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Feasibility Report for

2019 Pavement Rehabilitation Improvements

City of Elko New Market, MN

November 2018

Submitted by:

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Certification

Feasibility Report

For

2019 Pavement Rehabilitation Improvements

City of Elko New Market

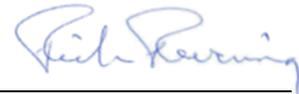
Elko New Market, MN

T17.116817

December 6, 2018

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By:



Rich Revering, P.E.

License No. 20711

Bolton & Menk, Inc.

Date: December 6, 2018

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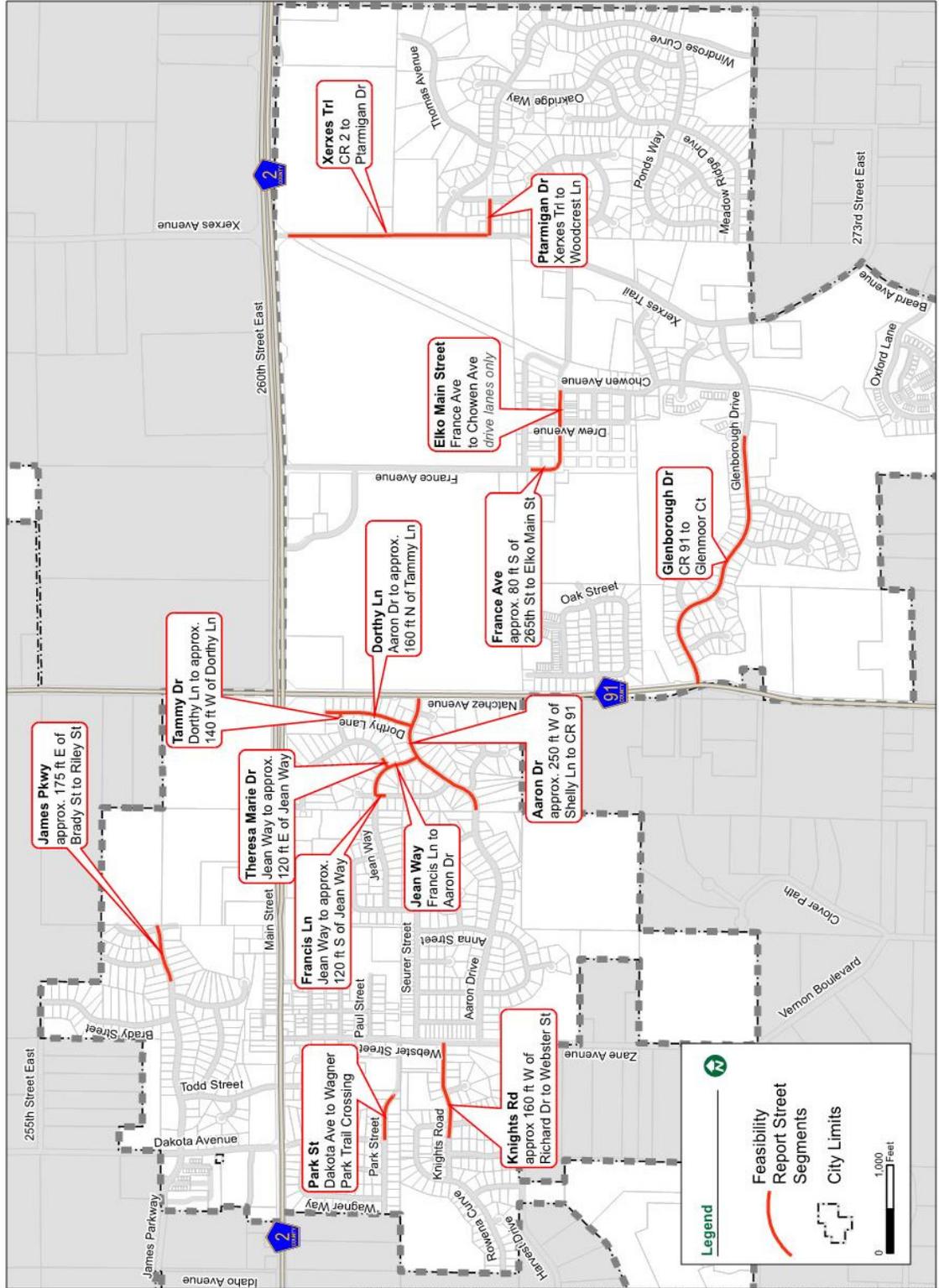
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EXECUTIVE SUMMARY

BACKGROUND & INTRODUCTION

The Elko New Market City Council ordered preparation of this Feasibility Study at its August 23, 2018, regular meeting. The purpose of the project is to extend the duration of acceptable pavement condition of the City streets shown below in Figure 1. This report has been completed to identify the appropriate improvements and rehabilitations needed as well as the related project costs and preliminary estimated assessments.



ELKO NEW MARKET PAVEMENT MANAGEMENT SYSTEM

The City of Elko New Market has been rating streets under its jurisdiction every two to five years since 2009. The ratings are tracked in a “Pavement Management System.” The system is a database of street segments that make up the city’s street mileage with rating data.

Each rating of a segment is done the same way. Various common pavement distresses are measured for each segment by observing the pavement either in the field or by high-quality aerial photography. A number is assigned to each distress type based on degree/severity and applied to a formula to calculate an overall numerical rating between 0 and 100 for each segment. The higher the rating, the better the pavement condition.

The ratings are made periodically and tracked to document the changing conditions and predict when ratings might fall below thresholds selected based on class of street and likelihood of acceleration of deterioration. The prediction is used to program improvement timing. The improvements to be made are based on the types of distresses behind the pavement’s condition, the condition of underlying utilities and subgrade, and current pavement section configuration.

The end-goal of the Pavement Management System is to preserve pavements at acceptable quality levels at the lowest long-term cost by making decisions based on data.

EXISTING PAVEMENT AND OTHER CONDITIONS

The streets shown in Figure 1 - Project Location Map consist largely of asphaltic concrete pavements at or approaching 20 years of age. The primary distresses observed consist of transverse, longitudinal, block and some alligator cracking.

The City’s Public Works Department staff has reported there are other street features showing signs of deterioration that should be considered to benefit from being bid as part of a larger project. These include faded or non-standard street name signs, corroding bolts on the buried portion of fire hydrants and water main valves, curbs with cracks or breaks that unduly affect function or appearance, and voids around catch basins due to improper sealing of pipes where they connect to the structures.

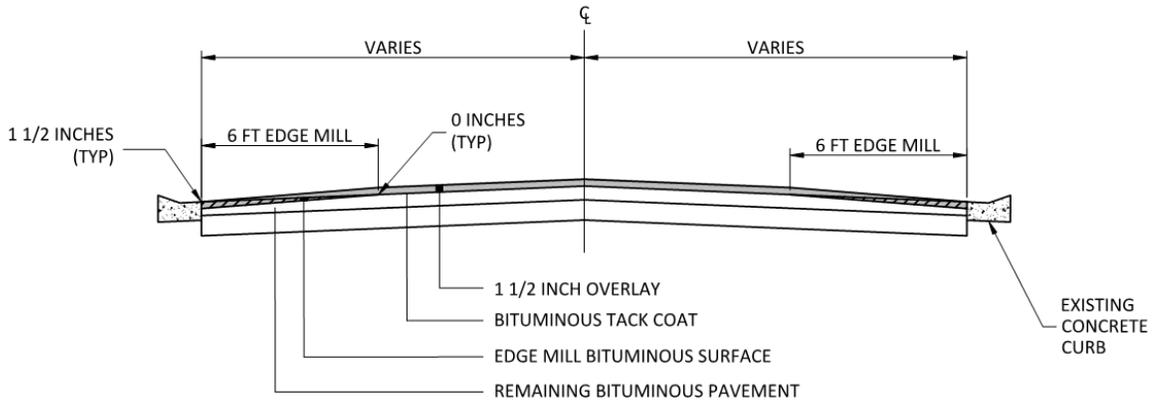
One street does show signs of a soft subgrade. Our experience on Jean Way and the distresses observed lead staff to believe the sand subgrade is inadequately drained.

For cracked curb and catch basin leaks we assume 0.5 percent of curb in the project will require removal and replacement and that 1 in 10 catch basins will require excavation and repair of joint seals and re-setting of castings prior to pavement rehab.

PROPOSED IMPROVEMENTS

No streets in the 2019 project area have previously been rehabilitated. All are still in their original pavement section configuration. None except Jean Way exhibit distresses consistent with subgrade problems. The primary distresses are cracks related to pavement age and traffic. Accordingly, the streets are good candidates for extension of pavement life by strengthening the existing pavement structure.

A common strategy in this case is to provide a thin (1 ½ inches or so) overlay to reinforce the existing pavement. Edge milling to allow a smooth tie-in to existing curbs would be provided. Manholes and gate valve boxes in the pavement area will need to be raised to meet the new road surface.



TYPICAL SECTION

We recommend drain tile be installed at key locations in the Jean Way sand subgrade. It is recommended street signs in the project area be replaced to the current standard and that deficient catch basin leaks be repaired.

ESTIMATED COSTS & PROPOSED FUNDING

A summary cost estimate for the project outlined above is provided in table ES-1 below.

Table ES-1 – Estimated Cost of Proposed 2019 Pavement Rehabilitation Project

Item	Estimated Quantity	Unit	Unit Price	Total Amount
MOBILIZATION	LUMP SUM	LUMP SUM	LUMP SUM	\$41,139.74
TRAFFIC CONTROL	LUMP SUM	LUMP SUM	LUMP SUM	\$8,227.95
MILL BITUMINOUS PAVEMENT	17777	SQ YD	\$1.20	\$21,332.40
REMOVE BITUMINOUS PAVEMENT	1683	SQ YD	\$2.50	\$4,207.50
SUBGRADE PREPARATION	1400	SQ YD	\$2.00	\$2,800.00
BITUMINOUS PAVEMENT	4061	TON	\$65.00	\$263,965.00
ADJUST MANHOLE CASTINGS	55	EACH	\$600.00	\$33,000.00
ADJUST VALVE BOX	52	EACH	\$100.00	\$5,200.00
CATCH BASIN REPAIR	6	EACH	\$1,000.00	\$6,000.00
HYDRANT BOLT REPLACEMENT	2	EACH	\$1,000.00	\$2,000.00
VALVE BOLT REPLACEMENT AND BOX ADJUST	2	EACH	\$1,000.00	\$2,000.00
REMOVE & REPLACE CONCRETE CURB w/TURF	258	LIN FT	\$30.00	\$7,740.00
4" PERFORATED DRAINTILE	1695	LIN FT	\$16.00	\$27,120.00
4" YELLOW STRIPING	3605	LIN FT	\$2.50	\$9,012.50
4" WHITE STRIPING	4940	LIN FT	\$2.50	\$12,350.00
PAVEMENT MARKINGS - WHITE	570	SQ FT	\$6.00	\$3,420.00
REMOVE & REPLACE STREET SIGN	45	EACH	\$250.00	\$11,250.00
			Subtotals:	\$460,765.09
			Contingency	\$23,038.25
			Est. Construction Total	\$483,803.34
			Est. Overhead	\$120,950.84
			Total Est. Project Cost	\$604,754.18

The project is proposed to be funded with City utility funds, general obligation bonds and assessments to individual properties. The net effect on the general fund is estimated at approximately \$348,000, paid over 5 or 10 years depending upon bond terms.

