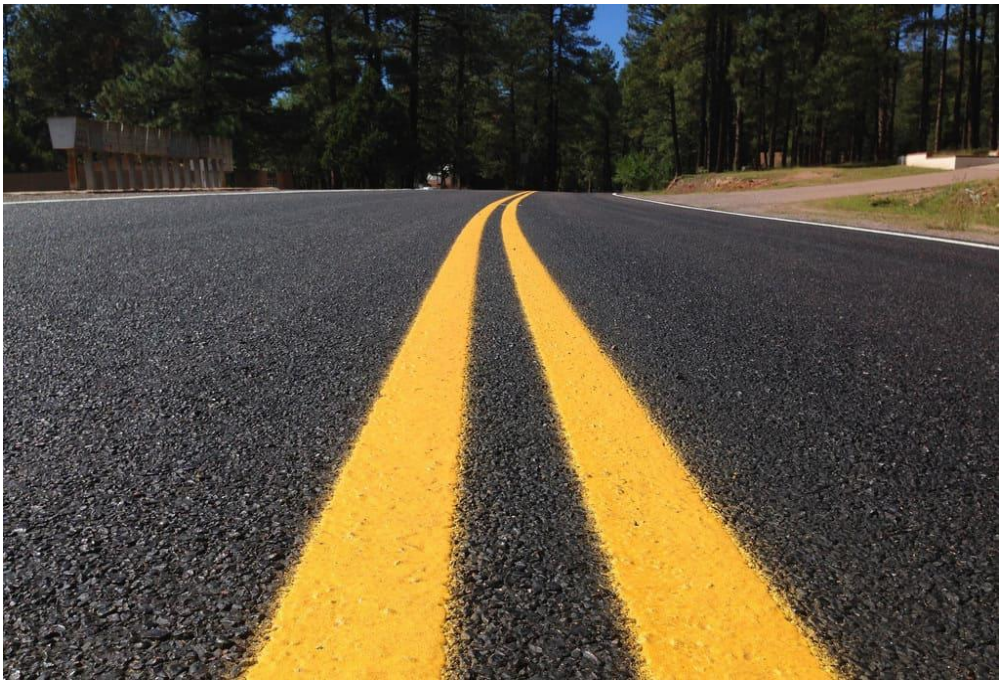
Town of Arlington



Roads Maintenance Report

2020

The Town of Arlington
Department of Public Works
Roads Maintenance

Public Works Road Maintenance Crew

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Introduction

The primary goal of the Public Works Department road maintenance program is to enhance mobility in our town and ensure the safety and viability of the town's road network.

Through use of the most current tools, technologies, and methodologies, we can establish the priorities of the program to help us achieve our goal. By selecting the right preventative or corrective treatment, for the right road, at the right time, we can maximize our budget and extend the life of one of our most expensive assets.

The Arlington Public Works Department is dedicated to providing that safety and mobility for commuters, citizens, cyclists, commerce, visitors and emergency responders.

Components of a Roadway

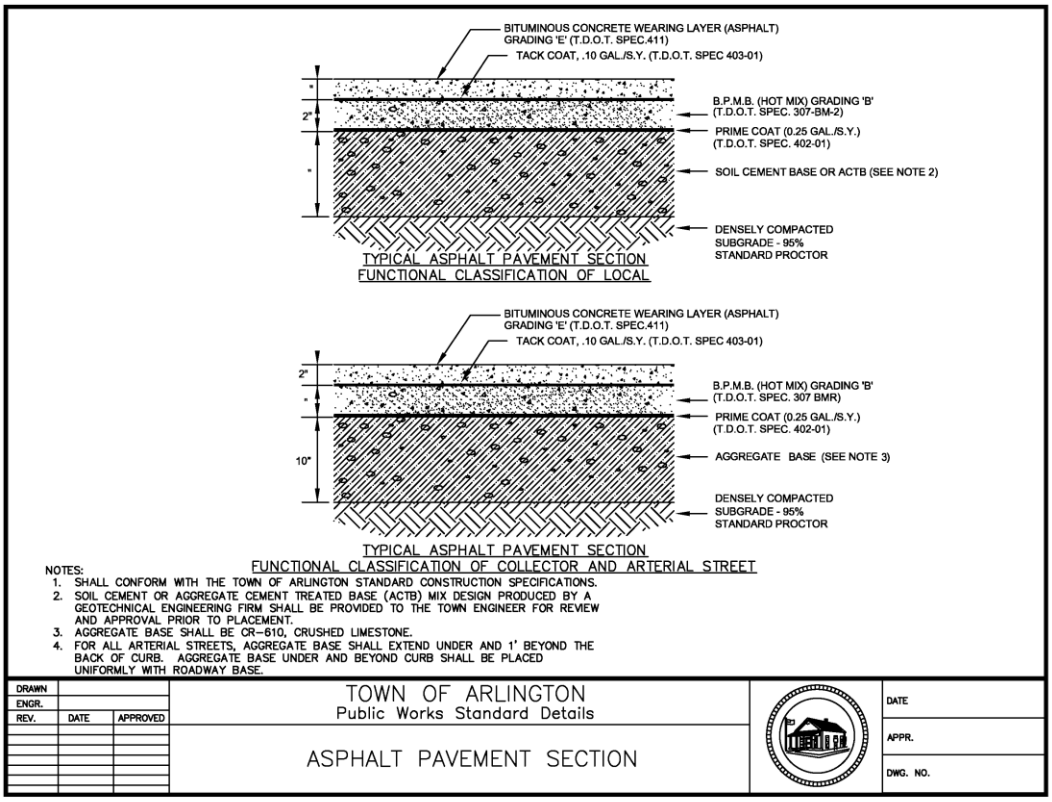


Figure 1

Probably the most obvious and most discussed aspect of a roadway is the asphalt surface. As such, this report will focus primarily on the asphalt surface portion of the roadway. However, it is worth mentioning that there are other components not only in the roadway structure that require repair from time to time, but components within the rights-of-way that Public Works is responsible for maintaining. The illustration in Figure 1 is the Town of Arlington's standard details showing the structural components of a roadway for local roads as well as collector and arterial roads. A local road, as defined by the Federal Highway Administration, is one that provides limited mobility and is a primary access to residential areas, businesses, farms, and other local areas. Speed limits tend to be between 20 and 45 miles per hour. Collectors are major and minor roads that connect local roads and streets with arterials. Collectors provide less mobility than arterials at lower speeds and for shorter distances. They balance mobility with land access. The posted speed limit on collectors is usually between 35 and 55 miles per hour. Arterials include freeways, multi-lane highways and other important roadways that supplement the interstate system. They provide the

highest level of mobility and the highest speeds over longer uninterrupted distances. Typically, speeds are between 50 and 75 miles per hour.

