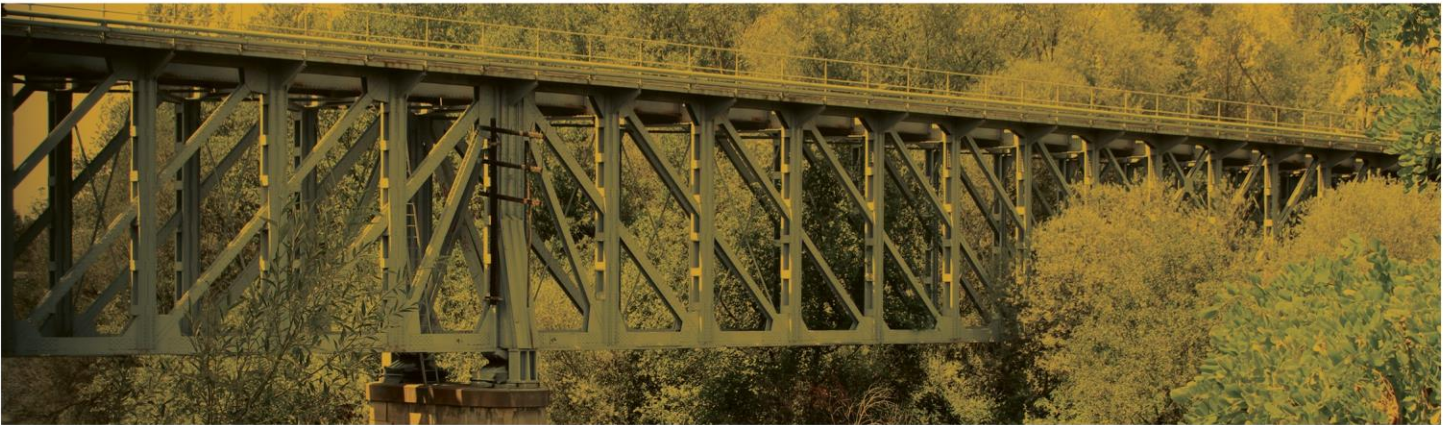




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OSIM Bridge Inspection

SUMMARY REPORT

Town of The Blue Mountains

Document Control

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1 Introduction

Tatham Engineering Limited was retained by the Town of The Blue Mountains to perform detailed visual inspections for 23 bridges and 13 culverts at various locations within town limits, including 5 pedestrian bridges. This work is required in compliance with Ontario Regulation (O.Reg.) 104/97 as amended by O.Reg. 472/10. This regulation states that bridges are to be inspected every two years and these inspections are to be conducted in accordance with the Ontario Structure Inspection Manual (OSIM). The objectives of this work are to:

- Identify maintenance, repair, rehabilitation needs, and load limit posting recommendations to protect and prolong the useful life of the structures; and
- Provide a basis for a management system for the planning and funding of the recommended works.

The structures that were inspected are listed in Table 1-3.

Table 1: Road Bridge Locations

BRIDGE NO.	ROAD NAME	LOCATION
B1	10 th Line	2.3 km N of Osprey/Blue Mountains Boundary
B2	6 th Sideroad	0.35 km W of 10 th Line
B3	6 th Sideroad	0.4 km W of 10 th Line
B4	9 th Sideroad	1.03 km E of Euphrasia - Blue Mountains
B5	12 th Sideroad	0.4 km W of 10 th Line
B6	10 th Line	0.01 km S of 12 th Sideroad
B7	12 th Sideroad	0.7 km W of Grey Road 2
B8	6 th Line	2.1 km N of Grey Road 19
B9	12 th Sideroad	0.05 km W of Grey Road 19
B11	21 st Sideroad	1.34 km E of Grey Road 13
B12	21 st Sideroad	0.15 km E of Grey Road 2
B13	Main Street (Heathcote)	0.4 km E of Grey Road 13
B14	24 th Sideroad	1.4 km W of Grey Road 2



BRIDGE NO.	ROAD NAME	LOCATION
B15	Slabtown Road	0.21 km W of Grey Road 13
B17	Clark Street	0.13 km West of Grey Road 13
B18	10 th Line	0.1 km N of Beaver Street
B19	11 th Line	0.02 km N of 33 rd Sideroad
B21	King Street East	0.2 km E of Bruce Street

Table 2: Culvert Locations

CULVERT NO.	ROAD NAME	LOCATION
C201	18 th Sideroad	0.62 km W of 10 th Line
C202	10 th Line	1.2 km S of 21 st Sideroad
C203	21 st Sideroad	0.52 km W of Grey Road 2
C204	6 th Line	0.29 km S of 21 st Sideroad
C205	Grand Cypress Lane	0.05 km E of Augusta Crescent
C206	Arrowhead Road	0.4 km S of Highway 26
C207	Indian Circle	0.16 km S of Grey Road 40
C208	Sunset Blvd	0.21 km E of Christie Beach Road
C209	Alice Street W	0.45 km W of Lansdowne Street S
C210	Arthur Street	0.3 km East of Peel Street
C211	11 th Line	0.28 km N of 33 rd Sideroad
C212	7 th Line	0.4 km S of Grey Road 40
C213	Pretty River Road	1.1 km N of Osprey-Blue Mountains Townline



Table 3: Pedestrian Bridge Locations

BRIDGE NO.	ROAD NAME	LOCATION
PB1	Georgian Trail	150 m NW of Lansdowne St. N
PB2	Bay St E	NW end of Street over Beaver River
PB3	Georgian Trail	30 m SE of Bruce St. N
PB4	Georgian Trail	280 m SE of Hwy 26
PB5 (B16)	10 th Line	0.5 km N of Grey Road 13

The detailed visual inspections required by Ontario Regulation 104/97 and 472/10 involve an element-by-element inspection of the structure. Elements are reviewed and their condition and performance are assessed based on observations made by the inspector. The condition is then quantified and categorized as excellent, good, fair, or poor. Action may be required if elements are partially or wholly in a deteriorated condition state or have a performance deficiency. Maintenance needs, rehabilitation, or replacement recommendations are then determined with associated time frames to assist the Town with prioritization of the work.

This report summarizes the results of the detailed visual inspections and provides costing and scheduling information for the recommended works. A brief listing of terms used to identify deficiencies with respect to condition or performance states are provided in **Appendix A**.