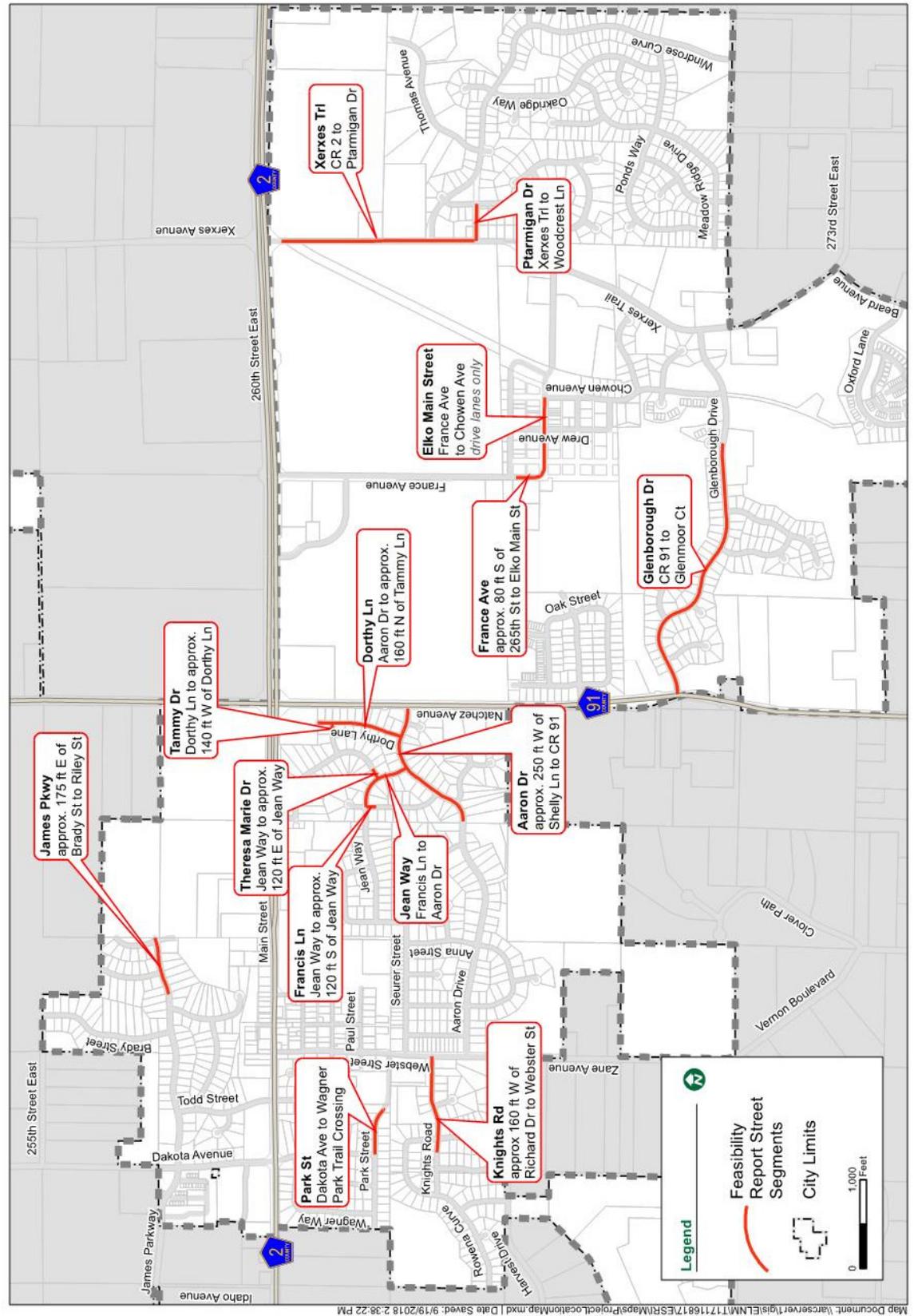
End of Executive Summary

PRELIMINARY ENGINEERING REPORT

INTRODUCTION

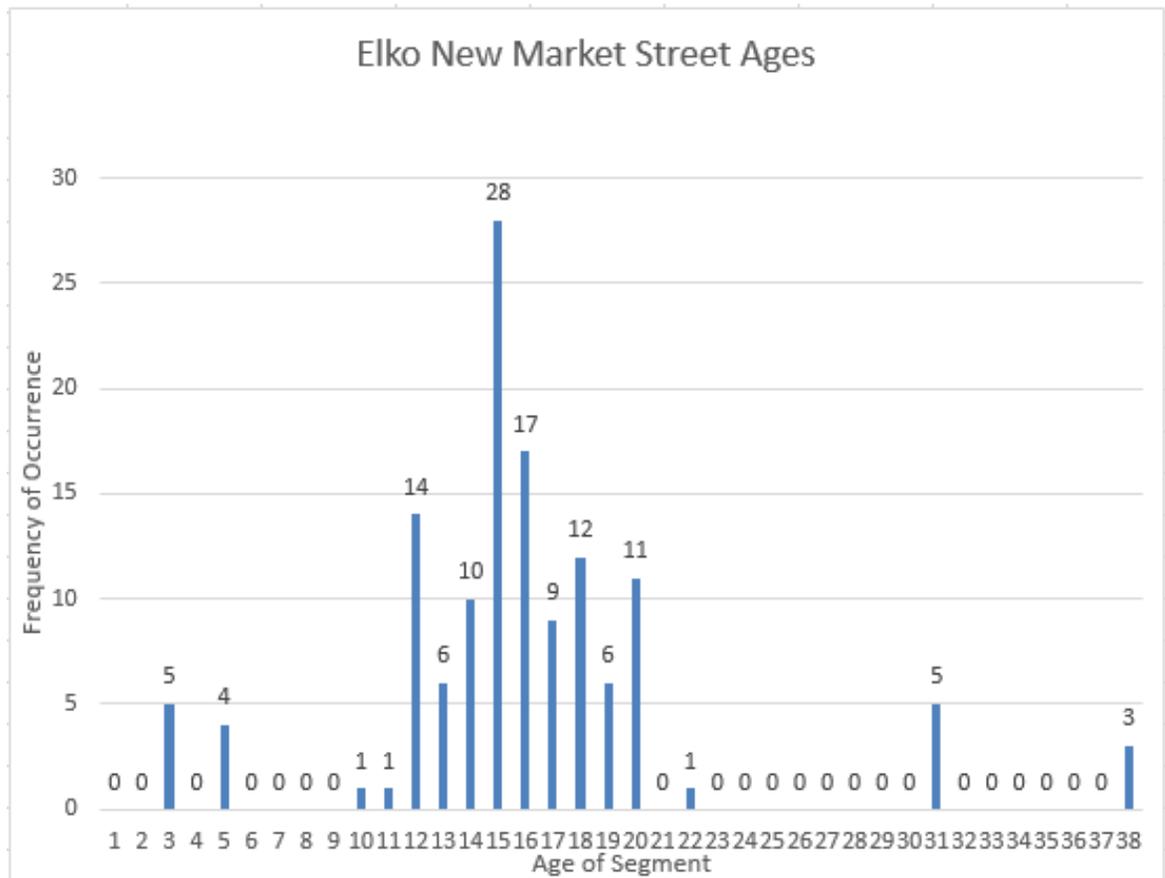
The Elko New Market City Council ordered preparation of this Feasibility Study at its August 23, 2018, regular meeting. The purpose of the project is pavement preservation (to extend the duration of acceptable pavement condition) of the City streets shown below in Figure 1.

This report has been prepared to identify the appropriate improvements and rehabilitations needed as well as the related project costs and preliminary estimated assessments.



BACKGROUND

The City of Elko New Market each year updates a 5-year Capital Improvement Program (CIP). The program lists, briefly describes and provides high-level cost estimates for projects expected to be financed by bond proceeds or significant expenditures from the City’s general or enterprise funds. Pavement rehabilitation first made an appearance in the CIP in 2016 as “2018 Pavement Overlays.” This decision was recommended by staff based on knowledge that many of the city’s pavements were constructed at roughly the same time and were aging. See Chart below. The preliminary scope and schedule for needed improvements was based on conditions being observed as part.



The City of Elko New Market has been rating streets under its jurisdiction every two to five years since 2009. The ratings are a key part of a “Pavement Management System.” The system consists of a database of street segments that make up all the city’s street mileage. State, county, and township roads are not tracked. Each City-owned street is broken into segments of commonality – that is, each segment will be the same age, width, and pavement section. This assumes that a segment of commonality will experience similar traffic volumes and loadings over its length and perform similarly over any given time period. Some streets have only one segment, some have several. The segments often are usually associated with specific subdivisions and phases. The database has age, length, width, and condition data based on the ratings from each year.

Each rating of a segment is done the same way. Various common pavement distresses are measured for each segment by observing the pavement either in the field or by high-quality aerial drone photography. Most distresses in Elko New Market are based on some type of crack. These cracks are counted whether they’ve been sealed or not. (Sealing doesn’t repair cracks; it minimizes

water penetration into base layers and delays development of adjacent cracks). Each segment is driven and noticeable “bumps” are counted to allow ride quality to also be a rating factor. A number is assigned to each distress type based on degree/severity and applied to a formula to calculate an overall numerical rating between 0 and 100 for each segment. The higher the rating, the better the pavement condition.



The ratings are made periodically and tracked to document the changing conditions and predict when ratings might fall below thresholds selected based on class of street and likelihood of acceleration of deterioration. The prediction is used to program improvement timing so projects can be grouped for economies of scale and the city can plan for financing and better interim maintenance decisions. The improvements to be made are based on the types of distresses behind the pavement’s condition, the condition of underlying utilities and subgrade, and current pavement section configuration.

The end-goal of the Pavement Management System is to preserve pavements at acceptable quality levels at the lowest long-term cost making decisions based on data rather than rules-of-thumb or complaints. Using these methods may result in unnecessary investment, or perhaps even more costly – acting too late.

EXISTING CONDITIONS

The streets shown in Figure 1 consist largely of asphaltic concrete (commonly referred to as bituminous) pavements at or approaching 20 years of age. The primary distresses observed consist of transverse, longitudinal, block and some alligator cracking. Examples of these distresses are shown below in Figure 2.



Map Document: \\arcserver1\gis\ELNMM\T116817\ESRI\Maps\DistressExamples.mxd | Date Saved: 9/19/2018 2:28:51 PM

The onset of alligator cracking is typically an indication that potholes will soon begin to appear. Potholes dramatically reduce ride quality, allow moisture to spoil subgrades, and increase maintenance demands. Accordingly, alligator cracking is a distress given higher weight in the rating computation and is a common distress present or soon anticipated on the streets recommended for rehabilitation in 2019.

Minor and major collectors in Elko New Market carry more traffic than local residential streets. Their function is a step or two removed from an access function towards a mobility function. To facilitate mobility, they are typically designed with fewer driveways and fewer STOP signs. They usually experience less parking and slightly higher speeds. We assumed the public's expectation on these roads for a smooth ride would be higher than it would for local streets, and the tolerance for potholes would be lower. Accordingly, the computed rating threshold for rehabilitation of collector roads was set at 76 and below. The threshold for local roads was selected at 69 and below. The objective is to make structural improvements at or before streets reach a Pavement Condition Index (PCI) of 60 or below.

