REFERENCE

The investigation is required to include a structural evaluation and protective coating assessment on the highway bridge and approach spans as follows:

Structural Evaluation

1. An assessment of the level of corrosion in members resulting in reduced structural capacity. This is to include a program of ultrasonic measurement.

2. Give a load rating for the bridge.

3. Investigate the condition of the counterweight.

4. Record significant levels of corrosion on marked up copies of the erection drawings.

5. Prepare recommendations on maintenance and repairs.

6. Give budget cost estimates and priorization of the maintenance/repair work.

Paint System Evaluation

1. An assessment of the paint system including degree of active rusting, degree of paint breakdown, thickness and adhesion of existing paints.

2. An evaluation of current maintenance practices and practical life of the paint system.

3. Options and recommendations, including budget cost estimates to include, at a minimum, continued or upgraded maintenance and new coating systems.

2.0 METHODOLOGY

2.1 Prime Consultant (Graeme & Murray Consultants Ltd.)

1. The previous full inspection of the road bridge was undertaken by Graeme & Murray Consultants Ltd. in 1978 when a record of the level of corrosion for every member was made. Following this inspection a major restoration of both road and rail bridges was undertaken with many members being replaced, particularly on the railway bridge deck. The bridges were then painted the present blue by overcoating the previous black.

   Files and drawings of this 1978 investigation were retrieved from archives in order to repeat a similar methodology and to compare the results.

2. The field investigation was carried out by a team of two staff members. The below deck steel and concrete was inspected from existing platforms and gantries, from the flanges of the east approach girders and by climbing the girders and bracing members where necessary. The upper portion of the bascule bridge was inspected from existing platforms and by climbing over the individual members. The main difficulty was the east approach span which does not have

a below deck gantry, however by climbing on to the bacing tees close to the abutments a close up inspection of the upper beams was possible. Those close to the abutments appeared to be representative of the general condition.

It was found that the ultrasonic investigation was of limited value. The equipment was bulky and not easily moved into difficult places, however measurements were taken at similar locations to those taken in 1978. The results although very accurate are specific to a pinpoint location whereas visually it is easily seen that conditions vary greatly in short distances. By far the most useful tool is a small pick to remove the surface rust or laminations and then make a visual assessment.

Much of the conditions have been photographed and "representative" photographs have been chosen to illustrate the commentary.

3. The actual field notes are included in Appendix I to the report and give the level of corrosion in a tabular manner referenced to the member designation given on the erection drawings. To better describe the detailed observations summary statements are made which correspond to specific recommendations for repair.

4. An analysis of certain affected elements was made where necessary in order to prepare recommendations for repairs.

5. During the investigation it became obvious that severe corrosion of members directly supporting the concrete deck would result in some form of load restriction being required. This load restriction would have to be maintained until replacement of the concrete deck and steel members below was undertaken. Over time the load limit will have to be progressively reviewed and reduced as corrosion continues.

6. The construction cost and priorization has been made for the items of work recommended.

7. The investigation did not include the electrical system and machinery, nor the concrete piers and abutments.

2.2 Subconsultants (Levelton Engineering Ltd.)

A painting assessment has been made by Levelton Engineering Ltd. and their report is included as Appendix 2. This has included the following:

1. History of the painting on the Johnson Street Bridge.

2. Research and discussion of environmental restrictions.

3. Recent developments in paint technology for bridges.

4. Discussion of cleaning and preparation options.

5. Discussion of total removal and repainting versus overcoating the existing paint.

6. Comparative cost estimates of different repainting options. No overall cost of implementing these was prepared as a policy discussion is required on future maintenance programs and or bridge replacement.

3.0 SUMMARY OBSERVATIONS

3.1 West Approach Span

1. The roadway surface is covered with a thin layer of asphalt. It has been worn through to the concrete deck slab over a small area at the east end. The longitudinal construction joints of the slab are reflected in the asphalt surface, most noticeably at the east end. The sidewalk surface on the south side and the curb on the north side are concrete which is in reasonable condition.

2. Dirt from the roadway penetrates the deck joints and deposits on the horizontal surfaces of angle bracing and beam flanges accelerating corrosion of these elements. (photo 1)

3. Water and chloride ingress into the structural concrete deck, particularly at construction joints is corroding the slab reinforcement and spalling the concrete in large sections from the soffit. (photo 2) Corrosion occurs extensively at the top flange of the upper transverse steel beams. (photo 3) The situation is typical throughout the west span. It must be emphasized that the construction joints are not solely the cause of corrosion. The members are exposed to airborne salt from proximity to the ocean.

4. Water and chloride ingress into the structural concrete deck occurs at the guardrail posts. The detail and problem is the same on both the north and south sides. Corrosion of the steel at the connection of the posts to the transverse steel beams is causing concrete spalling from the structural concrete deck. (photos 4 & 5) The problem is general, at most of the guardrail posts.