2 Inspection Summaries

The following summarizes the inspection observations and recommendations. In addition to the deficiencies addressed by the recommended works, a complete compilation of condition and performance information for each bridge can be found in the OSIM reports which include photos of each element. The OSIM forms are included in **Appendix B**.

Recommended works are categorized into maintenance or rehabilitation work. These categorizations are intended to differentiate between smaller scale maintenance work that could be completed by the Town's works department, and larger scale rehabilitation work that may require engineering design and tendering of the construction works. Additional investigations such as Material Condition Surveys, Underwater investigations, Structure Evaluations, etc. are identified both in the summaries below and the OSIM reports, along with recommendations for Enhanced OSIM Inspections which typically consist of the use of a Bridgemaster or similar bucket truck to enable a close-up within arms reach of all areas of the structure.

2.1 BRIDGE NO. 1 – DOBSON'S BRIDGE

Bridge No. 1 is located on 10th Line 2.30 km North of Osprey / Blue Mountains Boundary. The structure is a concrete rigid frame. The bridge has a 10.7 m span and is 8.1 m wide from edge to edge.

Generally, this bridge is in good condition with some wear and scaling. There is no evidence of movement or significant deterioration.

Maintenance work is recommended as follows:

- Annual bridge deck cleaning;
- Clean out stream bed of fallen trees and debris.
- Install object warning marker signs at ends of approach guide rail;
- Regrade gravel approaches;
- Installation of additional guide rail posts at the structure connections;
- Replacement of deteriorated guide rail posts; and

Rehabilitation work is recommended as follows:

- Replace end treatment and upgrade structure connection to current standard
- Replace deteriorated barrier posts



No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.2 BRIDGE NO. 2 – MITCHELLS CREEK BRIDGE

Bridge No. 2 is located on 6th Sideroad 0.35 km W of 10th Line. The bridge has a span of 7.5 m and is approximately 5.5 m wide. The structure consists of four (4) 0.98 m deep concrete t-beam girders with concrete bridge deck. It is noted that there is approximately 10 m between Bridge No. 2 and No. 3.

Generally, this bridge is in poor condition, with significant deterioration of the concrete girders. The watercourse is eroding the east abutment and the existing barriers do not meet current standard.

The bridge is currently posted with a load restriction of 10 tonnes.

Maintenance work is recommended as follows:

- Clear gutters and extend drains;
- Regrade the gravel wearing surface;
- Install narrow crossing sign on east approach.

This structure is recommended for replacement. It has far exceeded its service life. A Class Environmental Assessment Study to confirm the preferred improvement strategy was completed in 2019/2020. Replacement with a single lane single span structure was identified as the preferred solution. The design for the replacement of this structure along with Bridge No. 3 is currently underway with construction budgeted to be completed in 2022.

It is recommended that the next OSIM inspection occur in the summer of 2023.

2.3 BRIDGE NO. 3 – MITCHELLS CREEK BRIDGE

Bridge No. 3 is located on 6th Sideroad 0.4 km west of 10th Line. This bridge has a span of 7.9 m and an overall width of 5.5 m. The structure consists of four (4) 0.98 m deep concrete t-beam girders with concrete bridge deck. It is noted that there is approximately 10 m between Bridge No's 2 and 3.

Generally, this bridge is in poor condition, with significant deterioration of the concrete girders. The watercourse is eroding the east abutment and the existing barriers do not meet current standard.

The bridge is currently posted with a load restriction of 10 tonnes.



Maintenance work is recommended as follows:

- Clear gutters and extend drains;
- Regrade the gravel wearing surface; and
- Remove dead tree from watercourse.

This structure is recommended for replacement. It has far exceeded its service life. A Class Environmental Assessment Study to confirm the preferred improvement strategy was finalized in 2020. Replacement with a single lane single span structure was identified as the preferred solution. The design for the replacement of this structure along with Bridge No. 2 is currently underway with construction budgeted to be completed in 2022.

It is recommended that the next OSIM inspection occur in the summer of 2023.

2.4 BRIDGE NO. 4 – KNOX BRIDGE

Bridge No. 4 is located on 9th Sideroad 1.03 km East of Euphrasia – Blue Mountains Boundary. This bridge is a concrete rigid frame.

Generally, this bridge is in good condition. There is no evidence of movement or significant deterioration. No detailed investigations are recommended.

Maintenance work is recommended as follows:

- Clean gravel off the bridge deck;
- Repair concrete damage to parapet walls;
- Remove graffiti on abutment walls;
- Install object warning markers at buried ends of guide rail; and
- Regrade the gravel wearing surface at the approaches.

Rehabilitation work is recommended as follows:

- Install proper end treatments and provide additional posts at structure connections for approach guide rail.

Additional notes:

- The existing deck drains have minimal extension (less than standard) below the existing soffit, however there is no evidence of detrimental discharge. Deck drain extensions would be required to bring it up to standard, however the existing are performing well and extensions are not recommended at this time.



No load posting is recommended at this time for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.5 BRIDGE NO. 5 – MILL CREEK BRIDGE

Bridge No. 5 is located on 12 Sideroad 0.4 km West of 10th Line. This bridge is a concrete t-beam bridge with a span of 9 m and an overall width of 5.7 m.

Generally, this bridge is in fair to poor condition. There is significant deterioration of the exterior concrete beams and wingwalls and erosion of the abutment. It is recommended that a structure evaluation be carried out on this structure. Drawings will be required to complete the evaluation. Due to the age of the structure and the deteriorated condition of the exterior beam it is recommended that an 18-tonne maximum load posting be enacted in the interim.

Maintenance work is recommended as follows:

- Replace damaged section of barrier;
- Fix rotated barrier blocks;
- Install erosion protection at abutments and wingwalls.
- Repair eroded shoulders and provide a channel for drainage;
- Install object warning marker signs at west approach; and
- Replace deteriorated barrier posts;

Additional notes:

- This structure has exceeded its service life and based on the condition of the structure it is recommended that the Town plan for replacement in the next 6-10 years.

It is proposed that the next OSIM inspection occur in the summer of 2023.

2.6 BRIDGE NO. 6 – REDWING BRIDGE

Bridge No. 6 is located on 10th Line 0.01 km south of 12th Sideroad. The structure has a 7.7 m span length and is approximately 8.1 m wide from edge to edge. The structure is a concrete arch bridge.

