MUNICIPALITY OF SOUTH BRUCE

Road Condition Assessment

DECEMBER 2020

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1. INTRODUCTION

The Municipality of South Bruce retained Cobide Engineering (Cobide) to provide engineering services related to the completion of a Road Condition Assessment for all roadways within the Municipality.

In 1987 the Ministry of Transportation and Communication published a “Methods and Inventory Manual - Road Management Plan for Small Lower Tier Municipalities.” The Ministry, which is now the Ministry of Transportation Ontario (MTO), encourages the municipalities in the small lower tier group to undertake a road management study and formulate a road management plan using the guidelines set out in the manual.

This assessment, which will include the five (5) year period of 2021 – 2026, is the third assessment undertaken by the Municipality of South Bruce as part of its Asset Management Plan. The previous studies completed in 2008 and 2016 were built upon and used as background for this report. The road network and conditions however was not included in Public Sector Digest’s (PSD’s) previously completed Asset Management Plan however condition ratings were given to each segment of road. A base template was provided by PSD to compile information regarding the road sections.

1.1 PURPOSE

The purpose for undertaking a road management study is to:

a) Clearly identify the Municipality’s road system;

b) Inventory the road system by road section taking into account its use, condition, geometric elements and surface type;

c) Identify those road sections in need of improvement, the type of improvement and an estimate of cost;

d) Prepare a five (5) year maintenance and construction program within existing levels of expenditures.

In addition, the study will be a reference document for the Municipality of South Bruce for long range financial planning of the Municipality’s road needs to ensure that the level of service is provided within the expectations of ratepayers, Council and Staff.

Maps showing the various road segments are shown in Appendix A.

2. STUDY METHODS

2.1 GENERAL

Data for the road segments were collected and analyzed based on the procedures outlined in “SP-022 Flexible Pavement Rating – Guideline for Municipalities” (Ministry of Transportation (MTO), 1989) and “PAV-86-02 Pavement Condition Index (PCI) for Flexible Pavements” (Ministry of Transportation, 1992). The paved road segments were evaluated by identifying a specific set of pavement defect on the surface of the road and recording their severity and density as a proportion of the overall road segment in order to establish the Distress Manifestation Index (DMI).

A Ride Comfort Rating (RCR) was also established for each segment of paved road evaluated. As per SP-022 from the MTO, RCR is a subjective evaluation by a driver travelling at the posted speed limit and rating the road on a scale of 1-10. A rating of 10 would indicate a smooth ride with no discomfort to the driver while a rating of 0 would indicate a very rough road with significant discomfort to the driver.

The DMI and RCR are then used to establish the Pavement Condition Index (PCI) using a mathematical formula outlined in PAV-86-02 by the MTO. The PCI ranges from 0 to 100 and is a common performance indicator. The greater the PCI value, the higher the performance of the roadway.

Gravel Roads were analyzed based on the surface distresses outlined in “SP-025 Manual for Condition Rating of Gravel Surface Roads” (Ministry of Transportation, 1989). This document outlines distresses that are unique to gravel roads. Severity and density of distresses were then used to make recommendations for treatment. A Condition Rating (CR) was also provided for the gravel roads. Its important to note that the CR for gravel roads cannot be directly correlated to the RCR or PCI for paved roads and should only be used for comparing against other gravel roads.

The MTO recommends that the field work be complete in the spring when frost action is still visible and before routine maintenance has been completed. Due to the timing of award of the contract, this was not possible and field work was completed in the late summer and early fall. Based on this, some of the road segments ratings may be higher than they would have been if the field data had been collected in the spring. This will be most evident with the gravel road sections as they typically receive new gravel and are graded every spring to correct rutting, washboard etc that is caused by frost action.

2.2 INVENTORY AND APPRAISAL

An inventory of all the roads in the Municipality of South Bruce was reviewed and revised as necessary. A visual assessment of the structural integrity (condition rating) was made for each road section.

For inventory purposes, the road system has been divided into sections. Generally, a section is a street from one intersection to the next in an urban setting, or from concession to concession in a rural setting. Some sections are multiple blocks in length if there are similar surface types, roadside environments and in service dates. Each road has been assigned an asset ID number. The section numbers are shown on Maps SP1, SP2, SP3 and SP4 enclosed.

