Municipality of Middlesex Centre
Bridge Needs Assessment
2023

PRESENTATION TO
COUNCIL ON :
October 18, 2023
By: Ken Logtenberg, P.Eng.

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Scope of Presentation

- Scope of the Assessment
- Explain inspection method
- Summary of observations
- Recommended improvements
  - Maintenance improvements
  - Capital improvements
- Illustrate specific examples
- Costs Reducing Possibilities
- Concluding comments
- Questions

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Scope of Assessment

1. Assemble maps of structure locations and review information from previous bridge inspection reports
   - Added 24 structures in 2023 (2 retaining walls and 22 culverts)
2. Visually inspected all the structures and assemble notes on OSIM forms
3. Analysed the data
   - Develop list of general observations, prioritize the lists of needs, assign timelines and calculate probable costs.
4. Prepared a report and presented results

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Legislative Requirements

- Ontario Regulation 104/97, *Amended to O. Reg. 160/02* requires that all bridges be inspected under the supervision of a Professional Engineer every 2 years.
- These inspections are to be carried out in general accordance with the Ontario Structure Inspection Manual.
- In Ontario the definition of a bridge is any structure with a span of 3.0 m or greater.

Bridge Assessments Method

- Bridge inspection as per OSIM (Ontario Structure Inspection Manual developed by the MTO)
  - Recorded measurements and take photos of bridge major components and identified defects.
  - Assign condition ratings to components, based on visual observations and non-destructive testing
  - Calculate a Bridge Condition Index scores (BCI)
  - Timeline for repairs are based on the opinion of the Engineer, grouped in urgent, < 1 year, 1 - 5 and 6 – 10
  - As requested, we've added another category 11-20 years.
  - May identify needs for additional investigation work
  - Calculate probable costs to address the needs
  - Prioritized needs using scoring system and Engineer's opinion

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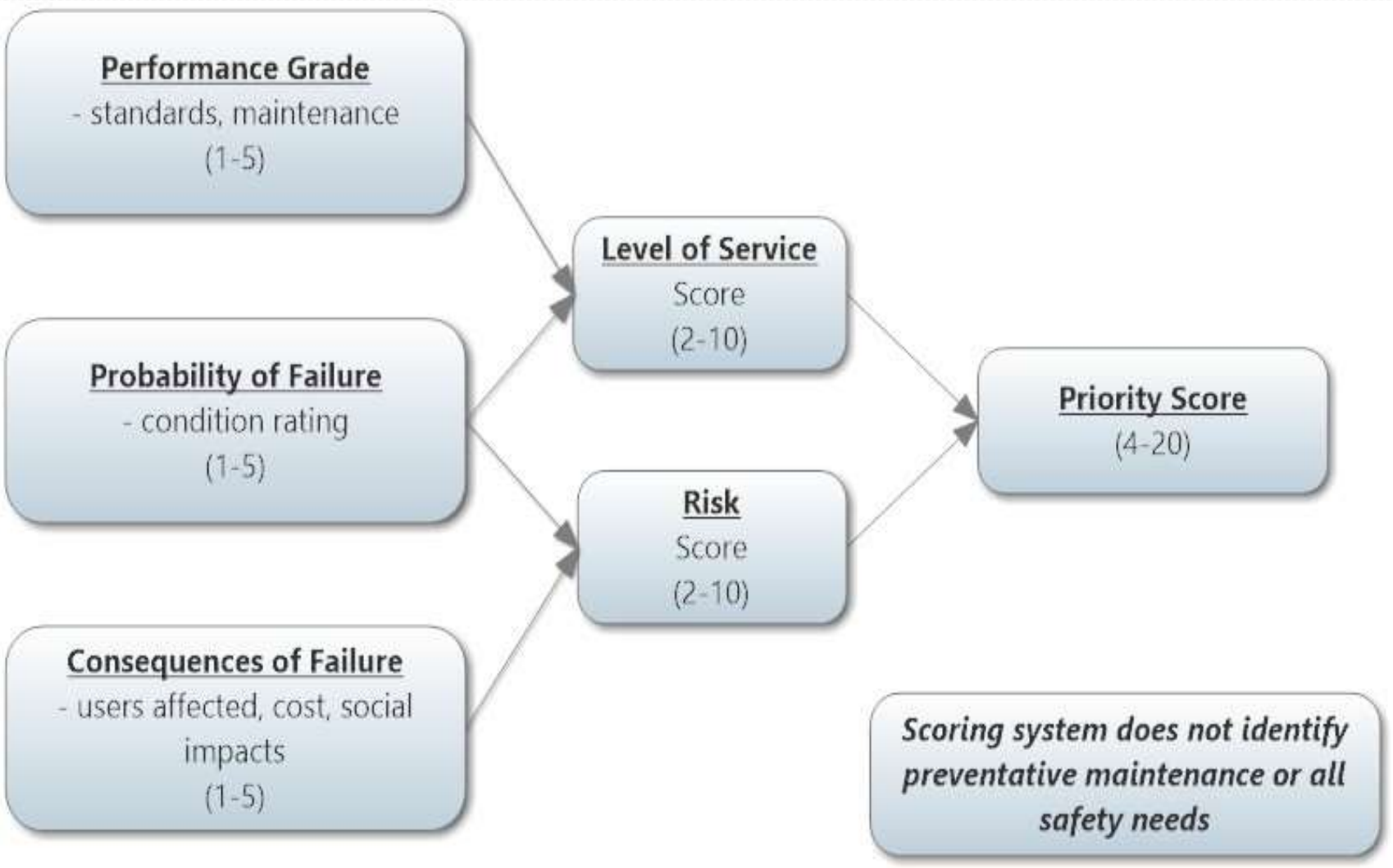
Simplified Priority Scoring System