Generally, this bridge is in good condition with some moderate concrete deterioration. No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Clean off bridge deck and review/adjust mounting height of barrier;
- Replace deteriorated guide rail posts;



- Provide erosion protection at southeast corner.
- Install object warning marker signs at all 4 approaches;

Rehabilitation work is recommended as follows:

- Concrete repairs to soffit, wingwalls, and abutments; and
- Install guide rail end treatment at NE approach.

No load posting is recommended at this time for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.7 BRIDGE NO. 7 – 12TH SIDEROAD

Bridge No. 7 is located on 12th Sideroad 0.7 km west of Grey Road 2. The structure has a 4.6 m span length and is approximately 15.3 m wide from edge to edge. The bridge is a concrete rigid frame structure.

Generally, this bridge is in good condition. There is no evidence of movement or significant deterioration. No detailed investigations are recommended.

Maintenance work is recommended as follows:

- Repair potholes; and
- Remove debris from watercourse.

Rehabilitation work is recommended as follows:

- Repair concrete soffit and abutment walls; and
- Replace or tighten cable guide rail and replace deteriorated posts.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.8 BRIDGE NO. 8 – 6TH LINE

Bridge No. 8 is located on 6th Line, 2.1 km North of Grey Road 19. The structure has a 3.6 m span length and is approximately 7.5 m wide. The structure is a concrete rigid frame.

Generally, this bridge is in fair to good condition. No detailed investigations are recommended.

Maintenance work is recommended as follows:

- Clear out aggraded stream bed material from beneath the structure.

Rehabilitation work is recommended as follows:

- Install guide rail over the structure and on both approaches; and



- Abutment concrete repairs.

Additional notes:

- Crack widths in soffit and abutment walls should be compared between current and future biennial inspections to determine if there is active movement or if they have stabilized.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.9 BRIDGE NO. 9 – 12TH SIDEROAD

Bridge No. 9 is located on 12th Sideroad, 50 m west of Grey Road 19. The structure has a 6.8 m span length and is approximately 5.2 m wide from edge to edge. The structure is a concrete arch type.

Generally, this bridge is in poor condition and exceeded its life cycle. Replacement is recommended in the next 5 years.

Maintenance is recommended as follows:

- Repair potholes; and
- Provide erosion protection to abutments and wingwalls.

No load posting is recommended for this bridge. Due to the deteriorated condition of the structure, it is recommended that the next OSIM inspection occur in the summer of 2023.

2.10 BRIDGE NO. 11 – MCGUIRE BRIDGE

Bridge No. 11 is located on 21st Sideroad 1.34 km east of Grey Road 13. The structure has an 8.8 m span length and is approximately 9.1 m wide from edge to edge. The structure is a concrete rigid frame.

Generally, this bridge is in good condition. There is no evidence of movement or significant deterioration. No detailed investigations are recommended.

Maintenance is recommended as follows:

- Install object warning marker signs at all 4 quadrants;
- Clean bridge and remove debris from gutters and drains; and
- Rout and seal asphalt cracks.

Rehabilitation work is recommended as follows:

- Install approach guide rail; and



- Extend drain pipes.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.11 BRIDGE NO. 12 – VICTORIA CORNERS BRIDGE

Bridge No. 12 is located on 21st Sideroad 0.15 km east of Grey Road 2. The structure has an 8.5 m span length and is approximately 9.4 m wide from edge to edge. The structure is a concrete rigid frame.

Generally, this bridge is in good condition. There is evidence of some settlement of the approaches. Structure guide rail ends are buried and present a vehicle launching hazard. No detailed investigations are recommended.

Maintenance is recommended as follows:

- Rout and seal cracks in asphalt as well as joints at approach slabs;
- Remove graffiti from abutment walls;
- Provide scour protection at west abutment face;
- Install object warning marker signs at approaches (two quadrants);
- Ramp asphalt on approach; and
- Repair rotated timber blocking in approach guide rail.

Rehabilitation work is recommended as follows:

- Install guiderail end treatments on approaches.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.12 BRIDGE NO. 13 – HEATHCOTE BRIDGE

Bridge No. 13 is located on Main Street in Heathcote 0.4 km east of Grey Road 13. The structure has an 8.7 m span length and is approximately 5.3 m wide from edge to edge. The structure is a timber deck on steel girder bridge supported on concrete abutments.

Generally, this bridge is in fair condition. The posted load limit for the structure is 5 tonnes, however it is recommended that the orange warning sign be replaced with a white legal load limit sign. Several rotten timber boards have been replaced since the last inspection.

Maintenance is recommended as follows:

- Replace timber ballast walls;



- Provide erosion control at south embankments;
- Clear vegetation from approaches to make signs and markers visible to traffic; and
- Clean debris from bearing seats.

Severe loss of road base material was noted on the approaches to the bridge. The plywood sheets that had been placed at the ends of the girders to retain the fill have rotted and in many locations are missing, resulting in loss of material from the road base. In addition, at each of the four corners, temporary concrete pads had been placed where granular material had previously been lost. These are now unstable and moving. We understand the Town has excavated the road material at each end of the bridge and installed a new ballast wall to retain the road fill.

A Class Environmental Assessment Study to confirm the preferred improvement strategy was finalized in 2020. Replacement with a single lane single span structure was identified as the preferred solution.

Due to the deteriorated condition of the structure components, it is proposed that the next OSIM inspection occur in the summer of 2023.

2.13 BRIDGE NO. 14 – INDIAN BROOK BRIDGE

Bridge No. 14 is located on 24th Sideroad 1.4 km west of Grey Road 2. The structure has a 13.75 m span length and is approximately 9.3 m wide from edge to edge. The structure is a concrete rigid frame.

Generally, this bridge is in very good condition. No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Clean debris from drains and gutters annually;
- Touch up railing with zinc rich paint;
- Clean graffiti from abutments;
- Provide erosion protection at northwest corner;
- Asphalt repair to approaches; and
- Install object warning marker signs;

Rehabilitation work is recommended as follows:

- Install additional posts at structure connections; and
- Install approach slabs.



Barrier connections for approach guide rail are not current standard and should be updated at the time of the next major rehabilitation. No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.14 BRIDGE NO. 15 - SLABTOWN BRIDGE

Bridge No. 15 is located on Slabtown Road 0.21 km west of Grey Road 13. The structure has a 26.3 m span length and is approximately 5.6 m wide from edge to edge. The structure is a concrete deck on prefabricated steel truss bridge.

