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March 27, 2020

Mr. Kevin Potter
Mr. John Lesnick
City of Kirtland
9301 Chillicothe Road
Kirtland, Ohio 44094

Sent Via email: kpotter@kirtlandohio.com (PDF Only)
jlesnickjr@kirtlandohio.com (PDF Only)

Re: Report on Network Level Pavement Evaluation
City of Kirtland – 2020 Visual Pavement Evaluation
Kirtland, Ohio
SME Project No. 083631.00

Dear Mr. Potter and Lesnick:

SME has completed our visual pavement evaluation for select roads within the City of Kirtland. This report presents the results of our observations and analyses, and presents our recommendations for the rehabilitation/reconstruction of the various paved areas at the reviewed facility.

The scope of services performed for this evaluation was conducted in general accordance with SME Proposal No. P04183.19. Mr. Kevin Potter of the City of Kirtland, authorized this evaluation.

We appreciate the opportunity to provide these services to you and the City of Kirtland. If there are any questions concerning this report, or if we can be of further service, please contact us.

Very truly yours,

SME

STATE OF OHIO
ALISON K. FRYE
E-82980
REGISTERED PROFESSIONAL ENGINEER

Mar 27 2020 4:54 PM

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Alison K. Frye, PE (OH)
Project Engineer

INTRODUCTION

PROJECT BACKGROUND

The City of Kirtland is interested in evaluating the existing condition of the pavements of selected city roads to develop a priority schedule for preventative maintenance and rehabilitation. The pavements range in age and condition with a portion of the pavements approaching their terminal service life (assumed at 15 to 20 years). The City has requested that a network level review be performed including visual evaluations to assess the nature and magnitude of the observed pavement distresses. As part of this review, the City requested preliminary engineering recommendations for repair types and for roads which will require non-destructive / destructive testing to finalize repair recommendations. This evaluation involved preliminary condition assessments only, no physical coring or other destructive testing was performed. Development of project level repair / rehabilitation recommendations was outside the requested scope of services.

The information obtained from the evaluation will be used to prioritize repairs based on condition, and to assist with developing the capital improvement and pavement maintenance programs. In Table 1, we present a list of the evaluated roadways along with pavement surface type and approximate roadway length. Approximately 5 miles of roadway was evaluated out of the 56 miles in the Kirtland road system.

TABLE 1: EVALUATED ROADWAY LIST

ROAD NAME	PAVEMENT SURFACE TYPE	APPROXIMATE LENGTH (MILES)
Billings Road	Asphalt	2.04
Regency Woods Drive	Asphalt	1.20
Springer Drive	Asphalt	0.40
Springer Court	Asphalt	0.08
Beechwood Drive	Asphalt	0.54
Crestwood Drive (North)	Asphalt	0.28
Crestwood Drive (South – Concrete)	Concrete	0.18
Elmwood Drive	Asphalt	0.16
Parkwood Drive	Asphalt	0.11

EVALUATION PROCEDURES

FIELD EXPLORATION

SME visited the sites on February 3, 2020, and February 11, 2020, to perform visual evaluations of the condition of the pavements utilizing the Pavement Surface Evaluation and Rating (PASER) system. The PASER system was developed by the Wisconsin Transportation Information Center at the University of Wisconsin, Madison and is in use by many agencies throughout the world. A copy of the PASER system rating guidelines are provided in Appendix B for reference. In general, the method consists of dividing the pavement into uniform sections based on the type of pavement, street, condition, usage, and other factors and assigning a condition rating from 1 (Failed) to 10 (Excellent). In addition to the PASER pavement survey, SME noted performed a brief review of the existing stormwater systems (storm sewer or swale) along each roadway segment. We included schematic diagrams depicting the PASER evaluation results and representative photos in Appendix A.

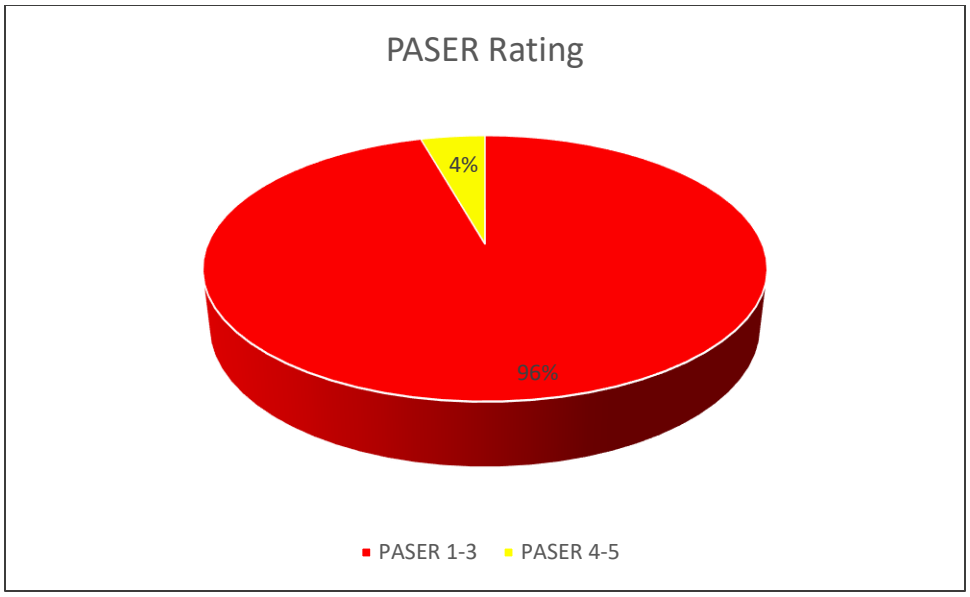


FIGURE NO. 1: PASER Rating Results by Percentage of Total Roads Evaluated

Of the over 598,000 square feet of pavement reviewed, approximately four percent of the road network rated between 4 and 5 (Poor to Fair) and the remaining 96 percent rated at 3 or less (Very Poor to Poor). Areas with a rating of 3 or below require major rehabilitation or reconstruction. The Pavements that are generally between 4 and 5 are identified as candidates for surface improvements such as asphalt overlays with localized full-depth repairs, and the sections of 6 to 8 can receive maintenance to address surficial distress to extend the pavement service life, at reasonable cost. Pavements above a rating of 8 are typically left alone and would be reviewed and re-scored at the next scheduled condition assessment period, Typically every 3 to 5 years. A typical Project Level, Decision Matrix for Pavement Maintenance is included in Appendix B for your consideration.

