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Summary Report
Visual Inspection of the Uxbridge Brook Culvert
Town of Uxbridge

March 2nd and 3rd 2009

Engineered Management Systems Inc.

Confined space entry inspection conducted by
Soderholm Maritime Services



engineered management systems inc.

Summary Report – Uxbridge Brook Culvert

Intent of Report

This report is supplemental to the report submitted by Soderholm Marine Services. It is intended to bring the large quantity of information collected during their inspection into a more concise and readily accessible format. We encourage the reader to review the Soderholm reports and videos if more information is required.

Culvert Position

Please note that we have not received clarification as to the precise positioning of the culvert as it winds its way under Brock Street West. The positioning we have provided is estimated by site observation and what information we have received to date. While it does not greatly impact our recommendations, the exact culvert layout should be established as part of the detailed design for replacement.

Previous Inspections

All municipal records indicate that the last previous inspection of this structure was in March 1987. Unfortunately, the results of that inspection offer little assistance in establishing a benchmark with respect to the rates of observed deterioration.

Report Navigation

This report is presented in an interactive format and should be reviewed using Adobe Reader v. 9 or later.

On the right side of each page is a navigation panel which will take the reader directly to the page of interest.

Under "Aerial Views" the reader is given a sense of location and orientation of the structure. Clicking on any of the Aerial View links will show the overall site from the specified height. Clicking on "Culvert Location" will display the culvert orientation with the limitations outlined above. Clicking on "Sections" will reveal the 9 major sections delineated by year of construction, building material and geometry. Lastly, clicking on the sections themselves will reveal summary information for that particular section.

On other pages, clicking on red, blue or green dots will reveal information or images related to that location.



Summary Report – Uxbridge Brook Culvert

Aerial Views

- [Aerial View \(36000 m\)](#)
- [Aerial View \(1500 m\)](#)
- [Aerial View \(500 m\)](#)
- [Culvert location](#)
- [Sections \(Click sections for more info\)](#)

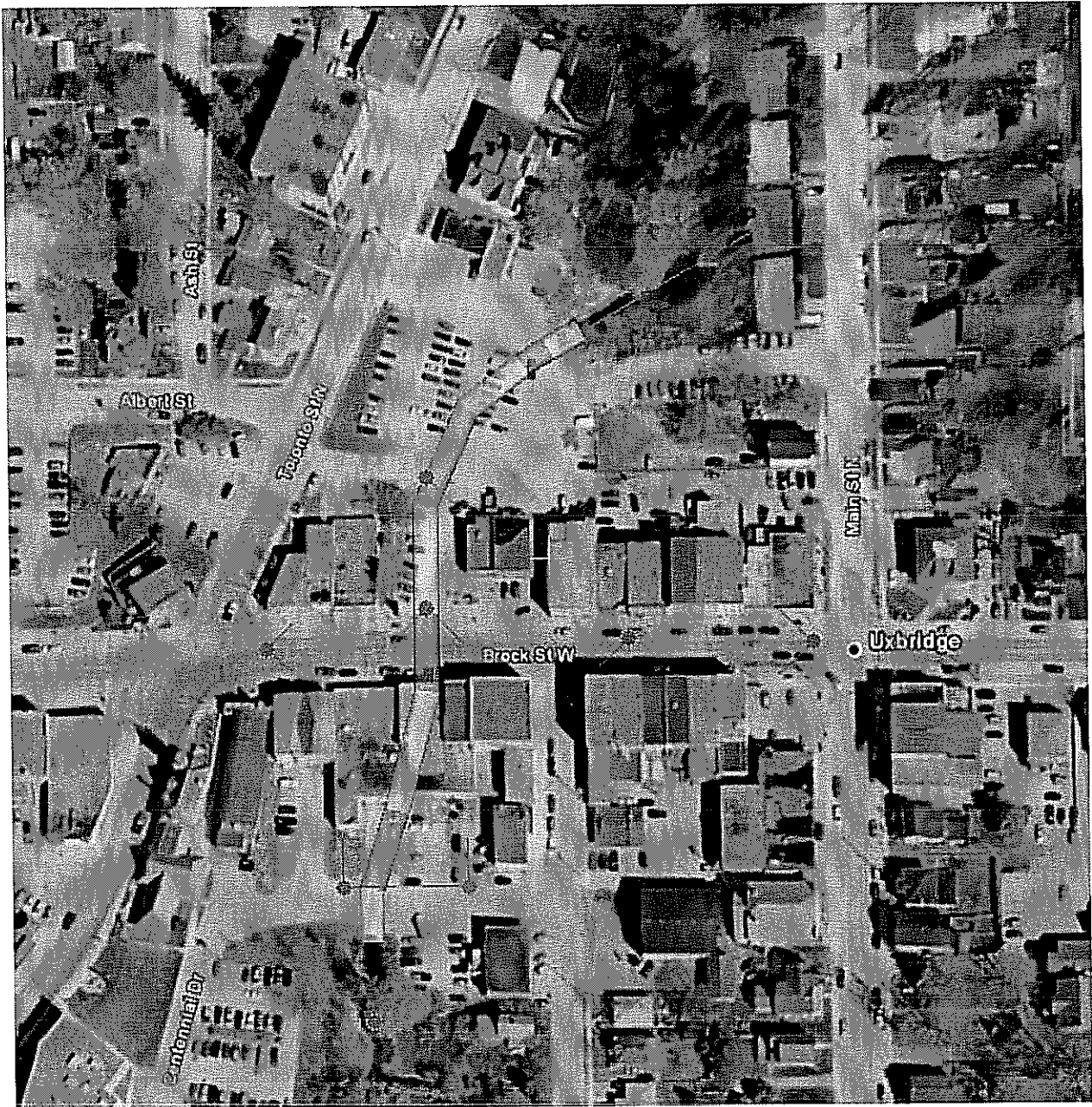
- [Aerial Views](#)
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Summary Report – Uxbridge Brook Culvert

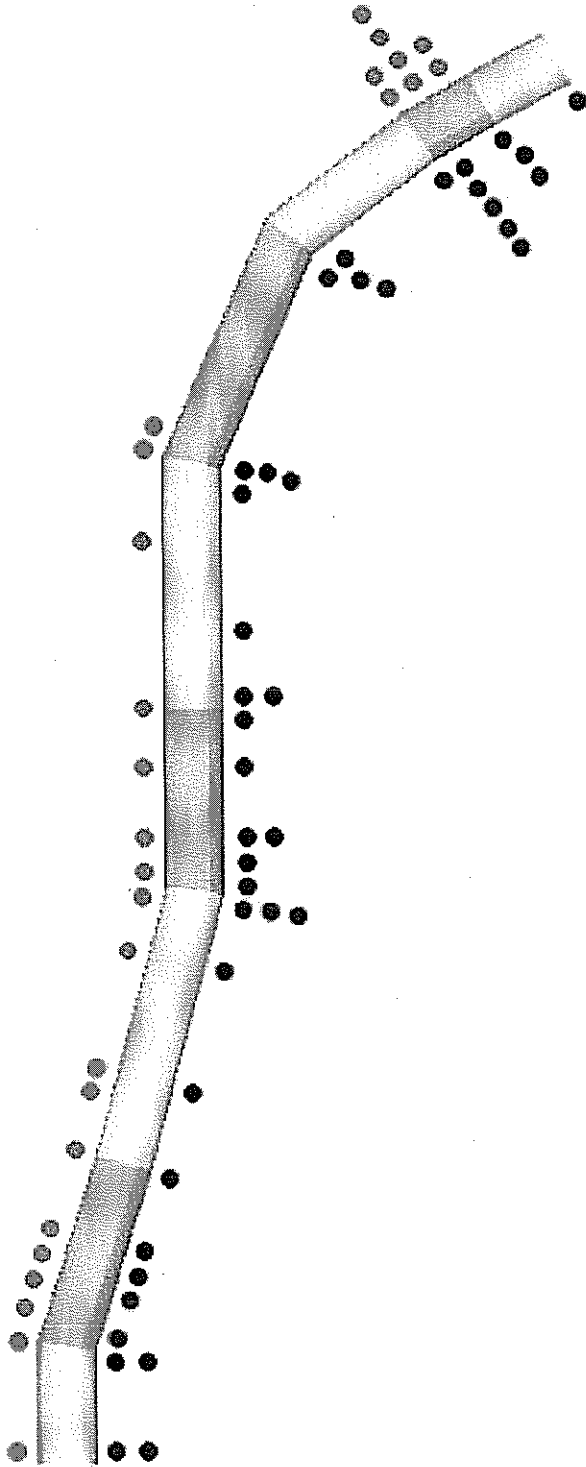
Site Imagery

- Aerial Views
- Site Imagery
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- Recommendations



Summary Report – Uxbridge Brook Culvert Culvert Imagery

Aerial Views
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Recommendations



Summary Report – Uxbridge Brook Culvert Recommendations

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Removals

Sections 5, 6, 7, 8 and 9 can be removed first and the watercourse left open. This will impact parking on the north side of Brock Street but, to our knowledge, this is not a major concern. Once removed this will effectively eliminate any potential for flooding as a result of collapse of any of these sections. This will also greatly enhance access to Sections 3 and 4 for continued monitoring and possible installation of a liner. We do not recommend replacement of these sections unless absolutely necessary. Apart from cost, long underground culverts are difficult to inspect and maintain and are continually prone to blockage. Reclaiming the watercourse would also offer an aesthetic enhancement to the area.

Strategy 1

If liners are an option from a stormwater management perspective (cross-sectional area available for flow will be reduced by as much as 20%) then this may be a viable alternative to replacement for strengthening the weakest culvert section, that under Brock Street (Section 4) as well as Section 3. Once in place, the liner can be pressure grouted around its circumference to stabilize the disintegrating masonry vault around it.

With Section 4 stabilized, Sections 1 and 2 can be excavated. A liner can then be installed into Section 3 followed by pressure grouting similar to Section 4. Sections 1 and 2 can then be replaced.

Strategy 2

While logistically difficult and somewhat more expensive, the preferred solution is to demolish the buildings over and adjacent to the culvert, close Brock Street, excavate entirely and reconstruct Sections 1 - 4. In this way a continuous culvert can be constructed, flow capacity can be increased, foundation issues can be dealt with throughout. It will also be possible to realign the culvert to a straight or at least near straight configuration reducing the potential for blockage.

Continue ...



Summary Report – Uxbridge Brook Culvert Recommendations (cont.)

Aerial Views
Site Imagery
Culvert Imagery
Recommendations

Timing

We have very little information as to the construction and design details of the various elements comprising this structure. Similarly, we have no information as to the condition of exterior surfaces. As such, it is not possible for us to assign a remaining service life to any element. The replacement/reconstruction of this asset should be considered a priority and be acted upon as soon as possible. All required environmental studies and subsequent engineering design should commence immediately.

In the interim we would suggest the following course of action:

Immediate removal of Sections 5-9. This will eliminate any potential for flooding due to collapse or blockage of these sections and it will make monitoring of the Sections below Brock Street and below the buildings on the South side of the street much easier. These removals will be necessary in any event regardless of which strategy is ultimately adopted.

Implementation of a monitoring program. The program should focus on the condition of Sections 3 and 4 and should involve monitoring for crack movement and increased loss of mortar. We would suggest this take place at 3 month intervals. It should be pointed out that all that can be achieved from such a program is early warning that the condition has worsened. It will not be possible to predict a safe remaining service life.

Install shoring below Sections 3 and 4. This will also be far easier to achieve after the aforementioned removals. Removal of any blockages arising from the shoring acting as an obstacle should be monitored on a weekly basis by municipal staff. Note - at this point in time shoring of these Sections has not been recommended only because of the potential for blockage and the difficulty in monitoring it and remedying it.

Move forward with Strategy 1 or Strategy 2 as appropriate. With the Sections adequately shored and a formal monitoring process in place, implementation of one of these Strategies should take place as soon as possible.

[Previous ...](#)



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INSPECTION REPORT

PROJECT: UXBRIDGE BROOK CULVERT INSPECTION

FOR: ENGINEERED MANAGEMENT SYSTEMS INC.

BY: PAUL COULOMBE

DATE: 2 & 3 MARCH 2009

LOCATION: HWY 47, TOWN OF UXBRIDGE

METHOD

The inspection was carried out by: an inspector and an inspector's helper, both breathing ambient air with SCBAs as back up air supplies. Support crew included: two entrance guards, a rescue man, a video operator, and a winch operator for the equipment raft/safety boat. The inspector used hard wired radio communication and videography equipment. Large fans were used to exchange the air in the culvert prior to and during the penetration. Prior to the inspection, a thorough JSA, and a confined entry plan and permit were produced and carried.

The scope of the inspection was to report on current conditions, and take measurements.

The inspection was witnessed by David Freisner of Engineered Management Systems.

OBSERVATIONS

Top materials surrounding and above the mouth of the culvert (south, inlet):

Undeterminable due to snow and ice cover due to time of year.

1st section of CSP - arched, 3.4m wide by 2.3m high, 14.6 metres long:

The culvert steel, galvanized coating, and bolted connections are in good condition, with minor localized rusting at some bolts holes on the west bolted connection.

Overburden consists of 10 cm of sand, small braches and cinder blocks on the bottom of the culvert.

1st transition - between CSP and the smaller concrete chamber:

The interface from round to square was partially filled with cinder blocks, and the balance formed with plywood and poured with concrete. Most of the forming plywood is still in-place. The cinder blocks are still in place and holding the background earthen materials. At the water line on the east wall, there is minor erosion, and no footing was detected. At the water line on the west wall, there was a sound footing detected and minor erosion between the bottom of the wall and the top of footing. There is no undermining of the footing on the west wall. The bottom of the CSP culvert was detectable and slightly above the creek bottom in the concrete chamber.

Small section of concrete chamber - 22.4 metres long:

The smaller section of concrete culvert is of poured-in-place construction. Width varies from 3.1 to 3.3 metres ID and height varies from 1.6 to 2.2 metres.

The west wall is poured on a concrete footing, and there is no undermining of the footing. There is minor erosion at the bottom of the wall above the footing for the first 6 metres, and there were 2 cold joints noticed in the wall. One of the cold joints as well as another vertical crack found in the wall have opened up near the bottom of the culvert, which suggests that the west wall has sunk downwards since construction.

The east wall had no detectable footing, but part of the wall was adjacent the remnants of a concrete floor. Where the east wall had no floor, there was no undermining of the wall detected.

This section of culvert also curves to the left throughout it's length.

Concrete quality in this culvert section is poor to fair.

Debris in this section consists of mud, carpets, chairs, bicycles, branches, cinder blocks, and concrete rubble.

Transition between the small concrete chamber and the larger concrete chamber:

There are two concrete interfacing walls (one on each side) and a concrete interfacing header poured in place in this transition from the small chamber to the larger chamber. Some areas are still formed in plywood. All exposed cold joints are intact. On the east side at the water line above the footing, the bottom of the transition wall has eroded away due to unmixed concrete in the pour (outside the affected area concrete is sound). On the west side at the water line, the transition wall overhangs the footing, and the overhanging corner has eroded away. Both footings are sound and not undermined.

Large section of concrete culvert - 5.5m wide by 2.3 metres high, 32 metres long:

This section of culvert is of poured-in-place walls on top of footings and precast ceiling construction. There is no detectable floor in the section.

Along the west wall there are a couple outcroppings of the footing with vertical rebar - possibly preparation for column and header reinforcement. For the last 6.5 metres of the west wall, the wall construction changes to cinder block end wise and mortar construction forming the transition to the stone archway. The footing is sound and not undermined with the exception of a little erosion nearing the south end.

Along the east wall the footing is sound with no erosion or undermining for the first 18 metres. There is a footing repair for the next 12 metres. The footing repair is sound with no undermining. The last 5 metres of the footing change course towards the mouth of the next culvert section (the next section is narrower than this one) forming a retaining wall and narrowing of the creek channel. The footing repair changes course with the footing and ends 2 metres from the end of this culvert section. Only the 2nd last metre of the retaining wall had minor undermining of 10 cm high by 15 cm deep by one metre long (for one metre beyond the repair).

There is a south wall on this culvert section with an opening the same size as the next culvert section.

Concrete quality in this culvert section is poor to fair.

Debris in this section consists of mud, a couch, bicycles, branches, and concrete rubble.

Transition between the large culvert section and the stone archway:

There is a space between the end wall of the concrete chamber and the leading wall of the stone archway. The footings from the concrete chamber extend to and butt up against the stone walls. The footings are quite eroded but still viable and have very little undermining. On top of the footings is concrete rubble, then an air space up to the road level.

Stone archway - 3.5m wide by 2.4m high, 22.5 metres long:

The archway is of mortared stone construction. There are no detectable footings in this culvert section, mortared stone continues below creek bottom. At the water line and below, 80% of the mortar has been washed away, and a few missing stones were noticed. Above water, 50% of the mortar is separated or missing, and the other 50% is still viable. The archway has cracks in the mortared stone from one side to the other every metre or so, cracks are up to 20mm wide. The archway bends to the right after 15 metres. After the bend, there are 3 horizontal steel tie bars across the ceiling. The 3rd tie bar is missing mortar and stone around it, suggesting that the archway has squatted since construction. Creek bottom composition is muddy sand and mortar rubble.

Transition between the stone archway and CSP:

The CSP is butted right up to the stone archway. Transition materials include a 2 metre long corrugated steel interfacing piece along the ceiling which is grossly deteriorated, and some placed concrete. Material behind the deteriorated ceiling piece is suspected to be placed concrete. Upstream cut end of CSP is grossly deteriorated due to damage to galvanized coating - localized to the first 5cm of culvert.

Section of CSP - arched, 3.3m wide by 2.2m high, 30.5 metres long:

With the exception of the first 5cm, this section of culvert including steel, coating, and bolted connections, is in very good condition. A few puncture holes were found in one location, probably from or before installation. One slightly caved in area was noticed in the ceiling, probably due to loose bolts from the time of installation. Overburden consists of 5 to 8cm of sand on the bottom of the culvert.

Transition from 2nd CSP to 3rd CSP:

The bottom 40% of the transition is sealed with placed concrete. The top 60% of the transition is sealed with concrete rubble and rags. The transition appears to be in as built condition.

Section of CSP - original shape undetermined, 3.7m wide by 2.2m high, 29 metres long:

The inspector can not determine whether this section is arched CSP - installed out of level, or flattened out [before installation] circular CSP - installed out of level, or just distorted from weight. The beginning of this section is 3.7 metres wide by 2.2 metres high, while the last third of this section is 4.0 metres wide by 1.9 metres high. CSP steel and galvanized coating is in good condition.

The east bolted connection is covered by a 25cm wide CSP cover plate welded in position. The welds are cold galvanized. The welds and cold coating are in fair condition.

There are two slightly caved in areas in the ceiling, probably due to loose bolts from the time of installation.

Overburden consists of 8 to 30cm of sand on the bottom of the culvert.

Transition from 3rd CSP to 4th CSP:

The bottom 40% of the transition is sealed with placed concrete. The top 60% of the transition is sealed with placed concrete over chunks of plywood to fill in the voids. The transition appears to be in as built condition.

Section of CSP - arched, 3.8m wide by 2.1m high, 19.7 metres long:

This section of culvert including steel, coating, and bolted connections, is in good condition. There is a welded elbow in this section just past the transition. The weld and the cold galvanizing coating are in good condition. There is a sand shoal just past the welded elbow, 0.75 metres high, half the width of the culvert.

Overburden consists of 8 cm to 75 cm of sand.

Transition from 4th CSP to 5th CSP:

The top 50% of the transition is sealed with placed concrete over chunks of plywood to fill in the voids. The transition appears to be in as built condition. The bottom 50% of the transition is obscured from view by a dam of arborous debris. The dam of debris is anchored by the vertical wooden shoring posts in the next culvert section.

Section of CSP - arched, 3.8m wide by 2.1m high, 10.3 metres long:

This section of culvert is shored by 6 vertical 6"X 6" wooden posts. Currently, only the 1st shoring post is weight bearing from the ceiling, and the cause of the dam of debris. The other 5 shoring posts are not functional. The dam of debris is holding back 36 cm of water elevation differential.

There is an outfall in the ceiling near the beginning of the section, and the cut out in the ceiling of the culvert for the outfall is 1.6 metres long. This enormous cut out is the reason for the weakening of the culvert and the caving in the area.

All the bolt holes along the west side bolted connection have ripped open - up to 6mm gap for the length of this culvert section. No torn bolt holes noticed on the east side of the culvert.

Overburden consists of 8 to 30 cm of sand and wood debris on the bottom of the culvert.

Transition from 5th CSP to 6th CSP:

The bottom 40% of the transition is sealed with placed concrete. The top 60% of the transition is sealed with galvanized tin. The inspector cannot determine whether the material behind the tin is placed concrete or concrete rubble.

Last section of CSP - arched, 3.8m wide by 2.1m high, 10 metres long:

This section of culvert including steel, coating, and bolted connections is in good condition. Overburden consists of 5 to 10 cm of sand, plus some rocks and wood debris on the bottom of the culvert.

Outside and around culvert outlet (north end):

Corrugated galvanized steel sheet retaining wall in line with culvert outlet is in very good condition. Interface between culvert and retaining wall appears to be in as built condition. The deck on top of retaining wall was hidden by a snow bank at time of the inspection.

See Observation Reports: Conditions Survey and Physical Measurements for more information.

RECOMMENDATIONS

Remove the larger arborous and domestic debris from the concrete chambers to prevent further collection forming a dam. *Chainage 38 metres.*

Pry away the deteriorated steel transition piece in ceiling of the transition (at the end of stone archway) to ensure the material behind is placed concrete, and not a flowable back fill that may pour through when the steel rusts away. *Chainage 122 metres.*

Remove debris dam near outlet. *Chainage 171 metres.*

Remove ineffective wooden shoring, which is creating a dam. *Chainage 171 to 181 metres.*

Design and install a reinforcing system upstream and downstream of the 1.6 metre cut out in the culvert. *Chainage 174 metres.* The reinforcing system should border the inside circumference of the culvert, as opposed to the existing centerline shoring system which has only trapped debris and created a dam.