Generally, this bridge is in good condition, as the superstructure was replaced in the last ten years. There is no connection between the approach guide rails and the barrier wall or connection to the guide rail over the structure. The gap between the approach guide rail and the bridge guide rail presents an opportunity for vehicles to snag and should be modified. Water was observed to be ponding on the north side of the concrete deck in 2017. No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Clean debris from expansion joint seals annually; and
- Clean bridge deck.

Rehabilitation work is recommended as follows:

- Modification to approach guide rail to improve safety.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.15 BRIDGE NO. 17 - BLACK BRIDGE

Bridge No. 17 is located on Clark Street in Clarksburg, 0.13 km West of Grey Road 13. The structure has a span length of 23.7 m and is approximately 7.5 m wide from edge to edge. The roadway width is limited to 4.3 m. The structure is a concrete bowstring arch.

No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Concrete repair of sidewalk delamination.

This structure underwent major rehabilitation in 2017 and therefore has no recommended rehabilitation needs.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.



2.16 BRIDGE NO. 18 – 10TH LINE

Bridge No. 18 is located on 10th Line 0.1 km north of Beaver Street. The structure has a 4.5 m span length and is approximately 10.4 m wide from edge to edge. The structure is a concrete rigid frame.

No detailed investigations are recommended at this time. Maintenance is recommended as follows:

- Clear debris from drains and deck edge annually; and

No rehabilitation work is recommended at this time.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.17 BRIDGE NO. 19 – 11TH LINE

Bridge No. 19 is located on 11th Line 0.02 km north of 33rd Sideroad. The structure has a 5 m span and is approximately 5.6 m wide from edge to edge. The structure is a solid slab concrete bridge constructed circa 1930.

Generally, this bridge is in fair condition overall. The abutments were found to be in fair to poor condition and there is a large crack at the southwest corner at the wingwall. Structure barriers are substandard and no approach barrier is currently installed. No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Repair potholes in deck wearing surface and regrade surface; and
- Remove tree growing at southwest wingwall.

Rehabilitation work is recommended as follows:

- Repair concrete wingwalls, and deck soffit;
- Replace existing structure barrier;
- Reface concrete abutments; and
- Install guide rail on approaches.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.



2.18 BRIDGE NO. 21 – KING STREET EAST

Bridge No. 21 is located on King Street East (Hwy 26) 0.2 km east of Bruce Street in Thornbury. This concrete deck on steel girder bridge has 3 spans. The two exterior spans are 16 m in length with a centre span of 33.5 m. It was originally constructed circa 1966 and was rehabilitated in 2010.

Generally, this bridge is in good to excellent condition overall. The bottoms of the centre span deck drains have medium corrosion. Some localized areas of the bottom flanges of the girders of the east span were noted to have paint coating failure with corrosion of the steel.

No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Clean out deck joints annually – for inspection of seals and to improve seal lifespan;
- Touch up bottom flange coating;
- Provide erosion control of west embankment and remove accumulated branches deposited on embankments;
- Rout and seal cracks in asphalt wearing surface at ends of approach slabs; and
- This structure has no recommended rehabilitation at this time.

No load posting is recommended for this bridge. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.19 CULVERT NO. 201 – 18TH SIDEROAD

Culvert No. 201 is located on 18th Sideroad 0.62 km west of 10th Line. The structure has a 3.8 m span length and is approximately 24.4 m long. The structure is a steel multi-plate pipe arch culvert. The road over the culvert has a 6.0 m wide travel width with a gravel wearing surface.

Generally, the culvert is in good condition.

No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Remove stump at inlet; and
- Provide rip rap erosion protection through barrel.

No rehabilitation work is recommended at this time.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.



2.20 CULVERT NO. 202 – 10TH LINE

Culvert No. 202 is located on 10th Line 1.2 km south of 21st Sideroad. The structure has a 3.9 m span length and is approximately 20.5 m long. The structure is an elliptical multi-plate corrugated steel pipe culvert. The road over the culvert has a 6.5 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in good condition, with light corrosion of the invert. The existing barriers consist of timber posts without any cable or steel beam guide rail. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

No maintenance is recommended at this time.

Rehabilitation work is recommended as follows:

- Install proper guide rail on both approaches and over structure.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.21 CULVERT NO. 203 – 21ST SIDEROAD

Culvert No. 203 is located on 21st Sideroad 0.52 km west of Grey Road 2. The structure has a 4.25 m span length and is approximately 37 m long. The structure is a precast concrete box culvert. The road over the culvert has a 7.0 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in good condition, however there is significant leakage through the joints. No associated deterioration of the concrete has been noted, however with continued moisture infiltration it will reduce the life span of the concrete units. The existing cable guide rail has loose cables. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

Maintenance is recommended as follows:

- Remove stumps and debris from waterway;
- Tighten cable in guide rail or replace.

No rehabilitation work is recommended at this time.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.



2.22 CULVERT NO. 204 – 6TH LINE

Culvert No. 204 is located on 6th Line 0.29 km south of 21st Sideroad. The structure has a 5 m span length and is approximately 20.8 m long. The structure is a concrete open bottom culvert. The road over the culvert has a 6.8 m wide travel width with a gravel wearing surface.

Generally, this culvert is in very good condition. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Level out rocks within culvert to build up scoured stream bed at northeast footing and remove aggradation along south abutment.

No rehabilitation work is recommended at this time.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.23 CULVERT NO. 205 – GRAND CYPRESS LANE

Culvert No. 205 is located on Grand Cypress Lane 0.05 km east of Augusta Crescent. The structure has a 4.9 m span length and is approximately 12.2 m long. The structure is a precast concrete arch culvert. The road over the culvert has a 6.1 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in good condition, however there is leakage through the joints. No associated deterioration of the concrete has been noted, however with continued moisture infiltration it will reduce the life span of the concrete units. Also, there is severe build-up of the stream bed and associated vegetation growth restricting flow through the culvert during high water events. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Clean out stream buildup and vegetation to reduce future flooding issues.

Rehabilitation work is recommended as follows:

- Install end treatments on steel beam guide rail;
- Replace rotted timber posts at all four quadrants;
- Replace joint seals between wingwalls and culvert; and



- Concrete patching of headwalls.

No load posting is recommended. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.24 CULVERT NO. 206 – ARROWHEAD ROAD

Culvert No. 206 is located on Arrowhead Road 0.4 km south of Highway 26. These twin CSP pipe arch culverts each have 2.1 m spans and are approximately 46.2 m long. The road over the culvert is 8.6 m wide in travel width with an asphalt wearing surface.