EXISTING CONDITIONS

PAVEMENT SURFACE

The existing pavement consists of asphalt for all roads evaluated except a section of Crestwood Drive that is surfaced with Portland cement concrete (PCC or concret). Portions of the asphalt and concrete areas appeared to have been recently patched prior to SME's visit. Areas of distress in the asphalt pavement include longitudinal, transverse, fatigue and block cracking, potholing and wheel rutting. There is evidence of extensive patching (partial depth and full depth). Observed distress in the concrete pavement includes popouts, corner cracks, and occasional mid-slab cracking. Partial depth joint repairs are present which consist of removing concrete around the joint and replacing it with asphalt. In the concrete area, the asphalt in the repair areas is showing signs of rutting and fatigue cracking.

For more information on pavement distress types, please see the following websites:

Asphalt Distress: https://pavementinteractive.org/reference-desk/pavement-management/pavement-distresses/

Concrete Distress: https://theconstructor.org/transportation/distresses-in-concrete-pavement/5507/

SURFACE DRAINAGE AND STORMWATER DRAINAGE STRUCTURES

The pavement surfaces along Beechwood Drive, Elmwood Drive, Parkwood Drive, and the asphalt portion of Crestwood Drive appear to have a flat cross slope. This makes surface drainage into the adjacent swales and catch basins difficult. In addition, the relatively shallow depth of some swales make it difficult to transport water away from the road and it is anticipated that during heavy or prolonged precipitation events the shallow swales/ditches fill up. That will cause water to migrate to the roadbed and extend back under the road sections causing softening/weakening of the pavement base and subgrade, which will have a significant impact on the roads ability to carry traffic loads and can lead to premature failure due to freeze and thaw action.

The steep longitudinal grades along the alignment of the concrete section of Crestwood Drive, Springer Drive, and Springer Court help direct surface flow to low points. Along Crestwood, catch basins located at the low points, within the curb alignment, appear to receive the majority of the surface flow. At Springer Drive, the low point is located at the intersection of Springer Court and Springer Drive. The surface drainage ponds at two structures in this area and generally drains slowly. Within the lawn area in the middle of the cul-de-sac at Springer Court, water was ponded during our site visit. As noted previously, ponded water adjacent to the road alignment can soften the ground surface and potentially migrate under the roadbed itself, if sufficient or prolonged exposure to excess moisture occurs. Positive and efficient drainage, whether it is from catch basins with storm sewer pipe or ditches / swales is a very important component in developing road networks that are durable and provide the desired service life. For each mid-term or long-term road rehabilitation project, improving of area stormwater drainage should be a TOP PRIORITY.

The varying grades along Regency Woods Drive and Billings Road result in variable effectiveness in surface drainage to adjacent swales and catch basins. Improvement to existing drainage conditions should again be a component included in the design process.

As stated previously, the overall poor and inadequate surface drainage is of significant enough extent throughout the road sections reviewed that SME recommends that a comprehensive stormwater examination, including performance of detailed topographic survey, should be completed prior to developing engineering documents to outline specific capital improvement programs.

Photographs depicting representative examples of the conditions observed during our review and presented by area are in included in the final report.

ANALYSIS AND RECOMMENDATIONS

The pavement repair / rehabilitation recommendations include several alternatives for Capital improvements, considered as long-term repairs which may include alternatives such as conventional complete reconstruction, or Full Depth Reclamation (FDR); along with mid-term recommendations; and short term and pavement preservation repairs. The recommendations presented in this report are based on our visual observations only.

It is strongly recommended that for both Mid-Term and Long-Term programs that appropriate engineering analysis and design be completed to confirm scope selection, ***address on site drainage issues***, and to provide the appropriate pavement cross section for the support of the appropriate traffic mix that impacts those specific areas. The engineering program should include site specific exploration including initial Non-Destructive Testing utilizing a Falling Weight Deflectometer (NDT FWD), pavement coring (based on the results of the NDT FWD), base and subbase sampling, dynamic cone penetrometer testing, soil borings, and laboratory testing to further assess the engineering properties of the existing pavements prior to construction. The individual pavement rehabilitation strategies considered by SME for the current facilities are described below.

LONG TERM CAPITAL IMPROVEMENTS

FULL RECONSTRUCTION

Typical programs for capital improvements can include a traditional process where the existing pavement surface (PCC or AC) and aggregate base are removed in their entirety, the subgrade is shaped to promote drainage or cut in areas with deficient pavement thickness, and drainage improvements and upgrades are installed. Finally, a new pavement section is constructed with imported aggregate base and new PCC / AC surface. This option will result in the longest service life as it removes unsuitable material, provides the opportunity to evaluate the subgrade and remediate soft areas, improve subsurface drainage, and involves replacement with new pavement material. However, the full reconstruction option is the most costly, and can have lengthy project construction durations. Full reconstruction is a suitable option for severely distressed pavements (PASER 1 to 3).

FULL DEPTH RECLAMATION

An alternate capital improvement approach could include Full Depth Reclamation (FDR) of the existing AC pavements. The FDR option includes pulverization and blending of the pavement layers and an engineered portion of the subgrade, mixing with a stabilization agent (Portland cement and/or Asphalt Emulsion or other chemicals) and grading and compacting to a sufficient depth to accept the proposed AC section. Drainage improvements and upgrades should be incorporated as well. This option allows the Owner to reuse an existing asset resulting in lower import/export requirements for new materials and reduce the disposal of existing materials. This process is particularly beneficial in regions or at facilities that require special testing of the materials to be disposed of at landfill facilities, which can significantly increase construction costs. This process has also shown be of shorter duration than a traditional complete reconstruction process.

However, FDR is not always a viable option for reconstruction; the FDR option is NOT an option for PCC pavements. FDR is not always economically viable for small areas since the mobilization costs may offset the cost savings associated with recycling of the existing pavement materials. Other options for PCC could be explored (in-situ applications, crack and seat, rubbelization, etc.) however these should be reviewed on a case by case basis.

MID-TERM REHABILITATION

CRUSH AND SHAPE

For facilities with adequate support in the subgrade soils (estimated resilient modulus (Mr) greater than 3,000 psi for greater than 75 percent of the site) but thin aggregate or AC sections, a crush and shape type rehabilitation may be appropriate. This process would include pulverizing the existing HMA and aggregate base and reshaping the salvaged base to accommodate site grades. The resulting surface would then be thoroughly proof rolled and areas with weak support would be undercut and replaced with suitable soils/aggregates prior to repaving. This process supports incremental site grading and drainage improvements as conditions require.

FULL DEPTH MILL AND OVERLAY

For AC pavements with relatively high levels of observable distress (PASER 1 to 3) and sufficient pavement support (estimated Mr, an index of support characteristic of the underlying subgrade soil, greater than 3,000 psi and adequate existing aggregate base thickness and strength). Full depth milling of the existing AC and resurfacing may be an appropriate rehabilitation strategy. For this process to be utilized, a complete geotechnical evaluation of the pavement, base, and underlying subgrade is required.