Weld a patch plate over the torn bolted connection on the west side of the 2nd last CSP section. *Chainage 171 to 181 metres.* Patch plate can be identical to the existing splice plate on the east side of the 3rd CSP section (at chainage 123 to 151 metres).

Implement a monitoring program for the two cracks on the west wall of the smaller concrete chamber that indicate settling. *Chainage 19.5 and 26 metres.*

Fill the void between the end of the large concrete chamber and the front wall of the stone archway with a non-compressible material. *Chainage 69 metres.* This may prevent further cracking of the mortared stone, and prevent further widening of the existing cracks in the stone archway.

Replace the washed out mortar at and below the water line in the stone archway with an underwater non-shrink grout such as *Speedcrete*. This will protect the remaining of the mortar from further erosion, as well as reinforce the bottom of the walls. *Chainage 69 to 91.5 metres.*

Inspection Report: Physical Measurements
 Project: Uxbridge Brook Culvert
 Client: Engineered Management Systems

Inspection Date: 02 & 03 March 2009
 By: Paul Coulombe

| <u>station in feet</u> | <u>station in meters</u> | <u>width in meters</u> | <u>height in meters</u> | <u>overburden depth in centimeters</u> | <u>notes</u> |
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|

1st section of CSP - arched, 3.4m wide by 2.3m high, 14.6 metres long

| | | | | | |
|----|------|------|------|----|-------------------|
| 0 | 0 | 3.4 | 2.3 | 10 | ←dimensional data |
| 10 | 3 | 3.5 | 2.25 | 10 | |
| 20 | 6 | 3.5 | 2.25 | 10 | |
| 46 | 14 | 3.5 | 2.25 | 10 | |
| 48 | 14.6 | 3.53 | 2.25 | 5 | |

1st transition - between 1st CSP and the smaller concrete chamber

| | | | | | |
|----|------|--|--|--|-----------------------------------------------|
| 48 | 14.6 | | | | culvert turns to the right at this transition |
|----|------|--|--|--|-----------------------------------------------|

Small section of poured concrete chamber - 3.3m wide by 1.6m high, 22.4 metres long

| | | | | | |
|-----|------|-----------|-----------|-----------|-----------------------------------------------------------------------------------|
| 48 | 14.6 | 3.1 - 3.3 | 1.6 - 2.2 | 0 and n/a | ←dimensional data |
| 122 | 37 | 3.1 - 3.3 | 2.2 | na | |
| | | | | | where the floor exists - there is no overburden |
| | | | | | where the floor exists - culvert height is 1.6m |
| | | | | | where the floor does not exist - creek bottom is 2.2m from the ceiling on average |
| | | | | | culvert curves to the left throughout the length of this section |

2nd transition - from the small concrete chamber and the larger concrete chamber

| | | | | | |
|-----|----|--|--|--|------------------------------------------|
| 122 | 37 | | | | culvert does not bend at this transition |
|-----|----|--|--|--|------------------------------------------|

Large section of concrete culvert - 5.5m wide by 2.3 metres high, 32 metres long

| | | | | | |
|-------|------|-----|-----|-----|----------------------------------------------------------------------------------------------------------|
| | | | | | wall are poured in place on top of footings, ceiling is precast |
| 122 | 37 | 5.5 | 2.3 | n/a | ←dimensional data |
| 225 | 69 | 5.5 | 2.3 | n/a | |
| | | | | | culvert is straight throughout the length of this section |
| 180.5 | 55 | | | | here of east wall begins the footing repair |
| 205 | 62.5 | | | | here on west wall: west wall changes to cinder block and mortar construction |
| 210 | 64 | | | | here the east footing begins to widen out and narrows the creek channel to the width of the next section |

Inspection Report: Physical Measurements
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 By: Paul Coulombe

| <u>station in feet</u> | <u>station in meters</u> | <u>width in meters</u> | <u>height in meters</u> | <u>overburden depth in centimeters</u> | <u>notes</u> |
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|

3rd transition - between the large culvert section and the stone archway

| | | | | | |
|-----|----|--|--|--|---------------------------------------------------|
| 225 | 69 | | | | culvert turns to the left at this transition (1□) |
|-----|----|--|--|--|---------------------------------------------------|

Stone archway - 3.5m wide by 2.4m high, 22.5 metres long

| | | | | | |
|-----|------|-----------|-----|-----|-----------------------------------|
| 225 | 69 | 3.4 - 3.5 | 2.4 | n/a | ←dimensional data |
| 300 | 91.5 | 3.4 - 3.5 | 2.4 | n/a | |
| 275 | 84 | | | | elbow to the right in the section |

4th transition - between the stone archway and CSP

| | | | | | |
|-----|------|--|--|--|-----------------------------------------------|
| 300 | 91.5 | | | | culvert turns to the right at this transition |
|-----|------|--|--|--|-----------------------------------------------|

2nd section of CSP - arched, 3.3m wide by 2.2m high, 30.5 metres long

| | | | | | |
|-----|------|-----|-----|---|-------------------|
| 300 | 91.5 | 3.3 | 2.1 | 5 | ←dimensional data |
| 334 | 102 | 3.3 | 2.2 | 6 | |
| 367 | 112 | 3.3 | 2.2 | 7 | |
| 401 | 122 | 3.3 | 2.1 | 8 | |

5th transition - from 2nd CSP to 3rd CSP

| | | | | | |
|-----|-----|--|--|--|--------------------------------------------------------|
| 401 | 122 | | | | culvert turns slightly to the right at this transition |
|-----|-----|--|--|--|--------------------------------------------------------|

3rd section of CSP - original shape undetermined, 3.7m wide by 2.2m high, 29 metres long

| | | | | | |
|-----|-----|-----|-----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | | | transition to next piece of CSP: inspector can not determine whether or not this next section of CSP is arched and installed out of level, or circular and flattened out (before installation) and installed out of level, or just weight loaded and distorted unevenly. |
| 401 | 122 | 3.7 | 2.2 | 8 | ←dimensional data |
| 420 | 128 | 3.8 | 2.1 | 15 | |
| 440 | 134 | 3.9 | 2 | 22 | |
| 459 | 140 | 4 | 1.9 | 30 | |
| 480 | 146 | 4 | 1.9 | 30 | |
| 495 | 151 | 4 | 1.9 | 30 | |

Inspection Report: Physical Measurements
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| <u>station in feet</u> | <u>station in meters</u> | <u>width in meters</u> | <u>height in meters</u> | <u>overburden depth in centimeters</u> | <u>notes</u> |
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|

6th transition - from 3rd CSP to 4th CSP

| | | | | | |
|-----|-----|--|--|--|---------------------------------------------------------------------------|
| 495 | 151 | | | | water level at this location is 0.8 meters from the bottom of the culvert |
|-----|-----|--|--|--|---------------------------------------------------------------------------|

4th section of CSP - arched, 3.8m wide by 2.1m high, 19.7 metres long

| | | | | | |
|-----|-------|-----|-----|---------|-----------------------------------------------------------------------------------------------|
| 495 | 151 | 3.8 | 2.3 | 30 | ←dimensional data |
| 500 | 152.5 | 3.8 | 2.3 | 8 to 75 | |
| 525 | 160 | 3.8 | 2.2 | 30 | |
| 550 | 167.6 | 3.8 | 2.1 | 30 | |
| 560 | 170.7 | | | 125 | |
| 500 | 152.5 | | | | culvert elbows to the right, mitred and welded angle in the CSP |
| 510 | 155.5 | | | | beginning of sand shoal, 0.75 meters high on east side, 8 cm from culvert bottom on west side |
| 550 | 167.6 | | | | water level at this location is 0.95 meters from the bottom of the culvert |
| 560 | 170.7 | | | | presence of dam made taking measurements impossible |

7th transition - from 4th CSP to 5th CSP

| | | | | | |
|-----|-------|--|--|--|------------------------------------------------------------------------------|
| 560 | 170.7 | | | | location of dam of arborous debris, culvert does not bend at this transition |
|-----|-------|--|--|--|------------------------------------------------------------------------------|

5th section of CSP - arched, 3.8m wide by 2.1m high, 10.3 metres long

| | | | | | |
|-----|-------|-----|------|-----|---------------------------|
| 560 | 170.7 | | | 125 | ←dimensional data |
| 565 | 172.2 | 3.9 | 2.05 | 30 | |
| 594 | 181 | 3.8 | 2.1 | 8 | |
| 565 | 172.2 | | | | first wooden shoring post |
| 594 | 181 | | | | last wooden shoring post |

8th transition - from 5th CSP to 6th CSP

| | | | | | |
|-----|-----|--|--|--|----------------------------------------|
| 594 | 181 | | | | culvert does not bend at this location |
|-----|-----|--|--|--|----------------------------------------|

Inspection Report: Physical Measurements
 Project: Uxbridge Brook Culvert
 Client: Engineered Management Systems

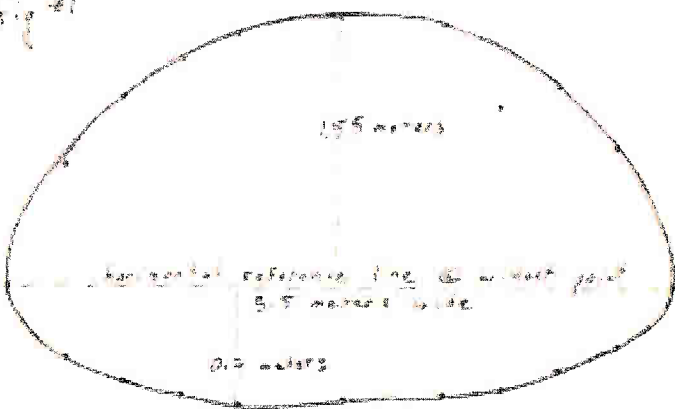
Inspection Date: 02 & 03 March 2009
 By: Paul Coulombe

| <u>station in feet</u> | <u>station in meters</u> | <u>width in meters</u> | <u>height in meters</u> | <u>overburden depth in centimeters</u> | <u>notes</u> |
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|
|------------------------|--------------------------|------------------------|-------------------------|----------------------------------------|--------------|

6th (last) section of CSP - arched, 3.8m wide by 2.1m high, 10 metres long

| | | | | | |
|-----|-----|------|------|----|-------------------|
| 594 | 181 | 3.75 | 2.15 | 10 | ←dimensional data |
| 626 | 191 | 3.75 | 2.15 | 10 | |

| | | | | | |
|--|--|--|--|--|--|
| | | | | | |
|--|--|--|--|--|--|

| station in meters | station in feet | video ref | description | photo no |
|----------------------|--------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| | | | <p>chainage begins at upstream mouth of culvert (southern end)</p> <p>all references to the clock are viewed facing north (downstream)</p> <p>at the time of the inspection, the inspector was not aware that arched profile culverts were in use, and suspected that the distorted shape of the culvert was a result of weight loading. This written log acknowledges the existence of arch CSP, and any discrepancy in the video dialogue should be disregarded.</p> | |
| 6 | 20 | 0:02:00 | <p>profile of arched culvert</p>  <p>profile of arch culvert shown on east side, west side typical</p> | 3 |
| | | 0:03:00 | <p>CSP steel and coating in good condition</p> <p>minor corrosion at bolted connection on west wall at 0900 - localized</p> | 2 |

Inspection Report: Conditions Survey
 Project: Uxbridge Brook Culvert
 Client: Engineered Management Systems

Inspection Date: 02 & 03 March 2009
 By: Paul Coulombe

| <u>station in meters</u> | <u>station in feet</u> | <u>video ref</u> | <u>description</u> | <u>photo no</u> |
|--------------------------|------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| | | 0:03:30 | culvert bottom composition: 4" of sand & gravel, debris of plywood, cinder blocks, branches where the bottom of this culvert section was detectable (0600), galvanized coating and corrugated steel appear to be intact | |
| 14.6 | 48 | 0:04:15 | transition from CSP to concrete chamber: | |
| | | 0:05:00 | east side of transition, very minor erosion at bottom of wall. photos at 0330 photos at 0200 of transition | 15, 16, 85 17 - 19, 86, 87 |
| | | 0:07:30 | west side of transition, erosion at bottom of wall w/ exposed rebar. photos at 0830 | 4, 5, 8, 9, 12, 14 |
| | | 0:08:10 | sound footing <u>under</u> west wall downstream of transition point minor erosion of bottom of west wall <u>above</u> footing extending from 14.6 to 19 meters transition in footing on below west wall, end of water line erosion area, no undermining of either footing | 76 - 80 81 |
| 16.8 | 55 | 0:08:50 | overhead storm grate - appears no longer in service, grate is square metal type, no light showing through, conduit through culvert ceiling is square shaped poured concrete | 26 |
| 18 | 60 | 0:09:40 | evidence of concrete floor, 40% remaining adjacent to east wall, interface in good condition spalled through weep hole in east wall just above water line with exposed rebar | 23, 24 |
| | | 0:10:30 | minor erosion at waterline, bottom of west wall <u>above</u> footing, footing intact, not undermined | 77 - 80 |

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|--------------------------|------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 19.5 | 64 | 0:10:40 | vertical cold joint in west wall: shows evidence of settling downward, 3/4" gap has opened up at bottom of joint | 20 - 22 |
| | | 0:10:55 | weep hole made of cast in cinder block at bottom of west wall just above footing, typical every 10' along west wall in this culvert section | |
| | | | there are two openings openings in the west wall, half way up the wall - openings are lined with 2" lumber, solid backing, not in use | 82 |
| | | 0:11:45 | spalled through weep hole in east wall just above water line | |
| | | 0:12:30 | east wall: interface between bottom of wall and floor - no erosion, no undermining | |
| 21 | 68 | 0:12:50 | 12" CSP outfall on east wall, back fill intact, no voids | 25 |
| | | 0:13:45 | only 20% of concrete floor remaining adjacent to east wall, interface between floor and wall in good condition - no erosion, no gap | |
| | | 0:14:15 | creek bottom composition where no floor: concrete rubble and cinder blocks, water 20" deep, sand and mud | |
| | | 0:14:30 | west wall has a footing - no erosion, no undermining | |
| 24 | 80 | 0:15:20 | overhead storm grate: grate is square cast steel type, conduit through culvert ceiling is square, and appears to be poured concrete | 83, 84, 88 29, 30 |
| | | 0:15:30 | 2 X 4 lumber nailed vertically to east wall, typical all along east wall in this culvert section | |
| | | 0:15:45 | spalled through weep hole in east wall just above water line w/ exposed rebar. hole dimensions: 5" wide, 4" tall, 11" deep. area spalled: 18" wide, 15" high | |
| | | 0:16:15 | west wall and footing: no erosion or undermining of footing | |
| | | 0:16:35 | west wall: cast in cinder block weep holes just above footing, typical every 10' for this section of culvert | |

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|--------------------------|------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| | | 0:16:55 | creek bottom composition: no more traces of a concrete floor | |
| | | 0:18:20 | east wall: no more floor, no footing detected, east wall extends beyond creek bottom, no undermining detected | |
| 26 | 85 | 0:18:30 | west wall: vertical crack in poured wall and footing - 1/4" crack in gap near bottom - evidence of downward movement. no erosion or undermining of footing | 27, 28 |
| 30 | 100 | 0:24:30 | overhead storm grate: grate is square cast steel type, conduit through culvert ceiling is square, poured concrete | 37 |
| 32 | 105 | 0:19:25 | east wall, 12" above water line: another spalled weep hole, 6"wide, 8" high, 9" deep | 32, 33 |
| | | 0:20:00 | presence of intact concrete floor 3' wide adjacent to east wall | |
| | | 0:20:20 | west wall: another cast in cinder block weep hole at wall bottom, interface between wall and footing is 100% intact, no erosion or undermining of footing, loose mud creek bottom in area | |
| 35 | 115 | 0:21:20 | east wall: 6" fiber pipe outfall, solid backing in square cut hole through east wall | 31 |
| | | | east wall: presence of footing 2' wide, intact, no erosion, no undermining | |
| | | 0:22:10 | west wall: footing typical, no erosion, no undermining | |
| 37 | 122 | 0:22:40 | transition to larger concrete chamber: east, ceiling, and west surfaces have an outside and an inside corner (construction of transition to larger chamber) | |
| | | | creek bottom composition: course and fine sands, stones and pebbles, debris consists of cinder blocks, branches, bicycles, and a couch | |

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| | | 0:25:50 | east wall outside corner above footing: corner eroded away, 19" wide, 16" high, exposed rebar. appears to be no fines or creme in concrete pour this area | |
| | | | east wall corner footing: sound footing below water, no undermining | |
| | | 0:26:50 | minor erosion between wall and footing east side of transition | 39 |
| | | 0:27:30 | cold joints gaps between 1/16" and 1/8" east side of transition, in good condition | |
| | | 0:27:45 | concrete is sound top half of east transition | |
| | | 0:27:50 | 4" plastic outfall in inside corner of transition, half way up, styrofoam fill, solid backing 14 deep | 40 |
| | | 0:28:40 | ceilings: both ceilings appear to be in good condition | |
| | | | east top side of transition: pour forming plywood still in place, cold joints appear in good condition, plywood appears to be nailed into concrete | |
| | | 0:29:10 | east wall of larger chamber: construction includes form tie holes | 41 |
| | | | east wall form tie holes: lower course of form tie holes are weeping moisture, typical this location to downstream | 42 |
| | | 0:30:00 | east: concrete is sound to slightly soft to chipping hammer | |
| | | 0:30:50 | west wall at transition: west wall 90 degree corners, west footing 45 degree corners | |
| | | 0:31:00 | west footing is intact in 45 degree configuration, no erosion, no undermining | |
| | | 0:31:10 | west: bottom of outside corner of wall is deteriorated away where it overhangs the footing | |
| | | | west: minor erosion of bottom of wall at interface with footing | |

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|--------------------------|------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| | | 0:31:35 | west: 2 X 4 lumber caught in pour creates a weep hole | |
| | | 0:31:50 | west: no undermining of footing at transition | |
| | | 0:32:20 | west inside corner of transition: 3/4" gap in cold joint, some sand back fill flowing through | |
| | | 0:33:30 | west inside corner of footings: 1/2" gap in joint, no erosion, no undermining, footing in sound condition | |
| | | 0:34:00 | west wall form tie holes: west wall has form tie holes typical of east wall | |
| | | 0:34:20 | west wall footing downstream: vertical surface below water still covered in form wood, form wood has separated and trapped creek bottom materials sand and mud. no erosion or undermining of west footing | 47, 48 |
| 47 | 155 | 0:36:10 | west wall: outcropping in the footing with heavy gauge vertical rebar protruding - appears to be preparation for a pillar and header | |
| | | 0:36:40 | footing in area is not undermined | |
| | | 0:37:00 | west wall cold joint: cold joint is sound tight | |
| | | 0:37:15 | west wall 4" outfalls: there are four various 4" outfalls in this chainage area on the west wall | 46, 50 - 52 |
| | | 0:37:40 | west wall footing: no erosion or undermining this whole section | |
| | | 0:38:20 | video dialogue indicates a repair. the inspector realized after the fact that the plywood was just left over forming material that had separated from the footing and trapped creek bottom | |
| | | 0:39:40 | west wall footing concrete: easy to chip with hammer, chipping depth 3/32", softer than wall concrete | 49 |
| | | 0:40:10 | east wall: wall and footing are sound, no erosion or undermining of footing | 54, 55 |

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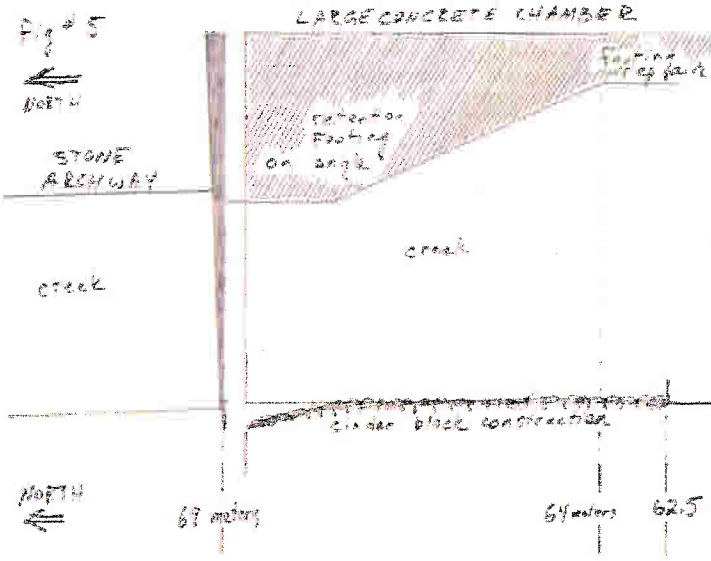
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| <u>station in</u> <u>meters</u> | <u>station in</u> <u>feet</u> | <u>video ref</u> | <u>description</u> | <u>photo no</u> |
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| 48.8 | 160 | 0:41:30 | <p>east wall: 3" plastic outfall - square opening cast around wood, 10" deep, solid back fill. wall is spalled between footing and outfall - 3" deep, 17" high, 48" wide. concrete in area is poor, surrounding concrete is sound</p> <p>creek bottom composition in area: various debris consisting of cinder block, concrete rubble, rocks, wood</p> <p>ceiling in area is sound</p> | 43 - 45 |
| 55 | 180 | 0:45:00 | <p>east wall: beginning of footing repair, which extends to chainage 67 meters</p> <p>footing repair: 24" high, 30" deep, top surface slopes up towards the wall. no erosion or undermining of footing repair</p> <p>0:46:25 east wall adjacent to repair area (due south): no signs of scour or undermining under the footing</p> <p>0:46:35 east wall: inactive 4" outfall</p> <p>0:47:00 west wall: conditions typical, wall and footing sound, no erosion or undermining of footing</p> <p>0:47:20 west wall: another outcropping of footing, no undermining</p> <p>0:47:40 west wall: more 4" outfalls in wall</p> <p>0:47:55 west wall: another outcropping of footing, no undermining</p> <p>0:48:20 west wall concrete: concrete is sound, no undermining</p> <p>0:48:50 ceiling in area is sound</p> <p>creek bottom composition in area: stone and concrete rubble</p> <p>0:49:30 camera on standby for 60 seconds</p> | |