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Scoring System Ranking

Priority Score Calculation Factors for Bridges

Consequence of Failure:

Average Annual Daily Traffic (AADT)

Traffic Volume	Value
0-49	1
50-199	2
200-499	3
500-999	4
>1000	5

Performance Grade: (Load limit + Struture Type Width Value) / 2

Load Limit

Posted	Value
No	1
Yes	5

Width Value if Bridge

Roadway Width (m)	Value
>= 7	1
6-6.9	3
< 6	5

OR

Width Value if Culvert

Overall Structure Width Criteria	Value
If the overall structure width > (10 m + (2 x Fill))	1
If the overall structure width < (10 m + (2 x Fill))	3
If the overall structure width > (7 m + (2 x Fill))	3
If the overall structure width < (7 m + (2 x Fill))	5

* Fill = Fill on structure (slope to road)

Probability of Failure:

BCI (Bridge Condition Index)

BCI	Value
85-100	1
70-84	2
55-69	3
40-54	4
< 40	5

Risk = Consequence of Failure + Probability of Failure

Priority Score = Risk + Level of Service

Level of Service = Performance Grade + Probability of Failure

- Simple scoring system to help prioritize the needs and develop a Risk Score and a Level of Service score that could be used for Asset Management and with other asset types
- The theoretical score should only be used as a guide. Other factors, preventative maintenance, cost savings strategies, other infrastructure needs and overwhelming safety needs should be considered when prioritizing.

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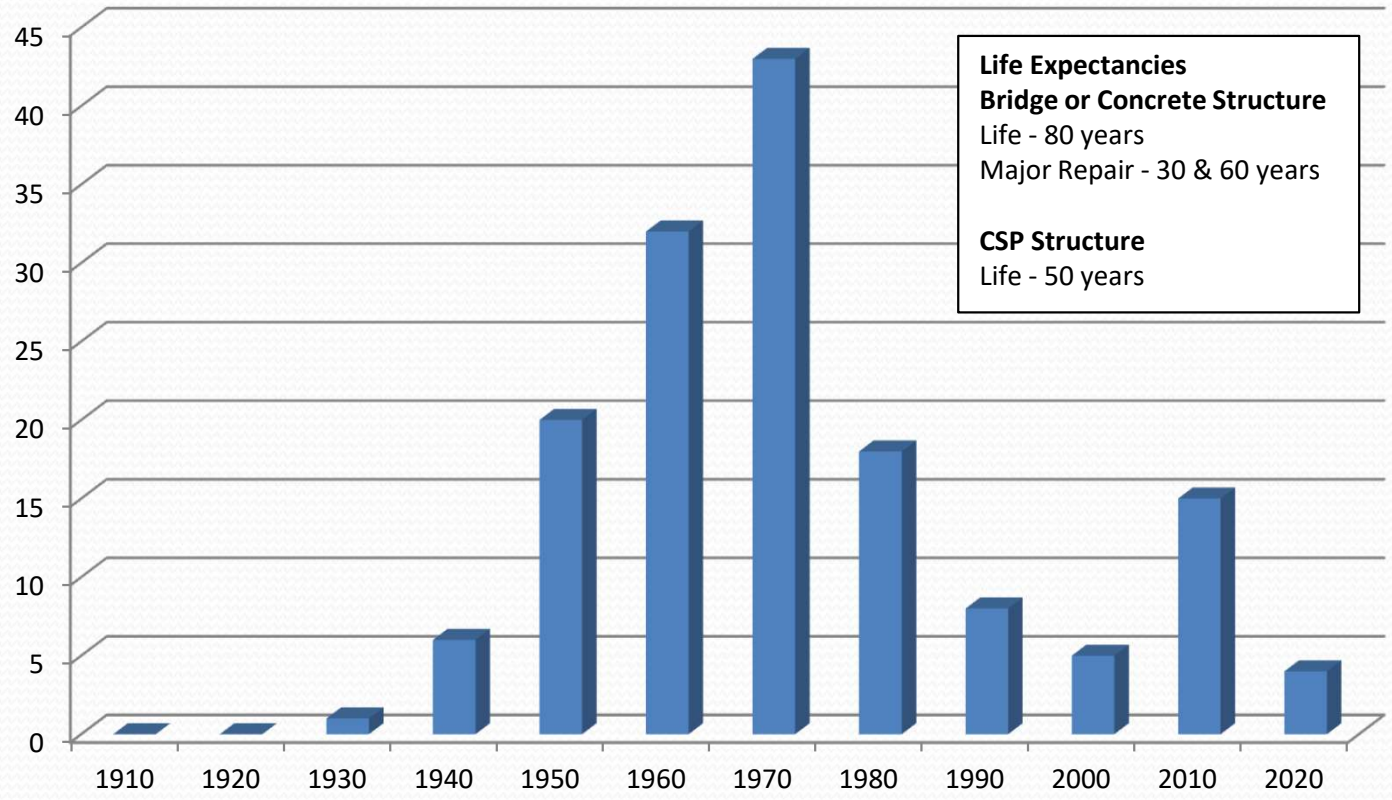
Figure No. 2- Age Distribution of Municipality Bridges
(Number of Bridges Built in the Decade)