PARTIAL DEPTH MILL AND OVERLAY (AC PAVEMENTS)

For AC pavements with moderate levels of observable distress (PASER 4 to 5) and sufficient pavement support (estimated Mr greater than 3,000 psi and adequate existing aggregate base thickness as determined through further project level analysis.). Partial depth milling of the existing AC and resurfacing may be an appropriate rehabilitation strategy. This process should include contingencies for targeted Full Depth Repairs to be identified after completion of partial depth milling to address localized areas of high levels of observable distress (PASER 1 to 3). This process may not be appropriate for many sites as the potential for poor support conditions in the existing pavement section and underlying sub-grade soils may result in excessive damage to the existing pavement system during the mill/overlay process. Reflective cracking due to underlying cracks in the remaining AC can seriously reduce the service life of this approach if the existing AC is severely deteriorated. Further, this option is not typically suitable where drainage (surface/subsurface) improvements are required / anticipated. This process requires a specific pavement evaluation to include coring to evaluate suitability of existing materials to support the program.

PARTIAL DEPTH MILL AND OVERLAY (PCC CONCRETE)

For PCC pavements with moderate levels of observable distress (PASER 4 to 5) and sufficient pavement support (estimated Mr greater than 3,000 psi and adequate existing aggregate base thickness as determined through further project level analysis.), partial depth milling of the existing PCC and resurfacing using AC may be an appropriate rehabilitation strategy. This process should include contingencies for targeted Full Depth Repairs to be identified after completion of partial depth milling to address localized areas of high levels of observable distress (PASER 1 to 3). This process may not be appropriate for many sites as the potential for poor support conditions in the existing pavement section and underlying sub-grade soils may result in excessive damage to the existing pavement system during the mill/overlay process. Reflective cracking due to underlying cracks in the remaining PCC can seriously reduce the service life of this approach if the existing PCC is severely deteriorated. Further, this option is not typically suitable where drainage (surface/subsurface) improvements are required / anticipated. This process requires a specific pavement evaluation to include coring to evaluation suitability of existing materials to support the program.

LOCALIZED SLAB REMOVAL AND REPLACEMENT

For PCC pavements with moderate levels of observable distress (PASER 3 to 4) and sufficient pavement support (estimated Mr greater than 3,000 psi and adequate existing aggregate base thickness as determined through further project level analysis.), localized slab removal and replacement may be an appropriate rehabilitation strategy. This process is typically not suitable where drainage improvements (surface/subsurface) improvements are required/anticipated. This process is also not suitable where significant improvements are required for the aggregate base and subgrade. This process requires a specific pavement evaluation to include coring to evaluate the suitability of the existing materials to support the program.

SHORT TERM REPAIRS

PAVEMENT PRESERVATION

For pavement with relatively low levels of observable distress (PASER 6 to 8) and sufficient pavement support Pavement Preservation type repairs may be appropriate. P&P type repairs are most appropriate for asphalt pavements with adequate support conditions (estimated subgrade Mr greater than 3,000 psi) and an estimated Structural Number, SN, an index of the structural capacity of the asphalt pavement layers, greater than 2.5 for a majority of the area. P&P type repairs are most appropriate for concrete pavement where full depth slab replacement or partial depth repairs are not necessary.

These repairs should include but are not limited to:

- Localized Full Depth Patching (AC & PCC)
- Localized Partial Depth Mill and Overlay (AC) (drive lanes, approaches, along curb and gutter affecting drainage, etc.)
- Crack/Joint Sealing
- Wide Crack Routing and Over banding
- Seal Coat
- Installing Concrete Collars around existing utility structures

RECOMMENDED REPAIR TYPES

In Table 2, we present a summary of the roadway ratings and the corresponding repair types.

TABLE 2: SUMMARY OF RECOMMENDED REPAIR TYPES

ROAD NAME	PAVEMENT SURFACE TYPE	PASER RATING	RECOMMENDED REPAIR TYPE	PRELIMINARY ESTIMATE OF COST
Crestwood Drive (South – Concrete)	Concrete	4	Mid-Term	$182,000
Billings Road	Asphalt	3	Mid-Term	$1,144,000
Regency Woods Drive	Asphalt	3	Mid-Term	$735,000
Springer Drive (East)	Asphalt	3	Mid-Term	$474,000
Springer Court	Asphalt	3	Long-Term	$71,000
Springer Drive (West)	Asphalt	2	Long-Term	$93,000
Beechwood Drive	Asphalt	2	Long-Term	$293,000
Crestwood Drive (North) and Oakwood Street Entrance	Asphalt	2	Long-Term	$183,000
Elmwood Drive	Asphalt	2	Long-Term	$71,000
Parkwood Drive	Asphalt	2	Long-Term	$69,000

FIELD EXPLORATION AND DESTRUCTIVE TESTING RECOMMENDATIONS

The above recommendations and appended rehabilitation priorities are contingent on the development of a full understanding of the existing pavement cross sections. The information in this report should be used to develop a coring and subsurface exploration program in preparation for refining the appropriate approach to each pavement's improvement program. O&M type repairs can be specified by visual evaluation; however, **we strongly recommend non-destructive testing (Falling Weight Deflectometer and/or destructive evaluation (Pavement Coring and Sampling) of the existing pavement surfaces, aggregate bases and subgrade soils prior to specifying a specific repair.**

If the FDR option is considered, we strongly recommend bulk samples of the pavement materials and underlying subgrade be collected and tested to evaluate the suitability of the existing materials for FDR. Laboratory mix design testing should be completed to select the appropriate stabilization additives and application rates.

In some cases, the existing pavement grades should be adjusted to provide more substantial positive drainage along with potentially significant reconfigurations in existing storm water facilities. In these locations we recommend performing a project specific topographic survey to supplement existing drawings and to accommodate design of the site changes.

A detailed assessment report for each pavement section (roads) is found in Appendix A. Within the detailed report a description of the preliminary recommended scope of construction is presented along with the engineer's opinion of construction cost. Additional improvements such as drainage improvements, curb and gutter or sidewalk have been incorporated with each detailed area, as conditions were noted visually in the field. **It should be noted that the engineer's opinion of construction cost DO NOT include soft costs such as a Construction Manager fee, permits, permit review or permit costs. Should these items be required, we request that the City contact SME to develop the scope of soft costs to be incorporated in the budgeting process.**