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| 62.5 | 205 | 0:50:30 | west wall: concrete is sound, interface between wall and footing is sound, no erosion of footing or undermining of footing detected | |
| | | 0:51:10 | 12" csp out fall in bottom of west wall: square hole formed in wood, back fill sound | 58 |
| | | 0:51:40 | another wood formed square opening in the west wall: concrete backing, not in use | 59 |
| | | 0:51:55 | sound concrete in west wall | |
| | | 0:52:10 | another 4" outfall: this one in the interface of the west wall and the ceiling | 57 |
| | | 0:52:20 | east wall: continuation of footing repair - repair is sound (<i>error in video dialogue</i>) | |
| | | 0:52:20 | no undermining of east wall footing repair | |
| | | 0:53:35 | minor crack in east wall footing repair: less than 1/16" | |
| | | | creek bottom composition in area: concrete rubble | |
| | | | note: the west wall of the large concrete chamber is in line with the west side of the stone archway. the east wall of the large concrete chamber is 2 meters beyond the east side of the stone archway. an angled retention footing is in place inside the north east corner of the large concrete chamber to ease water flow into the next section of culvert. east wall footing repair and west wall cinder block transition are included in the diagram below | |

| station in meters | station in feet | video ref | description | photo no |
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| | | | <p>top view of chamber from 62 to 69 meters</p>  | |
| 67 | 220 | 0:54:00 | <p>end of east wall footing repair: at chainage 67 meters</p> <p>0:55:20 west wall: end of poured concrete wall (chainage 62.5 meters), beginning of cinder block and mortar and rebar vertical to round transition, 6.5 meters long, with poured concrete footing underneath, and poured concrete header on top under ceiling. cinder block transition is sound</p> <p>0:56:20 west cinder block transition footing: minor erosion at top of footing, no undermining underneath footing</p> <p>0:56:50 2.5" outfall cast into top of footing: above water line</p> <p>footing is wet but intact, no undermining of footing, only one 4" X 4" eroded spot at chainage 67 meters</p> <p>0:57:50 concrete header at top south end of large concrete chamber: concrete is sound</p> <p>0:58:10 angled retention footing inside south east corner of large concrete chamber</p> | 61, 62 |

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| | | 0:58:20 | vertical crack in retention footing: 5/16 wide, no erosion | 65 |
| | | 1:00:10 | retention footing is undermined for 5' of it's length, from chainage 67 to 68 meters (from the end of the footing repair to the corner of the retention footing), undermining is 6" deep, and 4" high large concrete chamber ceiling: concrete is sound | |
| 69 | 225 | | note: the end concrete wall of the concrete box culvert section is adjacent to, but not touching the end stone wall of the stone archway culvert section, however, both concrete wall footings do butt up to the stone archway walls above and below the water line | 63 |
| | | 1:00:45 | transition from concrete chamber to stone archway: east side: 18" gap between end of concrete chamber and beginning of stone archway no separation between east concrete wall footing and stone archway wall (which has no footing) | |
| | | 1:03:00 | west side: 10" gap between end of concrete chamber and beginning of stone archway | |
| | | 1:03:30 | there are 2 layers of sound footings, minor erosion between end of footings and the beginning of the stone archway, erosion and undermining at bottom of transition between end of footings and stone wall - 12" deep X 6" high, with hard backing creek bottom composition in the area: sand | |
| | | 1:04:45 | end view of the west wall cinder block transition | |

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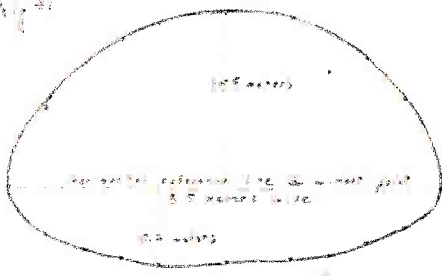
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| 69 | 225 | 1:05:30 | beginning of stone archway: stone archway has no detectable footing and no detectable culvert floor no footings, mortared granite rock multiple vertical cracks in mortar extending from one side to the other, cracks up to 3/4" thick - typical entire length of stone archway mortar at water line and below water line: 80% washed out mortar above water in poor to fair condition, 90% of mortar is in place, but only 50% of mortar is still intact (not hollow sounding) | |
| | | 1:08:10 | cracks in mortared stone wall: typical conditions | 69, 70 |
| 72 | 235 | 1:09:00 | over head storm grate: at 1200, through mortared stone ceiling, there is a 12"+/- pipe visible running horizontal (north - south) through the conduit a couple feet below street level | |
| | | 1:09:50 | interface between creek bottom and stone archway: no undermining - typical both sides mortar is considerably eroded at and below water line - typical both sides | |
| 73 | 240 | 1:10:40 | mortared seam in stone archway from one side to the other - typical (from repositioning archway form during construction): mortar is sound and intact | |
| 82 | 270 | 1:13:00 | void at water line on east side: 16" deep, 15" wide, 20" tall stone arch way is saturated and covered in icicles in this area from run off above | |
| | | 1:14:30 | void at water line on west side: 8" deep, 20" wide, 16" tall | |
| | | 1:15:00 | wet mortar it is 100% sound and intact | |

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| 84 | 275 | 1:16:00 | bend in stone archway: conditions typical: no footings, no undermining of archway, mortar seam intact, extensive mortar loss at and below water, cracks in archway from one side to the other up to 3/4" wide | |
| | | 1:17:00 | presence of 3 steel horizontal tie rods spanning ceiling of archway from one side to the other 4' above water: grossly scaled, 1/2" diameter of sound steel remaining | 67, 68 |
| | | | the third horizontal steel tie bar is no longer solidly stoned in, stone and mortar directly adjacent to the tie bar at both ends is loose or pulled out and missing - suggests squatting of the archway. sand and small stone present behind the voids - photo | 71 |
| | | 1:17:50 | creek bottom consists of sands, slightly muddy, and small rocks or mortar rubble. no foreign debris to speak of | |
| | | 1:18:40 | more multiple vertical cracks in mortar extending from one side to the other, cracks up to 3/4" thick - typical entire length of stone archway | |
| | | 1:19:20 | out fall in ceiling: at 1200, 16" clay tile pipe, appears to be capped off and not in use | |
| | | 1:20:50 | another typical crack in archway - this one up to 1" wide | |
| | | 1:21:40 | creek bottom composition: for entire stone archway - mostly sandy bottom | |

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| 91.5 | 300 | 1:21:50 | transition from stone archway to arched CSP: the CSP is butted right up against the stone, the topmost 7 feet of the transition includes another piece of corrugated steel | |
| | | 1:22:50 | photo at 1100, interfacing second piece of corrugated steel, 90% deteriorated for it's entirety | 73 |
| | | 1:23:10 | photo at 0900, culvert at transition west side: tight and sound | 72 |
| | | 1:23:50 | photos at 0300, culvert at transition east side: tight and sound | 74, 75 |
| | | 1:25:20 | photos at 1200, cut end of CSP and the interfacing second piece of steel on top: cut edge of CSP where galvanized coating has been damaged is mostly deteriorated | 89, 90 |
| | | 1:26:20 | profile of this section of arched CSP typical of the first piece of arched CSP <i>profile of arched culvert - smaller version</i>  | |
| | | 1:27:10 | end of day March 2nd, start of day March 3rd | |
| | | 1:28:00 | <i>correction in video dialogue - DISREGARD - chainage is 300 feet</i> | |

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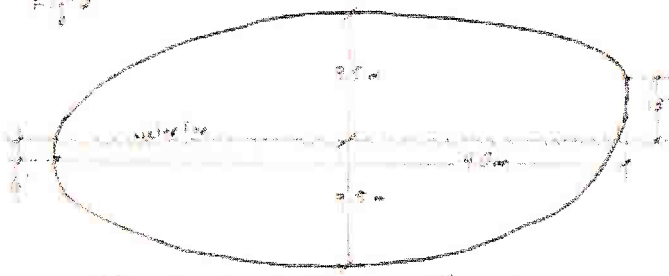
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| 93 | 305 | 1:28:40 | outfall in ceiling: at 1230, 22" diameter, steel lined, elbows off to the south east, interface between outfall steel and the CSP culvert is tight | 93 - 95 |
| | | 1:30:00 | photo at 0300, condition of CSP at bolted connection and at water line: very good, typical for this entire length of culvert | 91 |
| | | 1:32:20 | photo at 1000, localized corrosion at bolted connection: localized culvert bottom composition: heavy sand, 2 to 3" deep | 92 |
| 101.5 | 333 | | localized weeping through a bolt hole - east side | 96 |
| | | | localized deterioration of galvanized coating - east side | 97 |
| | | | photo at 1200: typical good condition of CSP | 98 |
| 103 | 338 | | photos at 1000: apparent puncture holes in CSP - localized | 99, 100 |
| 103.4 | 339 | | photo at 0230: the number 6 painted on CSP - noted in report for chainage reference only | 101 |
| 115 | 378 | 1:33:00 | localized cave down of the CSP at the bolted connection at 1200: bolted connection is opened up 3/16", ceiling deflected downward less than 4 cm, total affected area 3 meters where the bottom of this culvert section was detectable (0600), galvanized coating and corrugated steel appear to be intact | |

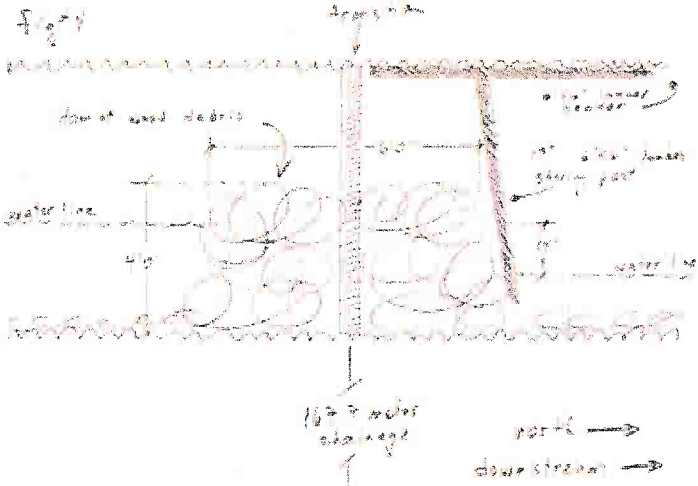
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| 122 | 401 | 1:35:00 | <p>transition to next piece of CSP: inspector can not determine whether or not this next section of CSP is arched and installed out of level, or circular and flattened out (before installation) and installed out of level, or just weight loaded and distorted unevenly.</p> <p>bottom 40% of transition is sealed with placed concrete, top 60% of transition is sealed with concrete rubble and rags. transition is sound and intact</p> <p>photo at 0900: widest gap in transition - 7" wide, concrete rubble backing</p> <p>photo at 0230: 5.5" offset in transition, concrete backing</p> | 102 104 |
| 123 | 404 | 1:42:50 | <p>at the 0230 position, starting at this location and continuing throughout the balance of this section (to chainage 151 meters), there is a 10" wide CSP splice plate covering the bolted connection welded in place. welds are coated in cold galvanizing compound</p> <p>photos of the welded in and cold galvanized splice plate: typical, cold galvanizing is 95% intact for balance of section</p> | 105 - 108 |
| 125.5 | 412 | 1:38:45 | <p>localized cave in of ceiling at bolted connection at 1130:</p> <p>photo shows 3/4" gap in bolted connection</p> <p>photo shows downward deflection in ceiling (end corners of meter stick are touching the CSP), maximum downward deflection is 6 cm, total area affected is 3 meters</p> | 110 109 |

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| 125.5 | 420 | 1:41:35 | another localized cave in of CSP at bolted connection at 1130: gap in bolted connection of 3/8", ceiling has deflected downward 5 cm, total area affected is 3 meters | |
| | | 1:45:00 | typical good condition of welds and cold galvanizing compound on splice plate at 0230 | |
| 140 | 459 | | <p>CSP culvert is 4.0 meters wide by 1.9 meters high at this location, most flattened out location. the 0300 position (east widest point) is 18" above the water line, and the 0900 position (west widest point) is 6" below the water line</p> <p><i>profile drawing of culvert at this chainage</i></p>  <p><i>profile of culvert (looking north) at chainage 459 meters</i></p> | |
| | | 1:45:50 | 6" fiber outfall at 0200 | 112 - 114 |
| | | 1:46:20 | photo at 0900 (west side): typical good condition of steel and fasteners | 111 |
| | | | where the bottom of this culvert section was detectable (0600), galvanized coating and corrugated steel appear to be intact | |

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| 151 | 495 | 1:48:40 | <p>transition from CSP to arched CSP:</p> <p>bottom 40% of transition is sealed with placed concrete, top 60% of transition is sealed with placed concrete over pieces of plywood, the plywood fills the gaps in the transition</p> <p>the ends of the CSP are flame cut, but the damage to the galvanized coating is much less, and the unprotected steel at the ends of the CSP are not noticeably deteriorated (like at chainage 91.5 meters)</p> <p>photo at 0900: gap in CSP is 4", concrete/wood backing is sound</p> <p>photo at 1100: off set gap (greatest) is 8", concrete/wood backing is sound</p> <p>photo at 1200: gap in CSP is 6", concrete/wood backing is sound</p> <p>photo at 0200: gap in transition is 0", off set gap is 5", concrete/wood backing is sound</p> | 115 116 117 118 |
| | | 1:51:30 | <p>arched CSP and galvanized coating in good condition</p> <p>where the bottom of this culvert section was detectable (0600), galvanized coating and corrugated steel appear to be intact</p> | |
| 152.5 | 500 | | <p>mitred and welded elbow in CSP: welds are cold galvanized, welds and galvanized coating are in good condition</p> <p>typical condition of welded and cold galvanized joint</p> <p>arched CSP culvert turns to the right at this mitred and welded location</p> | 119, 120 |

| station in meters | station in feet | video ref | description | photo no |
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| 170.7 | 560 | 1:58:00 | <p>transition is sealed with placed concrete over pieces of plywood, the plywood fills the gaps in the transition, typical of last transition from 0900 to 0300</p> <p>0900: gap is 0", off set is 3"</p> <p>1200: gap is 4.5" wide, off set is 4" (downstream is lower)</p> <p>0300: gap is 2" wide</p> | 123 - 125 |
| | | 2:02:00 | <p>also at this location is a water retaining dam of wood debris: the dam is held in place by the vertical 6 X 6" shoring posts in the following section</p> | |
| | | 2:02:30 | <p>dam of wood debris: includes branches, evergreen bows, long grasses, and a little domestic garbage</p> | 126 - 128 |
| | | 2:02:40 | <p>dam is 4' high, 6' deep, and the width of the culvert, water differential from one side of the dam to the other is 14"</p> <p><i>at this point in the video log we switch to the second recording tape</i></p> <p><i>profile drawing of dam and shoring posts</i></p>  | |
| | | | <p><i>inspection access hence forth is from the downstream mouth of the culvert</i></p> | |

Inspection Report: Conditions Survey
 Project: Uxbridge Brook Culvert
 Client: Engineered Management Systems

Inspection Date: 02 & 03 March 2009
 By: Paul Coulombe

| <u>station in</u> <u>meters</u> | <u>station in</u> <u>feet</u> | <u>video ref</u> | <u>description</u> | <u>photo no</u> |
|------------------------------------|----------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 173 | 568 | 2:05:40 | condition of arched CSP in next section at 0300 (east side): CSP steel and galvanized coating and bolted connection are in good condition | |
| | | 2:07:30 | culvert bottom composition, east side: 3 -4" of sand and silt, and the odd branch | |
| | | 2:08:00 | this next section of arched CSP culvert has been shored vertically by: 6 - 6 X 6" wood vertical posts, with an adjoining 6 X 6" header, and 2 X 8 plank angle braces. presence of a footer not detected | |
| | | 2:08:30 | 1st shoring post: holding back the dam of debris. post is still weight bearing but not plumb, the bottom of the post has been pushed downstream. post is eroded at and below water line, left over wood below water is as sound as wood above | |
| | | | photo of shoring post # 1: holding back dam of wood debris | 129 |
| | | | photo of shoring post # 1: erosion at water line | 130 |
| | | | photo of shoring header at post # 1: with shims intact and weight bearing from CSP above | 131 |
| | | | top of shoring post # 1 was not cut square - the inspector can not determine whether or not the post was installed plumb originally | |
| | | 2:10:10 | 2nd shoring post: eroded at water line, distorted and splintered from compression loading, erosion is 3/4" deep, cracking is 1.5" deep, compression loading has splintered the post to the west at the water line - post is broken and no good | 133 |
| | | | no longer weight bearing from CSP above header | 132 |
| | | 2:12:25 | 3rd shoring post: eroded, compression loaded and splintered, and broken. below water portion of shoring post is missing | 134 |

| <u>station in meters</u> | <u>station in feet</u> | <u>video ref</u> | <u>description</u> | <u>photo no</u> |
|--------------------------|------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| | | 2:12:55 | there is a splice in the header above the 3rd shoring post, and there is a 1.5" gap above it between it and the CSP above | |
| | | 2:14:20 | 4th shoring post: header is no longer tight and weight bearing eroded at water line, compression loading and splintering and breaking of the post on a 45 degree angle - post is no longer servicable | 135 |
| | | 2:16:05 | 5th shoring post: eroded 30% away, deterioration 1.5 deep on one side, but still solid | |
| | | 2:18:20 | 1.5" gap between top of header and CSP ceiling - header is not weight bearing | 136, 137 |
| | | 2:19:20 | 6th and last shoring post: header is not weight bearing post is eroded at and below water line | 138 |
| | | 2:21:10 | bolted connection at 0900 (west side): from chainage 171 to 180, all bolt holes are ripped and torn from one hole to the next and the CSP steel is pulled apart up to 1/4" | 144, 145 |
| 174.3 | 572 | 2:19:20 | 18" CSP outfall at 1000: problem spot - unnecessarily huge cut out in the CSP culvert to accommodate the outfall has created a huge weak spot in the CSP culvert which is caving in | |
| | | 2:21:10 | photos of the interfacing materials between the 18" CSP outfall and the arched CSP culvert | 139 - 143 |
| | | 2:22:25 | cut out in the CSP culvert for the 18" outfall is 22" wide by 60" long. materials filling in the huge gaps in the interface include chunks of CSP and galvanized tin. the huge weakened spot in the weight bearing part of the ceiling has resulted in the interface caving into the culvert | |
| | | 2:22:25 | the above affected area: 3 meters | |

Inspection Report: Conditions Survey
 Project: Uxbridge Brook Culvert
 Client: Engineered Management Systems

Inspection Date: 02 & 03 March 2009
 By: Paul Coulombe

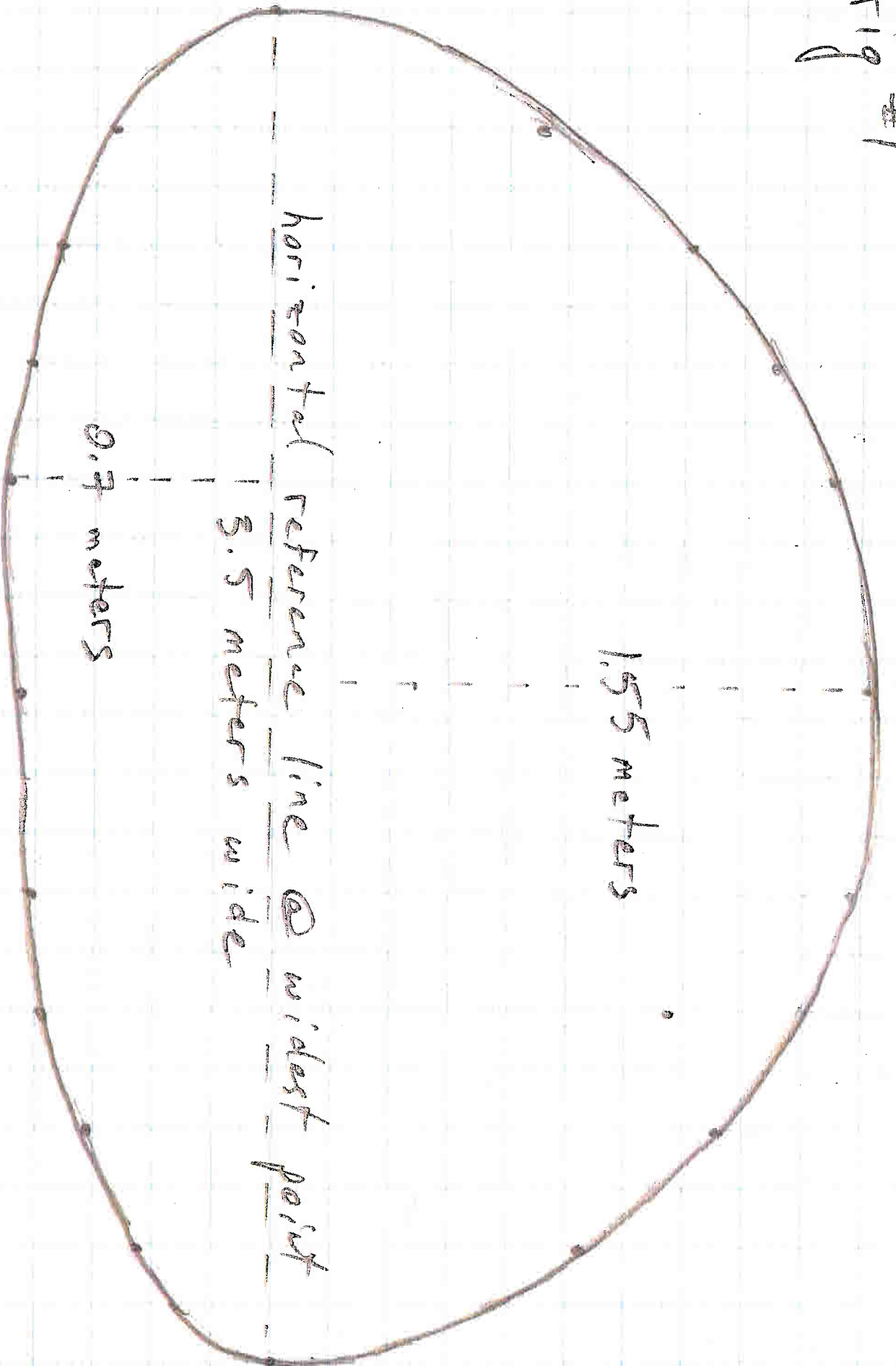
| <u>station in</u> <u>meters</u> | <u>station in</u> <u>feet</u> | <u>video ref</u> | <u>description</u> | <u>photo no</u> |
|------------------------------------|----------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 181 | 594 | | <p>transition from arched CSP to arched CSP: bottom 40% of transition is sealed with placed concrete, top 60% of transition is sealed with galvanized tin, the galvanized tin fills the gaps in the transition, inspector could not determine whether material behind tin was placed concrete or concrete rubble</p> | |
| | | 2:06:40 | east side of transition: backed by galvanized tin | 149 |
| | | 2:25:25 | west side of transition: backed by galvanized tin | 146 |
| | | 2:25:40 | steel straps behind rotten galvanized tin: straps tie in bolt holes from one CSP section to the other - localized at 1000, but suspect typical behind good tin for whole transition | 147, 148 |
| | | 2:26:25 | <p>typical good condition of galvanized tin at transition holding back transition materials</p> <p>culvert bottom composition: sand and silt, 2"</p> <p>where the bottom of these culvert sections were detectable (0600), galvanized coating and corrugated steel appeared to be intact</p> | |