Because traffic loads are usually higher on collectors and arterials than those of local roads, they are built with a more robust structure. (see Figure 1)

Other components integral to the roadway system are:

- Drainage Structures such as culverts, drain inlets, side ditches, and drain manholes

- Striping

- Curb and Gutter

- Signage and Signalization

- Guardrails and Retaining Walls

- Even Sidewalks are a component within many rights-of-way that are maintained by Public Works

Pavement Deterioration

Pavement deterioration is the process by which distress (defects) develop in the pavement under the combined effects of traffic loading, environmental, and other conditions. Listed below are the 20 asphalt distresses and their correlating classification. (see appendix A for an example of each)

Weather Based Distresses

- Block Cracking
- Joint Reflection
- Longitudinal and Transverse Cracking
- Raveling
- Weathering

Load Associated Distresses

- Alligator Cracking
- Edge Cracking
- Pothole
- Rutting
- Shoving
- Slippage Cracking

Other Distresses

- Bleeding
- Bumps and Sags
- Corrugation
- Depression
- Lane/Shoulder Drop
- Patch/Utility Cut
- Polished Aggregate
- Railroad Crossing
- Swell

These distress types combined with their severity and quantity within a specified distance of roadway are used to arrive at a number on a scale of 0-100. This is known as the Pavement Condition Index scale or PCI. The PCI number correlates to a pavement condition within a range from good to failed. This information is used to determine treatment options. Figure 2 is an asphalt deterioration curve. It shows a PCI range and the associated deterioration rate over time. Notice how rapidly the asphalt pavement begins to deteriorate between the fair and poor ranges.

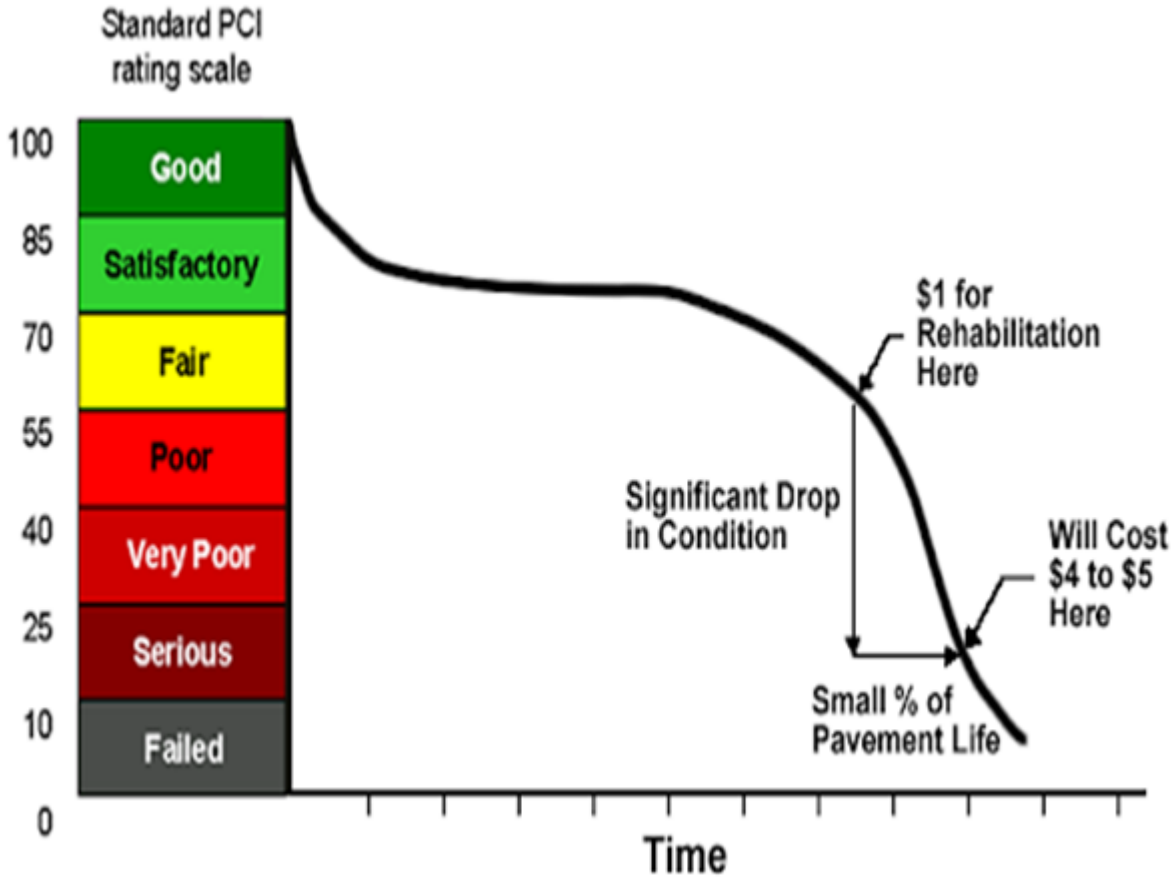


Figure 2

Surface Treatments Used in Road Maintenance

There are a number of different types of road maintenance surface treatments available depending on the condition of the road or road segment(s) to be treated. The type of treatment used may also depend on the desired number of years of life the pavement is expected to be extended. While there is a good selection of treatments available, there may be some limiting factors such as material availability, limited number of contractors authorized or equipped to provide a particular treatment, or mobilization for a particular treatment not available in the area may be cost prohibitive.

Preventative Surface Treatments

- Crack Sealing
- Slurry Seal
- Chip Seal
- Scrub Seal
- Cape Seal
- Fog Seal
- Micro Surfacing
- Ultra-thin Hot Mix Overlay

Corrective Treatments

- Structural Overlays
- Mill and Overlays
- Pothole Repair
- Patching
- Cold Planing and Micro Milling
- Hot in Place Recycling
- Cold in Place Recycling
- Full Depth Reclamation

The Town of Arlington's Road Maintenance

In 2018 the Public Works Department began to reassess our approach to road maintenance. Given the pace at which new roads were being added to the inventory, we knew we had to develop a better strategy. It would have to be a pragmatic plan that gave consideration to pavement preservation. If we could extend the useful life of our streets and roads not only would we save money in the long run, but we would improve the overall condition of our entire road network.

Crack Sealing

One of the first steps we took, being recommended as a first line of defense against asphalt deterioration, was to implement a crack sealing program. Crack sealing is much like repairing a leaking roof. If a leak is not sealed in a timely manner, the moisture can degrade the integrity of the entire structure. In fiscal budget year 2019/2020, Public Works purchased a new crack sealing machine. This machine is much safer, more efficient and can cover much more area in a shorter span of time than the old machine. Between July of 2019 and May of 2020, the Public Works Crew crack sealed the streets of 6 complete subdivisions and partial sections of several other roads and streets. This equates to approximately 16 lane miles. They used 18,000 pounds of material at a cost of $11,700. It is estimated that crack sealing extends the life of pavement by 3 to 5 years.