The criteria were set somewhat arbitrarily based on an approximate percentage of streets needing to be done each year and the ratings of streets with alligator cracking. Total city street mileage is 21.53. Assuming an average of 20 years to first rehabilitation, the City would need to improve, on average, a bit over one mile per year. Chart 1 clearly shows, however, that the streets weren't built at one mile per year. Using the rating data helps make decisions about which streets should be improved before age 20 and which ones can be delayed beyond year 20 to make improvement project sizes more manageable for financing and construction. The 2019 project includes 2.52 miles of rehabilitation.

Appendix A provides a roll-up of all street segments and pavement ratings by age for the three ratings available this far. Streets selected for the 2019 improvements are highlighted.

The size and frequency of future rehabilitation projects is beyond the scope of this report; however, it is recommended staff be directed to analyze and make recommendations annually based on updated ratings and the community's experience from implementing this project. Fewer larger projects may prove to be viable, or more frequent smaller projects may be indicated if the community feels the 2019 rehab project experience was too onerous.

The City's Public Works Department staff has reported there are other street features showing signs of deterioration that should be considered to benefit from being bid as part of a larger project. These include faded or non-standard street name signs, corroding bolts on the buried portion of fire hydrants and water main valves, curbs with cracks or breaks that unduly affect function or appearance, and voids around catch basins due to failed sealing of pipes where they connect to the structures.

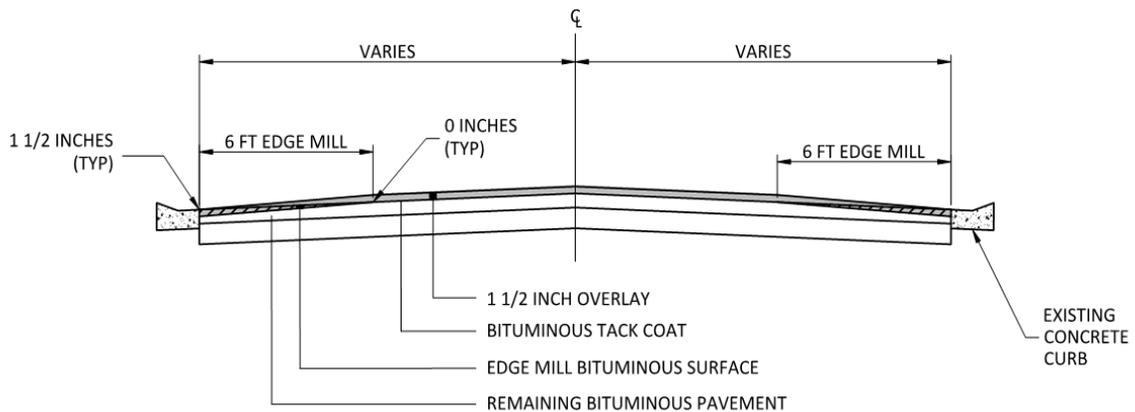
One street does show signs of a soft subgrade. Experience on Jean Way west of Francis Lane and the distresses observed lead staff to believe the sand subgrade is inadequately drained.

For cracked curb and catch basin leaks we assume 0.5 percent of curb in the project will require removal and replacement and that 1 in 10 catch basins will require excavation and repair of joint seals and re-setting of castings prior to pavement rehab. Bid items will be provided in the contract, but actual quantities for payment would be based on walking the project with the contractor and Public Works Superintendent and choosing where repairs will be made. Payment would be made only for actual work performed.

PROPOSED IMPROVEMENTS

No streets in the 2019 project area have previously been rehabilitated. All are still in their original pavement section configuration. None except Jean Way exhibit distresses consistent with subgrade problems. The primary distresses are cracks related to pavement age and traffic. Accordingly, the streets are good candidates for extension of pavement life by strengthening the existing pavement structure. Minimal removal of damaged structure is indicated.

A separate report is attached in Appendix B that provides background on pavement maintenance and rehabilitation strategies in Elko New Market. Based on this report and the existing conditions encountered, it is recommended the city place a thin (1 ½ inches or so) overlay to reinforce the existing pavement on the indicated streets. Since the subject roadways can handle this additional thickness with no undue buildup to affect traffic, drainage, or appearance, and good adhesion would be anticipated to the existing surface, full-width milling and removal of any existing asphalt is not recommended. Edge milling to allow a smooth tie-in to existing curbs would be provided. Manholes and gate valve boxes in the pavement area will need to be raised to meet the new road surface.



TYPICAL SECTION

We recommend drain tile be installed at key locations in the Jean Way sand subgrade. The resulting pavement cuts should be patched to match the original pavement section prior to installation of the overlay. Park Street's subgrade drainage was improved this way several years ago with good results after exhibiting similar distresses. Park Street was never overlaid after patching, but is included with this project.

Some agencies apply pavement fabric to the existing pavement prior to placing overlays. The fabric is for creating a moisture barrier that minimizes water coming through the pavement and getting into the base. On streets with poorly drained base layers, this strategy can slow the rate of reflective cracking and extend the life of the overlay.

We evaluated using this strategy on these pavements; however, most streets being rehabilitated have a two-foot sand layer beneath the aggregate base. The base layers of these streets are well drained. Main Street in Elko may not have this layer; however, it is a former Scott County roadway and was constructed for higher volumes of heavy traffic. None of the streets except Jean Way exhibit distresses consistent with wet subgrade, and we're proposing to correct that. It is our

opinion the pavement fabric costs would exceed the benefits for the streets included in this project.

The estimated project cost to replace bonnet bolts on all valves and hydrants in the project is approximately \$100,000. Replacement requires excavation down to the top of the pipe, shutting down the valve or hydrant, removing the corroded bolts and placing new, corrosion-resistant bolts, backfilling to correct densities, and replacing curb, turf, base and the base layers of asphalt prior to overlay. The advantage to doing this work with the overlay is that that patches will not be visible. We do not; however, recommend including this work.

The historical failure rate of these bolts in Elko New Market was about 0.13% per year over the past 20 years on over 20 miles of system. Applying this rate to the 2.52 miles of system and assuming repair costs are tripled when isolated repairs are made rather than as part of a larger project, the expected total cost of all failures based on probabilities over the 15-year life of the overlay is only \$700. The historical failure rate would have to increase by a factor of 143 to justify switching out all bolts in 2019. The Council is advised this analysis is based on assumptions, so the recommendation does pose a risk of higher costs per location and pavement patching if failures do occur. Based on the estimates, it appears to be a risk worth accepting. Costs for bolt replacement are not included in project estimates.

The description of pavement work above only includes the travel and parallel parking lanes of residential streets. Main Street in the downtown area of former Elko has perpendicular parking available on each side. These parking areas are paved with asphalt. The origin of the asphalt is unknown. Main Street was formerly a county highway. It was turned back to the City in association after the improvement of France Avenue in 2006 using county highway funds. The Main Street portion was not improved as the condition was adequate at that time and there was uncertainty about whether it should be redesigned to meet typical city standards (at significant expense) or remain as is.

This uncertainty remains; however, the road is deteriorating and an overlay is recommended on the travel lanes to extend remaining service life. The parking areas are too deteriorated to overlay or even reclaim. This asphalt will need to be removed and the subgrade prepared for new aggregate base and asphalt. The cost for the parking is included in the project estimate. It is proposed to either assess the parking reconstruction to benefitting commercial properties with their consent, or to omit the parking from the project in favor of parallel parking only. This will be discussed further under the financing section of this report.

Finally, Federal law requires that handicapped accessible ramps be installed when pavement improvements, including overlays, are being conducted on adjacent roadways. All sidewalks intersecting the project have ramps that complied with requirements when installed. It is not recommended these ramps be replaced with this project, so no pedestrian ramp costs are included in the estimate.

Replacement of street name signs in the project area is recommended and costs are included in the estimate. Replacement of deficient curbs and replacement of leaking catch basins is also recommended with this project prior to the overlay work.

PUBLIC ENGAGEMENT

An edge mill and overlay project is not unduly intrusive on the daily lives of affected residents; however, those owners of parcels adjacent to the work and that front on the projects are proposed to be assessed for a portion of the cost. Accordingly, staff has thus far posted concept-level information about the project on social media and provided an informational presentation at the October 8th Streets Expo hosted by the City and open to the public.

Staff's takeaway from these interactions include:

- A need for the City to better explain the reason for the overlay; that it is not to “fix” pavements, but to extend the pavement lifespan before extensive fixing is required. Interest in the method of selection of streets for overlay was an apparent result of this lack of information.
- A need to explain why the City has chosen the crack seal and overlay approach to maintenance in lieu of chip sealing (another common maintenance approach).
- Attendance by the public was meager given the scale of the proposed project and efforts to attract members of the public. Generic interest appears to be limited. Staff anticipates mailings to directly affected owners will generate more interest in the project.

State Statutes require two public hearings be held before assessments can be levied for the project. Each hearing requires individual mailed notice to affected parcels as well as published notice. The Council will be asked to schedule the first hearing at the time it accepts this report.

PERMITS/RIGHT-OF-WAY/COORDINATION

The proposed improvements will largely be limited to existing pavement areas. Some storm sewer repairs may involve disturbance of the boulevards behind curbs. The disturbance will be containing to public rights of way.

Owners of private utilities will be notified of the project so they may coordinate any upcoming utility improvement projects with the City project.

ESTIMATED PROJECT COSTS

Estimated construction costs for the street improvements are presented on the following page. These cost estimates are based upon public construction cost information. Since the consultant has no control over the cost of labor, materials, competitive bidding process, weather conditions and other factors affecting the cost of construction, all cost estimates are opinions for general information of the client and no warranty of guarantee as to the accuracy of construction cost estimates is made. It is recommended that costs for project financing should be based upon actual, competitive bid prices with reasonable contingencies.

Project Cost Estimate
 2019 Pavement Rehabilitation Feasibility Study
 Elko New Market, Minnesota

