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# City of Frontenac West End Subdivision Street Evaluation Summary Report

Prepared for:

City of Frontenac  
Department of Public Works  
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## Introduction

The City of Frontenac (City) requested Lochmueller Group (Lochmueller) evaluate the existing condition of streets within the West End Subdivision and make recommendations on necessary improvements.

This evaluation included the following:

- Pavement condition inspections and data collection.
- Pavement and Stormwater Drainage conditions analysis and evaluation.
- Pavement cores to determine composition of the existing pavement.
- Development of rehabilitation and/or reconstruction alternatives.

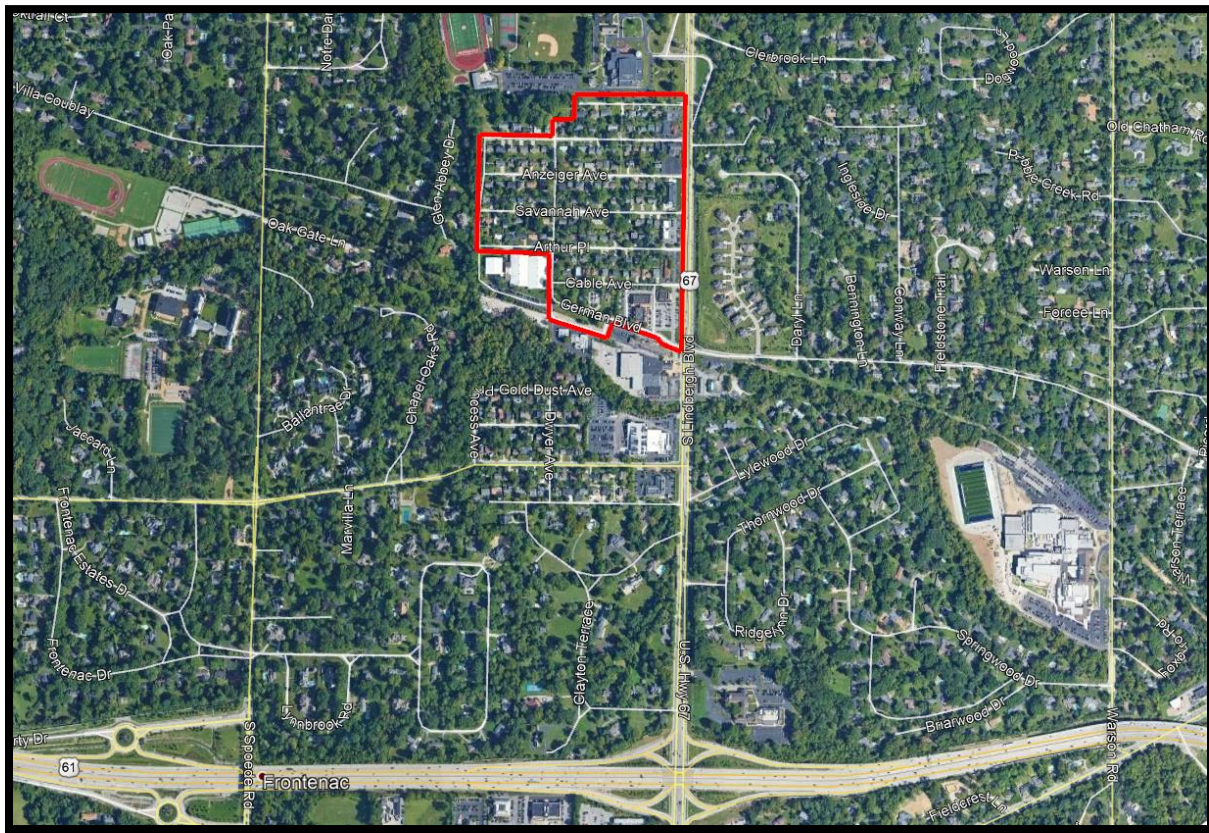
This report summarizes this evaluation and provides conclusions and recommendations on the findings.

## Evaluation Area

The West End Subdivision is located off US Highway 67/South Lindbergh Boulevard, approximately half a mile north of Interstate 64. The evaluation included all 9 streets within the subdivision, as well as German Boulevard and its southern loop encompassing almost 2 miles of roadway and over 25,000 square yards of pavement.