Inspection Report: Conditions Survey
 Project: Uxbridge Brook Culvert
 Client: Engineered Management Systems

Inspection Date: 02 & 03 March 2009
 By: Paul Coulombe

| <u>station in meters</u> | <u>station in feet</u> | <u>video ref</u> | <u>description</u> | <u>photo no</u> |
|--------------------------|------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 183 | 600 | 2:27:10 | 30" CSP outfall at 0300 (east side): interface appears intact | |
| | | | placed concrete at interface of 30" outfall - typical for circumference | 150 |
| | | | extension of 30" outfall into interface with CSP culvert, extension consists of another piece of 30" CSP cut to expand and wrap previous piece, cut is at the 1200 position | 152 |
| | | | gap at 1200 of 30" CSP extension piece into main culvert - solid concrete backing, extension piece is 15" long | 153 |
| | | 2:28:50 | typical good condition of arched CSP steel, galvanized coating, and bolted connections, profile matches 1st culvert section. this section has no torn bolt holes | |
| | | 2:30:15 | bottom composition mostly sand, some rocks and wood debris | |
| | | 2:30:25 | ceiling is sound | |
| 191 | 626 | | interface between outside of arched CSP outlet and surrounding retaining wall appear intact and not corroded | |
| | | 2:32:16 | END TAPE | |

Fig #1



horizontal reference line @ widest point
3.5 meters wide

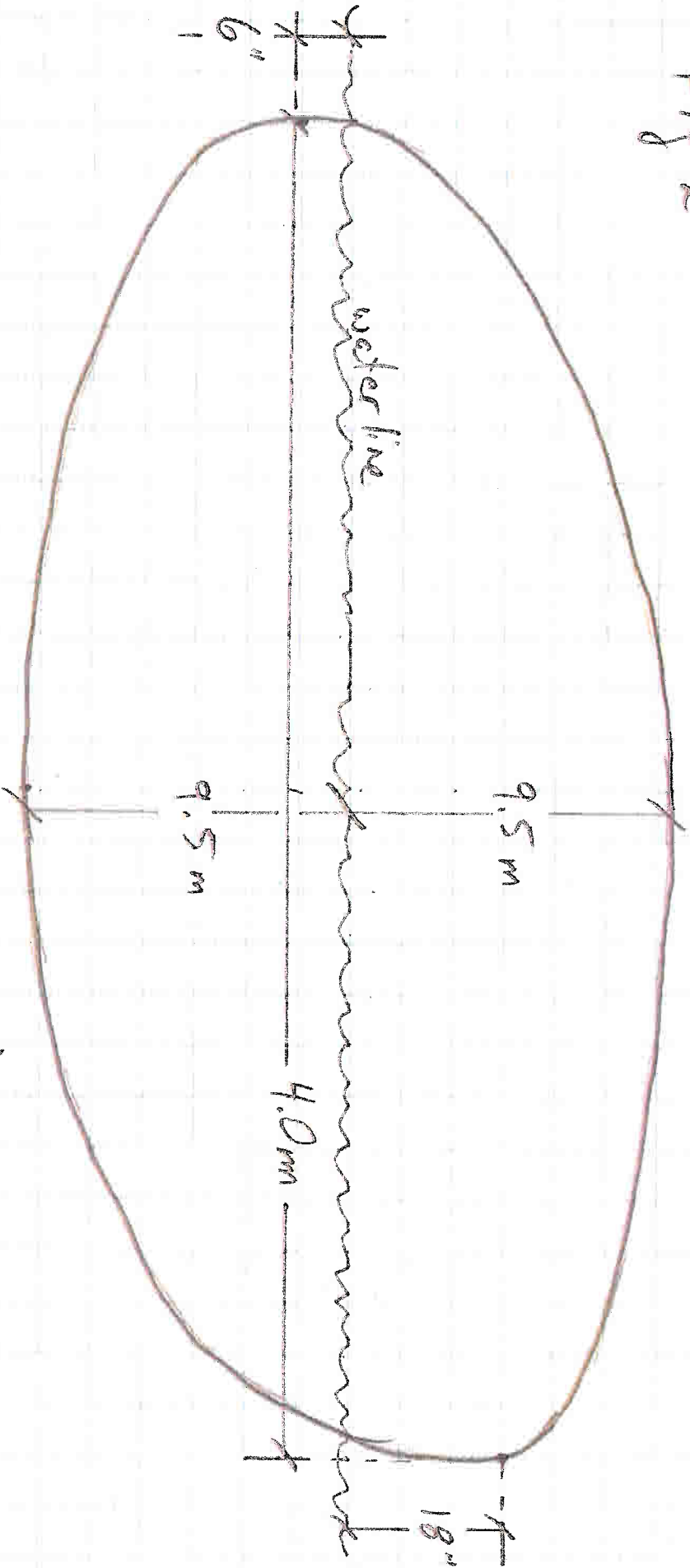
0.7 meters

1.55 meters

profile of culvert (facing north) at

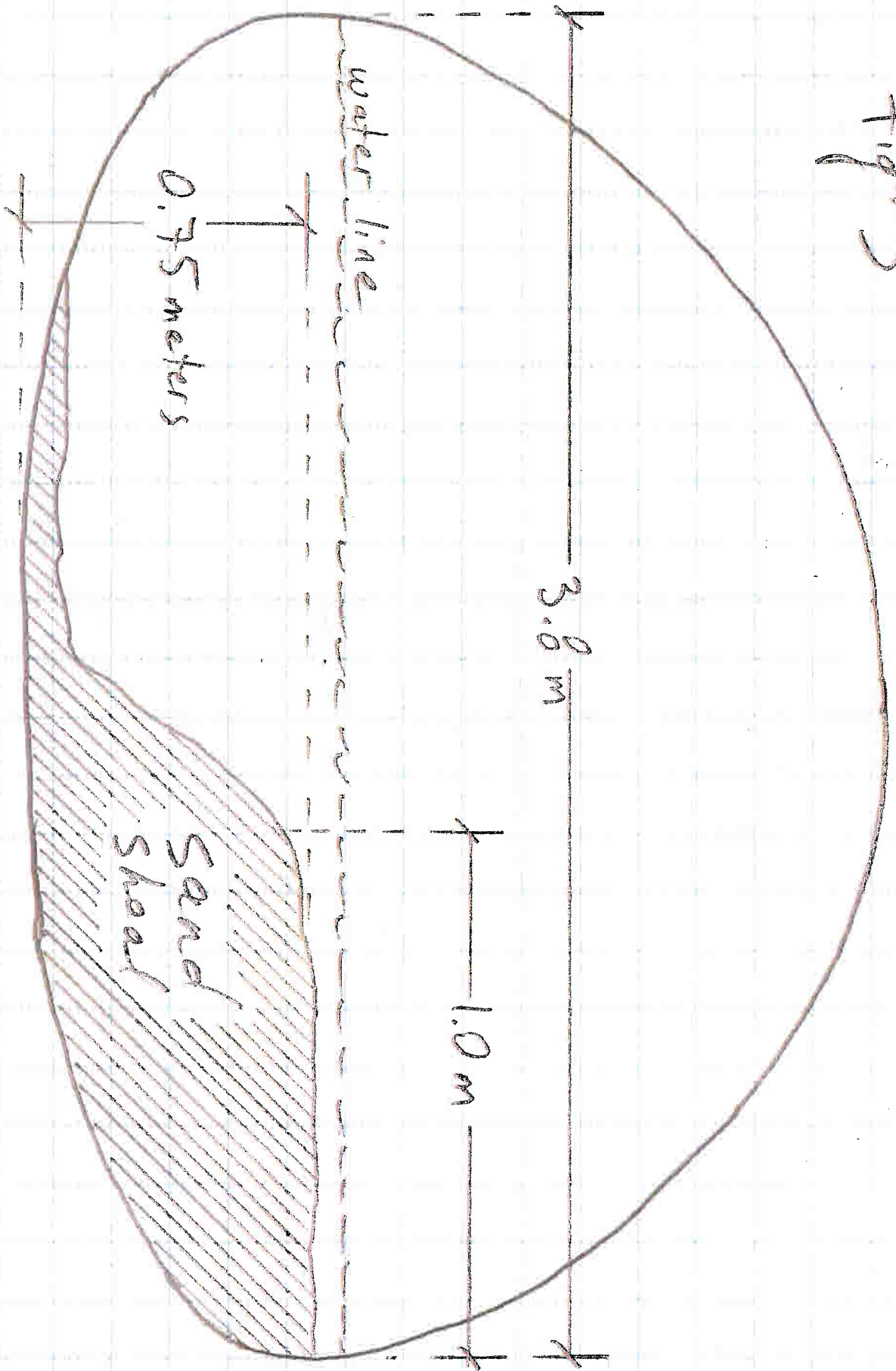
chainage 14 meters

Fig#2



Profile of culvert (facing north) at
chainage 459 meters

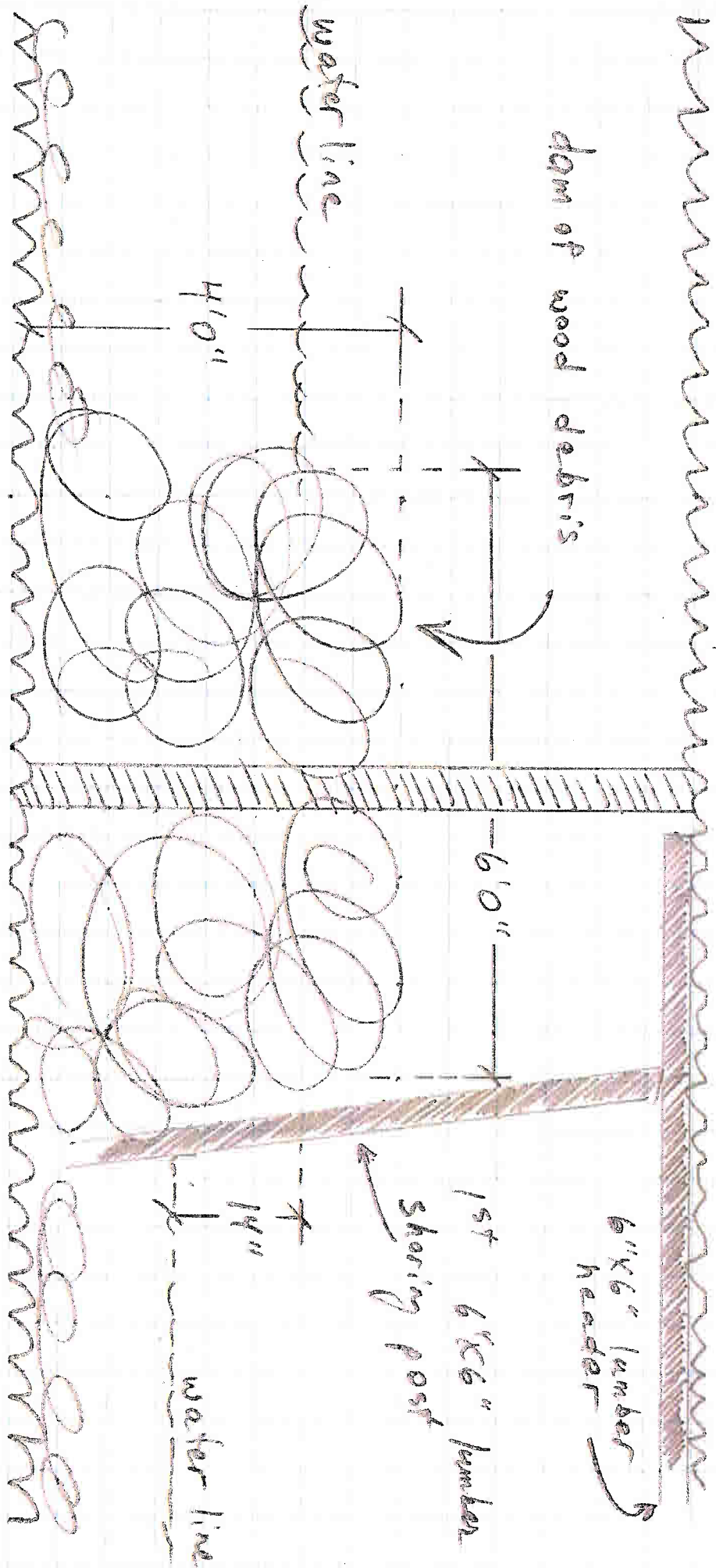
Fig #3



Profile of sand shoal in culvert (facing north)
at chainage 155 meters

Fig #4

Transition



dam of wood debris

water line

4'0"

6'0"

6"X6" lumber header

1st 6"X6" lumber shoring post

1'4"

water line

167.7 meter chainage

north →

downstream →

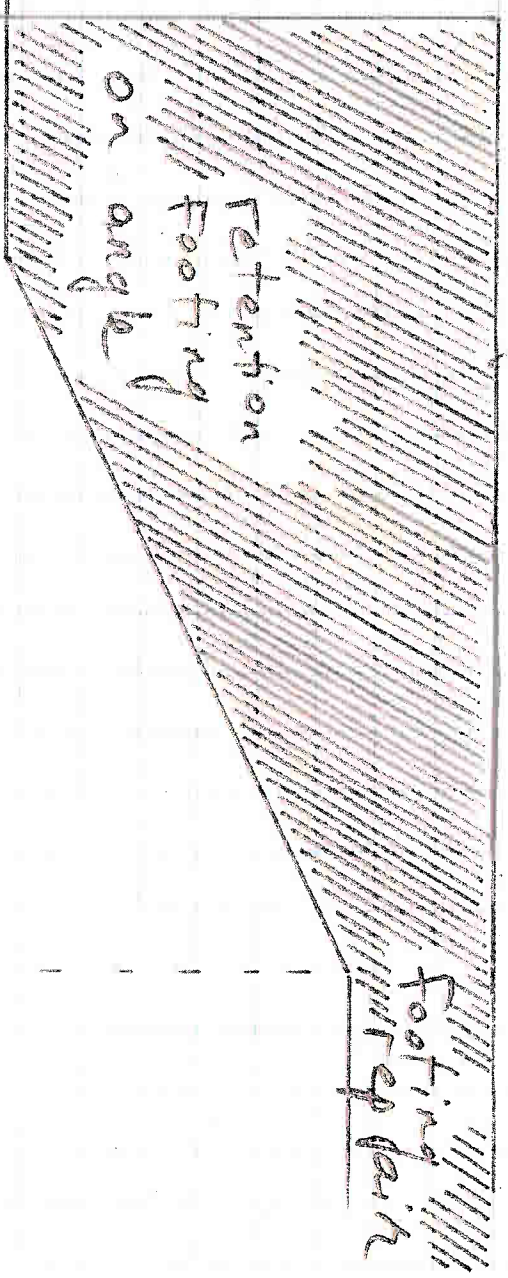
Fig # 5

NORTH

STONE
ALLEYWAY

creek

LARGE CONCRETE CHAMBER



creek

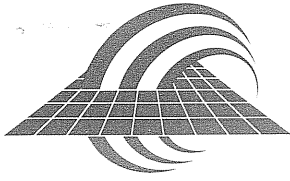
NORTH

69 meters

~~brick~~
cinder block construction

64 meters

62.5



July 8, 2009

FACSIMILE AND MAIL

Regional Municipality of Durham
605 Rossland Road East
P.O. Box 623
Whitby, Ontario L1N 6A3

Attention: Mr. Paul Foster
Project Manager, Transportation Infrastructure

Dear Sir:

**Re: Review of Video Record of Culvert Inspection
Uxbridge Brook Culvert
Township of Uxbridge, Regional Municipality of Durham
Our Project No. 08239**

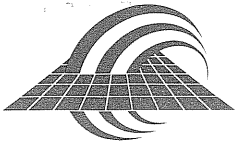
SRM Associates was asked to review a portion of the above noted video as it pertained to the existing stone arch structure under Brock Street in the Town of Uxbridge and to provide an opinion with respect to the structural condition as well as recommendations for carrying out any needed repairs.

The above noted inspection was carried out by Soderholm Maritime Services Inc. on March 2, 2009. Further, it is understood that the structure is thought to have been constructed between 1870 and 1890. The stone arch culvert is approximately 23 metres long and has no detectable footings.

The inspection video shows a stone arch structure with consistent deterioration along its length; medium to wide cracks extending laterally from one side to the other, voids and missing mortar along the waterline on both sides, and missing and delaminated mortar above the waterline.

Although the condition of the existing structure is considered poor to fair, it appears to be structurally sound at present. To continue to maintain the structural integrity of the existing stone arch culvert, the following repairs are recommended:

1. Inject cracks with an appropriate concrete repair grout.
2. Fill voids with mortared stone.
3. Remove all deteriorated and delaminated mortar and repoint with an applicable mortar.



Regional Municipality of Durham
Mr. Paul Foster
July 8, 2009
Page 2

It is estimated that upon completion of the above noted repairs, the remaining useful service life of the existing stone arch culvert will be extended by approximately 10-20 years. It is also recommended that the structure be inspected on a more frequent basis to monitor the condition of the culvert.

We trust the above meets with your immediate requirements. Kindly advise if additional information or clarification is required. We would be pleased to assist the Region with the implementation of the above repair recommendations.

Respectfully submitted,

SRM ASSOCIATES

John P. Semjan, P.Eng.
Principal, Manager, Transportation Structures

JPS/br

Municipal Culvert Appraisal

IDENTIFICATION

| | | | | | |
|----------------------|-----------------------------------|-----------------------|-------|----------------------------|-------|
| Control Code | 0 - N - UR - 09 | Culvert No. | 315-1 | 0 | |
| Municipal Name/Code | | Road Section No. | | | |
| Culvert Name | Brock Street West - Section 1 | MTO Site No. | - | - | |
| Road Name | Brock Street West | | | | |
| Location | 0.05 km E of Toronto Street North | | | | |
| Roadside Environment | U | | | | |
| Posting | t t t | Posting Sign | t t t | Crossing Type | O WAT |
| Bylaw No. | | Low Clearance Sign | m | Federal Navigable Waterway | |
| Bylaw Expiry Date | y m | Narrow Structure Sign | | | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|----------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundry Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name | | A. |
| Heritage Status | R | /No. | | B. |
| Special Designation | NSD | Adjacent Culvert No. | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 3.4 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.4 m | Upstream | H R |
| Material/Type | CPR - PAI | Max. Height | 2.0 m | Downstream | R |
| Crossing Skew | 0 - 0 ° | Culvert Length | 15.3 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 0.5 m | Foundation Type | UN |
| | | Culvert Floor | SC | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk | A N N 1.5 m |
| Operational Status | SW - OAT | Surface Width | 8 m | and Curb Barrier | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | Roadside Safety | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk | A m | | |
| Surface Width | m | and Curb Barrier | B m | | |

TRAFFIC DATA

| | | Traffic Count | | 10 Year Traffic Forecast | |
|--------------------|---------|------------------------|-------|--------------------------|-----|
| Legal Speed Limit | 50 | Year | -19 - | Year | |
| Route Designations | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

| CULVERT NEEDS | | | | TYPE AND TIME OF IMPROVEMENT | | | | |
|----------------------|-----|-----|--------------|-------------------------------------|-----------------------|--|--|---|
| | MCR | PCR | TIME OF NEED | Design Class | Design Platform Width | | | |
| Barrel | 5 | 6 | | | | | | m |
| Foundations | 5 | 6 | | Material/Type | | | | - |
| Inlet Component | 0 | 0 | | Width/Diameter | | | | m |
| Outlet Component | 5 | 6 | | Maximum Height | | | | m |
| Guide Rail/Barrier | 5 | 6 | | Culvert Length | | | | m |
| Streams/Waterways | 4 | 6 | | No. of Culverts | | | | |
| | | | | Depth of Fill | | | | m |

| FUNCTIONAL NEEDS | | | | a) | b) | c) | d) | e) |
|-------------------------|--------------------|-------------------|--------------|---------------------|------------------|-----|---------------------|--------------|
| | Existing Condition | Minimum Tolerable | TIME OF NEED | Type of Improvement | Costing Category | Qty | Time of Improvement | Cost (\$000) |
| ROAD OVER | | | | A | | | | |
| Platform Width | m | m | | B | | | | |
| Level of Service | | | | C | | | | |
| Roadside Safety | m | m | | D | | | | |
| ROAD UNDER | | | | | | | | |
| Surface Width | m | m | | | | | | |
| Level of Service | | | | | | | | |
| Min. Vertical Clearance | m | m | | | | | | |
| Sidewalks | | | | | | | | |

| IMPROVEMENT COST | | COST (\$000) |
|--------------------------------------------------|--|---------------------|
| Construction | | |
| Approaches | | |
| Detours | | |
| Traffic Control/Protection | | |
| Utilities | | |
| Other | | |
| Contingencies | | 10.00% |
| Total Construction | | |
| Right of Way | | |
| Engineering Environmental Assessment (E/A) Study | | |
| Engineering - Design and Supervision | | 20.00% |
| Total Project Cost | | |

| ENGINEERING RECOMMENDATIONS | | | | Eligibility for Contributions | | |
|------------------------------------|------|------|--------------|--------------------------------------|---------------------|------------------------|
| | Type | Year | Cost (\$000) | Non-Contributable Costs | Contributing Agency | Non-Contributable Cost |
| Culvert Drawings | | | | | | |
| Engineering Investigations | | | | | | |
| | A | | | | | |
| | B | | | | | |
| | C | | | | | |
| Single Posting | t y | m | d | | | |
| Evaluated Posting | | | | | | |
| Date | | y | m | | | |
| Monitoring | | | | | | |
| Closure/Date | y | m | d | | | |

| HISTORY | | | |
|-----------------------------------|------|----------------------------------|------|
| ENGINEERING INVESTIGATIONS | | CONSTRUCTION IMPROVEMENTS | |
| Type | Year | Type | Year |

Municipal Culvert Appraisal

Remarks

Culvert 315-1, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure is not posted with a load limit.
- Sections are numbered from South to North.
- Section 1 is a 3.4m +/- single span corrugated steel plate pipe arch culvert with approximately 0.5m of earth fill and an asphalt paved roadway.
- Asphalt paved roadway (Centennial Drive) is in generally good condition.
- Vegetative roadway embankments are in generally fair condition with severe erosion in the southeast quadrant.
- Concrete precast block retaining wall in the southeast quadrant is in generally good condition with localized light scaling.
- Stacked concrete retaining wall in the southwest quadrant is in generally good condition with shifting of the concrete sections.
- Corrugated plate steel pipe arch culvert is in generally good condition with light to moderate erosion below the spring line and localized flaking along sharp radii seam.
- Watercourse is unobstructed with no evidence of scour.
- No serious evidence of structural distress.
- Structure does not require posting with a load limit.