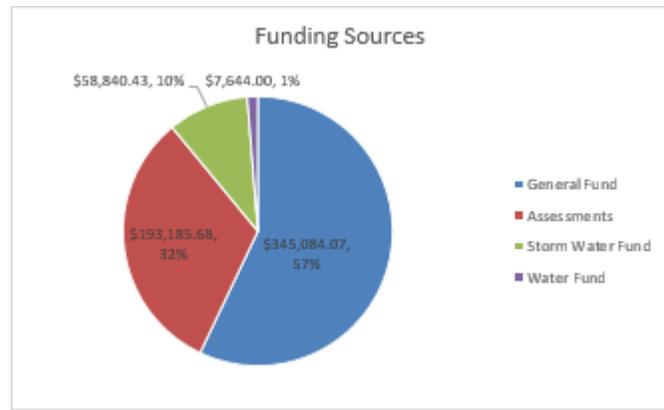


Date: 11/26/2018

Item	Estimated Quantity	Local/Minor Quantity	Major Quantity	Perp. Parking	Storm Fund Quantity	Water Fund Quantity	Unit	Unit Price	Local/Minor Cost	Major Cost	Parking Cost	Storm Fund Cost	Water Fund Cost	Total Amount
MOBILIZATION	LUMP SUM	-	-	-	-	-	LUMP SUM	LUMP SUM	\$25,577.12	\$8,194.37	\$2,845.50	\$4,002.75	\$520.00	\$41,139.74
TRAFFIC CONTROL	LUMP SUM	-	-	-	-	-	LUMP SUM	LUMP SUM	\$5,115.42	\$1,638.87	\$569.10	\$800.55	\$104.00	\$8,227.95
MILL BITUMINOUS PAVEMENT	17777	12,651.00	5,126.00				SQYD	\$1.20	\$15,181.20	\$6,151.20				\$21,332.40
REMOVE BITUMINOUS PAVEMENT	1683			1,400.00	283.00		SQYD	\$2.50			\$3,500.00	\$707.50		\$4,207.50
SUBGRADE PREPARATION	1400			1,400.00			SQYD	\$2.00			\$2,800.00			\$2,800.00
BITUMINOUS PAVEMENT	4061	2,904.00	840.00	277.00	40.00		TON	\$65.00	\$188,760.00	\$54,600.00	\$18,005.00	\$2,600.00		\$263,965.00
ADJUST MANHOLE CASTINGS	55	53.00	2.00				EACH	\$600.00	\$31,800.00	\$1,200.00				\$33,000.00
ADJUST VALVE BOX	52	51.00	1.00				EACH	\$100.00	\$5,100.00	\$100.00				\$5,200.00
CATCH BASIN REPAIR	6				6.00		EACH	\$1,000.00				\$6,000.00		\$6,000.00
HYDRANT BOLT REPLACEMENT	2					2.00	EACH	\$1,000.00					\$2,000.00	\$2,000.00
VALVE BOLT REPLACEMENT AND BOX	2					2.00	EACH	\$1,000.00					\$2,000.00	\$2,000.00
REMOVE & REPLACE CONCRETE CURB	258	98.00	-		120.00	40.00	LINFT	\$30.00	\$2,940.00			\$3,600.00	\$1,200.00	\$7,740.00
4" PERFORATED DRAINTILE	1695				1,695.00		LINFT	\$16.00				\$27,120.00		\$27,120.00
4" YELLOW STRIPING	3605		3,605.00				LINFT	\$2.50		\$9,012.50				\$9,012.50
4" WHITE STRIPING	4940		3,280.00	1,660.00			LINFT	\$2.50		\$8,200.00	\$4,150.00			\$12,350.00
PAVEMENT MARKINGS - WHITE	570	540.00	30.00				SQFT	\$6.00	\$3,240.00	\$180.00				\$3,420.00
REMOVE & REPLACE STREET SIGN	45	35.00	10.00				EACH	\$250.00	\$8,750.00	\$2,500.00				\$11,250.00
							Subtotals:		\$286,463.74	\$91,776.94	\$31,869.60	\$44,830.80	\$5,824.00	\$460,765.09
							Contingency		\$14,323.19	\$4,588.85	\$1,593.48	\$2,241.54	\$291.20	\$23,038.25
							Est. Construction Total		\$300,786.93	\$96,365.79	\$33,463.08	\$47,072.34	\$6,115.20	\$483,803.34
							Est. Overhead		\$75,196.73	\$24,091.45	\$8,365.77	\$11,768.09	\$1,528.80	\$120,950.84
							Total Est. Project Cost		\$375,983.66	\$120,457.24	\$41,828.85	\$58,840.43	\$7,644.00	\$604,754.18
							Assessable Amt		\$150,393.47		\$9,321.86			
							Units		134.80		39.00			
							Assmt Rate		\$1,115.68		\$239.02			
												Gen Fund		\$538,269.75
							Assessed Amount		\$183,863.82		\$9,321.86	Net Gen Fund		\$345,084.07

PROJECT FUNDING

The 2019 Pavement Rehabilitation Project is proposed to be funded with a mix of utility funds, general obligation bonds, and special assessments to benefitting properties. Based on the preliminary project estimates for both costs and special assessment for funding, a summary of project funding sources is as follows:



SPECIAL ASSESSMENTS

Preliminary estimated special assessments have been calculated per the City's Assessment Policy and tabulated in Appendix C. The proposed unit assessment per Residential Equivalent Density (RED) is \$1,115.68. This rate only applies to the improvement of travel lanes.

The number of REDs for commercial properties on Main Street in former Elko is based on the Metropolitan Council Environmental Services (MCES) Sewer Availability Charge (SAC) Manual. SAC is a measure of wastewater volumes based on the characteristics of the use, and thus is an indicator of traffic needed to generate activity on a site. It was felt SAC better represented traffic generation than front footage because the ratio of trips generated per square foot is believed to be substantially higher for these uses on a daily basis than trips generated from a residential unit. This application is consistent with the City's Assessment Policy.

For the golf course, clubhouse, and pool, SAC Manual REDs are not supported by actual historical water/wastewater use, which is very low relative to traffic generation as indicated by parking supply, so all front footage owned by these uses adjacent to the improvements was used to determine a fair number of REDs.

For the perpendicular parking the total number of stalls that could be provided based on pavement area was discounted for driveways and residential uses, leaving an estimated 40 stalls for commercial use. Examination of available offstreet parking for the two bars indicated a shortfall of about 39 stalls. 40% of the cost of 39 stalls was apportioned to the two bars based on their respective shortfalls. It is proposed to seek a voluntary agreement from the bars for the parking costs if the perpendicular stalls are included in the project. Should the bars feel the parking is not necessary, it is proposed the replacement parking only include 8-foot parallel parking lanes on each side of the street in the downtown Elko block. No curb and gutter or walks are proposed. Driveways and parking stalls would be marked with traffic paint. The cost estimates and draft assessment roll include costs for perpendicular parking.

PROJECT SCHEDULE

If this report is accepted and the Council authorizes the project to proceed at each milestone, the

following schedule is proposed for implementation of the project.

Present Feasibility Report to Council, Order Public Hearing.....	December 6, 2018
Conduct Public Improvement Hearing, Council Order Final Plans.....	January 10, 2019
Present Final Plans to Council, Council Orders Bids.....	February 14, 2019
Open Bids.....	March 4, 2019
Present Bids to Council, Order Assessment Hearing.....	March 14, 2019
Conduct Assessment Hearing, Council Awards Construction Contract.....	April 11, 2019
Construction.....	June, 2019 – October, 2019

FEASIBILITY & RECOMMENDATION

This report identifies the recommended improvements for the 2019 Pavement Rehabilitation Project. It also provides an estimated cost for the proposed work in 2019. The improvements are necessary based on the City's approach to minimizing long-term costs by extending remaining service life of pavements through timely maintenance.

From an engineering standpoint, this project, as proposed, is feasible, cost effective and necessary and it can best be accomplished by letting competitive bids for the work for 2019 construction. It is recommended that the work be done under one contract to complete the work in an orderly and efficient manner. The City Council with support from financial staff and consultants and based on this report and testimony from any Improvement Hearing, must determine the economic feasibility of the proposed improvements and funding solutions.

End of Preliminary Engineering Report

Appendix A: Roll Up of Street Segments and Ratings

Street Segment	Length	Width	2009 Rating	2016 Rating	2018			2009 Age	2016 Age	2018		2019 Mileage
					Rating	Rating	Rating			Pavement Age	Functional Class	
Francis Lane 2	109	31.34	100	97.5	81	52.5	0	9	16	18	local	0.021
Park St 2	297	29.34	100	92	69.5	55.5	0	11	18	20	local	0.056
Jean Way 1	847	31.34	100	95	82	57.5	0	9	16	18	local	0.160
Dorothy Lane 1	956	31.34	100	90	85.5	57.5	0	9	16	18	local	0.181
Tammy Dr 1	150	31.34	100	95	87	58	0	9	16	18	local	0.028
Theresa Marie 2	104	31.34	100	95	86	58.5	0	9	16	18	local	0.020
Ptarmigan Dr 1	199	24	100	91	79	60	0	4	11	13	local	0.038
Francis Ct 1	240	31.34	100	92.5	87	68.5	0	9	16	18	local	0.045
Oakridge Way 1	478	28	100	97	91.5	69.5	0	9	16	18	local	
Glenmoor Court 1	181	23	100	100	87.5	71	0	8	15	17	local	
Overlook St 2	116	31.66	100	100	97	71.5	0	7	14	16	local	
Oak Street 1	700	29.34	100	99	85.5	72.5	0	5	12	14	local	
Todd Ct 1	329	31.34	100	98	91	72.5	0	8	15	17	local	
Brady 1	1403	31.34	100	98	89.5	73.5	0	6	13	15	local	
Maverick Ave 1	858	31.34	100	98	92	73.5	0	8	15	17	local	
Oakridge Place 1	488	28	100	100	97	73.5	0	7	14	16	local	
Overlook Court 2	273	31.666	100	100	100	73.5	0	6	13	15	local	
Stirling Court 1	159	23	100	86.5	95	74.5	0	8	15	17	local	
Church Street 2	236	33	100	93.5	92	75	0	11	18	20	local	
Pond Court 1	426	29.34	100	99	88	76	0	5	12	14	local	
Brady 2	126	31.34	100	98	95	76	0	7	14	16	local	
Todd Street 2	1052	31.34	100	99	91	77.5	0	8	15	17	local	
Theresa Marie 1	1457	31.34	100	99	93	77.5	0	7	14	16	local	
Wagner 1	147	29.34	100	96	84.5	78.5	0	11	18	20	local	
Fairway Hills Drive 1	800	29.34	100	99	89	78.5	0	5	12	14	local	
Longridge Drive 2	204	27	100	95.5	95.5	78.5	0	8	15	17	local	
Church Street 1	309	30	100	100	74.5	80	0	1	8	10	local	
Park Ct 1	314	31.66	100	100	100	80	0		3	5	local	
Richard Dr 1	786	27	100	95.5	97.5	80.5	0	6	13	15	local	
Rowena Ct N 1	260	31.34	100	97	100	80.5	0	6	13	15	local	
Wagner 2	1303	29.34	100	100	97.5	81	0	10	17	19	local	
Meadowridge Court 1	642	28	100	100	100	81	0	6	13	15	local	
Meadow Road 1	152	28	100	100	92	81	0	10	17	19	local	
Rowena Curve 3	499	31.34	100	92.5	100	81.5	0	6	13	15	local	
Brady 3	1020	31.34	100	100	95.5	81.5	0	7	14	16	local	
Prairie St. 1	735	29.34	100	100	91	81.5	0	5	12	14	local	

Street Segment	Length	Width	2009			2016			2018			2019 Mileage
			Rating	2009 Age	2016 Age							
Oakridge Way 4	539	28	100	98	93.5	82	0	11	18	20	local	
Park St 1	636	29.34	100	99	98	82	0	10	17	19	local	
Overlook St 1	563	31.66	100	100	100	82.5	0	6	13	15	local	
Rowena Ct S 1	141	31.34	100	97.5	95	83	0	6	13	15	local	
Seuer Ct 1	263	31.66	100	100	94	83	0	7	14	16	local	
Wild Wings Pass 2	156	31.34	100	100	92	83	0	9	16	18	local	
Evergreen Ct. 1	403	29.34	100	95.5	89.5	83.5	0	5	12	14	local	
Holly Court 1	197	31.34	100	95	95.5	83.5	0	9	16	18	local	
Meadowridge Dr 3	928	28	100	100	93	84	0	6	13	15	local	
Anna St 1	493	31.66	100	100	94	84	0	6	13	15	local	
Oakhill Ct. 1	318	28	100	95	78	84.5	0	11	18	20	local	
Whispering Hills Ln 1	1246	29.34	100	100	91	84.5	0	5	12	14	local	
Paul St 1	744	22	100	95	86	84.5	0	29	36	38	local	
Riley Road 1	492	31.34	100	100	90	84.5	0	6	13	15	local	
West Louis St 1	500	27	100	98	90.5	85	0	22	29	31	local	
Francis Lane 1	732	31.34	100	99	90.5	85	0	6	13	15	local	
St Mary 2	622	26	100	90	88.5	85.5	0	22	29	31	local	
Maverick Ave 2	188	31.34	100	100	93	85.5	0	7	14	16	local	
Thomas Ave 1	1843	28	100	94.5	98	85.5	0	13	20	22	local	
Tammy Dr 2	186	31.34	100	94.5	92	86	0	7	14	16	local	
Blackpool Court West	186	23.34	100	100	98	86	0	6	13	15	local	
Weston Court 1	524	23	100	91.5	82	86	0	8	15	17	local	
Overlook Court 1	119	31.666	100	100	91	86	0	7	14	16	local	
Judy Court 1	173	31.34	100	95.5	94	86	0	6	13	15	local	
Woodcrest Ln 2	348	28	100	99	73.5	86.5	0	11	18	20	local	
Francis Dr 1	117	31.66	100	97	95	87	0	7	14	16	local	
J Roberts Way 1	213	31.34	100	100	98	88	0	7	14	16	local	
Hickory Ridge Drive 1	1326	27	100	100	94.5	88	0	3	10	12	local	
Blackpool Court East	568	23.34	100	100	99	88	0	6	13	15	local	
Meadowridge Dr 4	210	28	100	100	100	88	0	7	14	16	local	
Shelly Lane 1	482	31.34	100	98	92	88	0	6	13	15	local	
Woodcrest Ln 1	686	26	100	94.5	90	88.5	0	4	11	13	local	
Ponds Way 2	514	28	100	100	100	89	0	6	13	15	local	
St Mary 1	526	24	100	100	84.5	89	0	11	18	20	local	
St Joseph 2	284	26	100	84.5	90	89.5	0	22	29	31	local	
St Joseph 1	325	29.67	100	100	98	89.5	0	22	29	31	local	