2.2.1 SURFACE TYPE

The surface type can be defined as Asphalt which is High Class Bituminous (HCB) Asphalt (Hot Mix), Surface Treatment which is Low Class Bituminous (LCB) also known as Tar & Chip or Gravel.

Table 1 – Road Surface Type Summary

CROSS SECTION	LENGTH (KM)	PERCENTAGE
Hot Mix (HCB)	64.73	15.7%
Surface Treatment	174.07	42.1%
Gravel	174.45	42.2%
Total	413.25	100%

2.2.2 ROADSIDE ENVIRONMENT

Describes the location of the road and the existing characteristics of the road.

For inventory purposes, road sections have been identified as Urban, Semi-urban and Rural depending on their design elements and environment.

Urban	Roads with curb and gutter on both sides.
Semi-urban	Roads located in an urban environment without curb and gutter.
Rural	Roads that abut agricultural or forested lands typically with ditches. Some segments do not have any roadside drainage.

Table 2 shows a summary of the total length of road by cross section within the Municipality.

Table 2 - Roadside Environment Summary

CROSS SECTION	LENGTH (KM)	PERCENTAGE
Rural	389.99	94.4%
Semi Urban	9.51	2.3%
Urban	13.75	3.3%
Total	413.25	100%

2.2.3 CONDITION RATING

In general, the rating system is shown in Table 3 as follows:

Table 3 - Ride Comfort Rating Outline

RIDE COMFORT RATING		
9-10	Excellent	Very Smooth Ride
7-8	Good	Smooth Ride with few bumps
5-6	Fair	Comfortable with intermittent bumps
2-4	Poor	Uncomfortable with moderately rough and uneven surface
0-1	Very Poor	Uncomfortable with very rough and uneven surface – Nearly impassable

Table 4 shows a summary of the total length of each type of road per condition.

Table 4 - Ride Comfort Rating Summary

	2020		
Comfort Rating	LCB	HCB	Gravel
9 – 10 (Excellent)	10.39	17.76	0
7 – 8 (Good)	49.64	28.73	93.39
5 – 6 (Fair)	76.28	16.95	70.67
2 – 4 (Poor)	37.76	1.29	10.39
0 – 1 (Very Poor)	0	0	0

2.2.4 DISTRESS MANIFESTATION INDEX

The paved road segments were evaluated by identifying a specific set of pavement defect on the surface of the road and recording their severity and density as a proportion of the overall road segment in accordance with the MTO Flexible Pavement Condition Rating Manual. The inspection looked for the following defects:

- Surface Defects:
  - Ravelling and Coarse Aggregate Loss
  - Flushing
- Surface Deformations:
  - Rippling and Shoving
  - Wheel Track Rutting
  - Distortion
- Cracking:
  - Longitudinal
  - Centerline
  - Pavement Edge
  - Transverse
  - Mid-lane
  - Random

The pavement defects were also categorized based on the severity and density.

Examples of some of the Pavement Distresses can be seen in Appendix B.

For gravel roads the following defects were assessed:

- Surface Defects:
  - Loose Gravel
  - Dust
  - Potholes

- Breakup
- Surface Deformations:
  - Washboard
  - Rutting
  - Flat/ Reverse Crown
  - Distortion

The gravel defects were also categorized based on the severity and density.

All of the defect information is then combined to establish a DMI for the road segment.

2.2.5 PAVEMENT CONDITION INDEX

Upon completion of the road network inspection and rating, a Pavement Condition Index was established for each segment. The PCI value represents the overall road condition rating and is a combination of the DMI and RCR values. Based on the PCI, an estimated timeline to improvements can be estimated.

Improvement timelines are based on the criteria shown in Table 5 below:

Table 5 – Road Improvement Timeline

TIME OF IMPROVEMENT	PCI
Acceptable for Foreseeable Future	>80
6 to 10 Years	70 – 80
1 to 5 Years	50 – 70
Resurface Now	30 – 50
Rehabilitate Now	<30

2.2.6 ROAD IMPROVEMENTS AND COSTS

A sample recommended improvement has been determined based on past experience and relative to the condition rating and traffic use for the section. Prior to implementing the recommended improvements in future years, each segment should be assessed to determine if deterioration has continued as projected.

The cost is based on the “2020 Benchmark Costs” which are listed in Appendix C. These costs should be reviewed on an annual basis as the cost of asphalt, surface treatment and Micro Surfacing continue to increase.