- 51 bridges, 99 culverts and 2 retaining walls reviewed
- 5 structures > 80 years old, 26 structures < 25 years old
- Average age is 47 years

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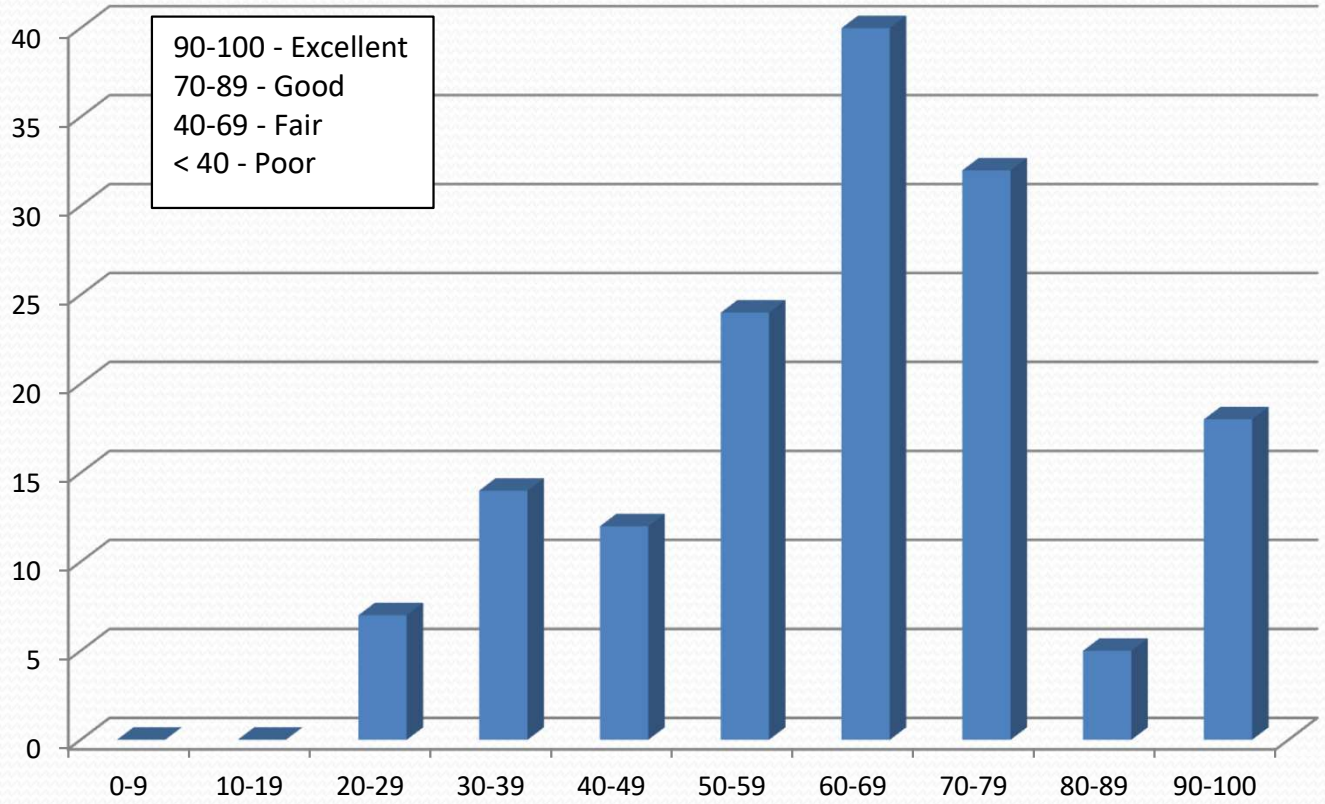
Bridge Assessment