Crack Sealing

Patching

Patches are used as a method of treating areas of localized distress. Depending on the extent of the failure, patches may be excavated to a depth at which a good foundation is reached. At that point, the layers of aggregate are replaced and properly compacted, and the surface layers of asphalt replaced. Where the underlying base structure is sound and the failure is in the surface layer of asphalt, the surface layer is milled and replaced with hot mix asphalt. In fiscal year 2019/2020, Public Works Crews used over 310 tons of hot mix asphalt patching localized failures at a cost of approximately $16,190. We have also begun to implement crack sealing of our patches to prevent moisture from entering around the edges. This should help extend the life of the patched areas.

Public Works Crew Applying a Surface Coat of Hot mix Asphalt in a Patch

Patches with Crack Sealed Edges

Potholes

Potholes are enemy number 1. They create the most complaints and have immediate potential to cause damage to tires, wheels, vehicle alignment and could even cause a vehicle to leave the roadway. While they can appear at any time, they seem to arise most often during the freeze/thaw periods of winter and during rainy weather of spring and fall. Public Works Crews put potholes as a top priority due to safety and vehicle damage concerns. During the times when potholes appear most, every Public Works truck is stocked with bags of cold mix asphalt. This allows us to address potholes immediately as we find them while conducting our daily business.

In Fiscal year 2019/2020, Public Works Crews filled hundreds of potholes using 22,050 pounds of cold mix asphalt at a cost of approximately $5,425.

Filling and Tamping a Pothole

Hot Mix Asphalt Overlay (Paving)

The useful service life of a road or street can be extended many years through the proper use of pavement preservation treatments. However, there comes a point in time when a road will need a new surface layer. This typically involves milling in some areas to prevent the new surface from rising above the edge of the concrete gutter, or the crown of the road becoming too high. Milling could be a partial milling or a milling of the entire road. Any necessary patching will also be done prior to overlay to repair localized failures. Once the integrity of the underlying structure has been restored and milling completed, a surface layer from 1 inch to 1 ½ inches of hot mix asphalt will be put in place. The final phase is to replace all painted markings. In fiscal year 2019/2020, Public Works contracted with a local paving company for all hot mix asphalt overlays. They were able to complete approximately 4.6 center line miles of paving at a cost of around $1,008,005. This cost does not include re-striping or other painted markings.

Dusty Field Rd. Overlay

Pavement Management Group (PMG)

As a part of our new pavement management plan, we knew it would be beneficial to utilize technology to help us map our way forward. After a year or more of research on pavement management systems, it appeared that with our limited manpower and training, it would be a daunting task to build a system on our own. So, in August of 2019 Public Works partnered with PMG to begin working on our new pavement management system. PMG set up the PAVER software developed by the U.S. Army Corps of Engineers, built our road and street inventory by sections, drove and video recorded each segment. With their training and expertise, they were able to give a PCI score (discussed on page 13) to each segment. Using this technology, we are already in the process of developing our maintenance plan for fiscal year 2020/2021, and beyond. The cost for PMG's services for the entire project was $29,150. This was approximately 2% of the overall Street Aid budget for 2019/2020. (see Appendix B for PMG's final report).

The Future of The Town of Arlington's Road Maintenance

The future of Arlington's road maintenance program is promising. Even in the face of the COVID-19 pandemic which has strained budgets. Armed with the information PMG has given us and a better knowledge of various road treatments, we are developing a plan that maximizes our budget to get the most out of the funds we have. By putting 70% of our street aid budget toward repairing our poorest roads, and 30% toward preservation of good roads for added service life, we will slowly improve the overall condition of our entire road network. We estimate in fiscal year 2020/2021, we will overlay approximately 3.3 centerline miles of roadway. This number could vary based on field conditions encountered. The plan for pavement preservation treatments is currently still in the planning stage. That information will be available as soon as the plan is finalized.

Town Road Projects

The Town currently has several major road projects in various stages, some of which are grant funded in part. The Highway 70 widening has just been completed and others are under way such as the Depot Square re-alignment and widening of Airline Rd. Other planned projects can be seen on the FY 2021 detailed Street Aid Budget plan on the next page.

43100 State Street Aid

Account	Description	ACTUAL 2016-2017	ACTUAL 2017-2018	ACTUAL 2018-2019	ORIGINAL 2019-2020	PROPOSED 2020-2021
	FISCAL YEAR					
	Expenditures					
200	CONTRACTUAL SERVICES **(Inmates, Spraying ROW)**	-	-		30,000	30,000
240	UTILITY SERVICE	303,980	340,461	375,555	370,000	390,000
254	ENGINEERING SERVICES	38,599	988	14,988	50,000	50,000
260	REPAIR AND MAINTENANCE SERVICES	-	-		-	-
267	REPAIR AND MAINTENANCE SIGNALS	9,498	10,506	4,982	15,000	15,000
268	REPAIR AND MAINT ROADS AND STREETS	579,750	446,200	626,057	1,270,000	900,000
320	OPERATING SUPPLIES	-	-		-	-
331	GAS, OIL, DIESEL FUEL, GREASE, ETC.	8,964	4,145		-	-
342	SIGNAGE	-	-		30,000	20,000
450	RAW MATERIALS	-	-		200,000	100,000
721	GRANT PED. AND BIKE TRAIL **(80/20)**	-	15,866	36,403	30,000	30,000
722	DONNELSON FARMS PKWY **(80/20)**	-	500	23,934	100,000	100,000
723	HAYES ROAD PROJECT	-	-		-	-
724	HWY 70 WIDENING **(80/20)**	58,015	78,682	131,156	500,000	500,000
725	AIRLINE ROAD WIDENING **(80/20)**	64,049	141,675	544,914	300,000	300,000
726	GRANT MILTON WILSON ROAD SOUTH	-	-		-	-
727	GRANT MILTON WILSON R	-	-		-	-
728	AIRLINE ROAD @ DOUGLASS ST. **(80/20)**	-	-		-	-
729	HALL CREEK BRIDGE **(36%)**	-	-		-	-
730	MILTON WILSON MIDDLE	-	-		-	-
731	TDOT LAMB ROAD	7,450	152,273	5,931	-	-
900	CAPITAL OUTLAY **(Hot Box Pavement $40K)**	2,920	130,801	122,389	348,000	324,000
	TOTAL STATE STREET AID	**$ 1,073,224**	**$ 1,322,096**	**$ 1,886,308**	**$ 3,243,000**	**$ 2,759,000**