Generally, these culverts are in good condition. The asphalt wearing surface on the approaches and over the structure has been repaved since the previous OSIM and is in good condition. The north culvert has severe sediment build-up and is currently dry. Minor scour is evident below the outlet of the south barrel. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Clear vegetation and buildup of sediment;
- Clean out sediment in north barrel; and
- Provide scour protection (armouring stone) at the south outlet;

No rehabilitation work is recommended. No load posting is recommended. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.25 CULVERT NO. 207 – INDIAN CIRCLE

Culvert No. 207 is located on Indian Circle 0.16 km south of Grey Road 40. This culvert consists of twin 2.45 m span precast concrete box culverts. The road over the culverts has a 6.1 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in good condition. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Clean out debris and stream bed material build up in stream;
- Rout and seal cracks in asphalt pavement if they widen.

No rehabilitation work is recommended at this time.



No load posting is recommended. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.26 CULVERT NO. 208 – SUNSET BOULEVARD

Culvert No. 208 is located on Sunset Boulevard 0.21 km east of Christie Beach Road. The structure has a 3 m span length and is approximately 13.5 m long. The structure is a steel multiplate pipe arch culvert. The road over the culvert has a 6.7 m wide travel width with a gravel wearing surface.

Generally, this culvert is in good condition, with some medium corrosion at the invert. Currently there is no guide rail installed. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended; however, a roadside protection assessment is recommended to determine if guide rail is required.

No maintenance or rehabilitation work is recommended at this time.

No load posting is recommended. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.27 CULVERT NO. 209 – ALICE STREET

Culvert No. 209 is located on Alice Street 0.45 km west of Lansdown Street South. The structure has a 6.1 m span length and is approximately 13 m long. The structure is a precast concrete box culvert. The road over the culvert has a 5.4 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in good condition, and the roadway has recently been repaved. The guide rail cables on approach and over the structure have been replaced with steel beam guide rail with the appropriate end treatments. There is no evidence of movement or significant deterioration.

No detailed investigations are recommended at this time.

Maintenance work recommended is as follows:

- Fill scour pocket with large rip rap;
- Improve channel at south end;
- Clear vegetation to inspect embankments; and
- In addition, as the drain inlets are covered, it is recommended that the Town review the drainage of the culvert during rain events to determine if ponding is occurring.

No rehabilitation work is recommended at this time.



No load posting is recommended. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.28 CULVERT NO. 210 – ARTHUR STREET

Culvert No. 210 is located on Arthur Street 0.3 km east of Peel Street. The structure has a 6 m span length and is approximately 17.3 m long. The structure is a precast concrete box culvert that has previously been widened at both ends. The road over the culvert has a 7 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in good to fair condition. Deterioration in the abutments and soffit has progressed since the 2015 OSIM inspection. There is no evidence of movement.

No detailed investigations are recommended at this time.

No maintenance work is recommended at this time.

Rehabilitation work is recommended as follows:

- Repaving of wearing surface;
- Concrete repair of soffit and abutments; and
- Replace guide rail.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.29 CULVERT NO. 211 – 11TH LINE

Culvert No. 211 is located on 11th Line 0.28 km north of 33rd Sideroad. The structure has a 3.25 m span length and is approximately 13 m long. The structure is a CSP arch culvert constructed in 2001. The road over the culvert has a 6 m wide travel width with a gravel wearing surface.

Generally, this culvert is in good condition. There is no evidence of movement.

No detailed investigations are recommended; however, a roadside protection assessment is recommended to determine suitability of existing guide rail.

Maintenance work is recommended as follows:

- Clear vegetation around inlet; and
- Clear vegetation around guide rail posts.

No rehabilitation work is recommended at this time.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.



2.30 CULVERT NO. 212 – 7TH LINE

Culvert No. 212 is located on 7th Line 0.4 km south of Grey Road 40. The structure has a 3 m span length and is approximately 12.6 m long. The structure is a CSP culvert constructed in 2007. The road over the culvert has a 6.2 m wide travel width with an asphalt wearing surface.

Generally, this culvert is in excellent condition, with minor scour at the base of the rock retaining wall. There is no evidence of movement.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Regrade shoulders to ensure guide rail mounting height remains within tolerance.

Recommended rehabilitation work is as follows:

- Repair undermining in rock wall.

No load posting is recommended for this culvert. It is proposed that the next OSIM inspection occur in the summer of 2023.

2.31 CULVERT NO. 213 – PRETTY RIVER ROAD

Culvert No. 213 is located on Pretty River Road 1.1 km north of Osprey-Blue Mountains Townline. The structure has a 4.9 m span length and is approximately 12.2 m long. The structure is a CSP culvert constructed circa 1960. The road over the culvert has a 6.7 m wide travel width with a gravel wearing surface.

The culvert has been replaced since the previous OSIM inspection in 2019 and is in excellent condition.

No detailed investigations, maintenance or rehabilitation work is recommended at this time.

It is further recommended that the next OSIM inspection occur in 2023 to monitor the condition of the culvert.

2.32 PEDESTRIAN BRIDGE NO. 1 – LANSLOWNE STREET NORTH BRIDGE

Pedestrian Bridge No. 1 is located on the Georgian Trail just northwest of Lansdowne Street North. The structure has a 14.33 m span length and is approximately 4.27 m wide from edge to edge. The structure consists of steel riveted wide flange girders, with rectangular solid wood floor beams and wood plank decking. The bridge has a 3.9 m wide deck surface with 38x184 “curb” planks and gravel trail approaches.

Generally, this bridge is in good condition, with work recommended on the substructure. There is no evidence of movement or significant deterioration.



No detailed investigations are recommended at this time

Maintenance work is recommended as follows:

- Bridge cleaning; clearing of the vegetation growth between deck planks; and
- Replace deteriorated 6x6 wood curb/retaining wall at the southwest corner.

Rehabilitation work is recommended as follows:

- Repair concrete abutment walls and wingwalls; and
- Install scour protection to avoid exposing more of the footing.

No rehabilitation work is recommended at this time.

Additional notes:

- The structural steel coating is failing, recoating of the steel will extend the life of the structure, however access and protection will be expensive. This bridge is located along the old railway line and the steel is oversized for the current loading.

It is proposed that the next OSIM inspection occur in the summer of 2023.