Figure No. 3 - BCI Distribution of Bridges
(Number of Structures in BCI Range)



- 21 structures with BCI scores ≤ 40
- Average BCI Score of 63 out of 100

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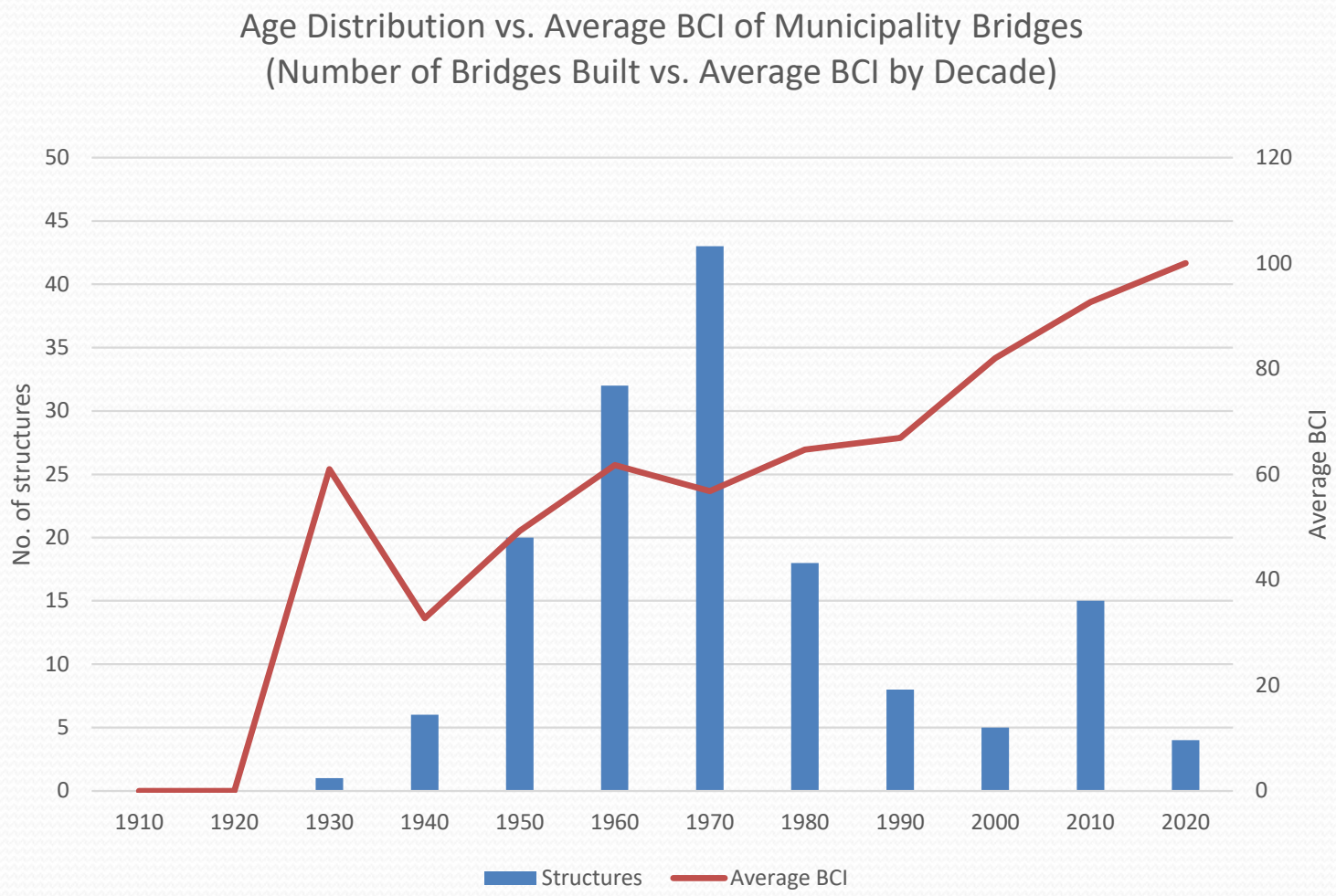