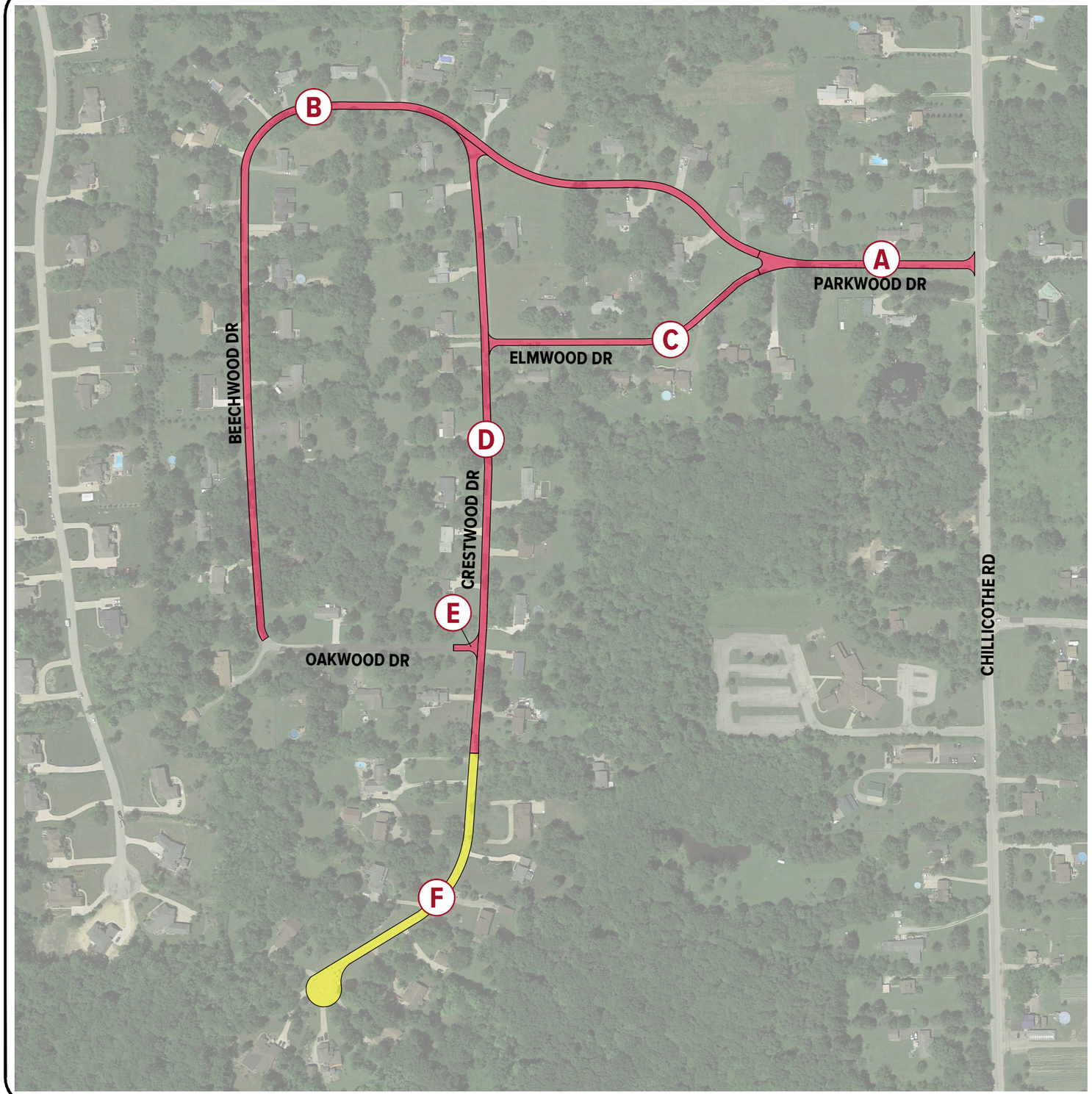
SIGNATURES

Prepared By:
Alison K. Frye, PE
Project Engineer

Reviewed By:
Anthony B. Thomas, PE (MI)
Senior Consultant

APPENDIX A

PASER DIAGRAM
PAVEMENT ASSESSMENT – PROGRAM BUDGET SUMMARY
PHOTO LIBRARY



SECTION #	PAVEMENT TYPE	AREA (SQ. FT.)	RATING
A	ASPHALT	13,461	2
B	ASPHALT	57,134	2
C	ASPHALT	13,684	2
D	ASPHALT	34,169	2
E	ASPHALT	1,541	2
F	CONCRETE	26,305	4
TOTAL	ASPHALT	143,105	

PASER LEGEND

COLOR	VAULE	CONDITION
	10	EXCELLENT
	9	EXCELLENT
	8	VERY GOOD
	7	GOOD
	6	GOOD
	5	FAIR
	4	FAIR
	3	POOR
	2	VERY POOR
	1	FAILED

A SECTION I.D.

NORTH

0' 300' 600'

GRAPHIC SCALE: 1" = 300'

NOTE:
BASE DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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Project

CITY OF KIRTLAND - 2020 VISUAL PAVEMENT EVALUATION

Project Location

KIRTLAND, OHIO

Sheet Name

PASER DIAGRAM

No.	Revision Date

Date 02/11/2020

CADD JGR

Designer AF

Scale AS NOTED

Project 083631.00

Figure No. 1

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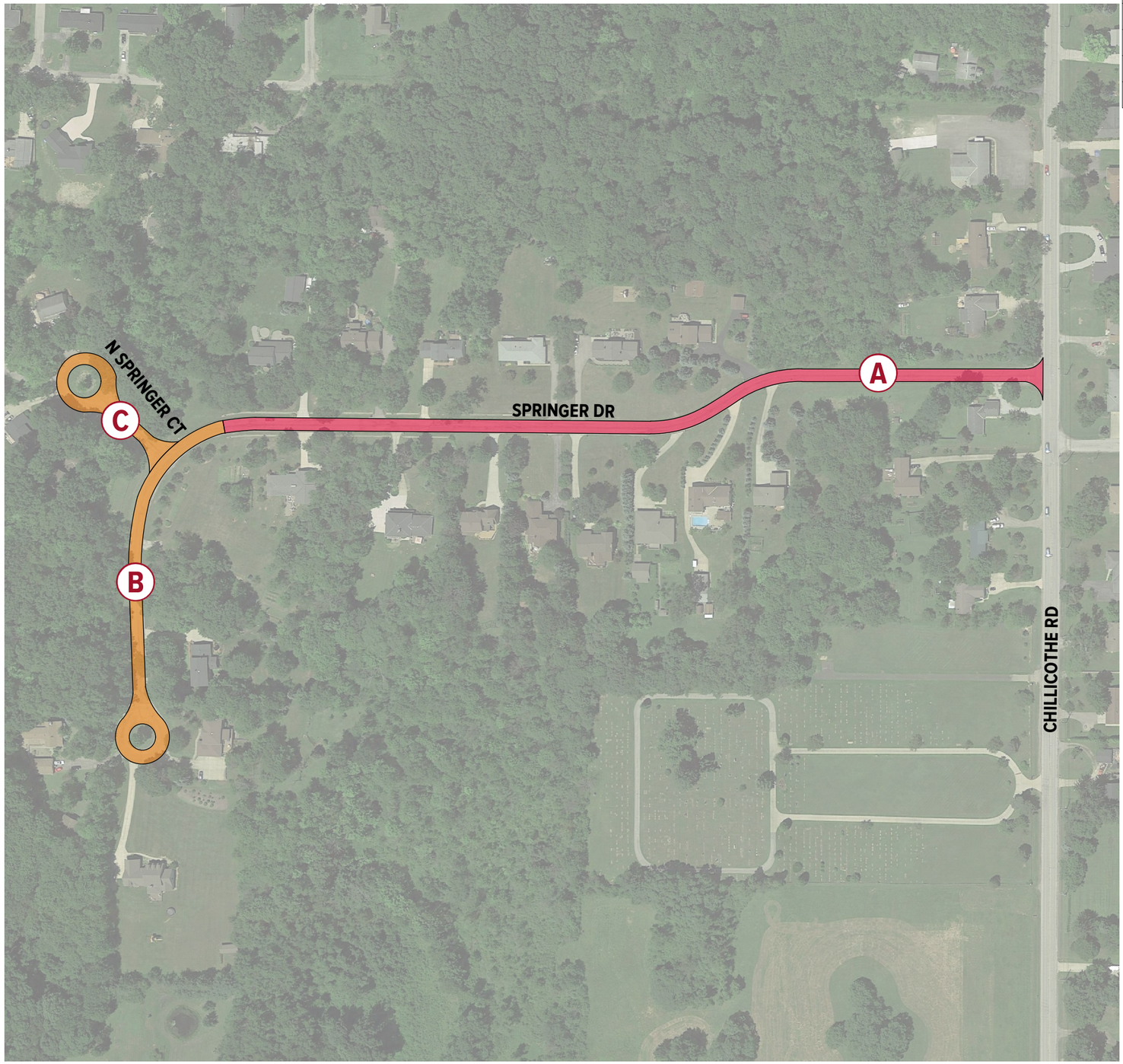