**Figure 1** below shows the location of the evaluation area while subsequent

**Figure 2** illustrates the subdivision streets included in the evaluation.



*Figure 1: Evaluation Area*

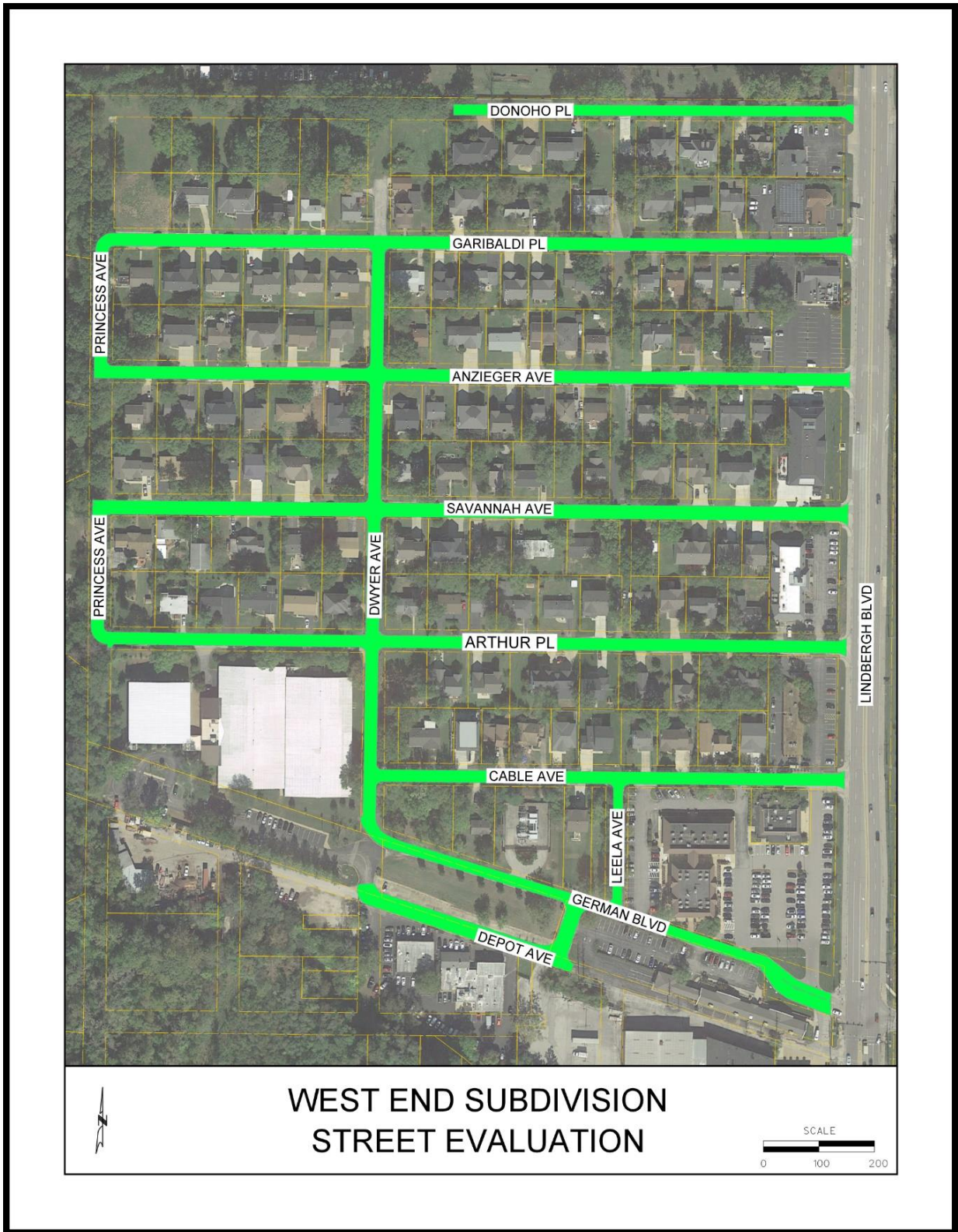


Figure 2: Subdivision Streets

## Pavement Condition Investigation

### Methodology

Each of the roads within the subdivision were driven to determine the existing condition. Surface defects found were noted and photographed. Examples of each type of defect considered are shown below.