2.33 PEDESTRIAN BRIDGE NO. 2 – HARBOUR BRIDGE

Bridge number two is located at the northwest end of Bay Street and crosses the Beaver River into the Thornbury Harbour. The bridge has two spans of 25 m and is approximately 1.8 m wide. The structure consists of two 450 mm deep riveted wide flange steel girders with a vertical wood slat decking. The superstructure is supported on three wood cribs with a concrete topping. Each support location has a set of wood stairs to provide access to the bridge. These stairs appear to be more recent additions and have not been painted to match the superstructure.

The structure is overall in fair to poor condition. Recoating the girders should be considered to extend the structure's service life. Deck replacement should be planned in the next five years.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Clean bearing seats annually to improve service life.

Rehabilitation work is recommended as follows:

- Replace severely deteriorated deck boards and top rail boards;
- Clean and recoat the girders and diaphragms;
- Replace retaining wall timbers;



- Replace deteriorated pier crib timbers; and
- Replace deteriorated stair elements.

It is proposed that the next OSIM inspection occur in the summer of 2023.

2.34 PEDESTRIAN BRIDGE NO. 3 – BEAVER RIVER BRIDGE

Bridge number three is located on the Georgian Trail 30 m East of Bruce Street North. This bridge is a hybrid with three different span types. The west span is 15 m and is spanned with two riveted wide flange steel beams with steel cross bracing between them, supported on concrete abutment and a concrete pier. The centre span is 29 m and is spanned with two steel girder trusses with steel cross bracing. This span is supported on the west concrete pier and to the east on a masonry pier. The eastern section of the bridge is a trestle bridge with nine wooden pile bents. The total span of the eastern section is 51 m made up of ten equal spans of 5.1 m. The eastern abutment is a timber post and lagging system.

The bridge superstructure appears to be in good condition in general. There is an area in the truss span at the west pier where the bottom chord has deformed. Given the truss was originally designed for a significantly higher load than its present use, the buckling is not a concern.

The west abutment has a large, delaminated area under the bearing seat and a significant amount of efflorescence and erosion at the tops of the abutments/wingwalls. The floor beams were reviewed where accessible and condition inferred for the remaining. These beams appeared to be in good condition with some weathering. The stone pier at the centre of the bridge has deteriorated mortar, some of which has already been previously re-pointed.

The east end pile bents do not show any signs of movement. Recent rehabilitation included encasing the deteriorating bases of these pile bents, as well as at the east abutment, for a depth below and above ground level.

Some of the wood cross bracing members, of the eastern pile bents are also showing signs of rot. The rehabilitation also included additional cross-bracing and longitudinal bracing. At the west end there is erosion of the bank where the ground water has cut a ditch through the bank down to the river. It is still stable with minimal loss of material however it is likely contributing the erosion of the west wingwalls.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Cleaning of deck and removal of vegetation between planks;
- Rotate and resecure top rail to level out the handrail;



- Clean debris buildup off girders and bearing seats at abutments and piers;
- Repoint center stone pier;
- Replace deck curb boards that are broken off or hammer in nails sticking up; and
- Re-point the centre stone pier.

Rehabilitation work is recommended as follows:

- Repair abutment – recommended to reface element;
- Replace Pier bearings; and
- Concrete patch repair west pier.

It is proposed that the next OSIM inspection occur in Summer 2023.

2.35 PEDESTRIAN BRIDGE NO. 4 – INDIAN BROOK BRIDGE

Bridge number four is located on the Georgian Trail 280 m Southeast of Highway 26. The bridge is a two span, two riveted wide flange girder structure. It is supported on concrete abutments at each end and a concrete pier wall between spans. The west span is 6.6 m and the east span is 11.3 m with a uniform deck width of 4.27 m.

Generally, this bridge is in good condition. No evidence of severe deterioration or movement was noted. There is a large crack in the centre pier; however, it does not appear that any movement has occurred.

No detailed investigations are recommended at this time.

Maintenance work is recommended as follows:

- Annual abutment and pier cleaning to extend service life.

Rehabilitation work recommended at this time is as follows:

- Replace damaged deck plank;
- Concrete repairs at abutments, ballast walls, wingwalls and piers; and
- Install rock protection around abutments and piers.

No rehabilitation work is recommended at this time.

It is proposed that the next OSIM inspection occur in Summer 2023.



2.36 PEDESTRIAN BRIDGE NO. 5 (B16) – CLENDENAN BRIDGE

Bridge No. 16 is located on 10th Line 0.5 km North of Grey Road 13. The structure has a 26.4 m span length and is approximately 5.1 m wide from edge to edge. The structure is a concrete deck on steel pony truss bridge.

Generally, this bridge is in fair to poor condition, and is currently closed to vehicular traffic. A temporary repair to the northeast bearing seat was completed in 2012 to keep the bridge open for pedestrian traffic. The northwest corner of the abutment and wingwall is cracked beneath the bearing seat and should be monitored for further deterioration and movement.

Should the Town wish to open the bridge to vehicles, full replacement is recommended.

No detailed investigations are recommended at this time.

No maintenance work is recommended at this time.

Rehabilitation work is recommended as follows:

- Repair hole in deck, crack repair;
- Reinforce or replace stringers in end bays (12);
- Repair northwest bearing seat; and
- Install erosion protection for southeast wingwall.

It is recommended that the pedestrian only load restriction be maintained. It is proposed that the next OSIM inspection occur in the summer of 2023.



3 Recommendations

All of the recommended maintenance and rehabilitation works for each of the bridges are listed in the bridge and culvert summaries in Section 2. The costs for the work at each of the structures are summarized in Table 8 (below) and include recommended time frames. As mentioned in Section 2 of this report, 'maintenance' work refers to those works that could be completed by the Town's works department, and 'rehabilitation' work refers to repair work that may require higher costs or specialized design. The costing information is preliminary and is for budgeting purposes only. Estimated costs do not include engineering design, tender preparation, project management, or construction inspection.

3.1 ADDITIONAL INVESTIGATIONS

One structure was identified as being in need of additional investigations and are listed below in Table 4. Two culverts were identified as being in need of a roadside protection assessment and are listed below in

Table 5.

Table 4: Bridges Requiring Additional Investigation

BRIDGE NO.	YEAR BUILT	STRUCTURE TYPE	RECOMMENDED ADDITIONAL INVESTIGATION	COST FOR BUDGET PURPOSES
5	1930	Concrete Deck on Concrete T-Beam	Structure Evaluation	\$5,000

Table 5: Culverts Requiring Roadside Protection Assessment

CULVERT NO.	YEAR BUILT	STRUCTURE TYPE	COST FOR BUDGET PURPOSES
C208	1970	CSP Arch	\$5,000
C211	2001	CSP Arch	\$5,000



3.2 LOAD LIMIT POSTING

There are currently three structures that are posted with a load limit as listed in Table 6.