SECTION #	PAVEMENT TYPE	AREA (SQ. FT.)	RATING
A	ASPHALT	32,135	2
B	ASPHALT	18,093	3
C	ASPHALT	9,792	3
TOTAL	ASPHALT	64,340	

PASER LEGEND

COLOR	VAULE	CONDITION
	10	EXCELLENT
	9	EXCELLENT
	8	VERY GOOD
	7	GOOD
	6	GOOD
	5	FAIR
	4	FAIR
	3	POOR
	2	VERY POOR
	1	FAILED

A SECTION I.D.

NORTH

0' 200' 400'

GRAPHIC SCALE: 1" = 200'

NOTE:
BASE DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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CITY OF KIRTLAND - 2020 VISUAL PAVEMENT EVALUATION

Project Location

KIRTLAND, OHIO

Sheet Name

PASER DIAGRAM

No.	Revision Date

Date 02/11/2020

CADD JGR

Designer AF

Scale AS NOTED

Project 083631.00

Figure No. 2

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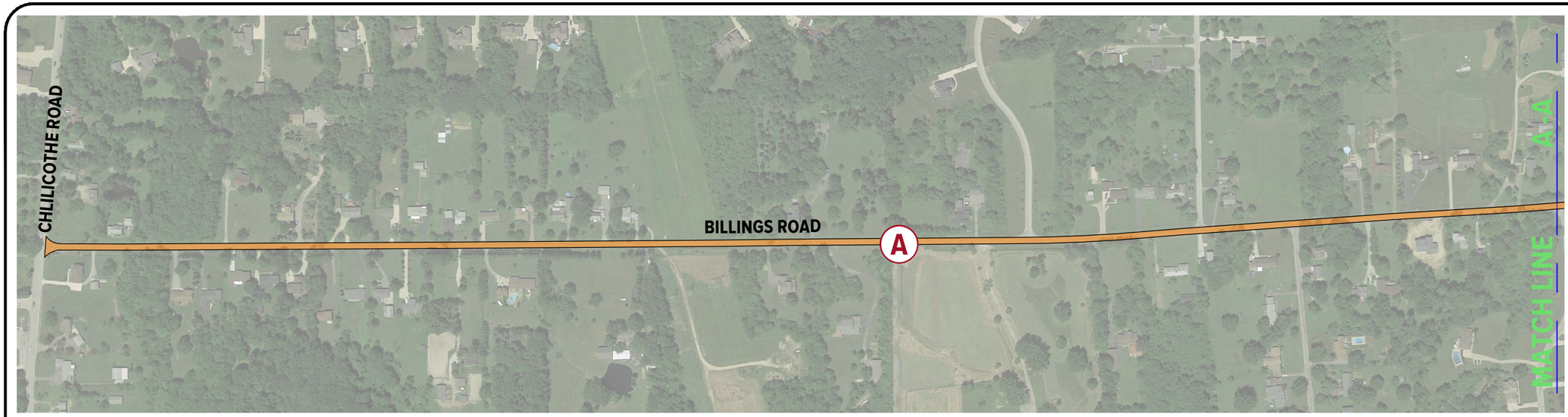

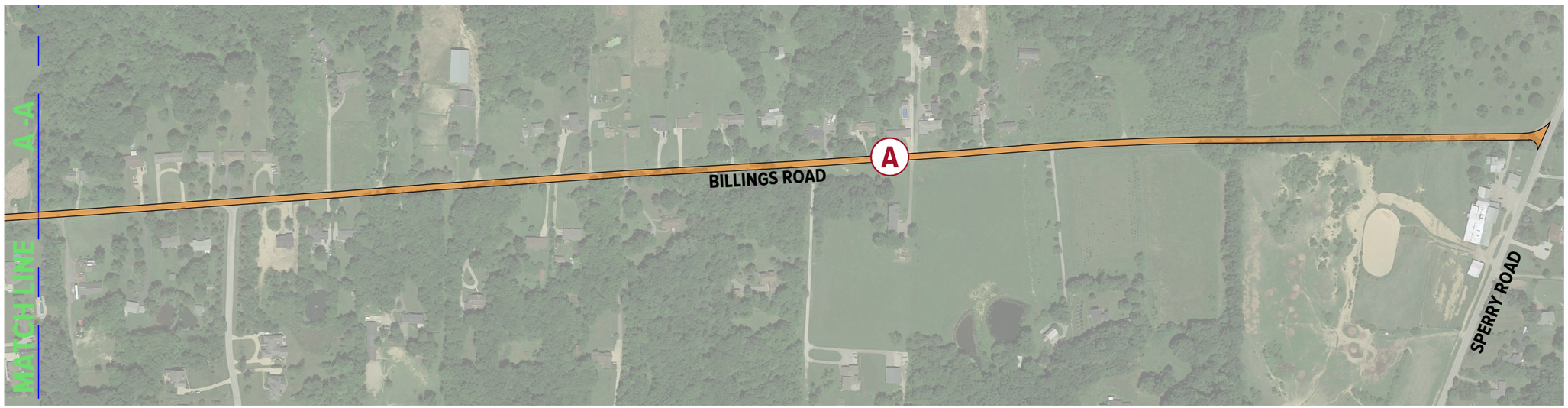

SECTION #	PAVEMENT TYPE	AREA (SQ. FT.)	RATING
A	ASPHALT	238,140	3
TOTAL	ASPHALT	238,140	

PASER LEGEND

COLOR	VAULE	CONDITION	COLOR	VAULE	CONDITION
	5	FAIR		10	EXCELLENT
	4	FAIR		9	EXCELLENT
	3	POOR		8	VERY GOOD
	2	VERY POOR		7	GOOD
	1	FAILED		6	GOOD

A SECTION I.D.

NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

NOTE:
BASE DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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CITY OF KIRTLAND
2020 VISUAL
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Project Location
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PASER DIAGRAM

No.	Revision Date

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Project 083631.00
Figure No. 3

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SECTION #	PAVEMENT TYPE	AREA (SQ. FT.)	RATING
A	ASPHALT	152,922	3
TOTAL	ASPHALT	152,922	

PASER LEGEND

COLOR	VAULE	CONDITION	COLOR	VAULE	CONDITION
	5	FAIR		10	EXCELLENT
	4	FAIR		9	EXCELLENT
	3	POOR		8	VERY GOOD
	2	VERY POOR		7	GOOD
	1	FAILED		6	GOOD

A SECTION I.D.

NORTH

0' 350' 700'

GRAPHIC SCALE: 1" = 350'

NOTE:
BASE DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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2020 VISUAL
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EVALUATION

Project Location
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Sheet Name
PASER DIAGRAM

No.	Revision Date

Date 02/14/2020
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Project 083631.00
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PAVEMENT PROGRAM - SUMMARY OF CONSTRUCTION COST

Parkwood Drive - Location 1						1
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.07	$0.02
2	Full Depth Patch	$ 83,000	3	$27,667	$6.17	$2.06
3	Mill/Patch /OL	$ 101,000	5	$20,200	$7.50	$1.50
4	Full Surface Reconstruct	$ 77,000	10	$7,700	$5.72	$0.57
5	Pulverize/Grade/OL	$ 65,000	12	$5,417	$4.83	$0.40
6	Full Depth Reclamation	$ 69,000	17	$4,059	$5.13	$0.30
7	Full Reconstruction	$ 91,000	20	$4,550	$6.76	$0.34

Beechwood Drive - Location 2						2
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.02	$0.01
2	Full Depth Patch	$ 350,000	3	$116,667	$6.13	$2.04
3	Mill/Patch /OL	$ 427,000	5	$85,400	$7.47	$1.49
4	Full Surface Reconstruct	$ 326,000	10	$32,600	$5.71	$0.57
5	Pulverize/Grade/OL	$ 275,000	12	$22,917	$4.81	$0.40
6	Full Depth Reclamation	$ 293,000	17	$17,235	$5.13	$0.30
7	Full Reconstruction	$ 384,000	20	$19,200	$6.72	$0.34

Crestwood Drive and Oak Street Entrance - Location 3						3
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.03	$0.01
2	Full Depth Patch	$ 219,000	3	$73,000	$6.13	$2.04
3	Mill/Patch /OL	$ 267,000	5	$53,400	$7.48	$1.50
4	Full Surface Reconstruct	$ 204,000	10	$20,400	$5.71	$0.57
5	Pulverize/Grade/OL	$ 172,000	12	$14,333	$4.82	$0.40
6	Full Depth Reclamation	$ 183,000	17	$10,765	$5.12	$0.30
7	Full Reconstruction	$ 240,000	20	$12,000	$6.72	$0.34

Crestwood Drive - Location 4						4
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.04	$0.01
2	Full Depth Patch	$ 146,000	3	$48,667	$5.55	$1.85
3	Mill/Patch /OL	$ 182,000	5	$36,400	$6.92	$1.38
4	Full Surface Reconstruct	$ 135,000	10	$13,500	$5.13	$0.51
5	Pulverize/Grade/OL	$ 112,000	12	$9,333	$4.26	$0.35
6	Full Depth Reclamation	$ 135,000	17	$7,941	$5.13	$0.30
7	Full Reconstruction	$ 162,000	20	$8,100	$6.16	$0.31

Springer Drive (East Section) - Location 5						5
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.03	$0.01
2	Full Depth Patch	$ 414,000	3	$138,000	$12.88	$4.29
3	Mill/Patch /OL	$ 474,000	5	$94,800	$14.75	$2.95
4	Full Surface Reconstruct	$ 501,000	10	$50,100	$15.59	$1.56
5	Pulverize/Grade/OL	$ 473,000	12	$39,417	$14.72	$1.23
6	Full Depth Reclamation	$ 482,000	17	$28,353	$15.00	$0.88
7	Full Reconstruction	$ 534,000	20	$26,700	$16.62	$0.83

Springer Drive (West Section) - Location 6						6
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.06	$0.02
2	Full Depth Patch	$ 92,000	3	$30,667	$5.08	$1.69
3	Mill/Patch /OL	$ 120,000	5	$24,000	$6.63	$1.33
4	Full Surface Reconstruct	$ 104,000	10	$10,400	$5.75	$0.57
5	Pulverize/Grade/OL	$ 88,000	12	$7,333	$4.86	$0.41
6	Full Depth Reclamation	$ 93,000	17	$5,471	$5.14	$0.30
7	Full Reconstruction	$ 122,000	20	$6,100	$6.74	$0.34

PAVEMENT PROGRAM - SUMMARY OF CONSTRUCTION COST

Springer Court - Location 7						7
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.10	$0.03
2	Full Depth Patch	$ 56,000	3	$18,667	$5.72	$1.91
3	Mill/Patch /OL	$ 71,000	5	$14,200	$7.25	$1.45
4	Full Surface Reconstruct	$ 62,000	10	$6,200	$6.33	$0.63
5	Pulverize/Grade/OL	$ 53,000	12	$4,417	$5.41	$0.45
6	Full Depth Reclamation	$ 56,000	17	$3,294	$5.72	$0.34
7	Full Reconstruction	$ 72,000	20	$3,600	$7.35	$0.37

Billings Road - Location 8						8
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 4,000	3	$1,333	$0.02	$0.01
2	Full Depth Patch	$ 1,207,000	3	$402,333	$5.07	$1.69
3	Mill/Patch /OL	$ 1,569,000	5	$313,800	$6.59	$1.32
4	Full Surface Reconstruct	$ 1,356,000	10	$135,600	$5.69	$0.57
5	Pulverize/Grade/OL	$ 1,144,000	12	$95,333	$4.80	$0.40
6	Full Depth Reclamation	$ 1,218,000	17	$71,647	$5.11	$0.30
7	Full Reconstruction	$ 1,600,000	20	$80,000	$6.72	$0.34