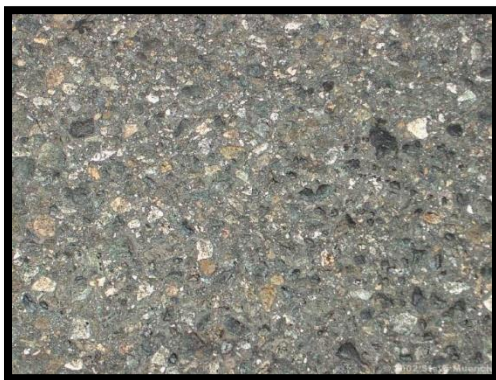
#### *Raveling*

Raveling is progressive loss of pavement material from the surface downward, caused by: stripping of the bituminous film from the aggregate, asphalt hardening due to aging, poor compaction especially in cold weather construction, or insufficient asphalt content. The severity varies. Examples are shown below.



#### *Flushing/Bleeding*

Flushing or bleeding is excess asphalt on the surface caused by a poor initial asphalt mix design or by paving or sealcoating over a flushed surface.



#### *Polishing*

Polishing is a smooth slippery surface caused by traffic wearing off sharp edges of aggregates.



*Rutting*

Rutting is displacement of material, creating channels in wheelpaths.



*Shoving*

Shoving or rippling is surfacing material displaced crossways to the direction of traffic.



*Transverse Cracks*

A crack at approximately right angles to the center line is a transverse crack. They are often regularly spaced.



*Reflection Cracks*

Cracks in overlays reflect the crack pattern in the pavement underneath.



*Slippage Cracks*

Cracks in overlays reflect the crack pattern in the pavement underneath.



*Longitudinal Cracks*

Cracks running in the direction of traffic are longitudinal cracks.



#### *Block Cracks*

Block cracking is interconnected cracks forming large blocks. Cracks usually intersect at nearly right angles. Blocks may range from one foot to approximately 10' or more across.



#### *Alligator/Fatigue Cracks*

Interconnected cracks forming small pieces ranging in size from about 1" to 6".



#### *Patches*

Original surface repaired with new asphalt patch material. This indicates a pavement defect or utility excavation which has been repaired.



*Potholes*

Holes and loss of pavement material caused by traffic loading, fatigue and inadequate strength.

### Pavement Condition Analysis

Based on the defect information collected in the field, each street was evaluated and rated. The rating scale ranges from 1 (failed) to 10 (excellent). **Table 1** below shows a breakdown of the rating system.

*Table 1: Pavement Rating System*

Rating	Visible Defects	General Condition/ Treatment Measures
10 Excellent	None.	Condition: New construction.
9 Excellent	None.	Condition: 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 1/4").	Condition: Recent sealcoat or new cold mix. Treatment: Little or no maintenance required.
7 Good	Very slight or no raveling, surface shows some traffic wear. Longitudinal cracks (open 1/4") due to reflection or paving joints. Transverse cracks (open 1/4") spaced 10' or more apart, little or slight crack raveling. No patching or very few patches in excellent condition.	Condition: First signs of aging. Treatment: Maintain with routine crack filling.
6 Good	Slight raveling (loss of fines) and traffic wear. Longitudinal cracks (open 1/4"– 1/2"). Transverse cracks (open 1/4"– 1/2"), some spaced less than 10'. First sign of block cracking. Slight to moderate flushing or polishing. Occasional patching in good condition.	Condition: Shows signs of aging. Sound structural condition. Treatment: Could extend life with sealcoat.
5 Fair	Moderate to severe raveling (loss of fine and coarse aggregate). Longitudinal and transverse cracks (open 1/2" 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.	Condition: Surface aging. Sound structural condition. Treatment: 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 (1/2" deep or less).	Condition: Significant aging and first signs of need for strengthening. Treatment: 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 1/2" but less than 2" deep). Occasional potholes.	Condition: Needs patching and repair prior to major overlay. Treatment: 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.	Condition: Severe deterioration. Treatment: Needs reconstruction with extensive base repair.
1 Failed	Severe distress with extensive loss of surface integrity.	Condition: Failed. Treatment: Needs total reconstruction.