Average BCI Score of structures built in a given decade correlates with the age of the structure

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Routine Maintenance Tasks

- Clean bearing seats to let water drain away from girders
- Pressure wash expansion joint seal and check for leaks
- Clean gravel off the curbs and deck
- Re-seal joints in walls with caulking
- Remove brush and logs blocking culverts
- Restore eroded stream banks, place rip rap at toe
- Grade shoulders to shed water off uniformly to minimize potential for washouts
- Minor guiderail and parapet handrail repairs

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List of Maintenance Needs

Site Number	Road Name	Recommended Improvement	BCI
B-113	Eight Mile Road	Clear vegetation, re-caulk gaps in curbs and barriers	71
B-118	Nine Mile Road	Re-caulk gaps in barrier walls	64
B-123	Ten Mile Road	Remove gravel in front of curbs	75
B-128	Wonderland Road	Rout and seal asphalt at deck ends and approach slab ends, place riprap	96
B-135	Adelaide Street	Place riprap up to wingtips.	73
B-308	Little Church Drive	Place riprap up to wingtips.	56
B-502	Fernhill Drive	Place riprap up to wingtips, investigate downstream for damming/debris	64
B-510	Greystead Drive	Clean out drains, place riprap in front of east abutment and up to wingtips	77
B-519	Ilderton Road	Clean out expansion joints and check for leakage, place riprap up to wingtips and at eroded areas	70
B-521	Ivan Drive	Place riprap in front of abutments and up to wingtips	67
B-522	Vanneck Road	Apply concrete sealer/hardener to inside face of barriers	68
B-523	Bear Creek Road	Place riprap	66
B-524	Gold Creek Drive	Re-set rotated spacer blocks on guiderail	70
B-528	Oxbow Drive	Regrade shoulders, place riprap up to wingtips	72
B-531	Coldstream Road	Place riprap in washout and extend down slope, regrade shoulders	70
B-536	Amiens Road	Regrade shoulders	68
C-103	Fourteen Mile Road	Tighten loose guiderail cables	81
C-109	Twelve Mile Road	Place riprap at corners, place roadway markers to identify culvert location	57
C-110	Thirteen Mile Road	Tighten and re-attach guiderail cables	91
C-125	Twelve Mile Road	Tighten loose guiderail cables, place riprap along footings	94
C-133	Clarke Road	Correct channel, place riprap to prevent further scour	63
C-148	Sixteen Mile Road	Place riprap all 4 corners	66
C-152	Eight Mile Road	Place riprap all 4 corners, repair subdrain	72
C-154	Nine Mile Road	Remove trees, repair subdrain	64
C-159	Sixteen Mile Road	Investigate buried drain and catch basin	38
C-309	Little Church Drive	Place riprap in front of wingwalls	54
C-310	Woodhull Road	Remove debris from end of culvert	40
C-311	Westdel Bourne	Place riprap	99

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List of Maintenance Needs

Site Number	Road Name	Recommended Improvement	BCI
C-501	Fernhill Drive	Place riprap all 4 corners	71
C-506	McEwan Drive	Remove debris	69
C-508	McEwan Drive	Place large riprap at side slopes	57
C-513	Duncrief Road	Remove sediment build-up at inlet of north barrel	40
C-516	Hedly Drive	Place riprap along footings	64
C-520	Ivan Drive	Replace damaged CSP section, restore roadway	51
C-525	Gold Creek Drive	Reconnect and tighten guiderail cables	83
C-540	New Ontario Road	Remove trees from east end, place riprap along footings	57
C-543	McEwan Drive	Place riprap on side slopes and extend into culvert	60
C-544	Ivan Drive	Place riprap all 4 corners	75
C-545	Coldstream Road	Place riprap along footings	39
C-555	McEwen Drive	Place riprap along footings	64
C-562	Amiens Road	Pace riprap at inlet and outlet	62
C-565	Wood Road	Place riprap	97
C-573	Poplar Hill Road	Remove trees	100
C-576	Poplar Hill Road	Pace riprap at inlet and outlet	40
C-577	Vanneck Road	Place riprap up side slopes	100
W-318	Harris Road	Remove vegetation in front and grade shoulder.	63
W-574	Old River Road	Remove large diameter trees above wall.	72

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General Comments

- Some culverts appear structurally sound but replacement proposed because they are narrow, wider culvert safer and able to accommodate agricultural equipment better
- Numerous bridges with leaking expansion joints at deck ends, recommend repairs to prevent deterioration of the girders at the abutments bearing seats
- Numerous bridges deck drains are short or corroded through, leads to deterioration of girders or deck soffit mid-span, install extensions or sleeve the drains
- We're generally recommending repairs to your bridges to preserve the remaining bridge components and extend life of bridges.