Municipal Culvert Appraisal

Maintenance Required

Comments

See Remarks

Rehabilitation

Immediate Maintenance - Restore embankment

Future Maintenance

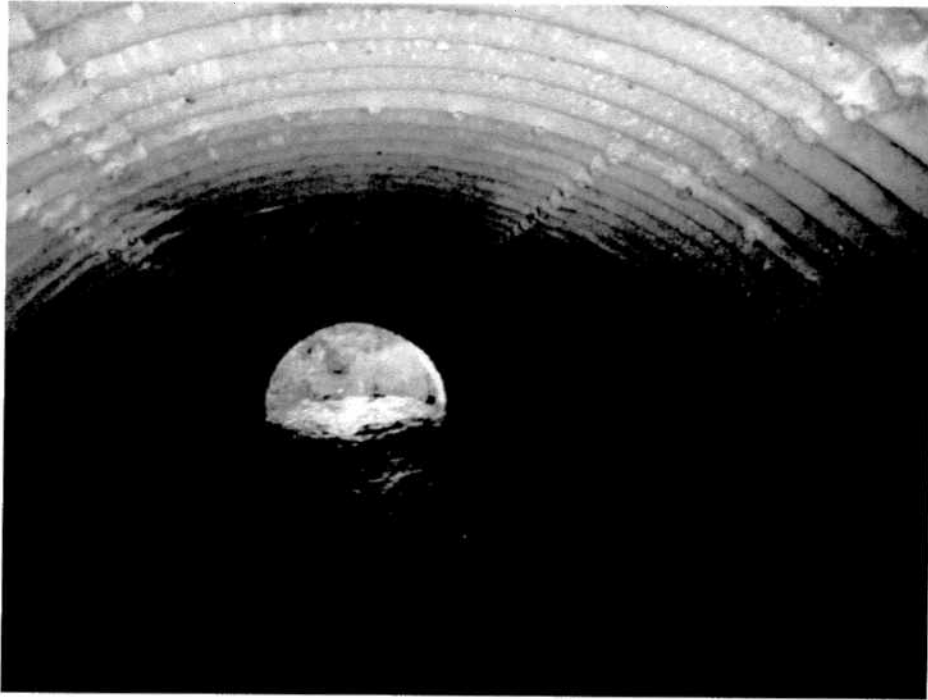
Periodic Maintenance



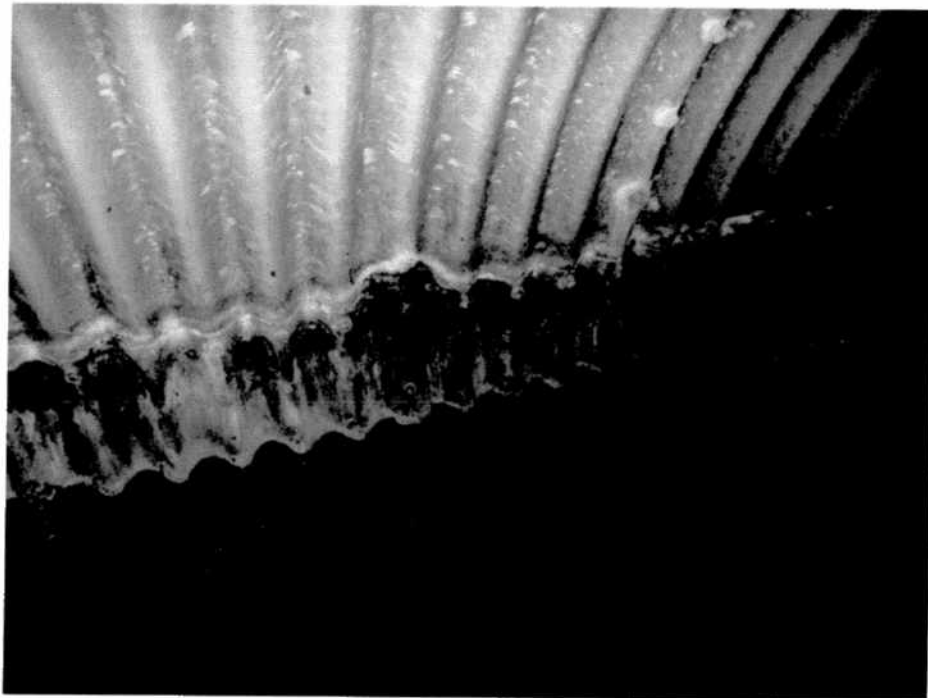
Photograph 1. Looking West at Roadway over Culvert ↑



Photograph 2. South Elevation ↑



Photograph 3. Looking North Through Barrel ↑



Photograph 4. Light to Moderate Corrosion of Culvert Wall ↑



Photograph 5. Severe Erosion of Southeast Embankment ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | | | |
|----------------------|-----------------------------------|-----------------------|-------|----------------------------|-------|
| Control Code | 0 - - - | Culvert No. | 315-2 | 0 | |
| Municipal Name/Code | | Road Section No. | | | |
| Culvert Name | Brock Street West - Section 2 | MTO Site No. | - | - | |
| Road Name | Brock Street West | | | | |
| Location | 0.05 km E of Toronto Street North | | | | |
| Roadside Environment | U | | | | |
| Posting | t t t | Posting Sign | t t t | Crossing Type | O WAT |
| Bylaw No. | | Low Clearance Sign | m | Federal Navigable Waterway | |
| Bylaw Expiry Date | y m | Narrow Structure Sign | | | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|---------------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundry Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name /No. | | A. |
| Heritage Status | R | Adjacent Culvert No. | | B. |
| Special Designation | | | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 3.4 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.4 m | Upstream | N |
| Material/Type | CPR - FRA | Max. Height | 2.0 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 15.3 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 0.6 m | Foundation Type | UN |
| | | Culvert Floor | EA | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|-----------------------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk and Curb Barrier | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | Roadside Safety | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|-----------------------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk and Curb Barrier | A m | | |
| Surface Width | m | | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| Legal Speed Limit | 50 | Traffic Count | | 10 Year Traffic Forecast | |
| Route Designations | | Year | -19 - | Year | |
| | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

| <u>CULVERT NEEDS</u> | MCR | PCR | TIME OF NEED | <u>TYPE AND TIME OF IMPROVEMENT</u> | | | | |
|----------------------|-----|-----|--------------|-------------------------------------|--|--|--|---|
| Barrel | 4 | 5 | | Design Class | | | | |
| Foundations | 5 | 5 | | Design Platform Width | | | | m |
| Inlet Component | 0 | 0 | | Material/Type | | | | |
| Outlet Component | 0 | 0 | | Width/Diameter | | | | m |
| Guide Rail/Barrier | 0 | 0 | | Maximum Height | | | | m |
| Streams/Waterways | 5 | 6 | | Culvert Length | | | | m |
| | | | | No. of Culverts | | | | |
| | | | | Depth of Fill | | | | m |

| <u>FUNCTIONAL NEEDS</u> | Existing Condition | Minimum Tolerable | TIME OF NEED | a) Type of Improvement | b) Costing Category | c) Qty | d) Time of Improvement | e) Cost (\$000) |
|-------------------------|--------------------|-------------------|--------------|---------------------------|------------------------|-----------|---------------------------|--------------------|
| <u>ROAD OVER</u> | | | | | | | | |
| Platform Width | m | m | | A | RSB | PC | 1-5 | 20 |
| Level of Service | | | | B | | | | |
| Roadside Safety | m | m | | C | | | | |
| <u>ROAD UNDER</u> | | | | D | | | | |
| Surface Width | m | m | | | | | | |
| Level of Service | | | | | | | | |
| Min. Vertical Clearance | m | m | | | | | | |
| Sidewalks | | | | | | | | |

| <u>IMPROVEMENT COST</u> | | COST (\$000) |
|--------------------------------------------------|----------------------------|-------------------------------|
| Construction | | 20 |
| Approaches | | |
| Detours | | |
| Traffic Control/Protection | | |
| Utilities | | |
| Other | | |
| Contingencies | 10.00% | 2 |
| Total Construction | | |
| Right of Way | | |
| Engineering Environmental Assessment (E/A) Study | | |
| Engineering - Design and Supervision | 20.00% | 5 |
| Total Project Cost | | 27 |
| Eligibility for Contributions | | |
| Non-Contributable Costs | | |
| | Contributing Agency | Non-Contributable Cost |
| | A | |
| | B | |
| | C | |
| | D | |
| Total Non-Contributable Cost | | 27 |
| Contributable Cost | | 100 |
| Municipal Percent of Contributable Cost | | 27 |
| Municipal Share of Cost | | |

| <u>ENGINEERING RECOMMENDATIONS</u> | | | |
|------------------------------------|------|------|--------------|
| | Type | Year | Cost (\$000) |
| Culvert Drawings | | | |
| Engineering Investigations | | | |
| | A | | |
| | B | | |
| | C | | |
| Single Posting | t y | m | d |
| Evaluated Posting | | t | t t |
| Date | | y | m |
| Monitoring | | | |
| Closure/Date | y | m | d |

| <u>HISTORY</u> | | <u>CONSTRUCTION IMPROVEMENTS</u> | |
|----------------------------|------|----------------------------------|------|
| ENGINEERING INVESTIGATIONS | | | |
| Type | Year | Type | Year |
| | | | |

Municipal Culvert Appraisal

Remarks

Culvert 315-2, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 2 is a 3.2m +/- span cast in place concrete open footing rigid frame culvert.
- Culvert is in generally fair to good condition with light to severe scour at the base of the west wall for 6m+/- length. Localized light to severe scaling and erosion at base of walls at other locations and at a storm sewer outlet. Severe honeycombing was noted on the walls at the north end.
- Watercourse is unobstructed with no evidence of scour.
- No serious evidence of structural distress.
- Structure does not require posting with a load limit

Municipal Culvert Appraisal

Maintenance Required

Comments

See Remarks

Rehabilitation

- Repair abutments

Immediate Maintenance

Future Maintenance

Periodic Maintenance



Photograph 1. Looking North Through Barrel ↑



Photograph 2. Severe Scaling and Erosion of Culvert Wall ↑



Photograph 3. Severe Scour at Base of Culvert Wall ↑



Photograph 4. Severe Scaling at Storm Sewer Outlet on Barrel Wall ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 0 - N - UR - 09 | Culvert No. | 315-3 |
| Municipal Name/Code | | Road Section No. | |
| Culvert Name | Brock Street West - Section 3 | MTO Site No. | - - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|----------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundary Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name | | A. |
| Heritage Status | R | /No. | | B. |
| Special Designation | | Adjacent Culvert No. | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|----------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 5.6 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 5.6 m | Upstream | N |
| Material/Type | CIP - FRA | Max. Height | 2.4 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 30.3 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 0.75 m | Foundation Type | UN |
| | | Culvert Floor | EA | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | and Curb Barrier | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | Roadside Safety | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk | A m | | |
| Surface Width | m | and Curb Barrier | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| Legal Speed Limit | 50 | Traffic Count | | 10 Year Traffic Forecast | |
| Route Designations | | Year | -19 - | Year | |
| | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

CULVERT NEEDS

| | MCR | PCR | TIME OF NEED |
|--------------------|-----|-----|--------------|
| Barrel | 5 | 5 | |
| Foundations | 5 | 5 | |
| Inlet Component | 0 | 0 | |
| Outlet Component | 0 | 0 | |
| Guide Rail/Barrier | 0 | 0 | |
| Streams/Waterways | 5 | 6 | |

TYPE AND TIME OF IMPROVEMENT

| | |
|-----------------------|---|
| Design Class | |
| Design Platform Width | m |
| Material/Type | - |
| Width/Diameter | m |
| Maximum Height | m |
| Culvert Length | m |
| No. of Culverts | |
| Depth of Fill | m |

FUNCTIONAL NEEDS

| | Existing Condition | Minimum Tolerable | TIME OF NEED |
|--------------------------|--------------------|-------------------|--------------|
| <u>ROAD OVER</u> | | | |
| Platform Width | m | m | |
| Level of Service | | | |
| Roadside Safety | m | m | |
| <u>ROAD UNDER</u> | | | |
| Surface Width | m | m | |
| Level of Service | | | |
| Min. Vertical Clearance | m | m | |
| Sidewalks | | | |

| a) | b) | c) | d) | e) |
|---------------------|------------------|-----|---------------------|--------------|
| Type of Improvement | Costing Category | Qty | Time of Improvement | Cost (\$000) |
| A | RSB | PC | 6-10 | 10 |
| B | | | | |
| C | | | | |
| D | | | | |

IMPROVEMENT COST

| | COST (\$000) |
|--------------------------------------------------|--------------|
| Construction | 10 |
| Approaches | |
| Detours | |
| Traffic Control/Protection | |
| Utilities | |
| Other | |
| Contingencies | 10.00% 1 |
| Total Construction | |
| Right of Way | |
| Engineering Environmental Assessment (E/A) Study | |
| Engineering - Design and Supervision | 20.00% 3 |
| Total Project Cost | 14 |

ENGINEERING RECOMMENDATIONS

| | | | |
|----------------------------|------|------|--------------|
| Culvert Drawings | | | |
| Engineering Investigations | | | |
| | Type | Year | Cost (\$000) |
| A | | | |
| B | | | |
| C | | | |
| Single Posting | t y | m | d |
| Evaluated Posting | | t | t t |
| Date | | y | m |
| Monitoring | | | |
| Closure/Date | y | m | d |

| Eligibility for Contributions | Contributing Agency | Non-Contributable Cost |
|-----------------------------------------|---------------------|------------------------|
| Non-Contributable Costs | | |
| | A | |
| | B | |
| | C | |
| | D | |
| Total Non-Contributable Cost | | 14 |
| Contributable Cost | | 100 |
| Municipal Percent of Contributable Cost | | 14 |
| Municipal Share of Cost | | 14 |

HISTORY

ENGINEERING INVESTIGATIONS

Type Year

CONSTRUCTION IMPROVEMENTS

Type Year

Municipal Culvert Appraisal

Remarks

Culvert 315-3, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 3 is a 5.6m +/- cast in place concrete open footing culvert.
- Culvert is in generally good condition with localized severe erosion of the concrete at drain outlets and localized light honeycombing.
- A precast concrete block section in the Northwest quadrant is in good condition.
- Watercourse is unobstructed with no evidence of scour.
- No serious evidence of structural distress.
- Structure does not require posting with a load limit.

Municipal Culvert Appraisal

Maintenance Required

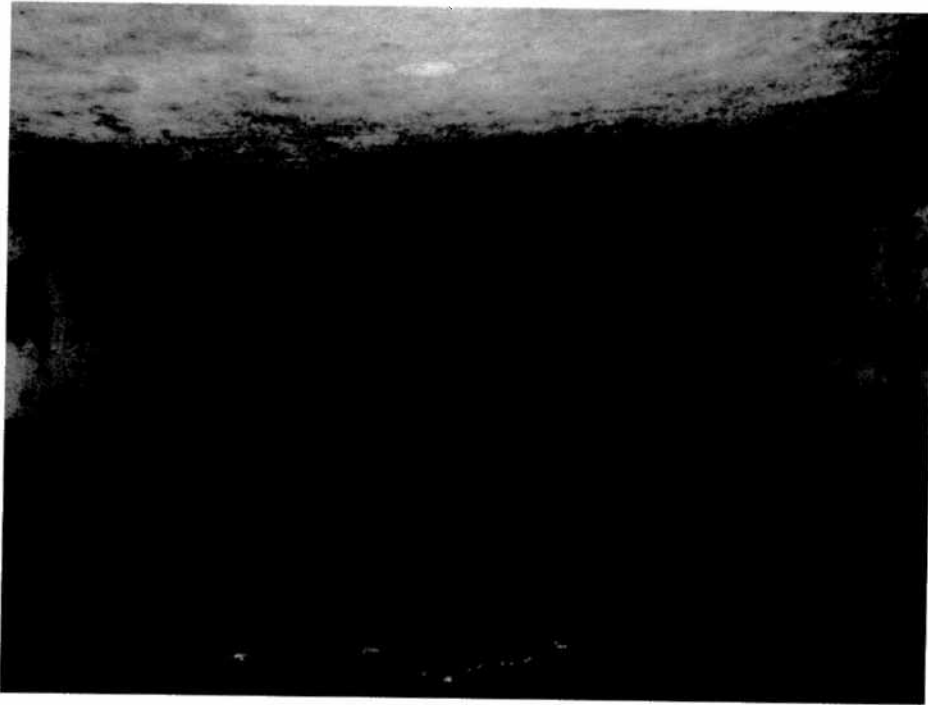
Comments See Remarks

Rehabilitation -Repair abutments

Immediate Maintenance

Future Maintenance

Periodic Maintenance



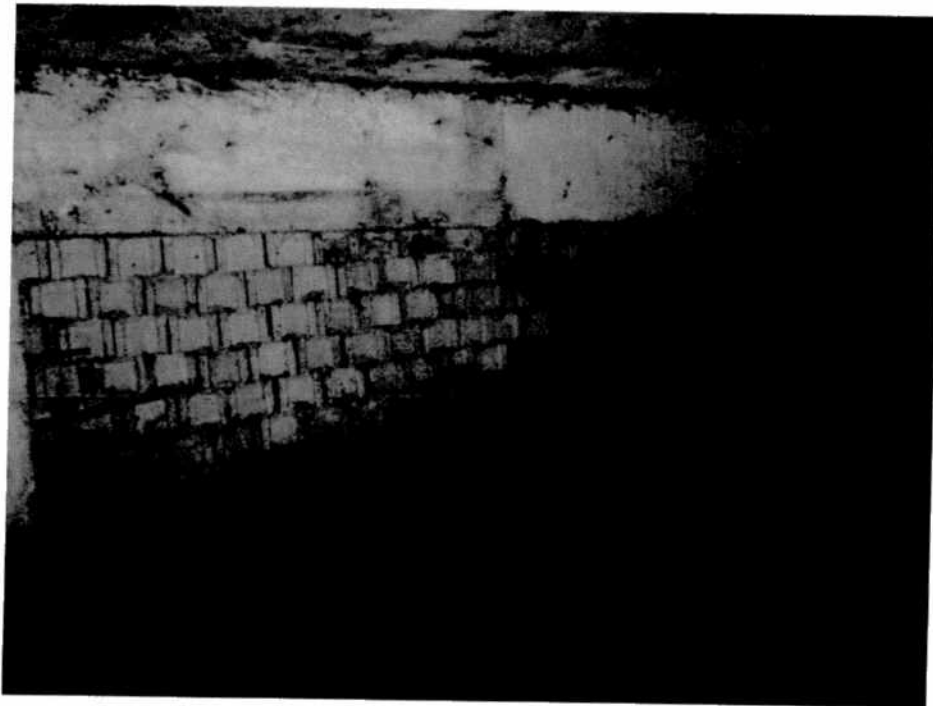
Photograph 1. Looking North Through Barrel ↑



Photograph 2. Light Honeycombing of Barrel Wall ↑



Photograph 3. Severe Erosion of Drain Outlet on Barrel Wall ↑



Photograph 4. Concrete Block Wall in Northwest Quadrant ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 0 - - - | Culvert No. | 315-4 |
| Municipal Name/Code | | Road Section No. | |
| Culvert Name | Brock Street West - Section 4 | MTO Site No. | - - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|---------------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundary Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name /No. | | A. |
| Heritage Status | R | Adjacent Culvert No. | | B. |
| Special Designation | | | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1930 | Cell/Span Width/Dia. | 3.6 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.6 m | Upstream | N |
| Material/Type | MAS - ACH | Max. Height | 2.3 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 21.3 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 0.9 m | Foundation Type | UN |
| | | Culvert Floor | EA | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|-----------------------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk and Curb Barrier | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | Roadside Safety | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|-----------------------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk and Curb Barrier | A m | | |
| Surface Width | m | | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| Legal Speed Limit | 50 | Traffic Count | | 10 Year Traffic Forecast | |
| Route Designations | | Year | -19 - | Year | |
| | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

CULVERT NEEDS

| | MCR | PCR | TIME OF NEED |
|--------------------|-----|-----|--------------|
| Barrel | 2 | 3 | |
| Foundations | 5 | 5 | |
| Inlet Component | 0 | 0 | |
| Outlet Component | 0 | 0 | |
| Guide Rail/Barrier | 0 | 0 | |
| Streams/Waterways | 5 | 6 | |

TYPE AND TIME OF IMPROVEMENT

| | |
|-----------------------|----------|
| Design Class | UALU |
| Design Platform Width | 21.3 m |
| Material/Type | PC - BOX |
| Width/Diameter | 3.6 m |
| Maximum Height | 2.4 m |
| Culvert Length | 21.3 m |
| No. of Culverts | 1 |
| Depth of Fill | 0.9 m |

FUNCTIONAL NEEDS

| | Existing Condition | Minimum Tolerable | TIME OF NEED |
|--------------------------|--------------------|-------------------|--------------|
| <u>ROAD OVER</u> | | | |
| Platform Width | m | m | |
| Level of Service | | | |
| Roadside Safety | m | m | |
| <u>ROAD UNDER</u> | | | |
| Surface Width | m | m | |
| Level of Service | | | |
| Min. Vertical Clearance | m | m | |
| Sidewalks | | | |

| a) | b) | c) | d) | e) |
|---------------------|------------------|-----|---------------------|--------------|
| Type of Improvement | Costing Category | Qty | Time of Improvement | Cost (\$000) |
| A REC | PC | | NOW | 30 |
| B RSL | PC | | NOW | 200 |
| C | | | | |
| D | | | | |

IMPROVEMENT COST

| | COST (\$000) |
|--------------------------------------------------|--------------|
| Construction | 230 |
| Approaches | 100 |
| Detours | |
| Traffic Control/Protection | 100 |
| Utilities | 50 |
| Other | |
| Contingencies | 10.00% 48 |
| Total Construction | |
| Right of Way | |
| Engineering Environmental Assessment (E/A) Study | 30 |
| Engineering - Design and Supervision | 20.00% 112 |
| Total Project Cost | 670 |

ENGINEERING RECOMMENDATIONS

| | | | |
|----------------------------|------|------|--------------|
| Culvert Drawings | | | |
| Engineering Investigations | | | |
| | Type | Year | Cost (\$000) |
| A | | | |
| B | | | |
| C | | | |
| Single Posting | t y | m | d |
| Evaluated Posting | | t | t t |
| Date | | y | m |
| Monitoring | | | |
| Closure/Date | y | m | d |

| Eligibility for Contributions | Contributing Agency | Non-Contributable Cost |
|-----------------------------------------|---------------------|------------------------|
| Non-Contributable Costs | | |
| | A | |
| | B | |
| | C | |
| | D | |
| Total Non-Contributable Cost | | |
| Contributable Cost | | 670 |
| Municipal Percent of Contributable Cost | | 100 |
| Municipal Share of Cost | | 670 |

HISTORY

ENGINEERING INVESTIGATIONS

Type Year

CONSTRUCTION IMPROVEMENTS

Type Year

Municipal Culvert Appraisal

Remarks

Culvert 315-4, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 4 is a 3.6m +/- span stone masonry arch culvert with approximately 0.9m of earth fill.
- Culvert is in poor to fair condition with a wide crack in the west wall to the crown near the South end. Severe loss of mortar along the base of both walls noted with minor fill migration into barrel. Localized loss of stones at base of walls to a maximum depth of 0.5m. Extensive encrustation near north curb line of road. Severe loss of mortar in west wall at North catch basin with a potential for loss of stones and localized failure.
- Watercourse is unobstructed with no evidence of scour.
- Structure does not require posting with a load limit.