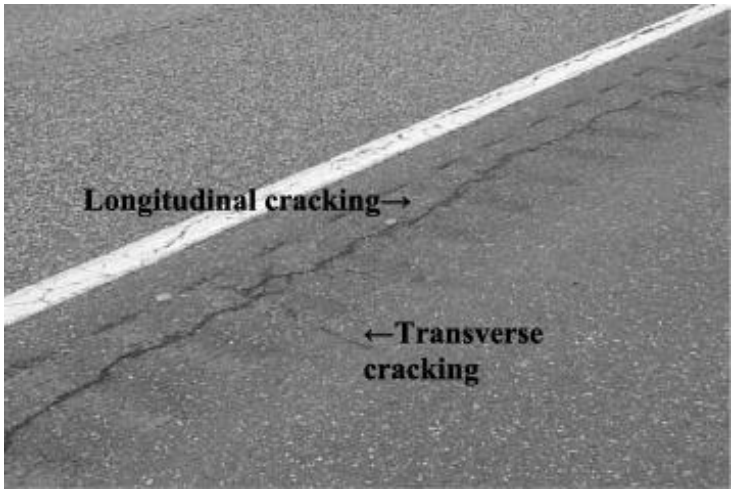
Conclusion

Our road network is one of the town's most expensive assets. It is also crucial to our connectivity, mobility, and economic development. Our motorists expect to have safe, reliable roads whether it's for their daily commute, a drive to the park, or a trip to Kroger. While esthetics are of some importance, it is the primary responsibility of Public Works to be sure those roads are safe and reliable. Road conditions are ever changing and the Public Works Department's road maintenance plan will evolve with these changes. We will utilize all the tools we have available in the tool box to be sure we are being good stewards of the tax payer's dollars and providing the best roads and streets possible.

Appendix A

Block Cracking

Joint Reflection



Longitudinal and Transverse Cracking

Raveling

Appendix A cont.

Weathering

Alligator Cracking

Edge Cracking

Pothole

Appendix A cont.

Rutting

Shoving

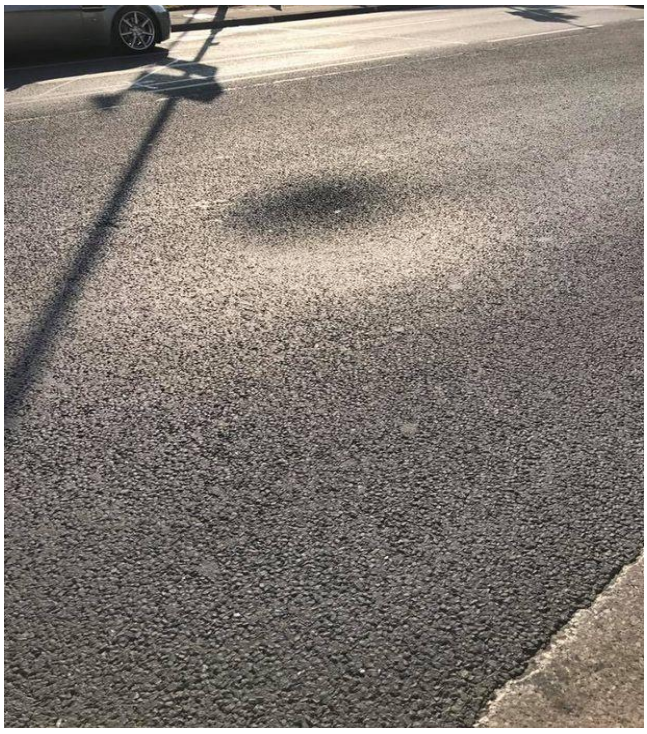
Slippage Cracking

Bleeding

Appendix A cont.

Bumps and Sags

Corrugation



Depression

Lane/Shoulder Drop

Appendix A cont.

Patch/Utility Cut

Polished Aggregate

Railroad Crossing

Swell

The Numbers at a Glance FY 2019/2020

Crack Sealing

- 16 lane miles
- 18,000 pounds of crack seal material
- Cost of $11,700
- Extends pavement life 3-5 years

Subdivisions completed

- Harrell's Ridge
- Buckshot Hill
- Arlington Station
- Arlington Downs
- Chapel Ridge
- Hidden Meadows

Patching

- 310 tons of hot mix asphalt used
- Cost of $16,190

Potholes

- 441 bags of pothole cold mix asphalt
- 22,050 pounds of material
- Cost of $5,425

Asphalt Overlay

- 4.6 centerline miles completed
- Cost of $1,008,005

Streets Paved

- Arlington Downs – Entire subdivision
- Stately Oaks West and South

- Stately Oaks Cove
- Kettlewood Cove
- Deer Park Cove
- Wolf Woods
- Wolf Pack
- Berry Patch
- Berry Patch Cove
- Mahogany Ridge
- Accord Cove
- Hidden Manor
- Chapel Ridge Subdivision (except Southern Winds)
- Indian Walk
- Dusty Field
- Dr. Logan Subdivision – Entire subdivision
- Hays – From Airline to top of hill
- Sumac – Eastern one third

Striping/Markings

- Total cost of striping 2019-2020 - $30,402

Areas Striped/Marked

- Memphis Arlington (Airline/ Jetway realignment)
- Donelson West
- Larry Anderson
- 205/Hwy 70 intersection (new pavement at Hwy 70 approach)
- White Oak subdivision (several stop bars)
- Jetway (partial)
- School crossings on Douglas and Memphis Arlington
- Town Hall upper parking lot

Appendix B
PMG Final Report

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PAVEMENT MANAGEMENT GROUP

FINAL PAVEMENT MANAGEMENT PROJECT REPORT

TOWN OF ARLINGTON, TN

Friday, May 22, 2020

Pavement Management Group

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INTRODUCTION

Pavement Management Group (PMG) recently provided a turn-key pavement management program (PMP) for the Town of Arlington, TN. The backbone of the PMP is the PAVER™ Pavement Management System (PMS), as well as the ASTM D6433-18 condition assessment, both developed by the U.S. Army Corps of Engineers.

The combination of PMG expertise, standardized condition assessment and the PAVER™ PMS under a complete scope of continued services provides for a data-driven approach to the annual maintenance and repair program of the roadway network.

This report provides a thorough definition of the services rendered and the roadway network condition results of our turn-key pavement management project.