An inventory summary of the road sections is presented in Appendix D. The summary includes the pertinent details relating to each section.

2.3 TRAFFIC VOLUMES

The traffic ranges shown on the appraisal sheets have been carried forward from the previous Roads Needs Study. On some roads the traffic ranges vary considerably from summer to winter.

It would be useful to the Municipality of South Bruce to have more actual recorded traffic counts on the roads. The information would help support decisions made by Council and the Manager of Operations

with respect to design elements for road improvements, and priorities for improvements and maintenance. It is therefore important to ensure that the proper traffic volume is recorded for each road section.

2.4 ROAD LIFE SPANS

Like all assets road experience “wear and tear” and must be maintained. The typical lifespan for each surface type is outlined below:

- Asphalt (HCB) – 20 year expected lifespan
- Surface Treatment (LCB) – 7 year expected lifespan
- Gravel – 80+ year expected lifespan however yearly maintenance is required
    - Since gravel roads require yearly maintenance, they deteriorate very slowly and are easily maintained at their current condition. Based on this it is very unlikely that a gravel road segment will require reconstruction.

As road deteriorate and resurfacing works are undertaken, there will typically be a reduction in lifespan each time resurfacing works are undertaken as existing deficiencies will eventually mirror from the existing base to the new surface.

2.5 GEOMETRIC DEFICIENCIES

The review of the horizontal and vertical alignments of the roads is beyond the scope of this study and have not been assessed. As roads are reconstructed or resurfaced, the segment should be reviewed to determine if there are geometric deficiencies and if they can be addressed via the proposed construction method.

3. SPECIFIC MAINTENANCE AND CONSTRUCTION NEEDS

Road sections with a condition rating of five (5) or less at the time of the road appraisal and roads that have been forecasted to become deficient within the five (5) year study period, the proposed rehabilitation has been costed. It should be noted that the report assumes that a like for like replacement program will be undertaken i.e. a surface treated road will have surface treatment re-applied. The Municipality may consider improvements based the increased life expectancies if budgets or funding sources allow. A decision to upgrade a road to a different surface type is a level of service decision that is beyond the scope of this report with the exception of in Town streets. If a full reconstruction is warranted, it is assumed that the segment would be urbanized.

The improvement strategies that can be applied to a segment of road are as follows:

Table 6 - Road Improvement Strategies

IMPROVEMENT CODE	DESCRIPTION
OV	Asphalt Overlay (50mm HL4) includes minor padding and repairs and shoulder gravel
SST	Single Surface Treatment
DST	Double Surface Treatment
GR	Gravel Resurfacing
PP	Pulverize and Pave (Rural or Semi Urban)
MP	Mill and Pave (Urban Only)
REC-G	Full Depth Excavation of Gravel Road and new Granulars
REC-ST	Full Depth Excavation of Surface Treated Road, new Granulars and Double Surface Treatment
REC-A	Full Depth Excavation of Asphalt Road, new Granulars and Two (2) lifts of Asphalt (50mm HL4 and 40mm HL3)
UR	Urban Reconstruction including Full Depth Excavation of Asphalt Road, new Granulars, curb and gutter on both sides and Two (2) lifts of Asphalt (50mm HL4 and 40mm HL3). Does not include sidewalk installation

Reconstruction improvements are basically activities that will improve the structural adequacy of the road. This will typically occur at the same time as the replacement of the underground infrastructure if the road segment is in an urban environment.

The estimated costs of proposed improvements are based on the 2020 Benchmark Costs referred to previously in this report, and listed in Appendix C.

4. FIVE YEAR IMPROVEMENT PLAN

The recommended five (5) year improvement program is presented below based on timeline of need.

The road sections that have been recommended for improvement have been selected by analyzing the data from the road inventory. The timing of some segments may need to be modified to align with other Asset Management Goals and replacement schedules for underground infrastructure.

The types of improvement proposed have been determined on the basis of the guidelines in the manual and consultation with the Operations Manager with respect to practicability and cost. These should be individually reviewed on a project specific basis prior to implementation to ensure the proposed improvement is still viable and makes sense to improve the road segment.

The recommended improvement program should be reviewed annually by Council and the Operations Manager. Revisions to the program may be necessary because of unexpected changes in the condition of some roads, or where work that was programmed could not be completed or conversely, where more work was completed than was scheduled due to Budget surplus.