Table 6: Currently Posted Bridges

BRIDGE NO.	LOAD POSTING
2 - Mitchells Creek Bridge	10 tonnes
3 - Mitchells Creek Bridge	10 tonnes
13 - Heathcote Bridge	5 tonnes

One additional structure is recommended for load posting as listed in Table 7.

Table 7: Recommended Structures for Load Posting

BRIDGE NO.	RECOMMENDED LOAD POSTING
5 - Mill Creek Bridge	18 tonnes



3.3 SUMMARY OF RECOMMENDED REHABILITATION WORK

Fifteen road bridges, five culverts, and five pedestrian bridges were identified as in need of rehabilitation work. They are summarized in Table 8 below.

Table 8: Rehabilitation Needs

NO.	YEAR OF CONST.	URGENT		WITHIN 1 YEAR		1-5 YEARS		6-10 YEARS	
		Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost
B1	1980					Replace approach guide rail	\$111,500		
B2	1930	-	-	-	-	Replacement		-	-
							\$2,239,000		
B3	1930	-	-	-	-	Replacement		-	-
B4	1981	-	-	-	-	Concrete Repair, Install End Treatments, & Deck Drains	\$94,000	-	-
B5	1930	-	-	-	-	-	-	Replacement	\$1,362,000
B6	1930	-	-	-	-	-	-	Concrete Repairs, Guide Rail Improvement	\$96,000
B7	1930	-	-	-	-	Concrete Repairs Guide rail repair	\$151,000	-	-
B8	1940	-	-	Barrier	\$85,000	Concrete Repairs	\$130,800	-	-



NO.	YEAR OF CONST.	URGENT		WITHIN 1 YEAR		1-5 YEARS		6-10 YEARS	
		Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost
B9	1930	-	-	-	-	Replacement	\$1,343,000	-	-
B11	1973	-	-	-	-	Deck Drains Approach Rail	\$98,600	-	-
B12	1995	-	-	Install Guide Rail End Treatments	\$37,500	-	-	-	-
B13	1950	-	-	-	-	Replacement	\$1,180,000	-	-
B14	1977	-	-	-	-	-	-	Install Approach Slabs and Repair Barrier	\$225,000
B15	1930	Approach Guide Rail Continuity	\$26,000	-	-	-	-	-	-
B19	1930	-	-	-	-	Concrete repairs of deck, abutments, wingwalls. Replace barrier, install guide rail on approaches	\$289,000	-	-
C202	1966	Install steel beam guide rail	\$78,000	-	-	-	-	-	-



NO.	YEAR OF CONST.	URGENT		WITHIN 1 YEAR		1-5 YEARS		6-10 YEARS	
		Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost
C205	1990	-	-	-	-	Repair barrier on structure and approaches, Patch culvert and seal wingwall connection joint	\$78,500	-	-
C208	1970	Roadside protection assessment	\$5,000	-	-	-	-	-	-
C210	1950	-	-	-	-	Concrete deck repair & waterproof, abutment concrete repair, repave, replace barrier on structure and approaches	\$442,000	-	-
C211	2001	Roadside protection assessment	\$5,000	-	-	-	-	-	-
C212	2007	-	-	-	-	Repair undermining in rock wall	\$5,000	-	-
PB1	unknown	-	-	-	-	Repair abutment concrete & add scour protection	\$99,000	-	-



NO.	YEAR OF CONST.	URGENT		WITHIN 1 YEAR		1-5 YEARS		6-10 YEARS	
		Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost	Description	Estimated Cost
PB2	1990	-	-	-	-	Replace deteriorated timber, clean and paint steel, replace northwest wingwall, replace rotten crib timber	\$240,500	-	-
PB3	unknown					Reface west abutment, patch repair pier	\$281,000		
PB4	unknown					Replace damaged deck board, concrete repair at abutment and pier	\$70,000		
PB5 / B16	1930					Replace stringers in end bays, repair north abutment, repair hole in deck	\$180,000		
Totals			\$114,000		\$122,500		\$7,032,900		\$1,683,000



3.4 PRIORITIZATION OF WORK

It is understood that the Town will not have the funding to complete all of the works immediately. The Town will therefore need to prioritize the structures to ensure that more urgently needed repairs are completed first.

In accordance with the 2009 Bridge Condition Index (BCI): An Overall Measure of Bridge Condition published by the Ministry of Transportation Ontario Engineering Standards Branch, a BCI, BCIP and BSI value was calculated for each structure. Essentially the BCI is a weighted average of the bridge elements and condition states. The BCIP is limited to only the percentage of poor condition of four main areas of the structure: deck, beams, substructure, and barrier. The BSI is the bridge sufficiency index which applies additional factors to the BCI based on sufficiency of the structure for the use such as reduced load posting, length of detour, geometry, and alignment.

Table 9 lists the BCI, BCIP and BSI for each of the bridges and culverts. Table 10 lists the BCI, BCIP and BSI for each of the pedestrian bridges. It is recommended that prioritization of rehabilitation occur based on the bridge sufficiency index, however, structures that have urgent action items should be addressed first.



Table 9: Road Structure Priority List

PRIORITY LEVEL	BRIDGE NO.	ROAD NAME	BCIP	BCI	BSI
High Priority (BSI < 40)	B3	6 th Sideroad	58.68	25.30	20.30
	B2	6 th Sideroad	59.81	26.06	21.06
	B5	12 th Sideroad	76.71	31.19	26.19
	B9	12 th Sideroad	74.75	37.17	30.17
	B19	11 th Line	77.45	39.98	33.98
Medium Priority (40 < BSI < 80)	B13	Main Street	83.84	63.54	49.54
	B6	10 th Line	97.40	57.59	55.59
	C210	Arthur Street	96.09	59.49	56.49
	B7	12 th Sideroad	98.35	66.38	61.38
	C208	Sunset Blvd	85.00	64.10	62.10
	B8	6 th Line	81.60	67.20	62.20
	B4	9 th Sideroad	99.85	64.48	62.48