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Major Repairs or Replacement Needs

- Combination of Engineering judgement, timeline for needs on OSIM report and theoretical scoring system to prioritize
- Needs to address structural safety concerns and preventative maintenance work, prioritized
- Sometimes other options are chosen; temporary repairs to delay work, or doing nothing and eventually close or replace the bridge
- Probable costs for assumed repair and replacement needs calculated based on 2023 costs, inflated as required

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Priority List of Repair and Replacement Needs – 5 year period

Site Number	Road Name	Recommended Improvement	BCI	Anticipated Construction Year	Theoretical Priority Score	Probable Cost
C-558*	Fernhill Drive	Replace structure	24	2023	12	$340,922.86
B-314*	Westminster Drive	Replace guiderail, re-galvanize parapet rails, patch repair soffit, girders and diaphragms, replace joint seals	70	2023	9	$308,610.34
B-505*	Vanneck Road	Patch and seal centreline, replace drains, waterproof and pave	56	2023	12	$169,784.33
B-301*	Carriage Road	Patch repair abutments and wingwalls, replace guiderail, jack and replace bearings, patch girders and diaphragms, patch deck top and edges, extend drains, convert to -semi-integral, patch barriers, waterproof and pave	59	2023	12	$583,826.33
B-108	Medway Road	Replace guiderail, convert to semi-integral, patch repair deck, waterproof and pave	66	2024	12	$681,000
B-530	Coldstream Road	Replace seals with expansion joints, jack and repair girder ends and bearing pedestals, replace bearings, replace deck drains, remove framing on diaphragms, patch deck, waterproof and pave	63	2024	11	$644,000
C-580	New Ontario Road	Replace structure	34	2024	13	$252,000
C-563	Lamont Drive	Replace structure	20	2024	12	$449,000
B-120	Nine Mile Road	Replace guiderail, convert to semi-integral, replace curbs and railings, raise and extend drains, patch repair deck, waterproof and pave	57	2024	10	$816,000
C-156	Thirteen Mile Road	Replace structure	28	2024	12	$368,000
C-572	Ivan Drive	Replace structure	26	2024	14	$286,000
C-155	Clarke Road	Replace structure	33	2025	14	$365,000
C-153	Sixteen Mile Road	Replace structure	22	2025	12	$409,000
C-575	McEwen Drive	Replace structure	32	2025	12	$264,000
C-131	Adelaide Street	Replace guiderail end treatments, patch repair concrete, place riprap	53	2025	15	$142,000
C-111	Thirteen Mile Road	Patch repair culvert and headwalls	57	2025	9	$59,000
C-556	Fernhill Drive	Replace structure	41	2026	10	$439,000

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Priority List of Repair and Replacement Needs – 5 year period, continued

Site Number	Road Name	Recommended Improvement	BCI	Anticipated Construction Year	Theoretical Priority Score	Probable Cost
C-560	Poplar Hill Road	Replace structure	42	2026	10	$389,000
C-567	McEwen Drive	Replace structure	44	2026	10	$262,000
B-140	Fourteen Mile Road	Mill, patch repair and overlay deck, waterproof and pave	62	2026	9	$284,000
B-523	Bear Creek Road	Replace drains, replace damaged railing post and missing nut	66	2026	10	$30,000
C-133	Clarke Road	Replace guiderail	63	2026	9	$79,000
C-317	Southdel Drive	Patch repair culvert ends or replace structure	28	2026	14	$125,000
B-115	Eight Mile Road	Replace guiderail at east end	69	2026	11	$34,000
C-568	Gold Creek Drive	Replace structure	34	2026	12	$261,000
B-528	Oxbow Drive	Replace drains, replace seals with expansion joints, patch deck, waterproof and pave	72	2027	10	$333,000
C-161	Sixteen Mile Road	Replace structure	27	2027	12	$261,000
C-506	McEwan Drive	Replace guiderail	69	2027	9	$64,000
B-536	Amiens Road	Replace drains, patch soffit around drains, patch repair curbs	68	2027	11	$46,000
C-315	Southdel Drive	Lower water and inspect	68	2027	9	$3,000
B-113	Eight Mile Road	Replace expansion joints, widen shoulders, waterproof and pave	71	2027	7	$254,000
C-138	Clarke Road	Patch repair cutoff wall	52	2027	12	$19,000
B-118	Nine Mile Road	Replace guiderail	64	2027	11	$61,000
B-521	Ivan Drive	Replace drains	67	2027	10	$28,000
C-117	Prospect Hill Road	Reconstruct slope and place riprap, remove tree, correct channel	56	2027	12	$20,000
B-144	Sixteen Mile Road	Replace or sleeve drains	70	2027	6	$28,000
B-130	Twelve Mile Road	Replace or sleeve drains, waterproof and pave	71	2027	7	$101,000
B-302	Brigham Road	Repair guiderail, extend drains	52	2027	13	$42,000
B-121	Ten Mile Road	Replace drains	73	2027	7	$19,000
C-520	Ivan Drive	Install guiderail	51	2027	12	$100,000
B-529	Oxbow Drive	Convert to semi-integral, patch repair deck, jack and replace bearings, replace curbs and barriers, construct approach slabs, replace drains, waterproof and pave	66	2028	12	$1,288,000
C-102	Thirteen Mile Road	Replace structure	38	2028	15	$340,000