5. The west ends of the main girders above the baseplate have severe corrosion. (photo 6) A comparison to a photograph of the '78 Report indicates how much the situation has deteriorated in 20 years.

6. There is some minor seepage through the fixed construction joint over the west abutment at the south end. This may be to blame for the main girder corrosion at the ends.

7. Immediately below the concrete deck accumulation of the rusted metal (oxides) on the top flanges of the transverse beams have lifted the concrete resulting in additional stresses within the structural concrete deck and leaving parts of it unsupported. (photo 7)

8. The main girders, (with the exception of the ends over the bearing plates), the main transverse beams and stringers are only minimally or superficially corroded, i.e. the severe corrosion is confined to the upper transverse steel beams.

9. A more stringent program of preventive maintenance is required with regular removal of debris and dirt removal followed by paint touch-up.

3.2 East Approach Span

1. The driving surface is the structural concrete deck and there is no asphalt. There are longitudinal construction joints which are filled with bitumen. The sidewalk surface on the south side and the curb on the north side are concrete which is in reasonable condition.

2. As is the case with the west span the construction joints in the concrete slab are causing serious corrosion problems in the structural steel in the area below. (top flange of the upper transverse beams). The bituminous seal to the joints appears to be ineffective. (photos 8 and 9).

3. The deck beam adjacent to the joint in the deck at the west end is in a particularly serious condition because of its inaccessibility which makes it impossible to clean or paint. (photo 10).

4. The guard rail post detail explained and depicted for the west span is similar for this span also.

5. All four bearing locations have varying degrees of corrosion to the bearing stiffeners and at all locations there is at least one stiffener which is corroded through entirely where it connects to the baseplate. (photos 11 and 12) The south east anchor bolt at the east end is severely reduced in cross section.

6. Accumulation of the rusted metal (oxides) on the top flanges of the transverse beams have lifted the structural slab so that it is poorly supported at certain locations. (photos 13 and 14) and any exceptional wheel load could easily cause cracking of the slab.

7. There is serious corrosion in the angle bracing between the main girders at some locations. (photo 15)

8. The absence of an inspection gantry limits inspection (and maintenance) to areas close to the abutments.

9. The main girders, (with the exception of the ends over the bearing plates), the main transverse beams and stringers are only minimally or superficially corroded, i.e. the severe corrosion is confined to the upper transverse steel beams.

10. A more stringent program of preventive maintenance is required with regular removal of debris and dirt removal followed by paint touch-up.

3.3 Bascule Span

1. The driving surface is a riveted steel grid deck which was installed in 1966 and which replaced an original wood deck. It is in acceptable condition although rivets occasionally fail and it is the practice of the City to repair this by welding.

We would expect this welding to lead to local failures from fatigue stresses. The sidewalk is transverse wood boards on sleepers over three longitudinally spanning steel channels. The wood deck is in acceptable condition. The concrete curbs to the roadway have some minor spalling.

2. The steel deck is supported on transverse steel beams. These were also part of the retrofit when the steel deck was installed and do not date from the original construction. These transverse steel beams are still in good condition although considerable debris from the road has accumulated on them. (photo 16) The flanges are cleaned by washing but are difficult to clean adequately for painting.

3. The longitudinal stringers have light corrosion only.

4. The main transverse floor beams are constructed as built up rivetted plate girders. There is a large buildup of debris from the roadway on the bottom flange which causes it to be constantly damp. Rivets which connect the plates and angles are seriously corroded at their heads. (photos 17 and 18).

5. Structural tees provide bracing between the main transverse floor beams and the bascule truss bottom chord. The connection is made through a large horizontal steel gusset plate. The gusset has been subjected to serious corrosion. The rivets connecting the tee were replaced with bolts in the '79 repairs. The gusset has thinned to an unacceptable degree. (photo 19).

6. The bottom chord of the bascule truss is comprised of longitudinal angles and side plates, linked by lattice flat bars. The bottom chord is only lightly corroded except for the locations where the floor beams and vertical truss members connect. Locally here the horizontal legs of the angles are thinned by heavy corrosion. The loss is estimated to be about 12% of the member. (photos 20 and 21).

7. One of the channels supporting the sidewalk has an unacceptable loss of section. (photo 22).

8. The double angle members of the cantilever brackets are thinned locally at the gusset connector plates. (photo 23).

9. Corrosion of the upper structure occurs more predominantly in the lighter members which are present for bracing and to ensure stability of the main bascule truss. The main truss members are only lightly corroded although photo 38 indicates one seriously deteriorated member.

3.4 Counterweight Span

1. The driving surface is a concrete slab which is of relatively recent construction and is presumed to have been constructed in 1966 as part of the work which removed the old wood deck. This concrete structure is in good condition. The sidewalk is timber similar to the bascule span except that the support structure extends for the operators hut. There is heavy corrosion of the channel sections in this area which have been strengthened in a rudimentary fashion. In two of the three channels the strengthening is ineffective. (photo 24).