Street Segment	Length	Width	2009			2016			2018			2019 Mileage
			Rating	2009 Age	2016 Age							
Wild Wings Pass 1	1334	31.34	100	100	98	89.5	0	9	16	18	local	
Wexford Lane	922	23.34	100	100	98	89.5	0	6	13	15	local	
Ptarmigan Court 1	86	27.34	100	99	94	90	0	3	10	12	local	
Jean Way 2	1116	31.34	100	100	93	90	0	9	16	18	local	
Ponds Way 1	477	28	100	98	99	90	0	9	16	18	local	
Cambridge Lane 1	492	23	100	98	100	90	0	8	15	17	local	
Williams St 2	295	30	100	98	83.5	90	0	22	29	31	local	
Anna St 3	124	31.66	100	100	92	90	0	7	14	16	local	
Todd Street 1	670	28	100	100	93	90	0	11	18	20	local	
Anna Court 1	430	31.66	100	100	93	90	0	6	13	15	local	
Oakridge Way 2	665	28	100	100	94	91	0	7	14	16	local	
Francis Dr 2	544	31.66	100	100	98	91	0	6	13	15	local	
Oxford Lane 1	2634	27.34	100	100	98	91	0	3	10	12	local	
Windrose Court 1	373	28	100	100	95	91	0	11	18	20	local	
Meadowridge Dr 2	1285	28	100	100	99	91	0	4	11	13	local	
Mac 1	874	29.34	100	100	100	91	0	10	17	19	local	
Longridge Drive 3	133	27	100	95	100	91.5	0	3	10	12	local	
Wild St 2	272	31.66	100	100	98	92	0	7	14	16	local	
Pondview Circle 1	135	31.34	100	100	95	92	0	3	10	12	local	
Old Town Road 1	827	27.66	100	100	99	92	0	3	10	12	local	
Williams St 1	304	25	100	99	88.5	93	0	29	36	38	local	
Carter St 1	682	31.34	100	100	90.5	93	0	6	13	15	local	
Anna St 2	162	31.66	100	100	95	93	0		3	5	local	
Seuer 1	2174	31.66	100	100	100	93	0	7	14	16	local	
Rowena Curve 1	792	31.34	100	100	100	93	0	3	10	12	local	
Longridge Drive 1	696	27	100	100	92	94	0	3	10	12	local	
Wild St 1	383	31.66	100	99	100	94	0	6	13	15	local	
Cedric Lane 1	543	31.34	100	99	100	94	0	5	12	14	local	
Drew Ave 1	340	25	100	100	100	95	0	3	10	12	local	
Shelly Court 1	270	31.34	100	100	94	95	0	6	13	15	local	
Park St 3	678	29.34	100	100	100	95	0	6	13	15	local	
Meadowridge Dr 1	390	28	100	100	100	96	0		1	3	local	
Ponds Circle 1	156	28	100	100	100	96	0		1	3	local	
Overlook Dr 1	1265	31.66	100	100	98	97	0		3	5	local	
Ponds Way 3	2013	28	100	100	100	97	0		1	3	local	
Rowena Curve 2	1302	31.34	100	100	100	97.5	0	3	10	12	local	

Street Segment	Length	Width	2009 Rating	2016 Rating	2018 Rating	2018			2019 Mileage			
						2009 Age	2016 Age	Pavement Age		Functional Class		
Dogwood Dr 2	827	28	100	100	97	98	0	1	3	local		
Saxon Drive 1	788	31.34	100	100	100	98	0	5	12	14	local	
265th St. E 1	1223	25	100	100	100	98	0	3	10	12	local	
Harvest Drive 1	250	26	100	81.5	45	99	0	29	36	38	Local	
Oakridge Way 3	446	28	100	100	81.5	99	0	10	17	19	local	
Dogwood Dr 1	173	28	100	100	96	99	0	4	11	13	local	
Marketplace 1	1400	43	100	100	100	100	0				local	
Dogwood Ct 1	333	28	100	100	100	100	0		1	3	local	
Main St 1	1077	24	100	96	72	50	0	22	29	31	Major Collector	0.204
Xerxes 1	2400	24	100	100	76.5	73.5	0	11	18	20	Major Collector	0.455
France 1	367	22	100	94	89	73.5	0	22	29	31	Major collector	0.070
France 2	2691	33	100	100	94	78.5	0	2	9	11	Major Collector	
Dakota 1	706	35.34	100	97	89.5	80.5	0	8	15	17	Major Collector	
255th 1	2650	35.66	100	100	94.5	81	0	3	10	12	Major Collector	
275th 1	1024	26	100	100	95	83.5	0	3	10	12	Major Collector	
Beard Ave 1	1754	26	100	98	96	83.5	0	3	10	12	Major Collector	
Dakota 2	1092	29.34	100	96.5	90	84	0	11	18	20	Major Collector	
Webster st 1	1760	29.67	100	100	100	86	0	6	13	15	Major Collector	
James Pkwy 4	2788	35.34	100	100	98	87	0	3	10	12	Major Collector	
Xerxes 3	1550	26	100	100	95	88	0	6	13	15	Major Collector	
Nevada Ave 1	1965	35.34	100	100	99	88	0	3	10	12	Major Collector	
Xerxes 2	3095	26	100	100	97	93	0	6	13	15	Major Collector	
Webster St 2	996	29.67	100	100	100	94	0	4	11	13	Major Collector	
Glenborough Drive 2	3194	35	100	98	75	63.5	0	8	15	17	Minor Collector	0.605
Aaron Dr 2	792	35.34	100	98	82.5	68.5	0	6	13	15	Minor Collector	0.150
James Pkwy 3	636	35.34	100	100	86	73.5	0	6	13	15	Minor Collector	0.120
Knights Road 1	1093	31.34	100	99	83	75.5	0	5	12	14	Minor Collector	0.207
Aaron Dr 1	868	35.34	100	96.5	90	75.5	0	9	16	18	Minor Collector	0.164
James Pkwy 2	1338	35.34	100	99	92	81	0	7	14	16	Minor Collector	
Chowen Ave 1	1237	27.34	100	99	94.5	84.5	0	6	13	15	Minor Collector	
James Pkwy 1	647	35.34	100	100	96.5	87	0	8	15	17	Minor Collector	
Windrose Curve 3	2092	36	100	99	93.5	84.5	0	11	18	20	Minor Collector	
Aaron Dr 3	708	35.34	100	97.5	95	88	0	5	12	14	Minor Collector	
Windrose Curve 1	1834	36	100	100	96	86.5	0	9	16	18	Minor Collector	
Aaron Dr 5	1653	35.34	100	100	95	91	0	-4	3	5	Minor Collector	
Glenborough Drive 1	1323	35	100	100	100	91.5	0	6	13	15	Minor Collector	

Street Segment	Length	Width	2009			2016			2018			2019 Mileage
			Rating	2009 Age	2016 Age							
Windrose Curve 2	1230	36	100	100	93	92	0	10	17	19	Minor Collector	
Knights Road 2	458	32.34	100	100	100	93	0	4	11	13	Minor Collector	
Aaron Dr 4	346	35.34	100	100	95	94	0	5	12	14	Minor Collector	
Chowen Ave 2	308	26	100	100	97	95	0	3	10	12	minor collector	
Chowen Ave 3	483	26	100	99	100	97	0	7	14	16	Minor Collector	

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Appendix B: Elko New Market Pavement Maintenance

ELKO NEW MARKET STREET PAVEMENTS

BACKGROUND

The City of Elko New Market is dedicated to the preservation of one of its largest assets in size and monetary value – its street pavements. In this report, preservation means keeping up a street in an acceptable condition for as long as there is a need for that street. It does not mean solely making the pavement last longer, although that is part of it. Preservation includes proper maintenance, timely rehabilitation to delay increases in deterioration rates that happen as conditions decline, and, finally, replacement - which begins the cycle all over again.

This report provides an overview of the City's pavements – how they're built, their typical life, types of distresses seen due to age, traffic, and weather, and the maintenance, rehabilitation, and reconstruction strategies used or planned in Elko New Market. An overview of management systems will also be provided.

A. Pavements and Their Construction

Blacktop, tar, asphalt, bituminous, and even macadam are all terms used by folks to describe the type of roadway pavement used exclusively on Elko New Market's local roads. The Construction Specification Institute's Masterspec calls it "Asphaltic Concrete Pavement" (as opposed to Portland Cement Concrete). The Minnesota Department of Transportation's Standard Specifications (the pavement bible in Minnesota) calls it "Plant Mixed Asphalt Pavement." This memo will use "asphalt pavement" to refer to the mix of hot bituminous material (asphalt), aggregates, and sand used to create a durable, dust free, and smooth-riding surface for roads. Other types of pavements won't be discussed here, but feel free to ask the City Engineer about them if you're curious.

Streets surfaced with asphalt pavements typically consist of layers constructed in the following order (bottom layer to top):

1. A roadbed prepared by removal of weak and/or wet material that is shaped and compacted to the desired cross-section and grade
2. (Sometimes) a subbase consisting of on-site or imported material, usually granular due to its free draining and strong-when-wet properties, shaped and compacted to the desired thickness
3. An aggregate base (commonly called "Class 5") layer of well mixed fine, medium, and large, angular aggregate particles, shaped and compacted as a high-strength, stable base for the asphalt pavement
4. A non-wearing course of asphalt pavement, usually consisting of a lower cost blend of aggregates and/or asphalt cement (AC) to add strength and additional smoothness in preparation for the final layer. This layer is usually at least two inches thick. It is also referred to as the "base course".

5. A sprayed-on layer of tack coat. This layer of asphalt material helps the non-wearing course bind with the final layer so they behave together more like a single layer.
6. The wearing-course layer of asphalt pavement. This is where the higher quality, more finely graded aggregates and often a better performing AC is used. The goal is a high-strength, smooth-riding, nice-looking final layer. The smaller rock and costlier oil allows tighter compaction and reduces brittleness in cold weather and undue softness in hot weather.