Regency Wood Drive - Location 9						9
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 3,000	3	$1,000	$0.02	$0.01
2	Full Depth Patch	$ 775,000	3	$258,333	$5.07	$1.69
3	Mill/Patch /OL	$ 1,008,000	5	$201,600	$6.59	$1.32
4	Full Surface Reconstruct	$ 871,000	10	$87,100	$5.70	$0.57
5	Pulverize/Grade/OL	$ 735,000	12	$61,250	$4.81	$0.40
6	Full Depth Reclamation	$ 782,000	17	$46,000	$5.11	$0.30
7	Full Reconstruction	$ 1,027,000	20	$51,350	$6.72	$0.34

Elmwood Drive - Location 10						10
SUMMARY OF ESTIMATED CONSTRUCTION COST / COST PER YEAR						
Repair Option	Repair Description	Est. Construction Cost	Service Life (Yrs)	cost/yr	cost/sf	cost/yr/sf
1	Routine Maintenance	$ 1,000	3	$333	$0.07	$0.02
2	Full Depth Patch	$ 84,000	3	$28,000	$6.14	$2.05
3	Mill/Patch /OL	$ 103,000	5	$20,600	$7.53	$1.51
4	Full Surface Reconstruct	$ 79,000	10	$7,900	$5.77	$0.58
5	Pulverize/Grade/OL	$ 66,000	12	$5,500	$4.82	$0.40
6	Full Depth Reclamation	$ 71,000	17	$4,176	$5.19	$0.31
7	Full Reconstruction	$ 93,000	20	$4,650	$6.80	$0.34

PHOTO NO. 1: Parkwood Drive – Facing East, Intersection with State Route 306

PHOTO NO. 2: Parkwood Drive – Facing West near Address 8201

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 3: Parkwood Drive – Facing West, Intersection with Elmwood Drive and Beechwood Drive

PHOTO NO. 4: Beechwood Drive – Facing Northwest, Intersection with Parkwood Drive

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 5: Beechwood Drive – Facing Northwest near Address 8137

PHOTO NO. 6: Beechwood Drive – Facing Northwest near Address 8121 – Stormwater Outlet to the North

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 7: Beechwood Drive – Facing Northwest, East of Intersection with Crestwood Drive

PHOTO NO. 8: Beechwood Drive – Drainage Swale with Plant Debris

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 9: Beechwood Drive – Facing West, East of Address 8041

PHOTO NO. 10: Beechwood Drive – Facing South near Address 10750

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 11: Beechwood Drive – Facing South near Intersection with Oakwood Drive

PHOTO NO. 12: Crestwood Drive, Facing North near Address 10714

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 13: Crestwood Drive, Facing North, South of Intersection with Elmwood Drive

PHOTO NO. 14: Crestwood Drive, Facing North near Address 10809

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 15: Crestwood Drive, Facing North, North of Intersection with Oakwood Drive

PHOTO NO. 16: Oakwood Drive – Facing East, Intersection with Crestwood Drive

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 17: Crestwood Drive, Facing South near Address 8078

PHOTO NO. 18: Crestwood Drive, Facing South near Address 10870, Transition from Asphalt to Concrete Surface

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 19: Crestwood Drive, Crack and Joint Repair

PHOTO NO. 20 : Crestwood Drive, Facing South near Address 10935

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 21: Crestwood Drive, Facing South near Address 10900

PHOTO NO. 22: Crestwood Drive, Facing South near Address 10955

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 23 : Crestwood Drive, Facing South near North end of Cul-de-Sac

PHOTO NO. 24: Crestwood Drive, Facing South near North end of Cul-de-Sac

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 25: Elmwood Drive, Facing East near Address 8100

PHOTO NO. 26: Elmwood Drive, Facing East near Address 8120

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 27: Elmwood Drive, Facing East near Address 8140

PHOTO NO. 28: Springer Drive, East End Facing West

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 29: Springer Drive, Facing West near Address 8170

PHOTO NO. 30: Springer Drive, Facing West near Address 8130

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 31: Springer Drive, Facing South near Address 8130, Concrete Swale with Leaf Litter

PHOTO NO. 32: Springer Drive, Facing West Near Intersection with North Spring Court

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 33: Springer Drive, Facing West Near Creek Crossing West of Intersection with North Springer Court

PHOTO NO. 34: Springer Drive Cul-de-Sac, Facing South

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 35: North Springer Court, Facing North near South end of road

PHOTO NO. 36: North Springer Court Cul-de-Sac, Facing South

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 37: North Springer Court Cul-de-Sac, Facing South

PHOTO NO. 38: Billings Road, West End Facing East

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 39: Billings Road, Facing East near Address 8262

PHOTO NO. 40: Billings Road, Facing East near Address 8395

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 41: Billings Road, Facing East Near Intersection with Wilbert Drive

PHOTO NO. 42: Billings Road, Facing East Near Intersection with Loreto Ridge Drive

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 43: Billings Road, Facing West Near Intersection with Sperry Road

PHOTO NO. 44: Billings Road, Facing West Near Intersection with Address 9100

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 45: Billings Road, Facing West Near Intersection with Address 9030

PHOTO NO. 46: Billings Road, Facing West Near Intersection with Address 8925

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 47: Billings Road, Facing West Near Intersection with Christina Drive

PHOTO NO. 48: Regency Woods Drive Road, Facing Northeast Near Intersection with Kirtland-Chardon Road

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 49: Regency Woods Drive Road, Facing Northwest Near Address 9251

PHOTO NO. 50: Regency Woods Drive Road, Facing North Near Intersection with Hemlock Ridge Drive

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 51: Regency Woods Drive Road, Facing Northeast Near Intersection with Riverwood Way

PHOTO NO. 52: Regency Woods Drive Road, Facing Northeast Near Address 9032

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

PHOTO NO. 53: Regency Woods Drive Road, Facing Souheast Near Intersection with Cardinal Drive

SME Project No.	City of Kirtland – 2020 Visual Pavement Evaluation
Photographs by:	Alison Frye
Date:	March 27, 2020
Project:	083631.00
Location:	Kirtland, Ohio