Based on pavement cores, the existing pavement surface is approximately 3 inches thick with an underlying rock base in some locations. Overall the streets are in very poor condition and are beyond the point of typical maintenance prolonging their life. The only areas of serviceable pavement are due to repairs from recent utility work. Multiple defects were found on each street resulting in an average rating between 1 and 2 for the entire subdivision. The severe cracking identified allows water to penetrate to the subgrade which furthers the deterioration. Below are some examples of the defects recorded during the investigation:



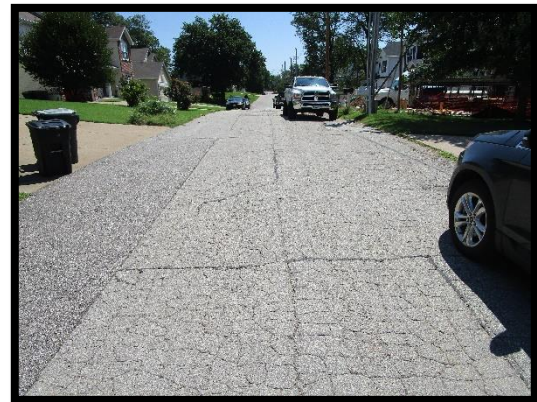
Donoho Place:  
Longitudinal & Transverse Cracking



Garibaldi Place:  
Alligator Cracking w/ Potholes



Savannah Avenue:  
Longitudinal & Transverse Cracking w/  
Alligator Cracking



Anzieger Avenue:  
Longitudinal & Transverse Cracking w/  
Alligator Cracking



Arthur Place:  
Longitudinal & Transverse Cracking,  
Alligator Cracking, Raveling, & Potholes



Cable Avenue:  
Longitudinal & Transverse Cracking,  
Alligator Cracking, Raveling, & Potholes



Princess Avenue:  
Longitudinal & Transverse Cracking,  
Alligator Cracking, & Raveling



Dwyer Avenue:  
Transverse Cracking, Alligator Cracking, &  
Raveling

## Stormwater Drainage Concerns

The investigation also discovered several stormwater drainage issues throughout the subdivision that impact the street pavement:

- Pavement and storm sewer pipe failure at the intersection of Anzieger Avenue & Dwyer Avenue.
- Stormwater ponding at 10470 Savannah Avenue.
- Stormwater ponding at 10469 Arthur Place.
- Storm sewer pipe failure under Cable Avenue at 10425.
- New stormwater inlets may be needed at the west end of Cable Avenue.
- Lack of curb causing street runoff to impact buildings residences at various locations.

These drainage issues should be also be addressed to prevent future problems.

## Rehabilitation Options

Based on the investigation findings, it is recommended that significant rehabilitation or reconstruction be performed on all streets within the West End Subdivision. As a result of the existing pavement conditions evaluated, Lochmueller has provided three (3) options with applicable cost estimates and service lives to satisfy future budgetary planning. The options with shorter service lives, while less costly up front, will require more investment in future years to maintain. In addition, all of the options will require ongoing maintenance, in the form of periodic crack sealing, to obtain the estimated service life. The drainage issues identified should also be addressed during the roadway rehabilitation work.

### *Option 1 - 2-inch Overlay w/ Fiber on Existing Pavement*

Due to its deteriorated condition, it is likely that the existing pavement could suffer severe damage during a milling operation. Therefore, Lochmueller does not recommend milling the existing surface to minimize driveway transition issues. A thin overlay of the existing pavement without milling would not extend the life of the pavement substantially. However, the addition of high-tensile strength fiber to the overlay layer would support the surface pavement’s structural stability. A 2-inch fiber reinforced overlay increases the strength and durability of the pavement as well as helps it resist premature cracking and rutting. **Table 2** reflects the estimated costs of Option 1.

TABLE 2				
OPTION 1 - 2 INCH OVERLAY W/ FIBER ON EXISTING PAVEMENT				
ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
BASE REPAIR	SY	1290	\$100.00	\$129,000.00
TACK COAT	GAL	2186	\$3.00	\$6,570.00
HMA SURFACE W/ FIBER, 2-INCH	TON	2880	\$95.00	\$331,200.00
STORMWATER DRAINAGE IMPROVEMENTS	LS	1	\$50,000.00	\$50,000.00
DESIGN, BIDDING, AND INSPECTION	LS	1	\$100,000	\$100,000.00
				<b>\$616,770.00</b>

Option 1 includes a small quantity for isolated base repair of the existing pavement, isolated curb and gutter installation to address major drainage issues, and replacement of damaged roadway culverts. With this option, driveway transitions would be addressed with an asphalt wedge at the edge of pavement. The anticipated life extension of the pavement with this option is approximately **5 years** with proper maintenance. Ongoing, annual, maintenance of the pavement is not included in the above estimate.

### *Option 2 – Full Depth Reclamation w/ 3-inch Overlay*

Full-depth reclamation is a process that effectively recycles the existing pavement in-place. The existing pavement and base layers are pulverized in place to use as the base course. Stabilizing additives are introduced to the mixture in order to increase strength and durability. The base is then compacted to create a smooth and stable surface for a 3-inch overlay. **Table 3** reflects the estimated costs of Option 2.