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Priority List of Repair and Replacement Needs – 5 year period, continued

Site Number	Road Name	Recommended Improvement	BCI	Anticipated Construction Year	Theoretical Priority Score	Probable Cost
C-119	Nine Mile Road	Replace guiderail, expose deck edges and place sub-drain	67	2028	10	$67,000
C-571	Ivan Drive	Replace structure	37	2028	12	$323,000
C-578	Fernhill Drive	Replace structure	38	2028	12	$341,000
					Total*	**$10,376,000**
					Average (5 Year)*	**$2,075,200**

*Total costs and average costs for the 1-5 year recommended work exclude projects scheduled for 2023 construction, as it has been assumed budgets for the specified work have been approved prior to issuing this report, and project scopes may not align with updates made to the individual structure report.

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List of Repair and Replacement Needs
6 to 10 year period

Site Number	Road Name	Recommended Improvement	BCI	Theoretical Priority Score	Probable Cost
B-122	Ten Mile Road	Convert to semi-integral, replace railings and curbs, waterproof and pave	69	9	$756,000
B-132	Ilderton Road	Replace structure	61	11	$1,353,000
B-134	Thirteen Mile Road	Patch repair deck edges, soffit, abutments and wingwalls, place riprap	54	12	$150,000
B-139	Fourteen Mile Road	Replace curbs and railings, patch repair deck and soffit, replace drains, place riprap, waterproof and pave	50	11	$353,000
B-303	Brigham Road	Patch repair deck and curbs, waterproof and pave	64	10	$146,000
B-308	Little Church Drive	Replace curbs and barriers, replace drains, mill and overlay deck, waterproof and pave	56	9	$287,000
B-312	Cook Road	Replace structure	35	13	$585,000
B-502	Fernhill Drive	Replace drains, mill and overlay deck	64	9	$174,000
B-512	Amiens Road	Convert to semi-integral, replace barriers and curbs, patch repair pier, patch repair soffit and diaphragms, replace drains, waterproof and pave	67	12	$1,498,000
B-517	Coldstream Road	Replace barriers and curbs, patch repair soffit, mill and overlay deck, waterproof and pave	63	11	$334,000
B-519	Ilderton Road	Replace drains, patch repair soffit, replace joint seals	70	10	$142,000
B-526	Vanneck Road	Convert to semi-integral, replace curbs and railings, patch repair deck, waterproof and pave	66	12	$813,000
B-535	Old River Road	Replace decorative end posts, replace guiderail, re-caulk gaps in parapets and curbs	65	12	$109,000
B-537	Oxbow Drive	Convert to semi-integral, replace barriers and curbs, raise and extend drains, patch girders, jack and replace bearings, patch repair deck, waterproof and pave	66	12	$1,063,000
B-538	Fernhill Drive	Replace drains	50	11	$35,000
C-137	Thirteen Mile Road	Patch repair SW corner	54	12	$21,000
C-157	Hyde Park Road	Replace structure	34	17	$394,000
C-159	Sixteen Mile Road	Replace structure	38	12	$390,000
C-162	Thirteen Mile Road	Replace structure	40	11	$297,000
C-547	Oxbow Drive	Replace structure, pave	50	14	$451,000

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List of Repair and Replacement Needs
6 to 10 year period

Site Number	Road Name	Recommended Improvement	BCI	Theoretical Priority Score	Probable Cost
C-551	Greystead Road	Replace structure	61	9	$430,000
C-554	Greystead Drive	Replace structure	36	13	$423,000
C-559	Vanneck Road	Replace middle section, waterproof	42	14	$327,000
C-566	Quaker Lane	Replace structure	57	8	$324,000
C-581	Coldstream Road	Replace structure	52	12	$383,000
				Total	**$11,238,000**
				Average (5 Year)	**$2,247,600**

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List of Repair and Replacement Needs Anticipated in 11 to 20 year period