APPENDIX B

PASER SYSTEM RATING GUIDELINES (ASPHALT CONCRETE AND PORTLAND CEMENT CONCRETE)
DECISION MATRIX FOR PAVEMENT

Asphalt PASER

Rating system

Surface rating	*Visible distress**	*General condition/ treatment measures*
10 Excellent	None.	New construction.
9 Excellent	None.	Recent overlay. Like new.
8 Very Good	No longitudinal cracks except reflection of paving joints. Occasional transverse cracks, widely spaced (40′ or greater). All cracks sealed or tight (open less than ¼″).	Recent sealcoat or new cold mix. Little or no maintenance required.
7 Good	Very slight or no raveling, surface shows some traffic wear. Longitudinal cracks (open ¼″) due to reflection or paving joints. Transverse cracks (open ¼″) spaced 10′ or more apart, little or slight crack raveling. No patching or very few patches in excellent condition.	First signs of aging. Maintain with routine crack filling.
6 Good	Slight raveling (loss of fines) and traffic wear. Longitudinal cracks (open ¼″–½″). Transverse cracks (open ¼″–½″), some spaced less than 10′. First sign of block cracking. Sight to moderate flushing or polishing. Occasional patching in good condition.	Shows signs of aging. Sound structural condition. Could extend life with sealcoat.
5 Fair	Moderate to severe raveling (loss of fine and coarse aggregate). Longitudinal and transverse cracks (open ½″ or more) show first signs of slight raveling and secondary cracks. First signs of longitudinal cracks near pavement edge. Block cracking up to 50% of surface. Extensive to severe flushing or polishing. Some patching or edge wedging in good condition.	Surface aging. Sound structural condition. Needs sealcoat or thin non-structural overlay (less than 2″)
4 Fair	Severe surface raveling. Multiple longitudinal and transverse cracking with slight raveling. Longitudinal cracking in wheel path. Block cracking (over 50% of surface). Patching in fair condition. Slight rutting or distortions (½″ deep or less).	Significant aging and first signs of need for strengthening. Would benefit from a structural overlay (2″ or more).
3 Poor	Closely spaced longitudinal and transverse cracks often showing raveling and crack erosion. Severe block cracking. Some alligator cracking (less than 25% of surface). Patches in fair to poor condition. Moderate rutting or distortion (greater than ½″ but less than 2" deep). Occasional potholes.	Needs patching and repair prior to major overlay. Milling and removal of deterioration extends the life of overlay.
2 Very Poor	Alligator cracking (over 25% of surface). Severe rutting or distortions (2″ or more deep). Extensive patching in poor condition. Potholes.	Severe deterioration. Needs reconstruction with extensive base repair. Pulverization of old pavement is effective.
1 Failed	Severe distress with extensive loss of surface integrity.	Failed. Needs total reconstruction.

** Individual pavements will not have all of the types of distress listed for any particular rating. They may have only one or two types.*

Concrete PASER

Rating system

Surface rating	*Visible distress**	*General condition/ treatment measures*
10 Excellent	None.	New pavement. No maintenance required.
9 Excellent	Traffic wear in wheelpath. Slight map cracking or pop-outs.	Recent concrete overlay or joint rehabilitation. Like new condition. No maintenance required.
8 Very Good	Pop-outs, map cracking, or minor surface defects. Slight surface scaling. Partial loss of joint sealant. Isolated meander cracks, tight or well sealed. Isolated cracks at manholes, tight or well sealed.	More surface wear or slight defects. Little or no maintenance required.
7 Good	More extensive surface scaling. Some open joints. Isolated transverse or longitudinal cracks, tight or well sealed. Some manhole displacement and cracking. First utility patch, in good condition. First noticeable settlement or heave area.	First sign of transverse cracks (all tight); first utility patch. More extensive surface scaling. Seal open joints and other routine maintenance.
6 Good	Moderate scaling in several locations. A few isolated surface spalls. Shallow reinforcement causing cracks. Several corner cracks, tight or well sealed. Open (¼" wide) longitudinal or transverse joints and more frequent transverse cracks (some open ¼").	First signs of shallow reinforcement or corner cracking. Needs general joint and crack sealing. Scaled areas could be overlaid.
5 Fair	Moderate to severe polishing or scaling over 25% of the surface. High reinforcing steel causing surface spalling. Some joints and cracks have begun spalling. First signs of joint or crack faulting (¼"). Multiple corner cracks with broken pieces. Moderate settlement or frost heave areas. Patching showing distress.	First signs of joint or crack spalling or faulting. Grind to repair surface defects. Some partial depth patching or joint repairs needed.
4 Fair	Severe polishing, scaling, map cracking, or spalling over 50% of the area. Joints and cracks show moderate to severe spalling. Pumping and faulting of joints (½") with fair ride. Several slabs have multiple transverse or meander cracks with moderate spalling. Spalled area broken into several pieces. Corner cracks with missing pieces or patches. Pavement blowups.	Needs some full depth repairs, grinding, and/or asphalt overlay to correct surface defects.
3 Poor	Most joints and cracks are open, with multiple parallel cracks, severe spalling, or faulting. D-cracking is evident. Severe faulting (1") giving poor ride. Extensive patching in fair to poor condition. Many transverse and meander cracks, open and severely spalled.	Needs extensive full depth patching plus some full slab replacement.
2 Very Poor	Extensive slab cracking, severely spalled and patched. Joints failed. Patching in very poor condition. Severe and extensive settlements or frost heaves.	Recycle and/or rebuild pavement.
1 Failed	Restricted speed. Extensive potholes. Almost total loss of pavement integrity.	Total reconstruction.

** Individual pavements will not have all of the types of distress listed for any particular rating. They may have only one or two types.*

DECISION MATRIX FOR PAVEMENT MAINTENANCE

Paser Rating	Description	Pavement Condition	Approximate Age	Remedy	Description
10	Excellent	New Construction, no defects	Less than 1 year old	No Action Required	Do Nothing
9	Excellent	Like New. More than 1 year old, no defects	More than 1 year old	No Action Required	Do Nothing
8	Very Good	Occasional cracks, cracks tight	less than 3 years old	Little or No Maintenance Required	Routine Maintenance (low)
7	Good	Cracks less than 1/4" width	Less than 5 years old	Maintain with Crack Seal	Routine Mainteinance (low to moderate)
6	Good	Cracks btwn 1/4" to 1/2" first signs of block cracking	More than 5 years old	Maintain with with Seal Coat/crack seal	Routine Maintenance (Low to moderate)
5	Fair	Cracks greater than 1/2" width, secondary cracks, less than 50% block cracking	Variable	Maintain w/ seal coat or thin overlay	Routine Maintenance / Surface Treatment (Moderate to High)
4	Fair	Greater than 50% block cracking, rutting, first signs of structural weaking	Variable	Structural Overlay	Surface Improvements
3	Poor	Less than 25% alligator cracking, moderate rutting, severe block cracking	Variable	Structural Overlay / Patching / Mill and Overlay	Capital - Surface Improvements (High)
2	Very Poor	Great than 25% alligator cracking, severe rutting, frequest potholes	Variable	Reconstruction with Base Repair/ Crush and shape possible	Capital Improvement
1	Failed	Loss of surface integrity	Variable	Reconstruction	Capital Improvement