PRIORITY LEVEL	BRIDGE NO.	ROAD NAME	BCIP	BCI	BSI
Medium Priority (40 < BSI < 80)	B17	Clark Street	100.00	76.93	65.93
	B15	Slabtown Road	99.98	74.91	66.91
	C202	10 th Line	89.80	69.19	67.19
	C209	Alice Street West	100.00	73.85	68.86
	C205	Grand Cypress Lane	98.24	71.36	69.36
	B18	10 th Line	100.00	69.60	69.60
	B1	10 th Line	100.00	73.85	69.85
	C201	18 th Sideroad	100.00	75.00	70.00
	C211	11 th Line	100.00	72.08	70.08
	C203	21 st Sideroad	99.25	70.27	70.27
	B21	King Street East	99.99	74.89	71.89
	B11	21 st Sideroad	99.85	74.66	72.66



PRIORITY LEVEL	BRIDGE NO.	ROAD NAME	BCIP	BCI	BSI
Medium Priority (40 < BSI < 80)	C207	Indian Circle	99.84	74.79	72.79
	B14	24 th Sideroad	100.00	74.85	72.85
	C204	6 th Line	100.00	74.57	74.57
	B12	21 st Sideroad	100.00	74.83	74.83
	C206	Arrowhead Road	100.00	74.99	74.99
	C212	7 th Line	100.00	81.55	79.55
Low Priority (BSI > 80)	C213	Pretty River Road	100.00	100.00	97.00



Table 10: Pedestrian Bridge Priority List

PRIORITY LEVEL	BRIDGE NO.	LOCATION	BCIP	BCI	BSI
High Priority (BSI < 40)	PB5 / B16	10 th Line, 0.5 km N of Grey Road 13	73.69	34.11	34.11
	PB1	Georgian Trail, 150 m NW of Lansdowne Street North	97.21	53.68	53.68
Medium Priority (40 < BSI < 80)	PB2	Harbour Path - NW end of Bay Street East over the Beaver River	97.25	51.65	51.65
	PB3	Georgian Trail, 30 m SE of Bruce Street North	97.13	68.46	68.46
	PB4	Georgian Trail, 280 m SE of Highway 26 N of Lakeshore Road	98.49	66.97	66.97



3.5 DISCUSSION AND SUMMARY

3.5.1 High Priority Structures

High priority structures are considered to be those that have a BSI of less than 40. Out of the 31 road structures within the Town, five are considered to be high priority. These structures are Bridges 2, 3, 5, 9, & 19. Out of the 5 pedestrian structures within the Town, one is considered to be high priority, Pedestrian Bridge 5 (B16). With the exception of any items listed as urgent, it is recommended that the rehabilitation works at these structures be attended to ahead of any of the medium and low priority structures.

3.5.2 Medium and Low Priority Structures

The majority of the structures within the Town are considered to be medium priority structures having BSI ratings of between 40 and 80. Rehabilitation of these structures in general should be considered after the rehabilitation of the high priority structures and before the low priority structures.

There is only one structure, Culvert 213, with a BSI number over 80 and it was recently replaced.

In addition, we recommend that all maintenance work be completed at all structures within two years.

We trust the above is sufficient for your purposes. If you have any questions or comments regarding the above, please do not hesitate to contact our office.



Appendix A: Definitions

Definitions

To convey the results of the visual inspections, defined terms are used to identify deficiencies with respect to condition or performance states. These terms are used in accordance with the OSIM guidelines and are defined below for clarification.

CONCRETE

Delamination: A discontinuity of the surface concrete which is substantially separated but not completely detached from concrete below or above it.

Efflorescence: A deposit of salts, usually white and powdery, on the surface of concrete left behind where water percolates through the concrete and dissolves or leaches chemicals from it.

Honeycombing: The result of improper or incomplete vibration of the concrete which results in voids being left in the concrete where the mortar failed to completely fill the spaces between the coarse aggregate particles.

Scaling: The local flaking, or loss of the surface portion of concrete or mortar as a result of the freeze-thaw deterioration of concrete. It is common in non air-entrained concrete but can also occur in air-entrained concrete in the fully saturated condition. It is prone to occur in poorly finished or overworked concrete where too many fines and not enough entrained air is found near the surface.

Scour: The removal of material from the stream bed or bank due to the erosive action of moving water in the stream. Scour can also cause removal of material supporting foundations.

Spalling: This is a continuation of the delamination process whereby the actions of external loads, pressure exerted by the corrosion of reinforcement or by the formation of ice in the delaminated area results in the breaking off of delaminated concrete. Spalling may also be caused by overloading of the concrete in compression.

WOOD

Wear and Abrasion: Wear is usually the result of dynamic and/or frictional forces generated by vehicular traffic, coupled with abrasive influx of sand, dirt and debris. It can also result from the friction of ice or water-borne particles against partly or completely submerged members. Abrasion is the deterioration of concrete brought about by vehicles or snow-plough blades scraping against concrete surfaces such as decks, curbs, barrier walls or piers.

Checks and Splits: Checks are longitudinal tissue separations along the side grain of wood members occurring across or through the annual growth rings. Splits are similar to checks, with more tissue separations, extending either through the wood member or from the side into the end grain, typically at the ends of the wood member.

Connection Deficiencies: connections loosened due to repetitive or dynamic loads, wear or decay of members.

Cracking, Splintering, Crushing and Shattering: physical damage as a result of impact loading or overloading of a member.

Fire and Chemical Damage: damage resulting from fire or from the use of non-preservative chemicals on the wood surface over a long period of time.

Insect Damage: Loss of section caused by tunnelling/boring by insects or larvae.

Rot or Decay: decomposition of wood.

Shakes: tissue separation that follow the growth rings and are visible at the ends of wood members.

Splits: severe separations similar to checks, extending to the ends of wood members.

Weathering: this occurs as a result of exposure to the actions of sun, rain, wind, frost and atmospheric pollutants, resulting in the gradual deterioration of the wood.

STEEL

Connection Deficiencies: loose connections, cracking or excessive corrosion of the connector, gusset plate or fasteners.

Corrosion: The deterioration of steel by chemical or electro-chemical reaction resulting from exposure to air, moisture, de-icing salts, industrial fumes and other chemicals and contaminants in the environment in which it is placed.

Cracking: linear fractures in steel extending partly or completely through the member.

Permanent Deformations: bending, buckling, twisting or elongation.

Patina: A relatively smooth rust layer, formed on weathering steel, which protects the underlying metal from further corrosion.

Appendix B: OSIM Forms

OSIM FORMS AVAILABLE UPON REQUEST

Appendix C: Key Map

FIGURES AVAILABLE UPON REQUEST