In addition to the annual review of the program, it is recommended that a major update of this Study be undertaken in approximately five (5) years.

4.1 RECONSTRUCT NOW

Based on the Pavement Condition Index, the following segments require full reconstruction as soon as possible.

Table 7 - Segments Requiring Immediate Reconstruction

Section ID	Street Name	From	To	Surface Material	PCI	Improvement	Projected Cost
4030	OTTER CR	Pinkerton St	Gray Court	HCB	12	Urban Reconstruction	$102,500.00
4031	OTTER CR	Gray Court	Dead End	HCB	12	Urban Reconstruction	$194,750.00
4032	GRAY CT	Otter Cres	Dead End	HCB	12	Urban Reconstruction	$102,500.00
4033	MELBA CT	Otter Cres	Dead End	HCB	12	Urban Reconstruction	$71,750.00
4057	LOUIS ST	Adam St	Louis St	HCB	17	Urban Reconstruction	$61,500.00
4058	LOUIS ST	Louis St	Dead End	HCB	17	Urban Reconstruction	$41,000.00
1022	CONCESSION 4	Bruce County Rd. 12	Side Rd. 5A	LCB	19	Reconstruction - Surface Treatment	$887,400.00
2037	CONCESSION 12 E	Hwy 9	Side Rd 15 N	LCB	19	Reconstruction - Surface Treatment	$290,000.00

4051	ADAM ST N	Absalom W	Dead End	HCB	22	Urban Reconstruction	$102,500.00
2046	CONCESSION 10 EAST	Hwy 9	Side Rd 15 N	LCB	22	Reconstruction - Surface Treatment	$632,200.00
1030	CONCESSION 10	Side Rd. 25 N	Side Rd. 20 B	LCB	23	Reconstruction - Surface Treatment	$603,200.00
1064	SIDEROAD 32	Conc. 10	Conc. 12	LCB	24	Reconstruction - Surface Treatment	$597,400.00
1032	CONCESSION 10	Bruce County Rd. 4	Side Rd. 10 B	LCB	24	Reconstruction - Surface Treatment	$591,600.00
1034	CONCESSION 10	Side Rd. 5 B	Side Rd. 1 B	LCB	25	Reconstruction - Surface Treatment	$591,600.00
2032	CONCESSION 10	B-Line	Bruce Rd 12	LCB	27	Reconstruction - Surface Treatment	$591,600.00
1026	CONCESSION 8	Bruce Rd. 4	Side Rd. 25 N	LCB	30	Reconstruction - Surface Treatment	$1,183,200.00
2026	CONCESSION 6 EAST	Side Rd 25	Side Rd 30 N	LCB	30	Reconstruction - Surface Treatment	$585,800.00

Staff and Council will need to factor in the amount of traffic on some of these segments before making decisions. Some segments only serve a limited number of users and therefore will be a lower priority than the road segments that have more users.

It should be noted that Cobide Staff have had previous discussions with the former Manager of Operations regarding the reconstruction of Otter Crescent, Gray Court and Melba Court along with Pinkerton Street.

4.2 RESURFACE NOW

Based on the Pavement Condition Index, the following segments require resurfacing as soon as possible.

Table 8 - Segments Requiring Immediate Resurfacing

Section ID	Street Name	From	To	Surface Material	PCI	Improvement	Projected Cost
1033	CONCESSION 10	Side Rd. 10 B	Side Rd. 5 B	LCB	32	Double Surface Treatment	$192,850.00
1047	CONCESSION 14 W	Bruce County Rd. 12	Side Rd. 5 B	LCB	33	Double Surface Treatment	$289,750.00
2079	SIDEROAD 20 NORTH	Bruce Rd 6	240m south of Bruce Road 6	LCB	33	Double Surface Treatment	$22,800.00
1031	CONCESSION 10	Side Rd. 20 B	Bruce County Rd. 4	LCB	34	Double Surface Treatment	$191,900.00
2050	CONCESSION 14	Side Rd 30N	Side Rd 25	LCB	34	Double Surface Treatment	$193,800.00
2045	CONCESSION 10 EAST	Side Rd 15 N	Side Rd 20 N	LCB	35	Double Surface Treatment	$195,700.00
2044	CONCESSION 10 EAST	Side Rd 20 N	Side Rd 25 N	LCB	35	Double Surface Treatment	$193,800.00