Asphalt pavement is considered a flexible pavement. When a load is placed on the surface, the pavement flexes, and the load is transferred and spread to the layers below in proportion to the strength of each layer. The objective is to spread the load so the force on the roadbed, or subgrade, is such that no permanent deformation of the soil occurs. It becomes evident then, that the strength of the subgrade is an essential part of the pavement design. A strong subgrade requires less spreading of the loads – a weaker pavement section is required. Elko New Market generally has weak subgrade soils, meaning a more robust (and expensive) pavement section is required.

B. Pavement Lifespan and Distresses

The enemies of asphalt pavements include water, freezing and thawing, excessive loads, repeated loads, and time. These can damage pavements independently, but when working together can be quickly destructive to a pavement. It is important they be managed well.

We typically expect a properly designed, constructed and maintained/rehabilitated pavement to “last” 35 to 40 years before it must be re-built from the subgrade up. Pavements will almost always need some type of more intensive maintenance or rehabilitation to reach this life. More information on this is provided in the next section.

The distresses that can occur in an asphalt pavement are legion. There are also multiple causes. This primer will stick to common distresses in Elko New Market.

The most common and non-preventable distress is shrinkage cracks. Asphalt pavement changes dimension with temperature. You might imagine this is a big issue in Minnesota. Additives in the AC help minimize this, however, asphalt pavements will all develop transverse (perpendicular to centerline) cracks across the roadway within a few years of construction. These cracks will typically be spaced uniformly every 30 feet or so.

There are other types of cracks that develop just from use. If you’ve ever broken a wire by bending it back and forth you can imagine how pavement cracks develop from the repeated flexing from loads. The concept is the same. Cracks from all reasons continue to develop in smaller and smaller blocks as the pavement ages. The important thing about cracks is that they create a conduit through the asphaltic pavement courses that allow runoff to weaken the aggregate base layer. They can also lead to complaints about ride quality if they become too deep or wide or there is an offset in the pavement. Cracks also lead to perceptions that the road is old or worn out.

As crack spacing gets smaller and smaller, the pavement will develop areas of “alligator cracking” (think of the pattern on alligator hide boots). The density of the cracks allows more water to weaken the base, and the loss of structural bridging means loads are more concentrated on the base layer. Alligator

cracking typically leads soon to potholes. This is where portions of the pavement are displaced, traffic and water pounds out weak base material, and a hole in the road deepens and widens and makes you spill your coffee if you hit it.

Pavements discolor over time from a deep black to a dull gray. This doesn't affect strength, it is primarily cosmetic. Pavements can also become brittle at the surface and some fine aggregates can be dislodged. The surface gets polished from high traffic volumes or heavy loads and skid resistance declines. This is a valid reason for some types of maintenance strategies such as a chip seal, but is not typically an issue on City streets due to low volumes and speeds.

C. Pavement Preservation

An important issue for the Council to consider is, "how bad is bad?" Or, "what is an acceptable pavement condition and what isn't?" This can be answered in many ways. The most conservative might be a strategy based on the volume of complaints being received, or an approach that only seeks to prevent or minimize vehicle damage. These approaches would probably mean some pretty tough-looking roads are kept in service. It might also mean a bigger street crew is needed. At the other extreme, a community could desire that its roads be constantly maintained in a smooth, dark, like-new condition. This would have notable budget impacts. There is no best answer. The selected threshold is a value judgment that will vary from community to community.

Elko New Market is pursuing a balance between always perfect and waiting for residents to start complaining. The City has not historically been concerned with keeping streets looking "new", but rather on minimizing undue pavement damage from water penetration at cracks and intervening when conditions reach a point where deterioration could accelerate. The selected approach also seeks to minimize long-term costs.

D. Pavement Maintenance Strategies

In this memo maintenance strategies are considered those practices that slow the development of further distresses or mitigate existing distresses. The Elko New Market Public Works Department has focused on annual crack sealing. This technique involves cleaning out cracks to create a reservoir for a high-strength rubberized sealant to be placed in them. The sealing minimizes water intrusion that can weaken the base and promote further cracking in the area of the original crack. It does not "weld" a crack together or prevent other shrinkage or flexural cracks. They will continue to develop over time.

Pothole patching has not yet been a prominent maintenance activity in Elko New Market, but it will increase as the streets age. This practice is an art and science of its own. It can vary from throwing some cold mix in a hole and stomping it into place as a quick fix, to excavating, shaping and carefully rebuilding pavement layers in a discrete area, to using infrared equipment to heat asphalt and allow it to be re-spread and compacted over a pothole-prone spot. There are lots of novel approaches, and you can make a patch look very nice – for a little while. It is our opinion that the onset of potholes is an indication that a request from the public for rehabilitation or reconstruction is not far away.

Snow plowing, catch basin maintenance, load restrictions, and street sweeping are also maintenance practices that help delay deterioration of the pavement. The first two help remove water from the pavement. Load restrictions keep heavy loads off pavements in the spring when they are at their weakest due to frost melt and water intrusion. Street sweeping removes incompressible materials that

can keep cracks open and make them harder to seal. Loose sand and gravel on the surface also poses a hazard and/or nuisance for street users.

E. Pavement Rehabilitation Techniques

Rehabilitation techniques are those that extend the usefulness of a deteriorated pavement and delay further deterioration. Rehabilitation is typically a more capital-intensive approach. In Elko New Market, we anticipate the primary rehabilitation strategy will be thin overlays. This is where the pavement is cleaned, spots or potholes repaired as needed, pavements near curbs or structures are milled down to prevent undesirable grade differentials, a tack coat is sprayed on, and an inch or two of asphalt wearing course pavement is paved onto the road. The road looks new and will ride better for a time. Many of the smaller and newer cracks will be bridged. Shrinkage cracks or other active cracks will reflect through fairly soon; however, the onset of potholes will be significantly delayed. The cost of the overlay is typically justified by the delay in reconstruction expenditures.

In Elko New Market a rehabilitation is planned for each street segment based on a measured decline in condition. This point is expected between a pavement age of 15 to 25 years. The rehabilitation is for improving the ride and restoring some strength to prolong the pavement's usefulness. Thin overlays been found to extend pavement life at a relatively low cost compared to reconstructing the street. Most agencies hope for another 10 to 15 years of acceptable service when a thin overlay is applied at the proper time.

Another common approach, although usually considered maintenance rather than rehabilitation, is to periodically apply a "chip seal" to existing pavements. A chip seal involves spraying an asphalt emulsion on the surface and spreading fine, crushed rock over it. When the water evaporates from the emulsion, the rocks stick to the oil left behind creating a very thin new wearing surface. During a recent economic analysis to compare chip sealing streets every 5 years versus placing a thin overlay at year 20, it was found that while any individual chip seal application is less costly than the overlay, over the long term the overlay equivalent cost is over 30 percent less than the chip seal approach. While some chip sealing was done by the developer after pavements were initially constructed in the Windrose subdivision, the City has not continued the practice. Instead, the City chose the overlay approach shortly after the cities merged in 2007. Overlay remains the favored option.

F. Pavement Reconstruction Methods

Reconstruction is just what it sounds like – take apart the street and rebuild it. Historically, that meant going down to the subgrade by removing pavement layers and starting over. This has advantages, especially if there are utilities below the street that also require attention, or the alignment, grade, and/or cross section of the street will be changing. As you might imagine, switching out all these layers is expensive. So much so that it is often advised that cities live with troublesome utilities, if possible, until the street needs reconstruction. On a full utility and street reconstruction project, the street alone can reach or exceed half the total project cost.

These days, technologies have evolved that provide more options for utility improvements and street reconstruction. Utility improvements won't be discussed here. Again, ask the City Engineer if you're curious. The use of Cold In-Place Recycling of pavements has become more common. This technique involves grinding up and mixing together the existing deteriorated asphalt pavement and underlying

base with a large machine called a “reclaimer”. The new product is then shaped and compacted to form a thicker, rejuvenated base for new pavement layers. Variations on the theme might include salvaging and recycling some of the asphalt pavement or blading the ground-up material aside to allow utility work to be done before re-placing and compacting it. This technique avoids the cost of picking up the old material and trucking it out and new material in, plus saves the cost of the new base materials. It also saves time. We expect that recycling will be a commonly used technique in Elko New Market when rehabbed pavements finally need to be reconstructed.

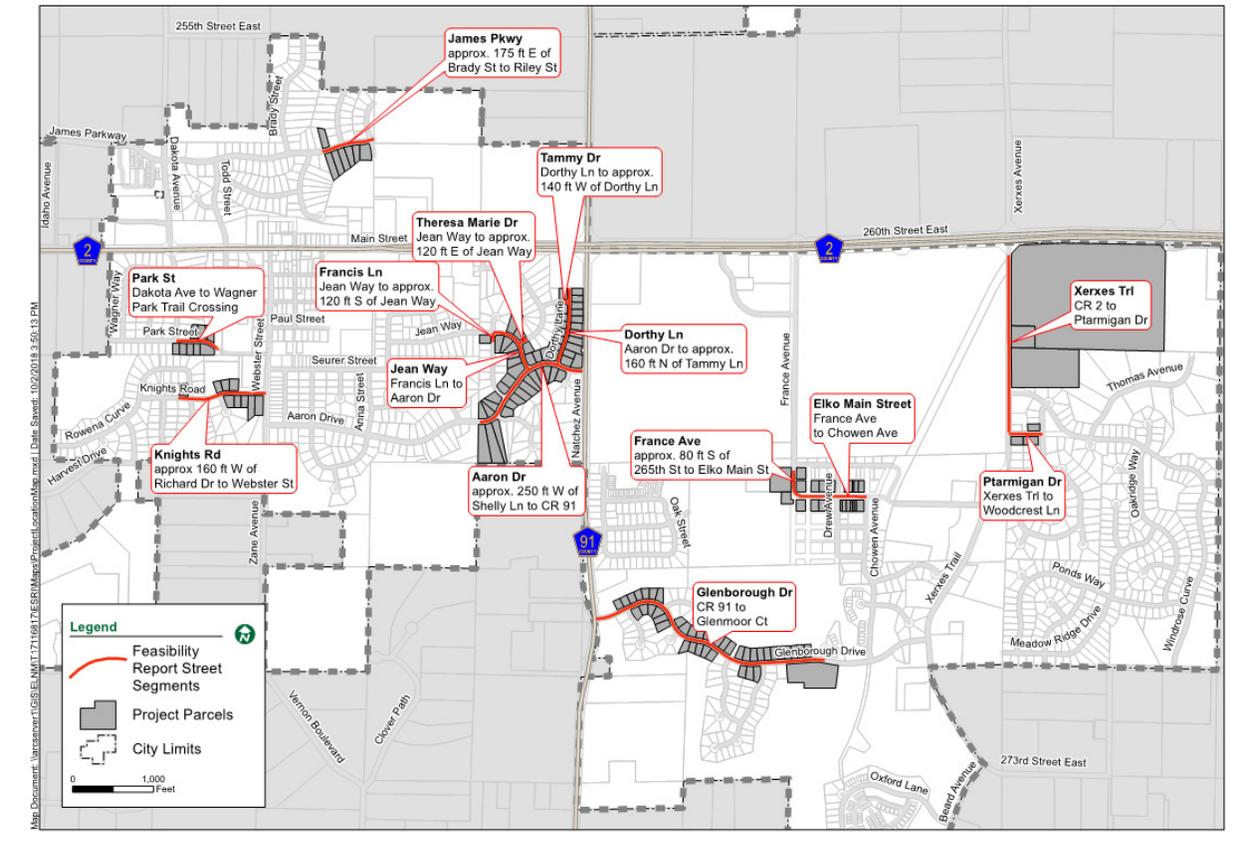
G. Pavement Management Systems

How do we keep track of where streets are at in their maintenance, rehab, and reconstruction cycle? By use of some sort of Pavement Management System. These can be as simple as a map that gets marked up every year to as elaborate as a customized software program that tracks every inspection, distress and dollar spent. They all share key features, or should, which are:

- Breaking the street system up into manageable segments of common location, age, section, etc.
- Some type of objective way of inventorying and tracking the existing pavement distresses
- Using the distresses to establish a pavement rating
- Matching maintenance, rehab, or recon strategies to the distresses
- Assigning costs to the various street segments based on the selected strategies
- Using pavement ratings and other criteria to prioritize and project a schedule for the work
- Updating the data in the system periodically so funding needs can be forecast

Elko New Market has been using a spreadsheet to track pavement rating data gathered by an engineer that examined each road segment. Automated systems that test road strength and measure other distresses are available but have not been deemed cost effective for Elko New Market roads at this point.