TABLE 3				
OPTION 2 - FULL DEPTH RECLAMATION W/ OVERLAY				
ITEM	UNIT	QUANTITY	UNIT COST	TOTAL COST
FULL DEPTH RECLAMATION	SY	25720	\$13.00	\$334,360.00
PRIME COAT	GAL	9460	\$3.00	\$28,380.00
HMA SURFACE, 3-INCH	TON	4320	\$80.00	\$432,000.00
STORMWATER DRAINAGE IMPROVEMENTS	LS	1	\$75,000.00	\$75,000.00
DESIGN, BIDDING, AND INSPECTION	LS	1	\$175,000.00	\$175,000.00
				<b>\$1,044,740.00</b>

Since Option 2 repurposes the pavement as a stabilized base, separate base repairs are not required. It also eliminates any concerns of existing cracks reflecting through to the new pavement. This option includes the isolated curb and gutter installation to address major drainage issues as well as roadway culvert replacement and additional storm sewer improvements to extend the life of the pavement. Most driveway transitions will be addressed by adjustment of the pavement cross slope during the reclamation grading and compaction process. There may be a need to provide an asphalt wedge transition at some driveways. The anticipated life extension of the pavement with this option is approximately **20 years** with proper maintenance. Ongoing, annual, maintenance of the pavement is not included in the above estimate.

*Option 3 – Full Depth Reconstruction w/ Curb & Gutter*

Full-depth roadway reconstruction removes all existing pavement and base layers. Once the existing layers are demolished and removed, any subgrade issues can then be investigated and addressed. This adds substantial life to the reconstructed pavement. A new 6-inch aggregate base and 3-inch Hot Mix Asphalt surface course would then be constructed. All entrances and driveways would be adjusted to tie-into the new pavement. This option also includes new curb and gutter to improve stormwater drainage. **Table 4** reflects the estimated costs of Option 3.

TABLE 4				
FULL DEPTH RECONSTRUCTION W/ CURB & GUTTER				
ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
PAVEMENT REMOVAL	SY	25720	\$7.50	\$192,900.00
EARTH EXCAVATION	CY	4290	\$10.00	\$42,900.00
TYPE 5 AGGREGATE BASE, 6-INCH	SY	27030	\$7.50	\$202,725.00
CURB & GUTTER	LF	20280	\$30.00	\$608,400.00
PAVED APPROACH	SY	1490	\$60.00	\$89,400.00
PRIME COAT	GAL	9460	\$3.00	\$28,380.00
HMA SURFACE, 3-INCH	TON	4320	\$100.00	\$432,000.00
STORMWATER DRAINAGE IMPROVEMENTS	LS	1	\$50,000.00	\$50,000.00
DESIGN, BIDDING, AND INSPECTION	LS	1	\$225,000.00	\$225,000.00
				<b>\$1,896,705.00</b>

Option 3 will address all pavement defects, repair the subgrade where necessary, and improve overall drainage. The anticipated life extension of the pavement with this option is approximately **30 years** with proper maintenance. Ongoing, annual, maintenance of the pavement is not included in the above estimate.

It should be noted that the analysis provided in this report represents only those needs identified as of the summer of 2020. It is to be expected that typical pavement deterioration will continue on the streets throughout the subdivision. Additionally, difficult freeze/thaw cycles may occur during this time that may exacerbate deterioration on some streets.

#### *Street Maintenance Plan*

Establishing a Street Maintenance Plan will extend the life of the street improvements and lower long term costs. To maintain an acceptable minimum pavement rating, periodic maintenance such as annual crack sealing, addressing new drainage issues early to prevent subgrade deterioration, and surface treatments or resurfacing when the pavement surface. For Option 1, the addition of the fiber to the asphalt mix will mitigate the cracking that naturally occurs in asphalt pavement, but over time there will still be cracks develop since the underlying deteriorated pavement will remain. After year 2 crack sealing is likely to cost \$15,000 to 25,000 per year for the life of the pavement or \$100,000 total over 5 years. For the reconstructed pavement in Options 2 and 3, the approximately 2 miles of pavement likely will not need significant crack sealing for several years. Starting at the end of year 5 the subdivision can expect to spend \$15,000 to \$25,000 per year on crack sealing for the life of the pavement or \$300,000 over 20 years and \$500,000 over 30 years.