Municipal Culvert Appraisal

Maintenance Required

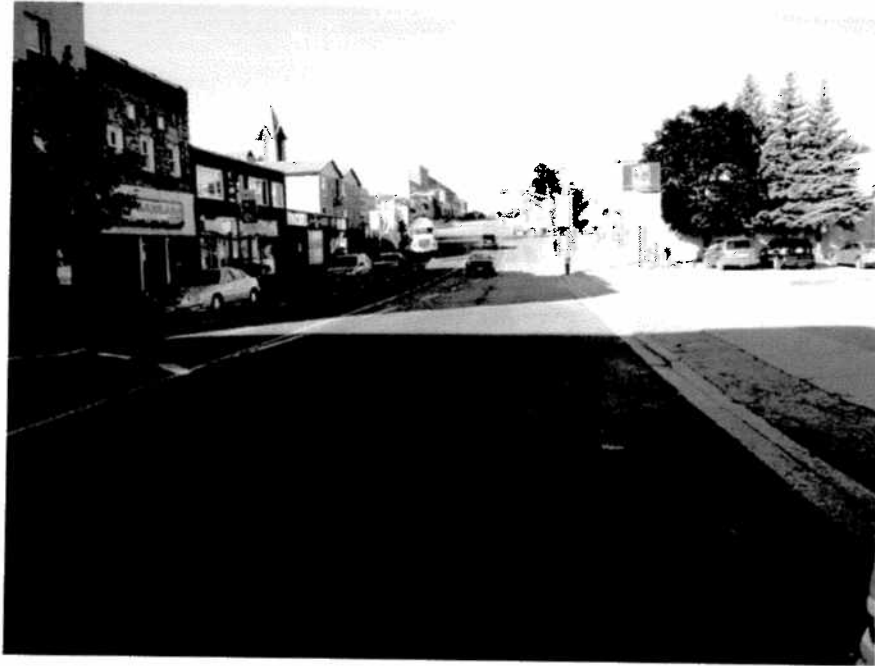
Comments See Remarks

Rehabilitation - Replace section 4 of culvert (section below Brock Street West)

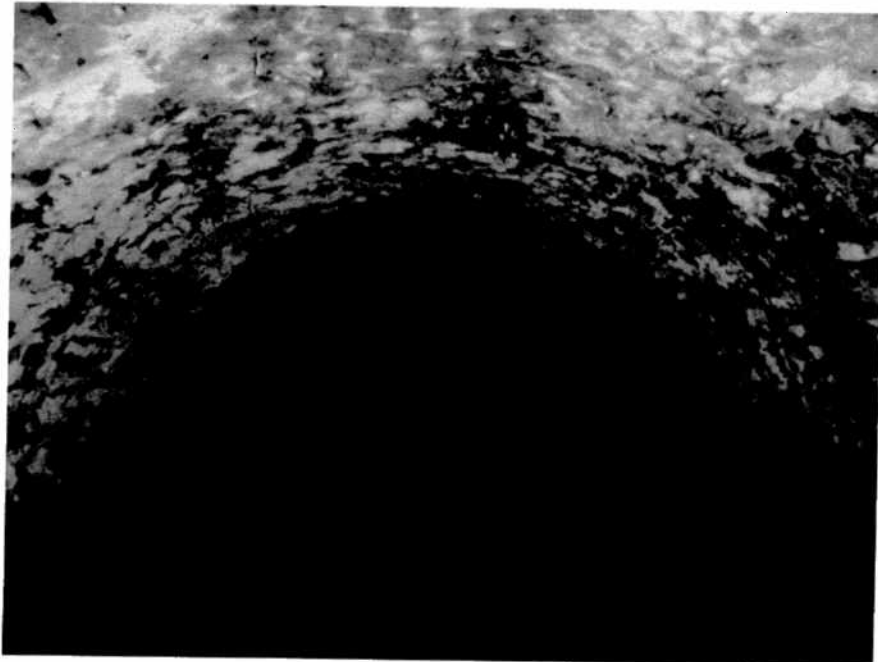
Immediate Maintenance - Brace culvert section at north curb line

Future Maintenance

Periodic Maintenance



Photograph 1. Looking West at Roadway over Culvert ↑



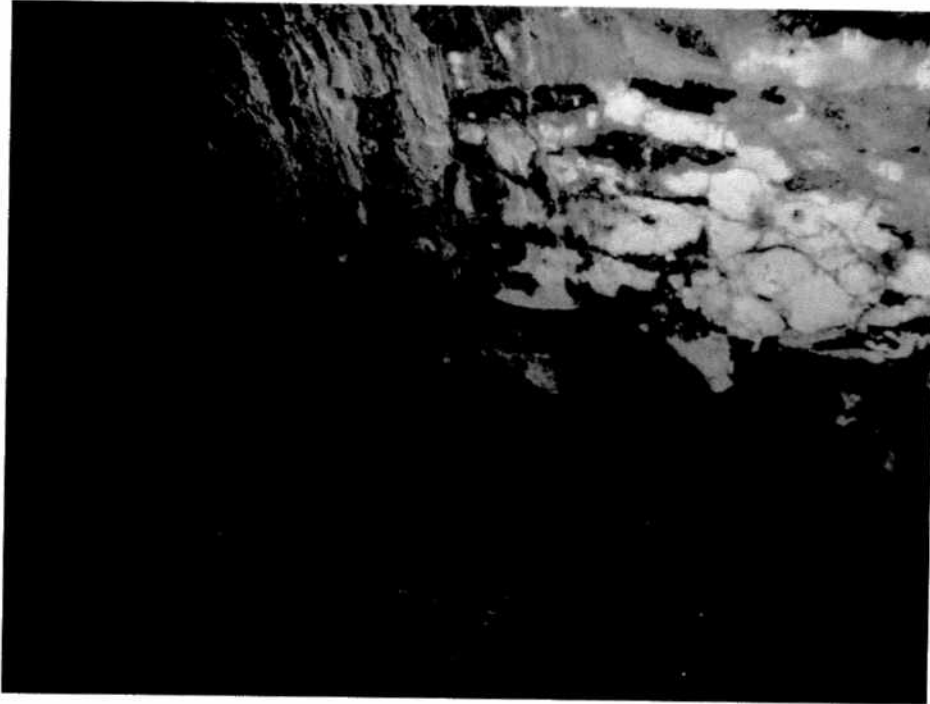
Photograph 2. Looking North Through Barrel ↑



Photograph 3. Wide crack in West Wall ↑



Photograph 4. Wide crack in West Wall ↑



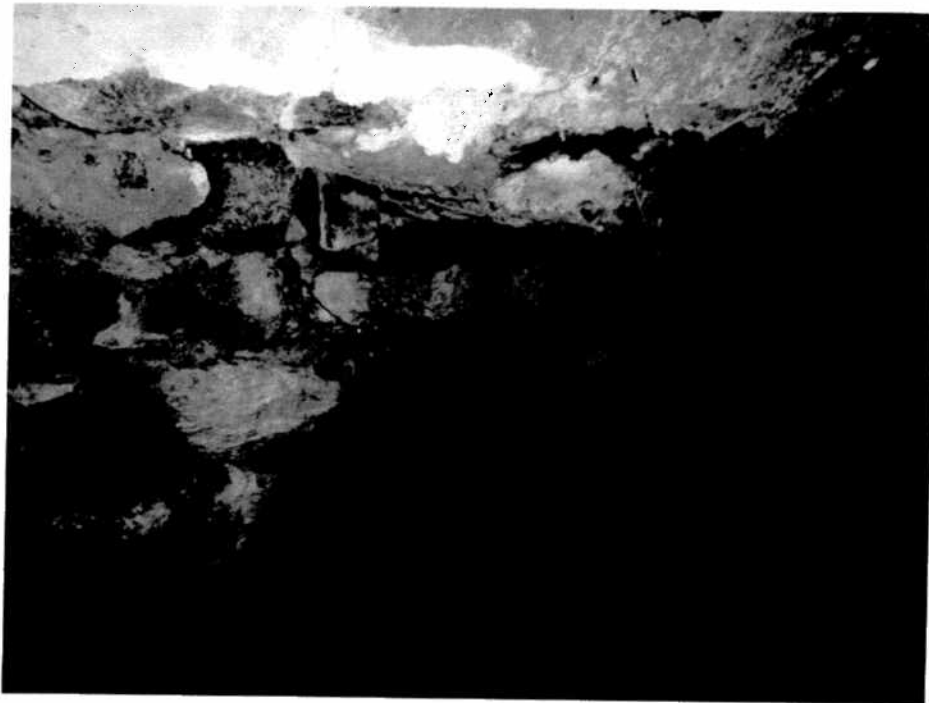
Photograph 5. Loss of Stone from Barrel Wall ↑



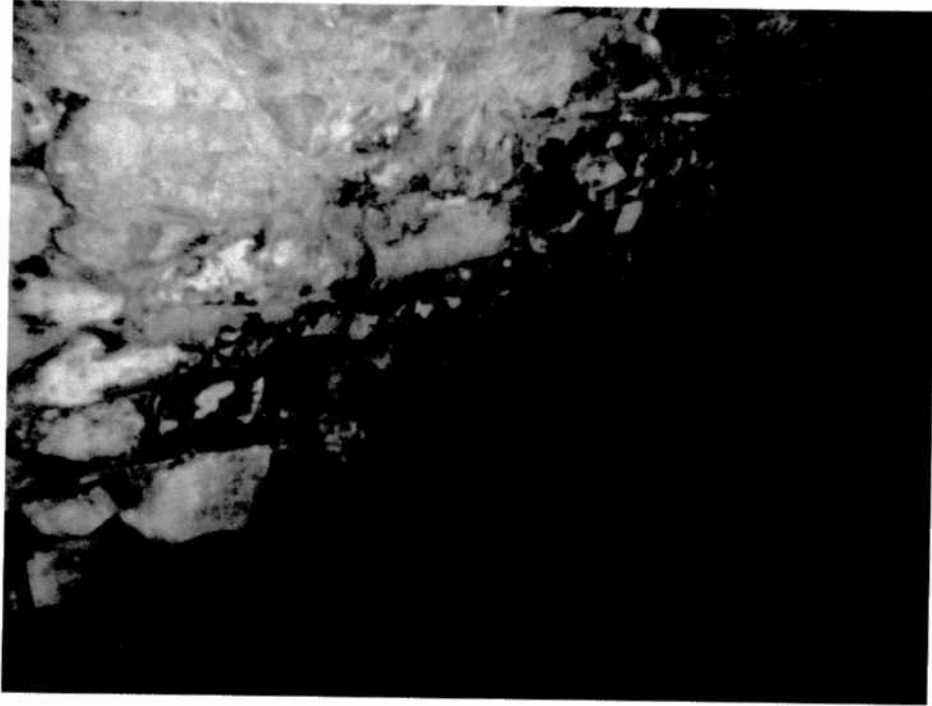
Photograph 6. Encrustation of Barrel ↑



Photograph 7. Loss of Mortar from Stones!↑



Photograph 8. Severe Loss of Mortar is Potential for Loss of Stones ↑



Photograph 9. Loss of Mortar from Barrel Wall ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 0 - - - | Culvert No. | 315-5 |
| Municipal Name/Code | | Road Section No. | |
| Culvert Name | Brock Street West - Section 5 | MTO Site No. | - - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|---------------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundary Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name /No. | | A. |
| Heritage Status | R | Adjacent Culvert No. | | B. |
| Special Designation | | | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 3.3 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.3 m | Upstream | N |
| Material/Type | CSP - PAI | Max. Height | 2.2 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 30 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 1.0 m | Foundation Type | UN |
| | | Culvert Floor | EA | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|-----------------------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk and Curb Barrier | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | Roadside Safety | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | | A N B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|-----------------------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk and Curb Barrier | A m | | |
| Surface Width | m | | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| | | Traffic Count | | 10 Year Traffic Forecast | |
| Legal Speed Limit | 50 | Year | -19 - | Year | |
| Route Designations | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

CULVERT

| NEEDS | MCR | PCR | TIME OF NEED |
|--------------------|------------|------------|---------------------|
| Barrel | 5 | 6 | |
| Foundations | 5 | 6 | |
| Inlet Component | 0 | 0 | |
| Outlet Component | 0 | 0 | |
| Guide Rail/Barrier | 0 | 0 | |
| Streams/Waterways | 5 | 6 | |

TYPE AND TIME OF IMPROVEMENT

| | | | | |
|----------------------------|-------------------------|------------|----------------------------|---------------------|
| Design Class | | | | |
| Design Platform Width | | | | m |
| Material/Type | | | | |
| Width/Diamete | | | | m |
| Maximum Height | | | | m |
| Culvert Length | | | | m |
| No. of Culverts | | | | |
| Depth of Fill | | | | m |
| a) | b) | c) | d) | e) |
| Type of Improvement | Costing Category | Qty | Time of Improvement | Cost (\$000) |

- A
- B
- C
- D

ENGINEERING RECOMMENDATIONS

Culvert Drawings

Engineering Investigations

| | Type | Year | Cost (\$000) |
|---|-------------|-------------|---------------------|
| A | | | |
| B | | | |
| C | | | |

| | | | | |
|-------------------|---|---|---|---|
| Single Posting | t | y | m | d |
| Evaluated Posting | | | t | t |
| Date | | y | m | |
| Monitoring | | | | |
| Closure/Date | y | m | d | |

Municipal Culvert Appraisal

Remarks

Culvert 315-5, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 5 is a 3.3m +/- corrugated steel pipe arch culvert with approximately 1.0m of earth fill.
- Culvert is in generally good condition with localized light corrosion. Localized light flaking was noted at the waterline.
- Watercourse is unobstructed with no evidence of scour.
- Structure does not require posting with a load limit.

Municipal Culvert Appraisal

Maintenance Required

Comments

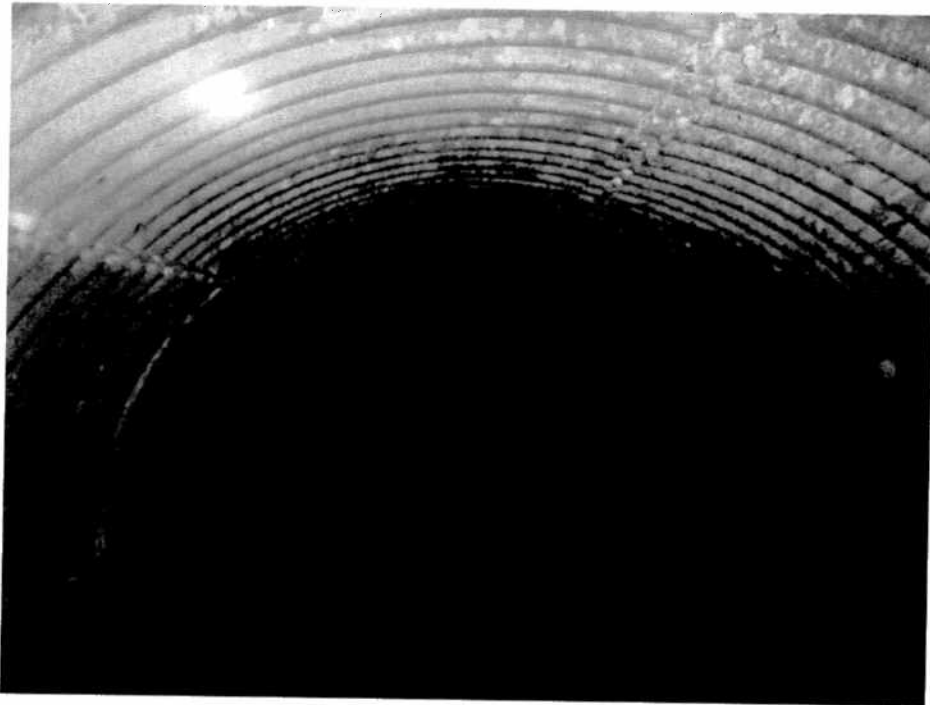
See Remarks

Rehabilitation

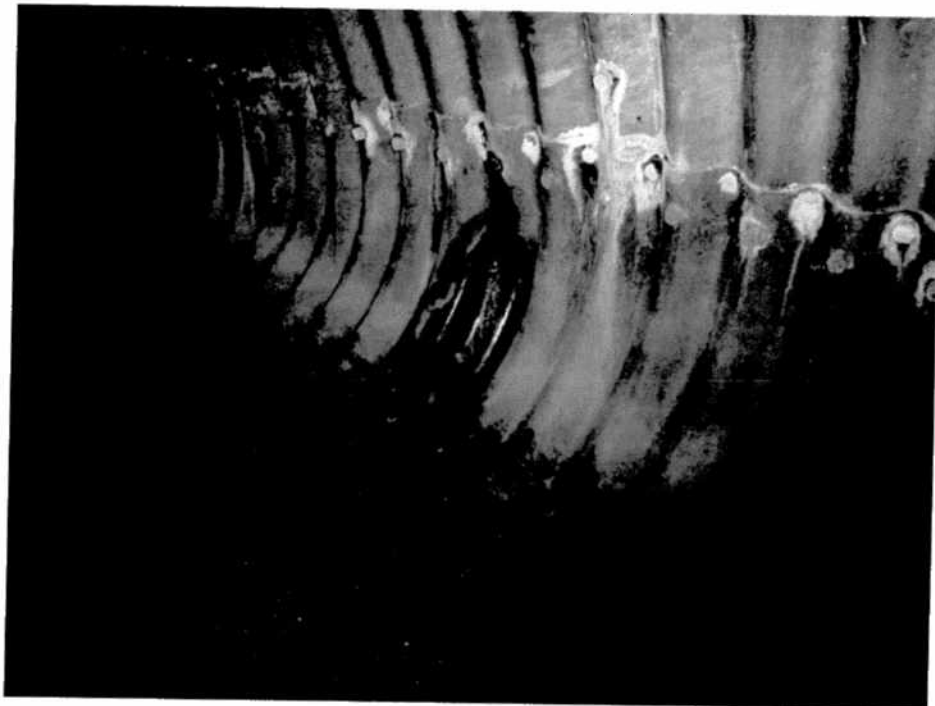
Immediate Maintenance

Future Maintenance

Periodic Maintenance



Photograph 1. Looking North Through Barrel ↑



Photograph 2. Light Corrosion of Barrel ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 0 - - - | Culvert No. | 315-6 |
| Municipal Name/Code | | Road Section No. | |
| Culvert Name | Brock Street West - Section 6 | MTO Site No. | - - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|---------------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundary Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name /No. | | A. |
| Heritage Status | R | Adjacent Culvert No. | | B. |
| Special Designation | | | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 3.7 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.7 m | Upstream | N |
| Material/Type | CPS - PAI | Max. Height | 2.2 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 29 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | T 1.0 m | Foundation Type | UN |
| | | Culvert Floor | SC | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|-----------------------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk and Curb Barrier | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | Roadside Safety | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | | A B |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|-----------------------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk and Curb Barrier | A m | | |
| Surface Width | m | | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| Legal Speed Limit | 50 | Traffic Count | | 10 Year Traffic Forecast | |
| Route Designations | | Year | -19 - | Year | |
| | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