Most Elko New Market pavements were constructed in roughly the same nine-year period and only crack filling has been indicated thus far.



The streets in the 2019 project were selected based on functional class and condition. Local road segments selected all had a Pavement Condition Index (PCI) rating of 69 or worse. The PCI is a 0 to 100 scale, with 100 being perfect condition. Most local streets included will be 19 years or older in 2019, although one will be only 14 years. Its condition; however, warranted inclusion. Local roads are roads that have little or no “through” traffic – most traffic is from residents accessing their homes. The thin overlay approach to extending remaining service life seeks to improve the pavement when or before its condition deteriorates by about 40 percent. This is approximated by a PCI of 60.

There are some local roads of unknown age, but likely older than the selected roads, with better-than-expected conditions based on measured distresses. The streets look distressed; however, close examination reveals the distresses are largely surficial due to uneven surface and fine cracks in one or more seal coat layers applied in decades past. Traffic volumes on these streets are very low. The City will want to consider when the time comes to rehabilitate these streets whether additional investment – perhaps incurring additional assessments – should be made to upgrade old water pipes, improve drainage, and add curb and gutter to bring these neighborhoods to current standards.

The project also includes minor and major collector roads. All major and minor collectors chosen had a PCI of 76 or worse and will be 15 years old or older in 2019. A higher threshold was selected for these

roads because they typically experience higher traffic volumes and loadings. It is also anticipated user expectations for condition and free flow of traffic are higher on through roads.

The roads selected result in a ratio of benefitting parcels per mile that is like the overall ratio throughout the city for the mix of local, minor and major collector roads. What this means is that assessments based on an approach where the City pays for major collectors and assesses 40 percent of the cost of local and minor collector overlays would be uniform over all rehabilitation projects if a similar ratio is maintained. The 2019 assessments should be like assessments in later years if the mix of roads selected continues to reflect the overall mix.

Appendix C: Preliminary Assessment Roll

DRAFT Assessment Roll - 2019 Pavement Rehabilitation										
PID Number	Parcel Address	Owner	On major collector ?	Comm. Use?	Computation Units	Assessment Units	Estimated Overlay Assessment	Estimated Parking Assessment	Est. Total Assessment	
230380330	9498 GLENBOROUGH DR	ANDERSON DAN T & LINDA J				1	1 \$ 1,115.68	na	\$ 1,115.68	
230190560	351 JAMES PKWY	ANDERSON JAY A				1	1 \$ 1,115.68	na	\$ 1,115.68	
230190170	336 JAMES PKWY	ANDERSON LARRY D & ANGELA S				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090050	2210 JEAN WAY	ARITA HAWA & KEFA ARITA				1	1 \$ 1,115.68	na	\$ 1,115.68	
230200350	317 KNIGHTS RD	ARVAN DAVID				1	1 \$ 1,115.68	na	\$ 1,115.68	
230070130	120 PARK ST	BACON GERALD L				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380210	9376 GLENBOROUGH DR	BEHNKEN STEVEN P				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090310	1018 TAMMY DR	BEREUTER ERIKA & JANNA E BEREU				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090300	1137 DORTHY LN	BERNARDY ADAM R				1	1 \$ 1,115.68	na	\$ 1,115.68	
230200340	319 KNIGHTS RD	BESEKE STEVEN P & PATRICIA A				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380200	9362 GLENBOROUGH DR	BOSCH GUY F & TRACEE M				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090280	1141 DORTHY LN	BOWMAN JOHNNY D				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380010	9020 GLENBOROUGH DR	BRAUN ALLEN M				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380070	9130 GLENBOROUGH DR	BRITTEN ANDREW L & SHEENA A BR				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380640	9421 GLENBOROUGH DR	BUNDE ALAN W				1	1 \$ 1,115.68	na	\$ 1,115.68	
230290210	9500 MAIN ST	BUSKE BRUCE R & SUPAPORN PHUNG	y			0	1 \$ 1,115.68	na	\$ 1,115.68	
230380260	9428 GLENBOROUGH DR	BYERS RICHARD W & JENNIFER L				1	1 \$ 1,115.68	na	\$ 1,115.68	
230130410	3309 AARON DR	BYRNE RICHARD				1	1 \$ 1,115.68	na	\$ 1,115.68	
230290310	9645 MAIN ST	CHALMERS JERRY W & CHERYL D	y			0	1 \$ 1,115.68	na	\$ 1,115.68	
230290320	Main	CHALMERS JERRY W & CHERYL D	y			0	0 \$ -	na	\$ -	
230070180	119 PARK ST	COLLIGNON AMBER J				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380600	9377 GLENBOROUGH DR	COLLINS CHRISTOPHER M				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380810	9575 GLENBOROUGH DR	COPPERHEAD DEVELOPMENT INC		Y		13.3	13.3 \$ 14,838.52	na	\$ 14,838.52	
230090340	3323 AARON DR	CRAWFORD ROBERT L & ELIZABETH				1	1 \$ 1,115.68	na	\$ 1,115.68	
230300010	10013 PTARMIGAN DR	CUTSFORTH DAVID A & MARLENE				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380020	9046 GLENBOROUGH DR	DAILEY DANIEL E				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380060	9118 GLENBOROUGH DR	DAO KHANG V & CHRISTINE C				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090510	1030 THERESA MARIE DR	DEUTH CRAIG R & BRENDA K				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380270	9438 GLENBOROUGH DR	DOHERTY PATRICK W				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380300	9466 GLENBOROUGH DR	DONNELLY JEFFREY J & MELISSA A				1	1 \$ 1,115.68	na	\$ 1,115.68	
230300060	10051 PTARMIGAN DR	DRAPER STANLEY J & DEBRA J				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090060	2212 JEAN WAY	DRIESCH KIMBERLY A & RICHARD J				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380040	9082 GLENBOROUGH DR	DYBSETTER KEITH D & LORI K ENG				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380280	9444 GLENBOROUGH DR	EASTMAN JANIS L & RONALD J				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380440	9359 GLENBOROUGH DR	ELANDER LEE RUSSELL III				1	1 \$ 1,115.68	na	\$ 1,115.68	
230190610	359 JAMES PKWY	ELKO NEW MARKET CITY OF				1	1 \$ 1,115.68	na	\$ 1,115.68	
239270120	26518 FRANCE AVE	ELKO NEW MARKET CITY OF	y			0	0 \$ -	na	\$ -	
230380320	Glenborough	FAREL ROGER B				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090210	1155 DORTHY LN	FOLEY KATIE				1	1 \$ 1,115.68	na	\$ 1,115.68	
230380290	9450 GLENBOROUGH DR	FORST DILLION T				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090370	1150 DORTHY LN	FOX LARRY				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090030	2206 JEAN WAY	FRAZIER ERIC T				1	1 \$ 1,115.68	na	\$ 1,115.68	
230290300	Main	FREDRICKSON TERRY L	y			0	1 \$ 1,115.68	na	\$ 1,115.68	
239270070	26540 FRANCE AVE	FRENG LANNY A	y			0	1 \$ 1,115.68	na	\$ 1,115.68	
230090260	1145 DORTHY LN	FRIEDGES TYRONE & TROY FRIEDGE				1	1 \$ 1,115.68	na	\$ 1,115.68	
230190550	347 JAMES PKWY	GABRIEL BRAD P & BREA L				1	1 \$ 1,115.68	na	\$ 1,115.68	
230190540	345 JAMES PKWY	GARVIS SCOTT M & JAYNE				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090420	1140 DORTHY LN	GROSAM TROY				1	1 \$ 1,115.68	na	\$ 1,115.68	
230090090	3318 AARON DR	GRUNWALD GARY A				1	1 \$ 1,115.68	na	\$ 1,115.68	
230200370	305 KNIGHTS RD	HAGEN ROBERT R & PETRA J				1	1 \$ 1,115.68	na	\$ 1,115.68	