2035	SCHAEFER ROAD	Conc. 12 E	Bruce Rd 3	LCB	35	Double Surface Treatment	$140,600.00
4048	ADAM STREET	Church St	Louis St	HCB	36	Mill and Pave	$21,000.00
1036	CONCESSION 12	Bruce County Rd. 12	Side Rd. 5 B	LCB	36	Double Surface Treatment	$285,000.00
2043	CONCESSION 10 EAST	Side Rd 25 N	Side Rd. 30 N	LCB	39	Double Surface Treatment	$192,850.00
2042	CONCESSION 10 EAST	Side Rd. 30 N	West Grey Boundary	LCB	40	Double Surface Treatment	$167,200.00
4047	ADAM ST S	Church St	Road Close Sign	HCB	40	Pulverize and Pave	$115,050.00
1073.1	SIDEROAD 25 SOUTH	200m South of Concession 2	300m South of Concession 2	LCB	42	Double Surface Treatment	$9,500.00
1029	CONCESSION 10	Side Rd. 32	Scott Court	LCB	43	Double Surface Treatment	$77,900.00
1029.2	CONCESSION 10	Side Rd. 32	Side Rd. 25 N	LCB	43	Double Surface Treatment	$38,000.00
1002	TURNBERRY-CULROSS WEST	Bruce Rd 4	Side Rd. 25	LCB	44	Double Surface Treatment	$237,500.00
4009	BEVERLEY ST	Absalom E	Dead End	HCB	44	Pulverize and Pave	$38,350.00
4053	FIRST STREET	Adam St	Peter St	HCB	44	Mill and Pave	$21,000.00
2107	CARRICK-BRANT EAST	Hwy9	Glesson Avenue	LCB	46	Double Surface Treatment	$49,400.00
4068	JANE ST N	Absalom StW	Ellen St	HCB	46	Pulverize and Pave	$29,500.00
4075	GUNN ST	Carroll	Ellen St	HCB	46	Pulverize and Pave	$26,550.00
1015	CONCESSION 2	Kings Rd.	Side Rd. 25	HCB	46	Pulverize and Pave	$595,900.00
2099	MAPLE CREEK DR	Bruce Rd 3	Dead End	LCB	46	Double Surface Treatment	$68,400.00
2000	HURON-BRUCE RD	B-Line	Bruce Rd 12	LCB	47	Single Surface Treatment	$51,500.00
1044	CONCESSION 14 WEST	Bruce Road 4	Side Rd 25 N	LCB	47	Single Surface Treatment	$102,000.00
2100	HIGHLAND CR	Maple Creek Dr	Dead End	LCB	49	Double Surface Treatment	$38,000.00
5013	WEISS DR	Bruce road 12	Dead End	HCB	49	Pulverize and Pave	$132,750.00
1028	CONCESSION 10	Side Rd. 32	Kinloss Boundary	LCB	50	Double Surface Treatment	$101,650.00
4046	CHURCH ST	Peter St S	Adam St	HCB	50	Pulverize and Pave	$35,400.00
1013	CONCESSION 2	Side Rd. 20	Bruce County Rd. 4	HCB	50	Asphalt Overlay	$252,500.00
4029	PINKERTON ST	Clark St	Otter Cres	HCB	50	Pulverize and Pave	$32,450.00

Staff and Council will need to factor in the amount of traffic on some of these segments before making decisions. Some segments only serve a limited number of users and therefore will be a lower priority than the road segments that have more users. When making decisions regarding priority, it is important to note the Ride Comfort Rating as some of these roads still drive relatively well considering the pavement distresses.

4.3 RESURFACE IN 1 – 5 YEARS

Based on the Pavement Condition Index, the following segments require resurfacing in the next 1 to 5 years.