CULVERT NEEDS

| | MCR | PCR | TIME OF NEED |
|--------------------|-----|-----|--------------|
| Barrel | 3 | 4 | |
| Foundations | 5 | 5 | |
| Inlet Component | 0 | 0 | |
| Outlet Component | 0 | 0 | |
| Guide Rail/Barrier | 0 | 0 | |
| Streams/Waterways | 5 | 6 | |

TYPE AND TIME OF IMPROVEMENT

| | |
|-----------------------|----------|
| Design Class | UALU |
| Design Platform Width | 29.0 m |
| Material/Type | PC - BOX |
| Width/Diameter | 3.6 m |
| Maximum Height | 2.4 m |
| Culvert Length | 29.0 m |
| No. of Culverts | 1 |
| Depth of Fill | 1.0 m |

FUNCTIONAL NEEDS

| | Existing Condition | Minimum Tolerable | TIME OF NEED |
|-------------------------|--------------------|-------------------|--------------|
| ROAD OVER | | | |
| Platform Width | m | m | |
| Level of Service | | | |
| Roadside Safety | m | m | |
| ROAD UNDER | | | |
| Surface Width | m | m | |
| Level of Service | | | |
| Min. Vertical Clearance | m | m | |
| Sidewalks | | | |

| a) | b) | c) | d) | e) |
|---------------------|------------------|-----|---------------------|--------------|
| Type of Improvement | Costing Category | Qty | Time of Improvement | Cost (\$000) |
| A REC | PC | | 1-5 | 20 |
| B RSL | PC | | 1-5 | 260 |
| C | | | | |
| D | | | | |

IMPROVEMENT COST

| | COST (\$000) |
|--------------------------------------------------|--------------|
| Construction | 280 |
| Approaches | 30 |
| Detours | 5 |
| Traffic Control/Protection | |
| Utilities | |
| Other | |
| Contingencies | 10.00% 32 |
| Total Construction | |
| Right of Way | |
| Engineering Environmental Assessment (E/A) Study | |
| Engineering - Design and Supervision | 20.00% 70 |
| Total Project Cost | 417 |

ENGINEERING RECOMMENDATIONS

| | | | | |
|----------------------------|------|------|--------------|--|
| Culvert Drawings | | | | |
| Engineering Investigations | | | | |
| | Type | Year | Cost (\$000) | |
| A | | | | |
| B | | | | |
| C | | | | |
| Single Posting | t y | m | d | |
| Evaluated Posting | | | t t t | |
| Date | | y | m | |
| Monitoring | | | | |
| Closure/Date | y | m | d | |

| Eligibility for Contributions | Contributing Agency | Non-Contributable Cost |
|-----------------------------------------|---------------------|------------------------|
| Non-Contributable Costs | | |
| | A | |
| | B | |
| | C | |
| | D | |
| Total Non-Contributable Cost | | |
| Contributable Cost | | 417 |
| Municipal Percent of Contributable Cost | | 100 |
| Municipal Share of Cost | | 417 |

HISTORY

ENGINEERING INVESTIGATIONS

Type Year

CONSTRUCTION IMPROVEMENTS

Type Year

Municipal Culvert Appraisal

Remarks

Culvert 315-6, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
 - Sections are numbered from South to North.
 - Section 6 is a 3.7m +/- span corrugated steel pipe arch culvert with approximately 1.0m of earth fill.
 - Culvert is in generally fair condition with cracks at the bolt hole locations in the West culvert wall for 4.0m at the top of the sharp corner radii.
- There is a welded patch along the east wall at the top of the sharp radii the full length of the culvert.
- The entire culvert was not placed in the normal position, the east wall is high, shifting the crown to the west.
 - Watercourse is unobstructed with no evidence of scour. There is an accumulation of sediment along the east wall.
 - Structure does not require posting with a load limit.

Municipal Culvert Appraisal

Maintenance Required

Comments

See Remarks

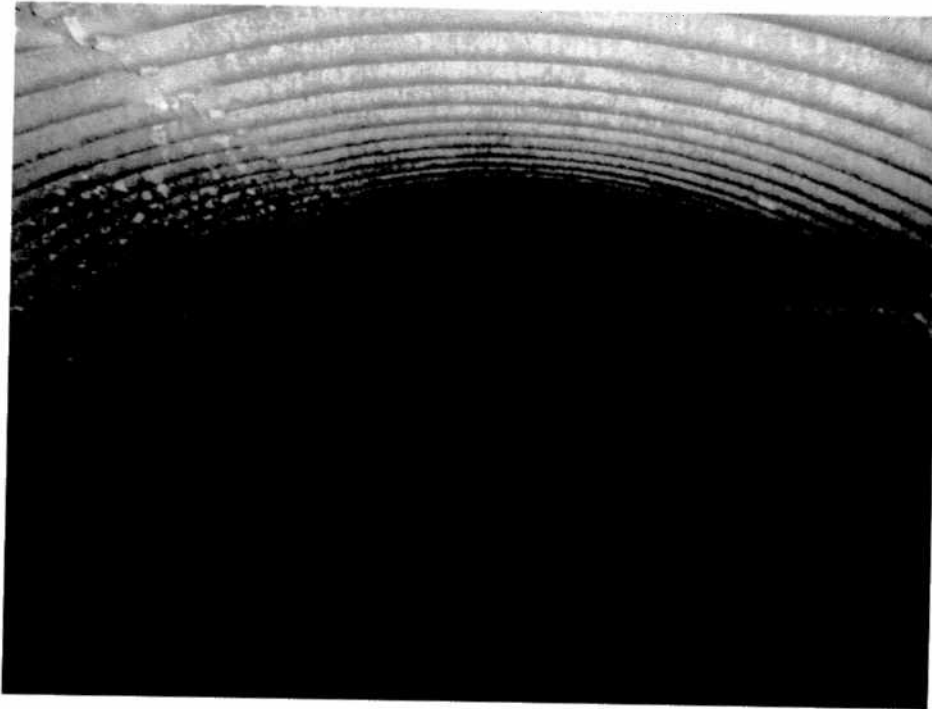
Rehabilitation

- Replace culvert section 6

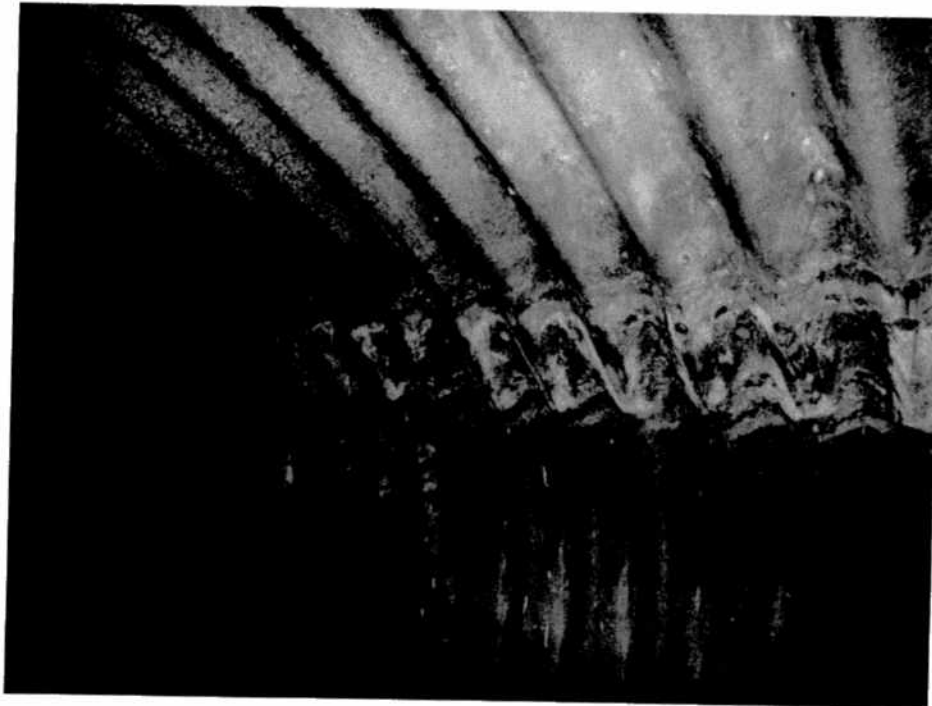
Immediate Maintenance

Future Maintenance

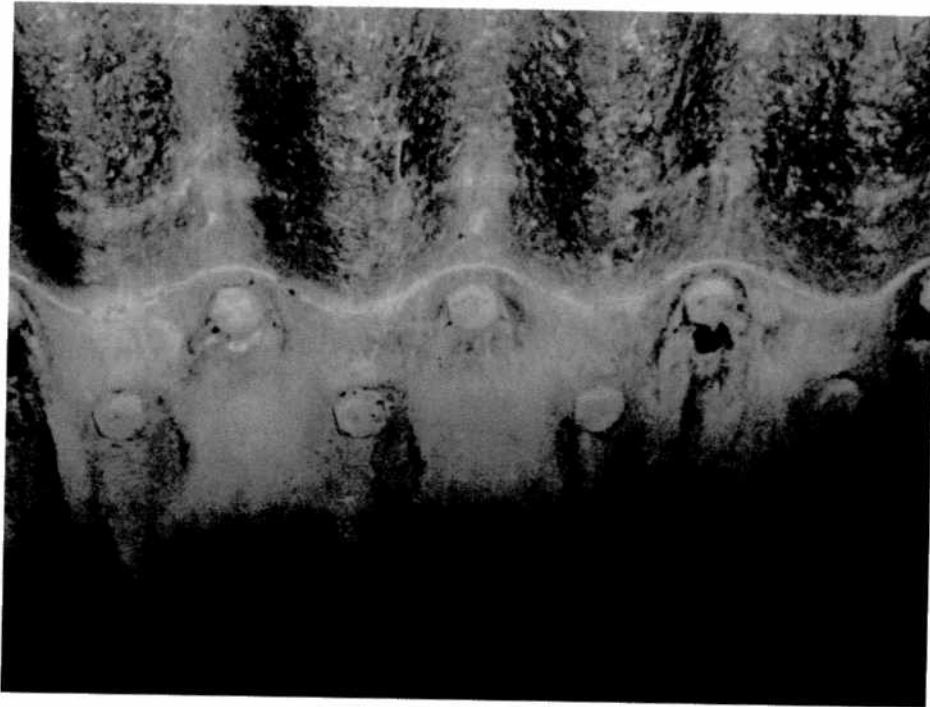
Periodic Maintenance



Photograph 1. Looking North Through Barrel ↑



Photograph 2. Welded Patch on East Wall ↑



Photograph 3. Crack at Bolt Hole Location on West Culvert Wall↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 0 - - - | Culvert No. | 315-7 |
| Municipal Name/Code | | Road Section No. | |
| Culvert Name | Brock Street West - Section 7 | MTO Site No. | - - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|---------------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundary Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name /No. | | A. |
| Heritage Status | R | Adjacent Culvert No. | | B. |
| Special Designation | | | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 3.8 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.8 m | Upstream | N |
| Material/Type | CPS - PAI | Max. Height | 2.1 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 19.7 m | Soil Condition | U |
| No. of Cells/Spans | 01 | Type/Depth of Fill | E 1.2 m | Foundation Type | UN |
| | | Culvert Floor | SC | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|-----------------------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk and Curb Barrier | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | Roadside Safety | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|-----------------------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk and Curb Barrier | A m | | |
| Surface Width | m | | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| Legal Speed Limit | 50 | Traffic Count | | 10 Year Traffic Forecast | |
| Route Designations | | Year | -19 - | Year | |
| | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

CULVERT

| NEEDS | MCR | PCR | TIME OF NEED |
|--------------------|-----|-----|--------------|
| Barrel | 3 | 4 | |
| Foundations | 5 | 5 | |
| Inlet Component | 0 | 0 | |
| Outlet Component | 0 | 0 | |
| Guide Rail/Barrier | 0 | 0 | |
| Streams/Waterways | 5 | 5 | |

TYPE AND TIME OF IMPROVEMENT

| | |
|-----------------------|----------|
| Design Class | UALU |
| Design Platform Width | 19.7 m |
| Material/Type | CP - BOX |
| Width/Diamete | 3.6 m |
| Maximum Height | 2.4 m |
| Culvert Length | 19.7 m |
| No. of Culverts | 1 |
| Depth of Fill | 1.2 m |

FUNCTIONAL NEEDS

| Existing Condition | Minimum Tolerable | TIME OF NEED |
|-------------------------|-------------------|--------------|
| ROAD OVER | | |
| Platform Width | m | m |
| Level of Service | | |
| Roadside Safety | m | m |
| ROAD UNDER | | |
| Surface Width | m | m |
| Level of Service | | |
| Min. Vertical Clearance | m | m |
| Sidewalks | | |

| a) Type of Improvement | b) Costing Category | c) Qty | d) Time of Improvement | e) Cost (\$000) |
|------------------------|---------------------|--------|------------------------|-----------------|
| A REC | PC | | 1-5 | 20 |
| B RSL | PC | | 1-5 | 180 |
| C | | | | |
| D | | | | |

IMPROVEMENT COST

| | COST (\$000) |
|--------------------------------------------------|--------------|
| Construction | 200 |
| Approaches | 30 |
| Detours | 5 |
| Traffic Control/Protection | |
| Utilities | |
| Other | |
| Contingencies | 10.00% 24 |
| Total Construction | |
| Right of Way | |
| Engineering Environmental Assessment (E/A) Study | |
| Engineering - Design and Supervision | 20.00% 52 |
| Total Project Cost | 311 |

ENGINEERING RECOMMENDATIONS

| Type | Year | Cost (\$000) |
|----------------------------|---------|--------------|
| Culvert Drawings | | |
| Engineering Investigations | | |
| A | | |
| B | | |
| C | | |
| Single Posting | t y m d | |
| Evaluated Posting | t t t t | |
| Date | y m | |
| Monitoring | | |
| Closure/Date | y m d | |

| Eligibility for Contributions | Contributing Agency | Non-Contributable Cost |
|-----------------------------------------|---------------------|------------------------|
| Non-Contributable Costs | | |
| | A | |
| | B | |
| | C | |
| | D | |
| Total Non-Contributable Cost | | |
| Contributable Cost | | 311 |
| Municipal Percent of Contributable Cost | | 100 |
| Municipal Share of Cost | | 311 |

HISTORY

ENGINEERING INVESTIGATIONS

Type Year

CONSTRUCTION IMPROVEMENTS

Type Year

Municipal Culvert Appraisal

Remarks

Culvert 315-7, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 7 is a 3.8m +/- corrugated steel pipe arch culvert with approximately 1.2m of earth fill.
- Culvert is in poor condition with cracks at bolt hole locations in the west culvert wall for 2.4m in the top of the bottom sharp radii. Several bolts are tilted.
- Watercourse is unobstructed with no evidence of scour. There is an accumulation of sediment along the east wall.

Municipal Culvert Appraisal

Maintenance Required

Comments See Remarks

Rehabilitation - Replace culvert section 7

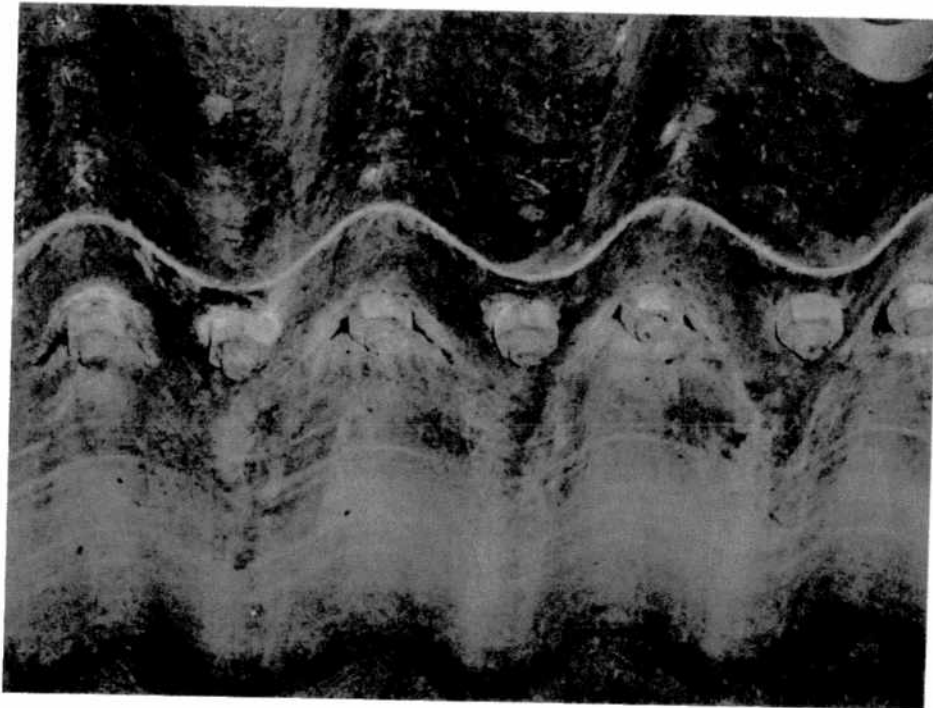
Immediate Maintenance

Future Maintenance

Periodic Maintenance



Photograph 1. Looking North Through Barrel ↑



Photograph 2. Crack at Bolt Hole Location on West Culvert Wall ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 0 - - - | Culvert No. | 315-8 |
| Municipal Name/Code | | Road Section No. | |
| Culvert Name | Brock Street West - Section 8 | MTO Site No. | - - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|---------------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundary Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name /No. | | A. |
| Heritage Status | R | Adjacent Culvert No. | | B. |
| Special Designation | | | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1970 | Cell/Span Width/Dia. | 3.8 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.8 m | Upstream | N |
| Material/Type | CPS - PAI | Max. Height | 2.1 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 10 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 1.5 m | Foundation Type | UN |
| | | Culvert Floor | SC | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|-----------------------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk and Curb Barrier | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | Roadside Safety | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|-----------------------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk and Curb Barrier | A m | | |
| Surface Width | m | | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| | | Traffic Count | | 10 Year Traffic Forecast | |
| Legal Speed Limit | 50 | Year | -19 - | Year | |
| Route Designations | | AADT | | AADT | |
| Transit | Truck | DHV Factor (%) | % | DHV Factor (%) | % |
| School | Bicycle | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

CULVERT

| NEEDS | MCR | PCR | TIME OF NEED |
|--------------------|-----|-----|--------------|
| Barrel | 2 | 1 | |
| Foundations | 5 | 5 | |
| Inlet Component | 0 | 0 | |
| Outlet Component | 0 | 0 | |
| Guide Rail/Barrier | 0 | 0 | |
| Streams/Waterways | 5 | 6 | |

TYPE AND TIME OF IMPROVEMENT

| | |
|-----------------------|----------|
| Design Class | UALU |
| Design Platform Width | 10 m |
| Material/Type | PC - BOX |
| Width/Diameter | 3.6 m |
| Maximum Height | 2.4 m |
| Culvert Length | 10 m |
| No. of Culverts | 1 |
| Depth of Fill | 1.5 m |

FUNCTIONAL NEEDS

| | Existing Condition | Minimum Tolerable | TIME OF NEED |
|-------------------------|--------------------|-------------------|--------------|
| ROAD OVER | | | |
| Platform Width | m | m | |
| Level of Service | | | |
| Roadside Safety | m | m | |
| ROAD UNDER | | | |
| Surface Width | m | m | |
| Level of Service | | | |
| Min. Vertical Clearance | m | m | |
| Sidewalks | | | |

| a) Type of Improvement | b) Costing Category | c) Qty | d) Time of Improvement | e) Cost (\$000) |
|------------------------|---------------------|--------|------------------------|-----------------|
| A REC | PC | | NOW | 20 |
| B RSL | PC | | NOW | 90 |
| C | | | | |
| D | | | | |

IMPROVEMENT COST

| | COST (\$000) |
|--------------------------------------------------|--------------|
| Construction | 110 |
| Approaches | 20 |
| Detours | 5 |
| Traffic Control/Protection | |
| Utilities | |
| Other | |
| Contingencies | 10.00% 14 |
| Total Construction | |
| Right of Way | |
| Engineering Environmental Assessment (E/A) Study | |
| Engineering - Design and Supervision | 20.00% 30 |
| Total Project Cost | 179 |

ENGINEERING RECOMMENDATIONS

| | Type | Year | Cost (\$000) |
|----------------------------|------|------|--------------|
| Culvert Drawings | | | |
| Engineering Investigations | | | |
| A | | | |
| B | | | |
| C | | | |
| Single Posting | t y | m | d |
| Evaluated Posting | | | |
| Date | | y | m |
| Monitoring | | | |
| Closure/Date | y | m | d |

| Eligibility for Contributions | Contributing Agency | Non-Contributable Cost |
|-----------------------------------------|---------------------|------------------------|
| Non-Contributable Costs | | |
| | A | |
| | B | |
| | C | |
| | D | |
| Total Non-Contributable Cost | | |
| Contributable Cost | | 179 |
| Municipal Percent of Contributable Cost | | 100 |
| Municipal Share of Cost | | 179 |

HISTORY

ENGINEERING INVESTIGATIONS

Type Year

CONSTRUCTION IMPROVEMENTS

Type Year

Municipal Culvert Appraisal

Remarks

Culvert 315-8, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 8 is a 3.8m +/- corrugated steel pipe arch culvert with approximately 1.3m of earth fill and an asphalt paved wearing surface.
- Asphalt paved wearing surface is in generally fair condition with cracks.
- Culvert is in poor condition with cracks at bolt hole locations in the west culvert wall for 13m and the east culvert wall for 8m in the top of the bottom sharp radii. The culvert has been shored. The shoring is in poor condition exhibiting severe deterioration and fractured posts, making the shoring ineffective.
- Watercourse is unobstructed with no evidence of scour.