PID Number	Parcel Address	Owner	On major collector ?	Comm. Use?	Computation Units	Assessment Units	Estimated Overlay Assessment	Estimated Parking Assessment	Est. Total Assessment
230290070	9630 MAIN ST	HAMANN JUSTIN	y			0	1 \$ 1,115.68	na	\$ 1,115.68
230380430	9351 GLENBOROUGH DR	HANSON DAVID H & LORI M				1	1 \$ 1,115.68	na	\$ 1,115.68
230380230	9390 GLENBOROUGH DR	HARMER JAY W				1	1 \$ 1,115.68	na	\$ 1,115.68
230090290	1139 DORTHY LN	HERBECK JACOB D & CARRIE L STA				1	1 \$ 1,115.68	na	\$ 1,115.68
230070160	103 PARK ST	HERTAUS TODD M				1	1 \$ 1,115.68	na	\$ 1,115.68
230090410	1142 DORTHY LN	HESS JEFFREY				1	1 \$ 1,115.68	na	\$ 1,115.68
230290170	9596 MAIN ST	HOLLIDAY TIMOTHY D	y			0	1 \$ 1,115.68	na	\$ 1,115.68
230090220	1153 DORTHY LN	HOUSER COREY A & STEPHANIE A B				1	1 \$ 1,115.68	na	\$ 1,115.68
230090400	1144 DORTHY LN	IH3 PROPERTY MINNESOTA LP				1	1 \$ 1,115.68	na	\$ 1,115.68
230090230	1151 DORTHY LN	JENSEN CHARLES & VICKIE				1	1 \$ 1,115.68	na	\$ 1,115.68
230380030	9060 GLENBOROUGH DR	KANFIELD WILLIAM J & DENISE L				1	1 \$ 1,115.68	na	\$ 1,115.68
230200410	320 KNIGHTS RD	KENNGOTT JAMES T				1	1 \$ 1,115.68	na	\$ 1,115.68
230130160	3306 AARON DR	KERVINA LEE M				1	1 \$ 1,115.68	na	\$ 1,115.68
230530010	BP Pool	KJ Wak, Inc		y		1.5	1.5 \$ 1,673.52	na	\$ 1,673.52
239260013	26253 XERXES AVE	KNIPP JOSEPH C & TRACY	y			0	1 \$ 1,115.68	na	\$ 1,115.68
230070200	125 PARK ST	KNUTSEN RONALD & HEIDI				1	1 \$ 1,115.68	na	\$ 1,115.68
230380380	9568 GLENBOROUGH DR	KRASKA KYLE				1	1 \$ 1,115.68	na	\$ 1,115.68
230090350	3325 AARON DR	KROSKA DIANA M & JOHN A				1	1 \$ 1,115.68	na	\$ 1,115.68
230380250	9414 GLENBOROUGH DR	LAWSTUEN CARL J				1	1 \$ 1,115.68	na	\$ 1,115.68
230090100	3320 AARON DR	LEESON ANTHONY J				1	1 \$ 1,115.68	na	\$ 1,115.68
230090390	1146 DORTHY LN	LEMAY ROBERT G & JESSICA R				1	1 \$ 1,115.68	na	\$ 1,115.68
230130130	3312 AARON DR	LEWIS LACEY E				1	1 \$ 1,115.68	na	\$ 1,115.68
230130120	3314 AARON DR	LUEBBERT RICHARD K & SHARI A				1	1 \$ 1,115.68	na	\$ 1,115.68
230290100	9660 MAIN ST	MAHONEY MICHAEL P & SARA B	y	y		0	5 \$ 5,578.39	\$ 1,673.15	\$ 7,251.55
230290260	9575 MAIN ST	MARILYN K GREEN TRUST AGREEMEN	y			0	0 \$ -	na	\$ -
230290270	Main	MARILYN K GREEN TRUST AGREEMEN	y			0	1 \$ 1,115.68	na	\$ 1,115.68
230090500	2205 JEAN WAY	MATHEW BINOY				1	1 \$ 1,115.68	na	\$ 1,115.68
230090360	3327 AARON DR	MATTHIES DANIELLE NICOLE				1	1 \$ 1,115.68	na	\$ 1,115.68
230380620	9395 GLENBOROUGH DR	MCBRIDE JEFFREY T & JANET L				1	1 \$ 1,115.68	na	\$ 1,115.68
230090270	1143 DORTHY LN	MERRIMAN CHRISTOPHER				1	1 \$ 1,115.68	na	\$ 1,115.68
230380340	Glenborough	METRO LAND LLC				1	1 \$ 1,115.68	na	\$ 1,115.68
230130080	3207 AARON DR	MIKUNDA TORY M & DANIELLE R				1	1 \$ 1,115.68	na	\$ 1,115.68
239260030	26315 XERXES AVE	MILLER JAMES P & CAROLYN A	y			0	1 \$ 1,115.68	na	\$ 1,115.68
230090120	3324 AARON DR	MISCHKE SCOTT D & DEBRA S				1	1 \$ 1,115.68	na	\$ 1,115.68
230090010	3002 FRANCIS LN	MOHN BILLY				1	1 \$ 1,115.68	na	\$ 1,115.68
239260010	26071 XERXES AVE	MOOSBRUGGER SUSAN & JOSEPH J C	y			0	1 \$ 1,115.68	na	\$ 1,115.68
230130370	3300 AARON DR	NAATJES JONATHAN R & DEBRA L				1	1 \$ 1,115.68	na	\$ 1,115.68
230130360	3302 AARON DR	NELSON ROBB A & DEBRA R				1	1 \$ 1,115.68	na	\$ 1,115.68
230190530	337 JAMES PKWY	NEW MARKET PROPERTIES LLC				1	1 \$ 1,115.68	na	\$ 1,115.68
230090070	2214 JEAN WAY	NGUYEN HIEP T				1	1 \$ 1,115.68	na	\$ 1,115.68
230130350	3304 AARON DR	NORRIS CHRISTOPHER & CHRISTINE				1	1 \$ 1,115.68	na	\$ 1,115.68
230380610	9383 GLENBOROUGH DR	O'CONNELL GINA MARIE				1	1 \$ 1,115.68	na	\$ 1,115.68
230230210	440 KNIGHTS RD	O'NEILL RYAN				1	1 \$ 1,115.68	na	\$ 1,115.68
230090020	2204 JEAN WAY	ORTH SCOTT P & CHRISTINE M				1	1 \$ 1,115.68	na	\$ 1,115.68
230090080	3316 AARON DR	OSIECKI TYLER J & KRISTIN M				1	1 \$ 1,115.68	na	\$ 1,115.68
230200360	309 KNIGHTS RD	PARENT DAVID T & DARCI				1	1 \$ 1,115.68	na	\$ 1,115.68
230090240	1149 DORTHY LN	PATOCK MICHAEL T & MELODY M				1	1 \$ 1,115.68	na	\$ 1,115.68
230380400	9091 GLENBOROUGH DR	PETERSEN ROSS T & VUOKKO T				1	1 \$ 1,115.68	na	\$ 1,115.68
230290080	Main	PLATINUM PIONEERS LLC	y	y		0	0 \$ -	na	\$ -
230290090	9646 MAIN ST	PLATINUM PIONEERS LLC	y	y		0	6 \$ 6,694.07	\$ 7,648.70	\$ 14,342.78
230130090	3205 AARON DR	RASMUSSEN KEITH N				1	1 \$ 1,115.68	na	\$ 1,115.68

PID Number	Parcel Address	Owner	On major collector ?	Comm. Use?	Computation Units	Assessment Units	Estimated Overlay Assessment	Estimated Parking Assessment	Est. Total Assessment
230290280	9561 MAIN ST	REEVES MARK	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230090320	1031 THERESA MARIE DR	REICHMUTH CHRISTOPHER D & CATH			1	1	\$ 1,115.68	na	\$ 1,115.68
230380690	Glenborough	REMEY STEPHEN A			1	1	\$ 1,115.68	na	\$ 1,115.68
230070150	100 PARK ST	RHEIN ETAL SCOTT A			1	1	\$ 1,115.68	na	\$ 1,115.68
230070140	110 PARK ST	RHEIN SCOTT A & LISA M			1	1	\$ 1,115.68	na	\$ 1,115.68
230330130	26424 WOODCREST LN	ROEPKE JACOB T			1	1	\$ 1,115.68	na	\$ 1,115.68
230090130	3326 AARON DR	RUHLAND BRIAN J & AMBER L RUHL			1	1	\$ 1,115.68	na	\$ 1,115.68
230380420	9300 GLENBOROUGH DR	SCEARCY CHAD T & AMY E			1	1	\$ 1,115.68	na	\$ 1,115.68
230200400	322 KNIGHTS RD	SCHALLEHN JOEL & MARY			1	1	\$ 1,115.68	na	\$ 1,115.68
230200380	303 KNIGHTS RD	SCHMITZ CHRISTINE M			1	1	\$ 1,115.68	na	\$ 1,115.68
230090200	1157 DORTHY LN	SCHULTZ CYNTHIA M			1	1	\$ 1,115.68	na	\$ 1,115.68
230090250	1147 DORTHY LN	SCHULTZ PAUL & ALICIA			1	1	\$ 1,115.68	na	\$ 1,115.68
230130150	3308 AARON DR	SCHWENK MICHAEL			1	1	\$ 1,115.68	na	\$ 1,115.68
230380220	9382 GLENBOROUGH DR	SEEPERSAUD SHAHABUDEEN & BENI			1	1	\$ 1,115.68	na	\$ 1,115.68
230380700	9459 GLENBOROUGH DR	SHAWN JACK P & VICKI M MILLER			1	1	\$ 1,115.68	na	\$ 1,115.68
230090380	1148 DORTHY LN	SHENOUDA REDA A & MONA H			1	1	\$ 1,115.68	na	\$ 1,115.68
230380350	9528 GLENBOROUGH DR	SIGL BECKI J			1	1	\$ 1,115.68	na	\$ 1,115.68
230290150	9546 MAIN ST	SIMBA WILDER M & HESBON N & YA	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230090190	3335 AARON DR	SMITH JONATHAN & GLORIA			1	1	\$ 1,115.68	na	\$ 1,115.68
230070170	115 PARK ST	SPRIGGS SHAWNA			1	1	\$ 1,115.68	na	\$ 1,115.68
230200390	324 KNIGHTS RD	STEHR DENNIS A & SUSAN K			1	1	\$ 1,115.68	na	\$ 1,115.68
230380370	9556 GLENBOROUGH DR	STENZEL STEPHEN			1	1	\$ 1,115.68	na	\$ 1,115.68
230380050	9102 GLENBOROUGH DR	STINNETT ROBERT S & CAROL M			1	1	\$ 1,115.68	na	\$ 1,115.68
230380360	9540 GLENBOROUGH DR	STINNETT ROBERT S & CAROL M			1	1	\$ 1,115.68	na	\$ 1,115.68
230130420	3311 AARON DR	STRATTON CHAD M			1	1	\$ 1,115.68	na	\$ 1,115.68
230380410	9125 GLENBOROUGH DR	TELLEZ DANIEL			1	1	\$ 1,115.68	na	\$ 1,115.68
230380240	9400 GLENBOROUGH DR	THORESON GREGORY B			1	1	\$ 1,115.68	na	\$ 1,115.68
230380310	9478 GLENBOROUGH DR	TYMA PETER J			1	1	\$ 1,115.68	na	\$ 1,115.68
230380390	9055 GLENBOROUGH DR	ULMEN BARRY			1	1	\$ 1,115.68	na	\$ 1,115.68
230090040	2208 JEAN WAY	VANDERVEEN LISA R			1	1	\$ 1,115.68	na	\$ 1,115.68
230090330	3321 AARON DR	VELIN TREVOR A & TAMARA S			1	1	\$ 1,115.68	na	\$ 1,115.68
230380630	9409 GLENBOROUGH DR	WALTON JOSHUA			1	1	\$ 1,115.68	na	\$ 1,115.68
230130100	3203 AARON DR	WEAVER JENNIFER E			1	1	\$ 1,115.68	na	\$ 1,115.68
230090110	3322 AARON DR	WENZEL JEFFREY S & LINDA K			1	1	\$ 1,115.68	na	\$ 1,115.68
230290160	9566 MAIN ST	WESTLIE BERNARD S & KATHLEEN	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230290060	9616 MAIN ST	WIERSON PROPERTIES LLC	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230290200	26511 FRANCE AVE	WIERSON PROPERTIES LLC	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230290330	9631 MAIN ST	WIERSON PROPERTIES LLC	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230290340	Main	WIERSON PROPERTIES LLC	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230290350	9615 MAIN ST	WIERSON PROPERTIES LLC	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230290360	Main	WIERSON PROPERTIES LLC	y		0	0	\$ -	na	\$ -
230070190	121 PARK ST	WIGHT ROBERT A			1	1	\$ 1,115.68	na	\$ 1,115.68
230130140	3310 AARON DR	WILKINS ANDREW L & JODY K			1	1	\$ 1,115.68	na	\$ 1,115.68
230190570	355 JAMES PKWY	WILLIAMS SCOTT W & CARIEANN L			1	1	\$ 1,115.68	na	\$ 1,115.68
230290230	9511 MAIN ST	WOLTER JOHN & MARILYN	y		0	1	\$ 1,115.68	na	\$ 1,115.68
230380710	9471 GLENBOROUGH DR	ZAK NICHULIS G & NICOLE L			1	1	\$ 1,115.68	na	\$ 1,115.68
230130110	3201 AARON DR	ZELLER JAMES A & DIXIE			1	1	\$ 1,115.68	na	\$ 1,115.68

Services Provided:

Civil & Municipal Engineering

Water & Wastewater Engineering

Transportation Planning & Engineering

Structural Engineering

Aviation Services

Water Resources Engineering

Landscape Architecture

Land Surveying

Geographic Information System

Project Funding & Financing

Bolton-Menk.com