Table 9 - Segments Requiring Resurfacing within 5 Years

Section ID	Street Name	From	To	Surface Material	PCI	Improvement	Projected Cost
4023	CLARK STREET	Lambert St	Pinkerton St	HCB	51	Pulverize and Pave	$26,550.00
4021	KLEIST ST	Dietz St	Clark St	HCB	51	Pulverize and Pave	$26,550.00
4022	CLARK ST	Kleist St	Lambert St	HCB	51	Pulverize and Pave	$26,550.00
2034	SCHAEFER ROAD	Bruce Rd 3	Conc. 10	LCB	52	Single Surface Treatment	$29,250.00
4036	LAMBERT ST	Dietz St	Absalom St	HCB	53	Pulverize and Pave	$38,350.00
4034	OTTER CR	Pinkerton St	Clark St	HCB	53	Pulverize and Pave	$56,050.00
1037	CONCESSION 12	Side Rd. 5 B	Side Rd. 10 B	LCB	53	Single Surface Treatment	$51,000.00
4049	ADAM ST.	Louis St	First St	HCB	54	Mill and Pave	$17,500.00
4050	ADAM ST	First St	Absalom W	HCB	54	Mill and Pave	$21,000.00
4076	GUNN ST	Ellen St	Absalom W	HCB	55	Pulverize and Pave	$29,500.00
2033	CONCESSION 10	Schaefer Rd	B-Line	LCB	55	Single Surface Treatment	$33,000.00
4042	PETER ST S	Absalom St W	First S	HCB	55	Pulverize and Pave	$35,400.00
4069	JANE ST S	Ellen St	Carroll St	HCB	55	Pulverize and Pave	$29,500.00
2038	CONCESSION 12 E	Side Rd 15 N	Side Rd 20 N	LCB	56	Single Surface Treatment	$51,750.00
2029	CONCESSION 8 WEST	Side Rd 5 S	Absalom Street	LCB	56	Single Surface Treatment	$61,250.00
2019	SIDEROAD 41	Conc. 4	Hwy9	LCB	56	Single Surface Treatment	$25,500.00
2027	CONCESSION 6 EAST	Side Rd 20 N	Side Rd 25	LCB	56	Single Surface Treatment	$51,500.00
1038	CONCESSION 12	Side Rd. 10 B	Bruce County Rd. 4	LCB	57	Single Surface Treatment	$51,000.00

2031	CONCESSION 8 WEST	B-Line	Bruce Rd 12	LCB	58	Single Surface Treatment	$51,000.00
2021	CONCESSION 4 E	Grey Cty Rd 10	Side Rd 30 N	LCB	59	Double Surface Tratment	$151,050.00
2039	CONCESSION 12 EAST	Side Rd 20 N	Side Rd 25	LCB	59	Single Surface Treatment	$50,750.00
1016	CONCESSION 2 (East Portion)	Kinloss Boundary	Kings Rd.	HCB	59	Asphalt Overlay	$100,000.00
2040	CONCESSION 12 EAST	Side Rd 25	Side Rd 30 N	LCB	59	Single Surface Treatment	$51,000.00
4067	ELLEN ST	Jane St N	Dead End	HCB	59	Pulverize and Pave	$26,550.00
1069	SIDEROAD 25 NORTH	Conc. 8	Dead End	LCB	59	Single Surface Treatment	$26,000.00
4006	GEORGE ST	Absalom St	Daniel St	HCB	59	Mill and Pave	$14,000.00
4007	DANIEL ST	100 m West of George St	Jonathan Cr	HCB	59	Mill and Pave	$5,250.00
4008	JONATHAN CRESCENT	Daniel St	Daniel St	HCB	59	Mill and Pave	$45,500.00
4065	ELLEN ST	John St	Gunn St	HCB	59	Pulverize and Pave	$38,350.00
4066	ELLEN ST	Gunn	Jane St N	HCB	59	Pulverize and Pave	$32,450.00
2036	CONCESSION 12 E	Hwy9	Schaefer Rd	LCB	60	Single Surface Treatment	$32,250.00
1009	MARGARET ST	Huron Bruce Rd	Dead End	HCB	60	Pulverize and Pave	$76,700.00
2105	CONCESSION 14	Schmidt Rd	Hwy9	LCB	60	Single Surface Treatment	$50,000.00
4042.1	PETER ST S	First St	Louis	HCB	61	Pulverize and Pave	$29,500.00
1017	CONCESSION 4	Kinloss Boundary	Side Rd. 25	LCB	62	Single Surface Treatment	$96,750.00
4039	DIETZ ST	Lambert St	Kleist St	HCB	62	Pulverize and Pave	$29,500.00
2053	SIDEROAD 30 NORTH	Conc. 14 W	Brockton Bdy	LCB	62	Single Surface Treatment	$31,750.00
1014	CONCESSION 2	Side Rd. 25	Side Rd. 20	HCB	62	Asphalt Overlay	$255,000.00
4056	LOUIS ST	Peter St S	Adam St	HCB	62	Mill and Pave	$21,000.00
2028	CONCESSION 6 EAST	Hwy9	Side Rd 20 N	LCB	63	Single Surface Treatment	$41,250.00
2049	CONCESSION 14	Side Rd 25 N	Side Rd 20N	LCB	63	Single Surface Treatment	$51,000.00
2006	HURON-BRUCE RD	Grey Road 10	Highway# 9	HCB	63	Single Surface Treatment	$34,500.00
4077	MEL ST	Absalom W	Fred St	HCB	63	Pulverize and Pave	$35,400.00
2103	SCHMIDT ROAD	Conc. 14	Carrick-Brant	LCB	63	Single Surface Treatment	$31,250.00