PROJECT SCOPE OF SERVICES

- Verification and addition of inventory items including entering all previous work history
- Provide an HD video of each pavement section within the wards contracted
- Determine total samples to inspect per section
- Identify all distress types, severity levels and quantities within each sample
- Calculate the Pavement Condition Index (PCI) for each pavement section
- Assign all pavement management data to GIS
- Create GIS current condition map
- Create a Google Earth KMZ file of street conditions with HD video streaming link
- Provide a complete inventory and condition listing of each pavement section
- Provide a final report of findings
- Provide continued support services

NETWORK INVENTORY AND CONDITION SUMMARY

- 88 centerline miles
- 228 lane miles (lane = 10 feet wide)
- 12,052,534 square feet
- 717 management sections
- Average network PCI of 70
- Average network condition category of GOOD

ASTM INSPECTION PROCESS

The PAVER™ PMS defines the pavement network in terms of "Branches" and "Sections." The client's roadway network consists of all streets maintained within the agency, each broken down into logical management sections, typically on an intersection by intersection basis.

Within each section, the total number of possible sample locations is first determined, and then approximately 10% of these samples are inspected following ASTM D6433-18. The trained inspector analyzes the HD video using a state-of-the-art HD monitor system to identify all distresses occurring within the selected, representative sample location, while simultaneously entering the distress data into the PAVER™ database for the Pavement Condition Index (PCI) calculation. The result is a PCI score for each sample location, as well as the entire pavement section.

SAMPLE DEFINITION

Following ASTM D6433-18, a sample unit size must be between 1,500 and 3,500 square feet for proper PCI calculation. For consistency, each sample location size is determined to be 100' long x the width of the pavement section. If the section width is over 35' wide, the sample size becomes half the width x 100'. If the section area is less than 1,500 sf in area size, the entire section becomes the sample size.

DISTRESS DEFINITION

Twenty possible distress types can occur within asphalt-based roadways and nineteen possible distress types that can occur within concrete. The U.S. Army Corps of Engineers publishes the PAVER™ Asphalt and Concrete Distress Manuals. These manuals describe each distress type, the criteria to determine each severity level (low, medium, high), and how to measure each. The asphalt distress types and correlating classification are highlighted below in Figure 1.

01 – Alligator Cracking	06 – Depression	11 – Patch/Utility Cut	16 – Shoving
02 – Bleeding	07 – Edge Cracking	12 – Polished Aggregate	17 – Slippage Cracking
03 – Block Cracking	08 – Joint Reflection	13 – Pothole	18 – Swell
04 – Bumps and Sags	09 – Lane/Shoulder Drop	14 – Railroad Crossing	19 – Raveling
05 - Corrugation	10 – L&T Cracking	15 – Rutting	20 – Weathering

LOAD ASSOCIATED DISTRESS	CLIMATE BASED DISTRESS	OTHER DISTRESS

Figure 1. Asphalt Distresses

PCI AND CONDITION CATEGORY DEFINITION

The PCI is on a scale of 0 – 100, with 0 being the worst and 100 being the best. PAVER™ calculates it through the input of distress type, severity, and quantity information. Figure 2 illustrates the factors that go into the PCI as well as the seven condition categories of the PCI.

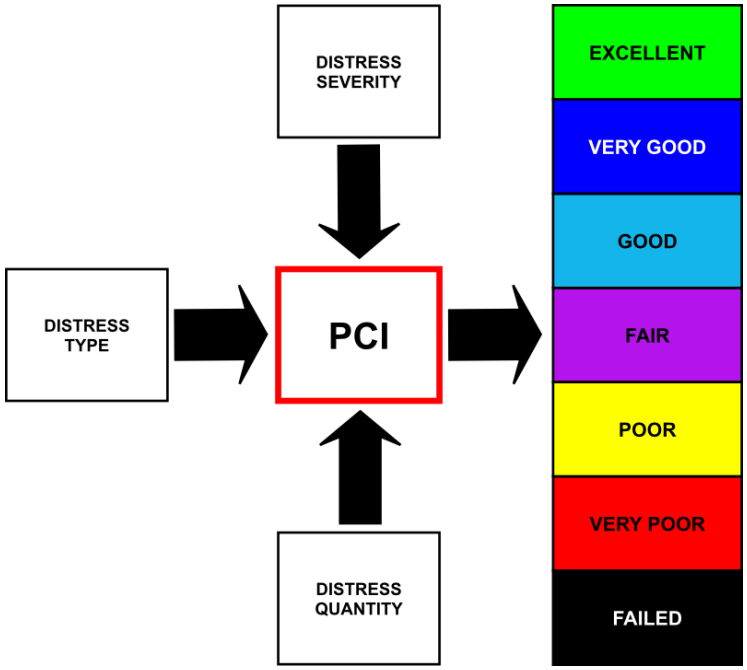


Figure. 2 Factors Determining PCI Value

To further simplify the PCI, the following condition categories along with the recommended maintenance action for each have developed by PMG:

CONDITION CATEGORY	RECOMMENDED ACTION	LOW PCI VALUE	HIGH PCI VALUE
EXCELLENT	REJUVENATOR/DO NOTHING	92	100
VERY GOOD	MICROSURFACING/CRACK SEAL	82	91
GOOD	CAPE SEAL/MICROSURFACING	68	81
FAIR	ASHPALT OVERAL/CAPE SEAL	50	67
POOR	MILL & OVERLAY PARTIAL DEPTH REPAIRS	35	49
VERY POOR	MILL & OVERLAYWITH FULL DEPTH REPAIRS	20	34
FAILED	FULL DEPTH RECLAMATION/RECONSTRUCTION	0	19