Municipal Culvert Appraisal

Maintenance Required

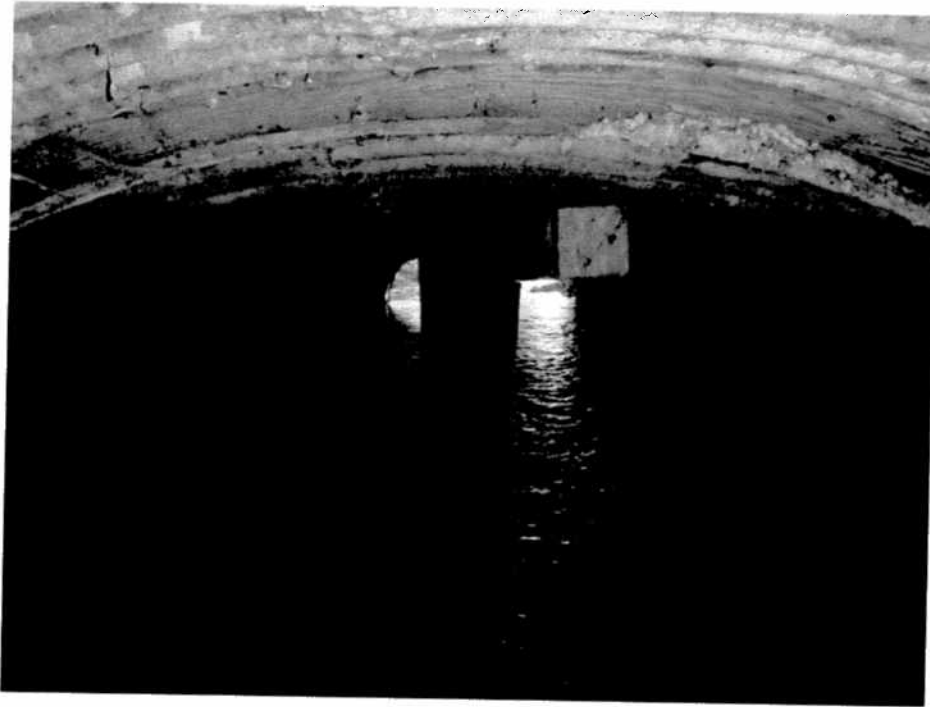
Comments See Remarks

Rehabilitation - Replace culvert section 8

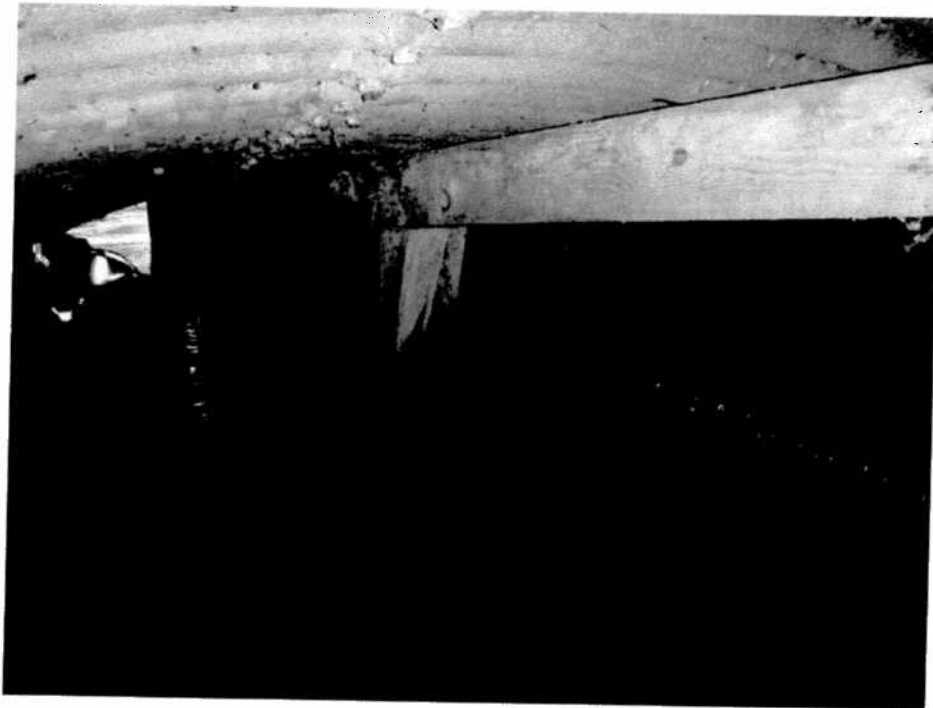
Immediate Maintenance - Replace shoring

Future Maintenance

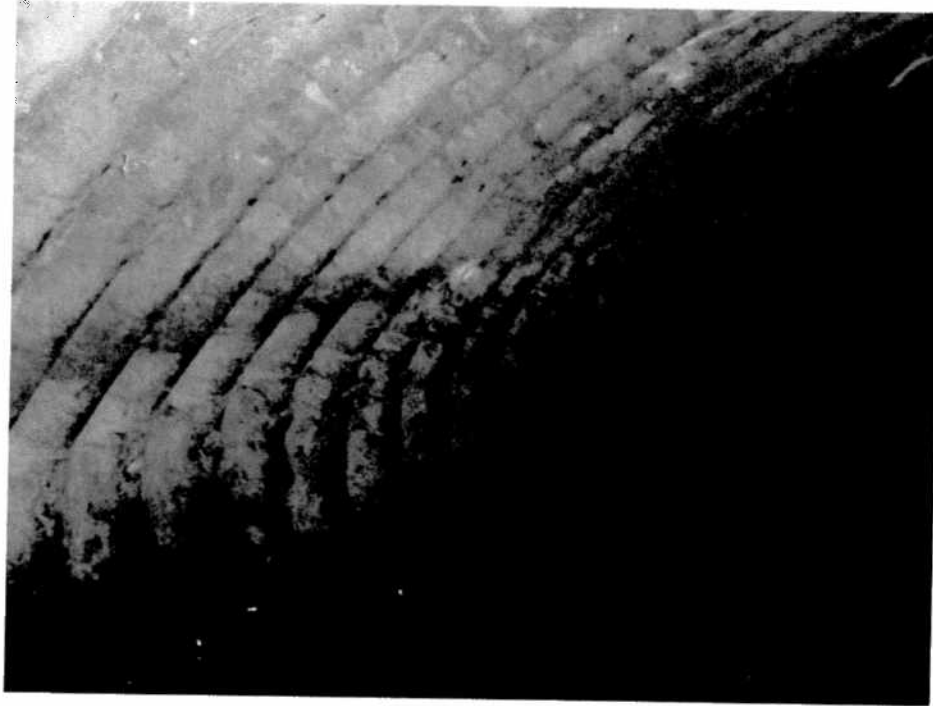
Periodic Maintenance



Photograph 1. Looking North Through Barrel ↑



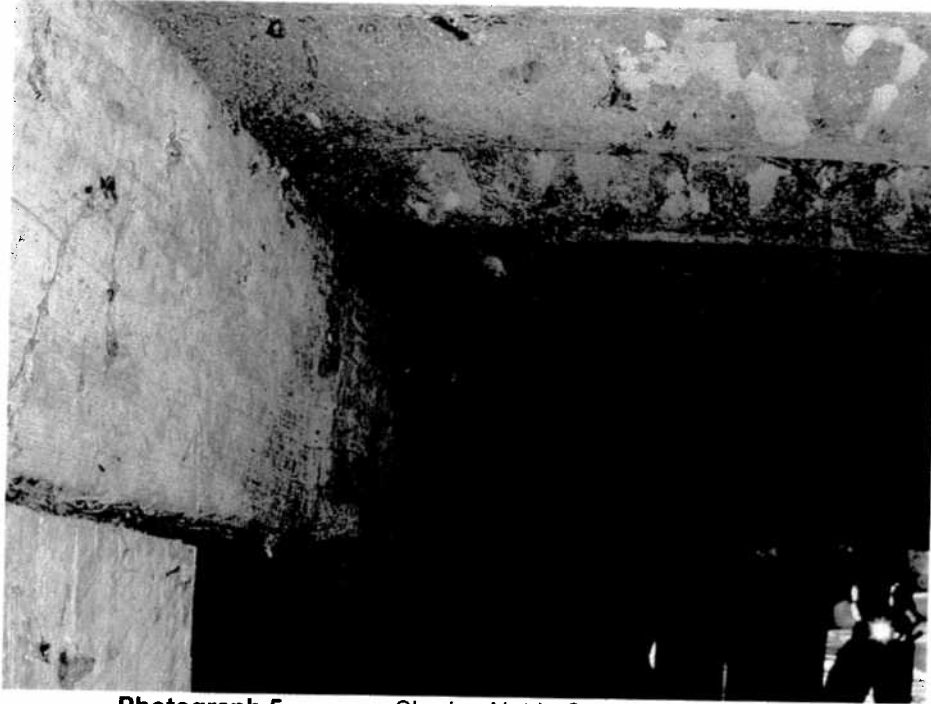
Photograph 2. Sag in Culvert Obvert ↑



Photograph 3. Minor Crimping of West Barrel Wall ↑



Photograph 4. Crack at Bolt Hole Location in Culvert Wall ↑



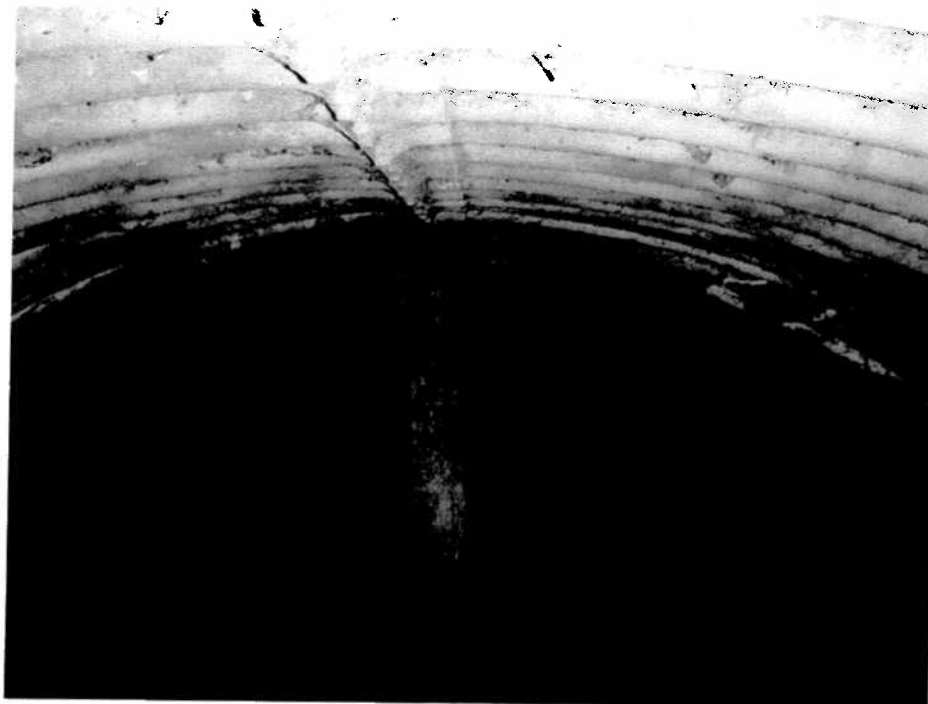
Photograph 5. Shoring Not in Contact with Barrel ↑



Photograph 6. Crack at Bolt Hole Location in Culvert Wall ↑



Photograph 7. Crack at Bolt Hole Location in Culvert Wall ↑



Photograph 8. Looking North Through Barrel ↑

Municipal Culvert Appraisal

IDENTIFICATION

| | | | |
|----------------------|-----------------------------------|----------------------------|-------|
| Control Code | 4 - N - UR - 09 | Culvert No. | 315-9 |
| Municipal Name/Code | 10603 | Road Section No. | |
| Culvert Name | Brock Street West - Section 9 | MTO Site No. | - |
| Road Name | Brock Street West | | |
| Location | 0.05 km E of Toronto Street North | | |
| Roadside Environment | U | | |
| Posting | t t t | Posting Sign | t t t |
| Bylaw No. | | Low Clearance Sign | m |
| Bylaw Expiry Date | y m | Narrow Structure Sign | |
| | | Crossing Type | O WAT |
| | | Federal Navigable Waterway | |

RAILWAY OVERPASS/UNDERPASS

| | | | |
|-------------------------------|----|-----------------------------|-------|
| Railway Company | | Original Board Order Number | |
| Railway Subdivision | | Date | y m d |
| Subdivision Mileage | mi | Current Board Order Number | |
| Transport Canada Crossing No. | | | y m d |
| Number of Tracks | | Seniority | |

JURISDICTION

| | | | | |
|---------------------|---------|----------------------------|---|--------------------------------------------|
| Ownership | O A MUN | Boundry Culvert | N | Local/Area Municipality (Upper Tier Only!) |
| | B | Adjacent Municipality Name | | A. |
| Heritage Status | R | /No. | | B. |
| Special Designation | | Adjacent Culvert No. | | |

EXISTING CONDITIONS (General)

| | | | | | |
|--------------------|-----------|----------------------|---------|-----------------|---------|
| Year Constructed | A 1980 | Cell/Span Width/Dia. | 3.8 m | End Treatment | A B C D |
| | B | Total Width/Dia. | 3.8 m | Upstream | R H |
| Material/Type | CPS - PAI | Max. Height | 2.1 m | Downstream | N |
| Crossing Skew | 0 - 0 ° | Culvert Length | 10 m | Soil Condition | U |
| No. of Cells/Spans | 1 | Type/Depth of Fill | E 1.5 m | Foundation Type | UN |
| | | Culvert Floor | SC | | |

ROAD OVER CULVERT

| | | | | | |
|---------------------|----------|----------------|------|------------------------|-------------|
| Existing Road Class | | Platform Width | 15 m | Safety Curb / Sidewalk | A N N 1.5 m |
| Operational Status | 2W - OAT | Surface Width | 8 m | and Curb Barrier | B N S 1.5 m |
| Surface Type | HCB | No. of Lanes | 2 | Roadside Safety | A N |
| | | | | | B N |

ROAD THROUGH CULVERT

| | | | | | |
|---------------------|---|------------------------|-----|----------------------------|---|
| Existing Road Class | | No. of Lanes | | Traffic Barrier | |
| Operational Status | - | Median Type/Width | m | Minimum Vertical Clearance | m |
| Opening Width | m | Safety Curb / Sidewalk | A m | | |
| Surface Width | m | and Curb Barrier | B m | | |

TRAFFIC DATA

| | | | | | |
|--------------------|---------|------------------------|-------|---------------------------------|-----|
| Legal Speed Limit | 50 | Traffic Count | | 10 Year Traffic Forecast | |
| Route Designations | | Year | -19 - | Year | |
| Transit | Truck | AADT | | AADT | |
| School | Bicycle | DHV Factor (%) | % | DHV Factor (%) | % |
| | | DHV (vph) | vph | DHV (vph) | vph |
| | | Trucks (%) | % | Trucks (%) | % |
| | | Peak Directional Split | % | Capacity (vph) | vph |
| | | 10 Year Growth Factor | | 20 Year AADT | |

APPROVALS

| | | | |
|---------------------------|-------------------|-----------------------|----------------------|
| Date | y 09 m 10 | Professional Engineer | D.L. BAXTER, P. ENG. |
| Municipality/Company Name | AECOM Canada Ltd. | | |

Municipal Culvert Appraisal

| <u>CULVERT NEEDS</u> | | | <u>TYPE AND TIME OF IMPROVEMENT</u> | | | | |
|----------------------|-----|-----|-------------------------------------|-----------------------|------------------|-----|---------------------|
| | MCR | PCR | TIME OF NEED | | | | |
| Barrel | 5 | 6 | | Design Class | | | |
| Foundations | 5 | 6 | | Design Platform Width | | | m |
| Inlet Component | 0 | 0 | | Material/Type | | | |
| Outlet Component | 5 | 6 | | Width/Diamete | | | m |
| Guide Rail/Barrier | 0 | 0 | | Maximum Height | | | m |
| Streams/Waterways | 5 | 6 | | Culvert Length | | | m |
| | | | | No. of Culverts | | | |
| | | | | Depth of Fill | | | m |
| | | | | a) | b) | c) | d) |
| | | | | Type of Improvement | Costing Category | Qty | Time of Improvement |
| | | | | | | | e) Cost (\$000) |
| | | | | A | | | |
| | | | | B | | | |
| | | | | C | | | |
| | | | | D | | | |

ENGINEERING RECOMMENDATIONS

Culvert Drawings

Engineering Investigations

| | Type | Year | Cost (\$000) |
|-------------------|------|------|--------------|
| A | | | |
| B | | | |
| C | | | |
| Single Posting | t y | m | d |
| Evaluated Posting | | t | t t |
| Date | | y | m |
| Monitoring | | | |
| Closure/Date | y | m | d |

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Remarks

Culvert 315-9, Brock Street West, 0.05km East of Toronto Street North, Township of Uxbridge:

- Structure not posted with a load limit.
- Sections are numbered from South to North.
- Section 9 is a 3.8m +/- corrugated steel pipe arch culvert with approximately 1.5m of earth fill and an asphalt paved wearing surface.
- The asphalt paved wearing surface is in generally good condition.
- Vegetative roadway embankments are in generally good condition with minor to moderate erosion in the Northeast quadrant.
- Corrugated steel pipe arch culvert is in good condition.
- Steel sheet pile headwall and retaining wall are in good condition.
- Watercourse is unobstructed with no evidence of scour.
- No serious evidence of structural distress.
- Structure does not require posting with a load limit.

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Maintenance Required

Comments

See Remarks

Rehabilitation

Immediate Maintenance

Future Maintenance

- Restore embankment

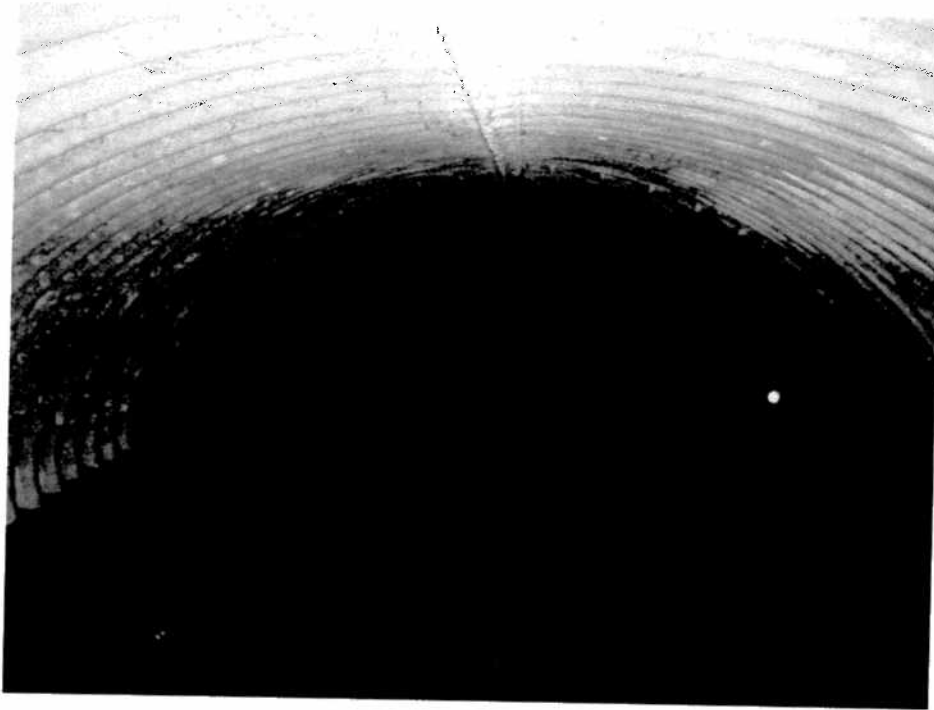
Periodic Maintenance



Photograph 1. North Elevation ↑



Photograph 2. Asphalt Over Culvert ↑



Photograph 3. Looking North Through Culvert ↑



Photograph 4. Minor to Moderate Erosion of Embankment in Northeast Quadrant ↑

The recent visual inspection of the Masonry Arch culvert was carried out on June 2010, following the seismic activity occurring in Southern Ontario by Joseph Kumentas P.Eng. (Region's Structural Project Manager) and Mr. Dave Dunn (Region's Engineering Technician). The inspection was undertaken in accordance with OSIM (Ontario Structure Inspection Manual) requirements and guidelines. Basic methodology of the inspection was separated into two elements and they are "Performance Deficiencies" and "Material Condition".

Performance Deficiencies of a culvert structure relate to its ability to provide adequate support to the above fill material and live loads without appreciable movements and accommodate design flow requirement.

Material Condition indicated general defect that are found in concrete, steel, wood, masonry, aluminum, asphalt pavement and coating. Each defect is inspected and the causes producing it are identified. Severity levels are established. The following defects commonly occurring in masonry: cracking, splitting, spalling, loss of mortar and stones. Loss of mortar is the result of destructive actions of frost, erosion or softening by water containing dissolve sulphates or chlorides.

Comparing current inspection findings to previous inspection results over long periods of time is an essential step in determining the over-all performance of a structure. The results of the inspection undertaken in 1987 and 2009 by AECOM (formerly TSH) were carefully reviewed and utilized as benchmark to assist in determining the over all performance of the Masonry Arch culvert during the 2010 inspection.

Based upon the recent inspection's observation, the existing structure is considered to be in good to fair condition in term of performance. At the time of the inspection there were no indication of "additional" sign of over-stressed of the material, especially in the critical areas of the culverts. The majority of the "cracks" and mortar losses "areas" were in a non-progressive state. In terms of the "Material Condition" it is considered to be fair to poor condition. Hence, there was no sign/indication suggested that the existing culvert's structural integrity has been compromised or failure in performance in near future.

Based on the finding of the inspection, it is recommended to reinstate/repair all "loss" mortar and cracks in timely manner in order to extend the life-span and to improve the performance of the culvert. It is further recommended that a yearly structure inspection should be carried out until the completion of the repair. Upon completion of the repair a regular bi-annual inspection should be undertaken until the culvert is replaced. A hydrology study indicated that the existing opening of the culvert is not adequate to accommodate the hydrology design requirement, hence culvert replacement was recommended.

Present time, the region is in the process of preparing a "Repair"/"Maintenance project for the Masonry Arch culvert.