1066	KINLOSS-CULROSS	Conc. 8	Bruce County Rd. 6	LCB	64	Single Surface Treatment	$50,000.00
4024	CLARK STREET	Pinkerton	Stinson St.	HCB	64	Pulverize and Pave	$29,500.00
4025	STINSON ST	Clark St	Dietz St	HCB	64	Pulverize and Pave	$26,550.00
1046	CONCESSION 14 WEST	Side Rd. 5 B	Side Rd. 10 B	LCB	64	Single Surface Treatment	$51,000.00
1020	CONCESSION 4	Bruce Rd. 4	Side Rd. 10	LCB	65	Single Surface Treatment	$50,750.00
2101	WOODLAND CT	Maple Creek Dr	Dead End	LCB	65	Single Surface Treatment	$3,500.00
2016	CONCESSION 4	Bruce Rd 28	Side Rd 5 S	LCB	66	Single Surface Treatment	$50,750.00
4045	CHURCH ST	Hwy9	Peter St. S	HCB	66	Pulverize and Pave	$29,500.00
2012	CONCESSION 2	B-Line	Side Rd 5 S	HCB	66	Asphalt Overlay	$255,000.00
1006	HURON-BRUCE RD	Side Rd. 5 A	London Road	LCB	66	Single Surface Treatment	$102,000.00
1027	CONCESSION 8	Side Rd. 25 N	Kinloss Boundary	LCB	67	Single Surface Treatment	$97,750.00
2112.1	SIDEROAD 30	Hwy9	Concession 6E	LCB	67	Single Surface Treatment	$24,750.00
1035	CONCESSION 10	Side Rd. 1 B	Bruce Rd. 12	LCB	67	Single Surface Treatment	$25,750.00
2051	CONCESSION 14	West Grey Boundary	Side Rd 30 N	LCB	67	Single Surface Treatment	$46,750.00
4043	PETER ST S	Louis St	Church St	HCB	67	Pulverize and Pave	$35,400.00
2014	CONCESSION 4	B-Line	B-Line	LCB	67	Single Surface Treatment	$51,250.00
1025	CONCESSION 8	Bruce Rd. 4	Side Rd. 10 A	LCB	68	Single Surface Treatment	$50,750.00
2024	SIDEROAD 45	Hwy 9	Seip Road	LCB	69	Single Surface Treatment	$26,000.00
4035	LAMBERT ST	Clark St	Dietz St	HCB	69	Pulverize and Pave	$26,550.00
2013	CONCESSION 2	Bruce Rd 12	Bruce Rd 12	HCB	70	Asphalt Overlay	$257,500.00
4038	DIETZ ST	Pinkerton	Lambert St	HCB	70	Pulverize and Pave	$26,550.00

Staff and Council will need to factor in the amount of traffic on some of these segments before making decisions. Some segments only serve a limited number of users and therefore will be a lower priority than the road segments that have more users. When making decisions regarding priority, it is important to note the Ride Comfort Rating as some of these roads still drive relatively well considering the pavement distresses. These segments also need to be reassessed prior to resurfacing to determine if they have continued to deteriorate to a point for requiring resurfacing or if they maintain an acceptable PCI.

4.4 OVERALL CONDITION ASSESSMENT

Overall, the roadways within South Bruce are in good condition. On a distance weighted assessment, the PCI for the Municipality is 68.3. Based on the majority of roads being LCB and gravel, which have relatively short life spans before requiring intervention, this is a good PCI. More than 60% of the roads are more than 5 years away from requiring resurfacing.

Since the cost to rehabilitate roads in poor condition is significantly more pre kilometer than maintaining or improving roads in fair condition, it would be financially prudent to address the roads in better condition and keep them there while trying to address the worst roads rather than ignoring the roads in fair condition and only focusing on the worst roads.