Table 1. Condition Category Values

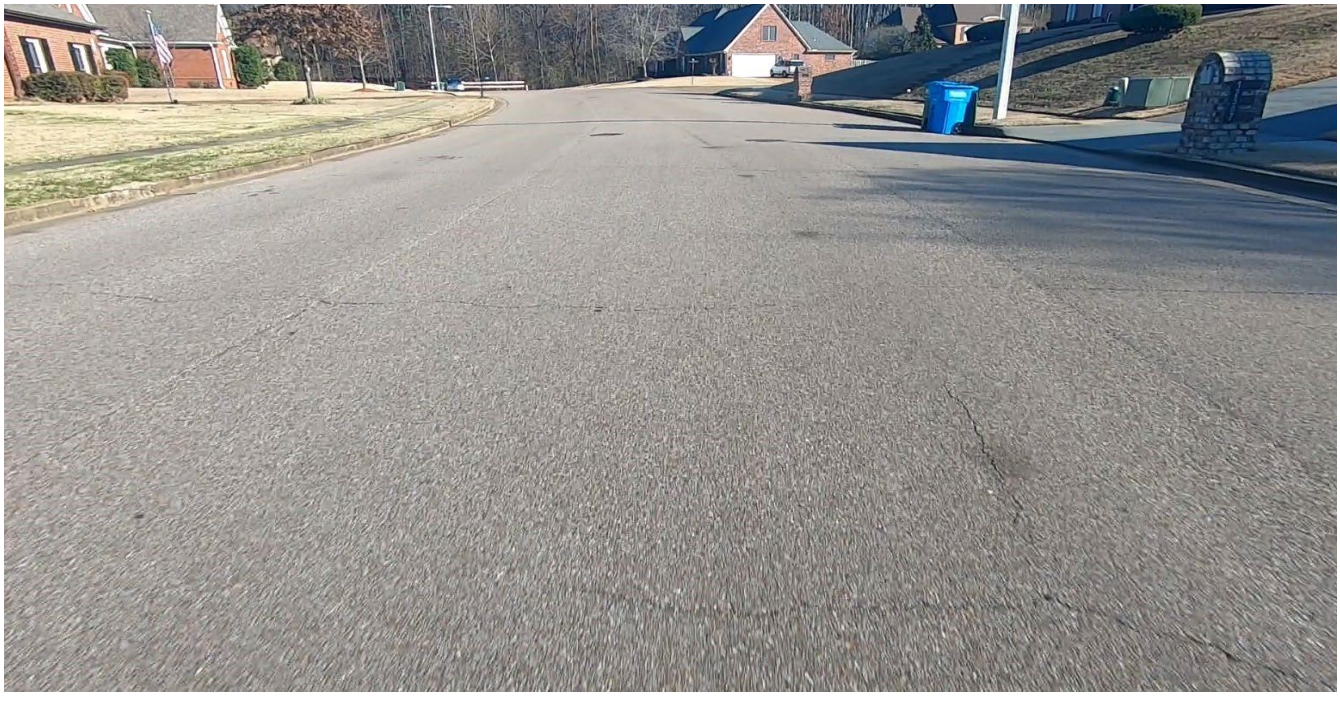
EXAMPLES OF CONDITIONS

During the inspection process, our video capture team records a high definition video of each pavement section. The following screenshots provide visual insight as to what roadways look like at the various condition category stages:

EXCELLENT CONDITION

UPPER GRANGER CV | SECTION 01 | PCI 100

VERY GOOD CONDITION



DARGIE DR | SECTION 05 | PCI 88

GOOD CONDITION

HIDDEN MEADOWS CV | SECTION 01 | PCI 72

FAIR CONDITION

ROLLING FOREST DR | SECTION 01 | PCI 60

POOR CONDITION

LUBOV RD | SECTION 02 | PCI 37

VERY POOR CONDITION

There are no sections now in the “Failed” condition category

FAILED CONDITION

There are no sections now in the “Failed” condition category

NETWORK CONDITION RESULTS

After completion of the 2019 pavement management project, PMG has determined that the average PCI for the Town of Arlington’s 88 centerline mile (228 lane mile) street network is a 70 and considered to be in GOOD condition. Table 2 displays the condition summary data by category across the network, while Figure 3 further illustrates the condition breakdown in graph form by lane miles.

CONDITION CATEGORY	PAVEMENT AREA	LANE MILES	SECTIONS	PERCENT AREA
FAILED	0	0	0	0
VERY POOR	0	0	0	0%
POOR	459,030	9	30	4%
FAIR	5,109,091	97	295	42%
GOOD	4,539,053	86	263	38%
VERY GOOD	1,007,667	19	50	8%
EXCELLENT	937,351	18	78	8%
TOTALS	12,052,191	228	716	100%

Table 2. Condition Summary

CONDITION GRAPHS

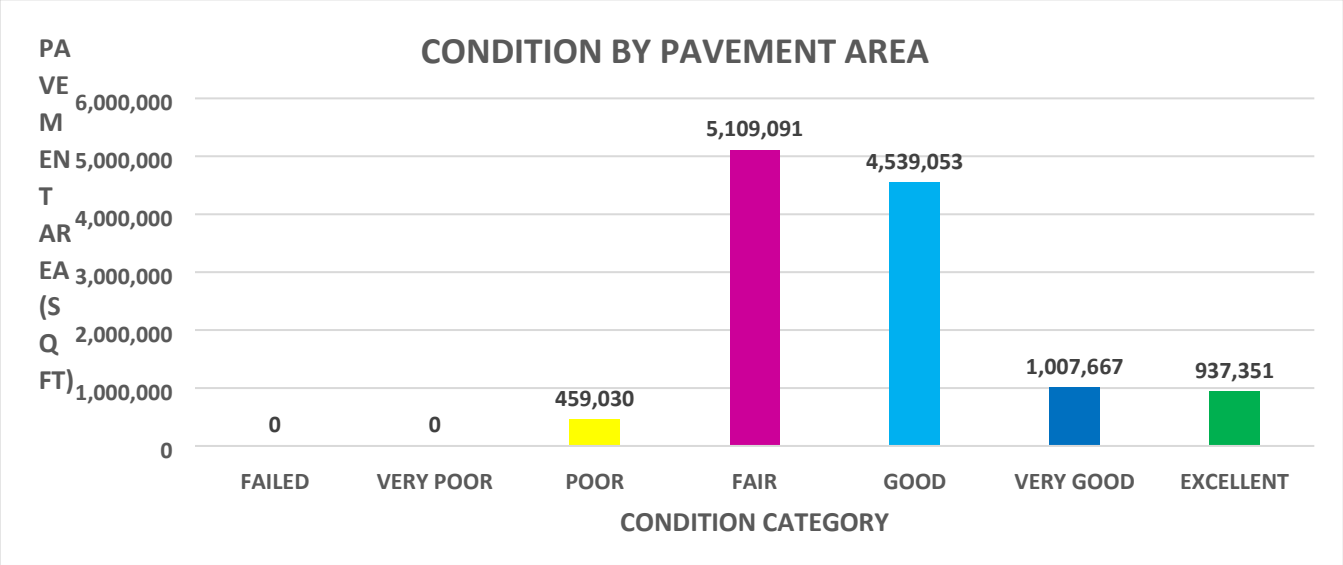


Figure 3. Lane Miles by Condition Category

GIS ASSIGNMENT AND INTEGRATION

As part of this project, PMG received the street centerline shapefile from the client and was able to assign all pavement management data to the correlating GIS segments. Through GIS assignment, PMG can produce map driven project deliverables such as the latest condition GIS map example shown in Figure 4 below. PMG also created and provided a PDF file format of this map for plotting purposes upon the conclusion of the project.