Site Number	Road Name	Recommended Improvement	BCI	Theoretical Priority Score	Probable Cost
B-142	Fifteen Mile Road	Replace curbs and barriers	71	9	$280,000
B-145	Adelaide Street	Replace barriers and guiderail, waterproof and pave	68	12	$400,000
C-149	Mill Lane	Replace structure	54	10	$801,000
C-532	Oxbow Drive	Replace structure, pave	60	12	$396,000
C-541	Coldstream Road	Replace structure, pave	47	14	$572,000
C-545	Coldstream Road	Replace structure, pave	39	15	$397,000
				Total	**$2,846,000**
				Average (10 Year)	**$284,600**

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Awarded Projects

C-558 Replacement (Fernhill Drive)

B-314 Repairs (Westminster Drive)

B-301 Repairs (Carriage Road)

B-505 Repairs (Vanneck Road)

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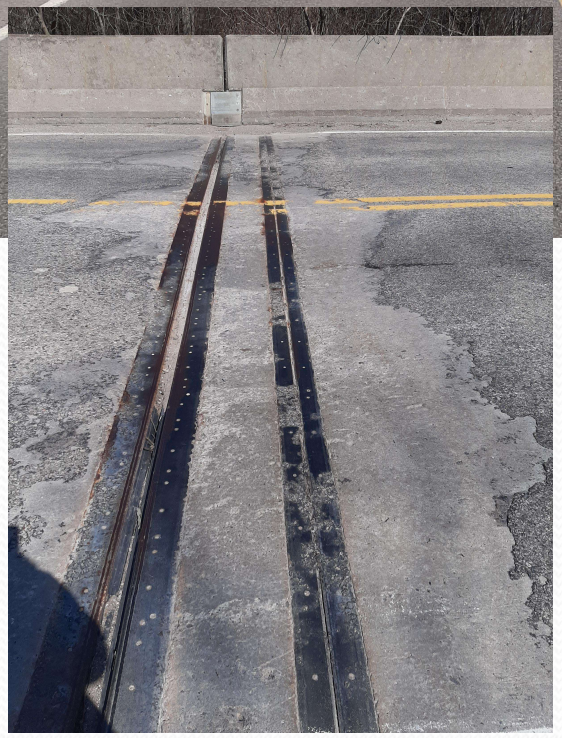
B-108 – Medway Road



- Convert to semi-integral abutments
- Replace guiderail
- Patch repairs to deck top
- Include waterproofing and paving

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B-120 – 9 Mile Road

- Convert to semi-integral abutments
- Replace curbs and railings
- Patch repair deck top
- Replace guiderail
- Waterproof and pave

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C-580 – New Ontario Road

- 1.8m clear span (smallest structure in inventory) rectangular concrete culvert
- Footings exposed full length, walls out of plumb approx. 100mm over full height, deck ends deteriorating, medium to wide vertical cracks in culverts walls
- Replacement of this structure should be considered high priority due to potential for walls/footings to slide inward. Staff should periodically monitor road surface and report any signs of settlement.

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B-530 – Coldstream Road

- Replace seals with expansion joints
- Patch repair bearing pedestals and girder ends, replace bearing pads
- Replace deck drains
- Patch repair deck top, waterproof and pave

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C-156 – 13 Mile Road

-2021-

-2023-

- Culvert structure in overall poor condition and actively deteriorating
- Roadway is paved but narrow on approaches and across structure
- Repairs are not recommended due to the age and width of the structure

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C-572 – Ivan Drive

- Culvert structure in overall poor condition
- Load limit recommended in May 2023
- Deterioration rate likely to increase
- Repairs are not recommended due to the age and width of the structure

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Costs Reducing Possibilities

- Combining like-projects or geographically close sites into one Contract has the potential to reduce project costs by up to 10% by way of economies of scale

- Pre-purchasing CSP pipes or concrete box culverts, providing access to Municipal pits, or hauling excavated soil or granulars for projects can eliminate Contractor markup on those items, potentially reducing costs by up to 15%*

- Completing lower complexity repairs and smaller replacements with Municipal staff can eliminate Contractor labour and markup, potentially reducing costs by up to 35%*

- * Not reflective of additional costs borne by the Municipality for additional time and effort by staff

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Concluding Summary

- Recommending a combination of culvert replacements, bridge repairs and maintenance type work.
- Only 2 small span bridge replacements proposed within next 20 years.
- $10.376 million of needs identified to be completed within the next 5 years or $2.075 million / year
- $11.238 million of needs identified to be completed within the 6 to 10 year period or $2.248 million / year
- $2.846 million of needs identified to be completed within the 10 to 20 year period or $285,000 / year
- Approximately $386,000 of maintenance needs identified; these estimates are based on 2023 Contract costs
- Follow-up inspections required every 2 years; therefore, priorities for future work may change

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Questions

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