There are a number of roads that have a low PCI based on pavement distresses which play a large role in the determination of the PCI but that still drive relatively well. Therefore, the roads may actually deteriorate fairly slowly and may not need immediate attention. There may be an opportunity to delay works on these roads to focus capital investments on other road segments. Since the PCI has not been determined in previous Roads Needs Studies it is impossible to determine the rate they are deteriorating at. Some of the roads requiring improvements specifically in the urban centers may align with other priorities for infrastructure replacements.

Since there is no way to keep all roads at high PCI's it is important to keep the roads that are at a high PCI where they are so the early interventions such as crack sealing and replacing shoulder gravel that have minimal costs and high return on investment need to be a priority.

Crack sealing of any HCB roads that are in good shape needs to remain a priority as it provides a cost-effective method of prolonging the service life of asphalt surfaces. Based on the changing weather patterns, there are a lot more freeze thaw cycles in recent years. Freeze thaw cycles are the hardest on roads and if the moisture can be kept out of the road base it will ensure the roads can last longer.

With climate change intensifying the freeze/thaw cycles crack sealing is a means to stretch limited funds to extend the life of asphalt road assets. When water penetrates into a crack in asphalt or into the granular base and it freezes, the volume increases by 9%. This results in pressure of +/- 8,700 psi at -5°C to +/- 29,000 psi at -21°C which eventually opens the cracks wider and breakdowns the asphalt resulting in cracks spreading out from the initial moisture entry point.

The Municipality of South Bruce has demonstrated the benefits and effectiveness of this technique to seal the asphalt surface from moisture penetration. In the areas where the municipality has sealed the various cracks, the cracks remain in excellent condition and performance to date do not show any failure of cohesion which is an early indicator of crack widening.

As expected, due to underlining structural issues and age there are new cracks developing, however the new cracks are not originating from these sealed cracks. The timely maintenance to prevent moisture penetration never ends.

Shouldering edges of HCB and LCB assists in structural integrity of the road base and drains water away from edge of pavement. As evident from the collection of the road data for this study, the municipality is doing a commendable job on maintaining the critical edge of pavement. Attention and maintenance to any drop-off area or low granulars will extend the life of that section of road.

Due to the nature of LCB, when it is overlayed with another layer of Surface Treatment, it has a short lifespan and also mirrors through any deficiencies in the existing roadway. Therefore, if a road has irregular crossfall or significant deficiencies it doesn't make sense to do a single surface treatment to extend the life as the full lifespan of the surface treatment will not be achieved due to the deficiencies mirroring though. This means that there may be some roads that are not worth trying to keep at the service level they are at and could left a couple of years to deteriorate to a point where it makes sense to proceed with a bigger project to repair the deficiencies and get a longer lifespan from the newly reconstructed road.

Prior to selecting segments to be upgraded it is important to review types, severity and density of the distresses in the subject road segment to understand the circumstances that may have caused the distinct distresses and if any modifications are warranted in certain sections of this project.

There may also be opportunity to improve small sections of a segment that are in the worst shape to increase the overall PCI of the road network without having to invest as much capital.

5. CONCLUSIONS & RECOMMENDATIONS

1. This study has been provided to aid the Municipality of South Bruce in completion of their Asset Management Plan. It is intended as a guide and needs to be reviewed in conjunction with other infrastructure assets needs.

2. The costs of gravel, asphalt and surface treatment should be closely monitored by the Municipality of South Bruce, as the studies benchmark costs will be affected by these increases.

3. The Municipality should set aside funds from the maintenance budget each year for crack sealing and shoulder gravel of the roads that have a high PCI to ensure the rate of deterioration is minimized.

4. That a major update of the Road Management Study be undertaken in five (5) years.

5. That if any federal or provincial infrastructure programs are announced during the five (5) year study period, the Municipality of South Bruce should consider using all or part of the funding for road improvements.

Sincerely,

Cobide Engineering Inc.

Travis Burnside, P. Eng.

David Burnside, Technologist

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APPENDIX A

ROAD INVENTORY MAPPING

APPENDIX B

DISTRESS EXAMPLES

APPENDIX C

CONSTRUCTION COSTS

APPENDIX D

ROAD INVENTORY AND ASSESSMENTS