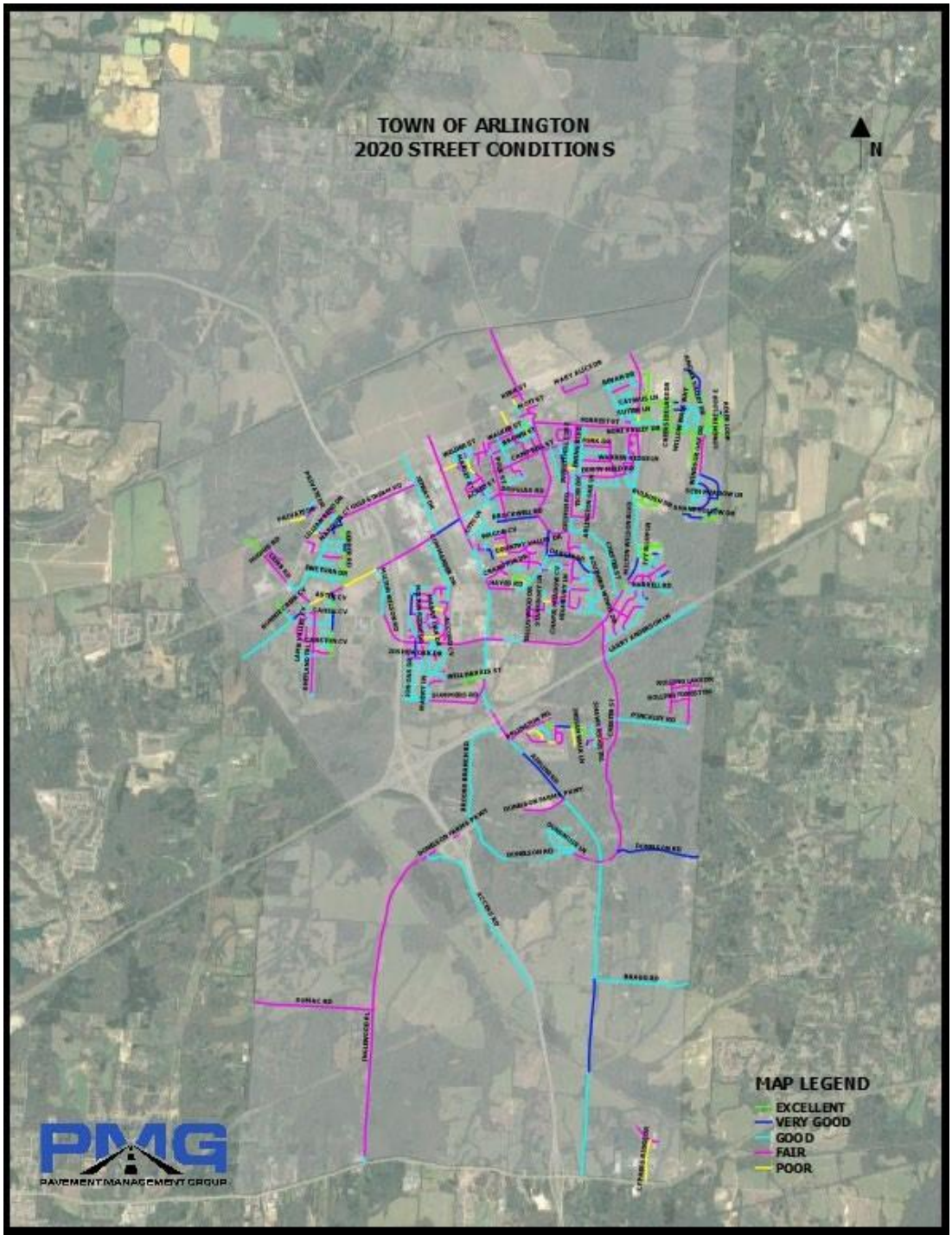


Figure 4. Street Section Latest Condition Maps

GOOGLE EARTH WITH STREAMING VIDEO

PMG created and published a Google Earth project file to include the latest street conditions with accompanying streaming video. All video is hosted online and in the cloud by PMG to a private dedicated channel for the client. Simply browse the City map, identify a section to view, and click the icon to access the associated streaming video.

To access the Google Earth and Streaming Videos, all that is required is Google Earth to be installed, a high-speed internet connection, and our provided Google Earth KMZ file.

The native 1080P full HD videos for each section are available on the provided external hard drive in MPEG 4 format. They will play on any video player software such as Windows Media Player or VLC Player (recommended).

Figure 5 illustrates the Google Earth condition mapping with streaming video capability:

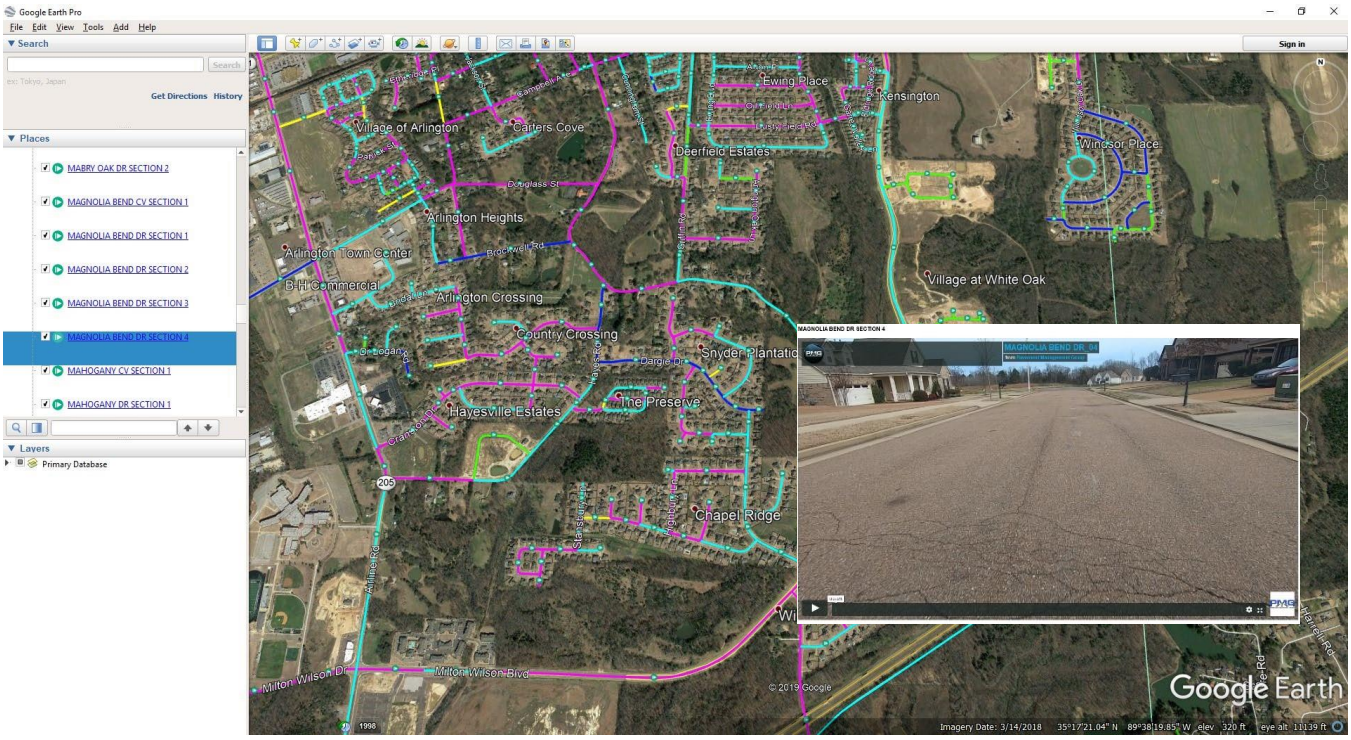


Figure 5. Google Earth Condition Layer with Video Streaming

BUDGET AND TARGET DRIVEN SCENARIOS

One of the biggest benefits of your turn-key pavement management program is PMG industry-specific experience coupled with industry-specific software analysis tools from the PAVER™ software. PMG leverages these analysis tools to create Town-specific system tables, decision trees, and pavement lifecycle models. With a tailored system in place, PMG can then create numerous "What-If scenarios" to identify future budget deficiencies, network average conditions, or even specific roadway and section future expectations.

These "What-If" scenarios are either budget driven or target driven.

An example of a budget-driven scenario:

If the expected annual budget is $900,000 each year over the next five years, what is the expected resulting network condition each year?

An example of a target-driven scenario:

If the current average network condition is a 70 PCI, what is the budget required each year over the next five years to achieve a five-point increase to 75 PCI?

For initial project reporting purposes, PMG took a look at the following five budget scenarios over the next five years and charted the results below in Figure 6.

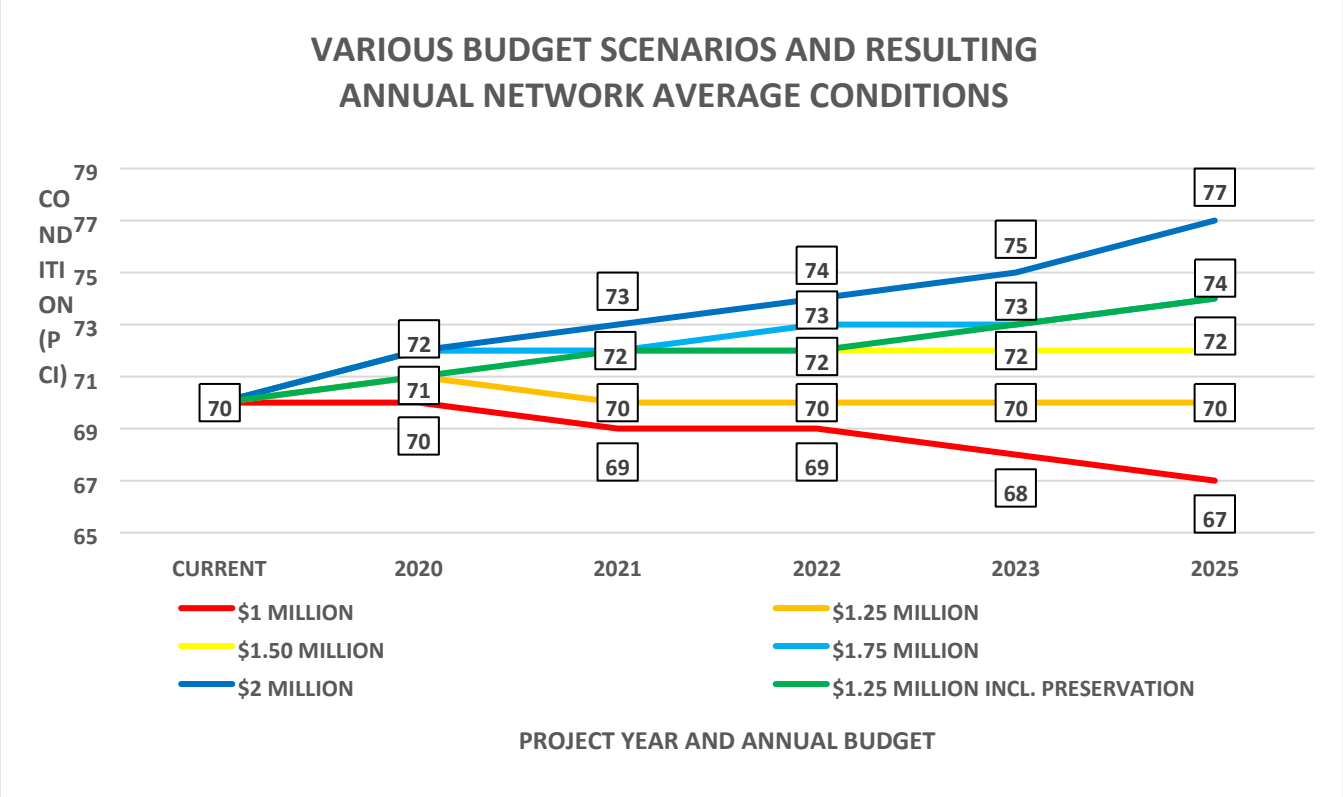


Figure 6. Five Year Analysis of Various Budget/Target Driven Scenarios

CONCLUSION

PMG provides critical roadway inventory and condition data with the sole goal of creating a data-driven approach to your annual maintenance and repair program. Our project deliverables and services assist our clients in maximizing their yearly budgets, extending pavement service life, while optimizing roadway network conditions. The final result is a win-win situation for staff, decision-makers, and citizens alike.

The Town of Arlington is responsible for the maintenance and repair of 88 centerline miles (228 lane miles) of roadways. Through the ASTM D6433-18 PCI study, PMG has determined that the street network has an average PCI of 70, which falls into the "Good" condition category.

In operating from a "Worst to First" major maintenance and repair strategy, and with a continued crack seal program, the network average condition will drop approximately three PCI points over the next five years, spending $1,000,000 each year. PMG recommends an annual budget of $1,750,000 to reach and maintain an average network PCI of 74 over the next five years with this strategy.

If pavement preservation opportunities become available within the area, PMG would recommend a $1,250,000 annual maintenance repair budget with 70% of the budget going towards Poor roadways, and 30% going towards Fair and Good roadways utilizing preservation treatments and a continued crack seal program. Over the next five years, the Town would experience the same condition increase as in the $1,750,000 "Worst to First" recommendation strategy above. This would yield a greater impact of treatments each year while saving $2,500,000 over the five years.

PMG would like to thank you for the opportunity to provide your agency with our turn-key pavement management services. Our goal is to provide the highest level of services and support, providing our clients with the data, tools, and expertise necessary to be successful in their pursuits of pavement management. Should you require any additional information or support regarding this PCI study or the PAVER™ PMS, please do not hesitate to ask.

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