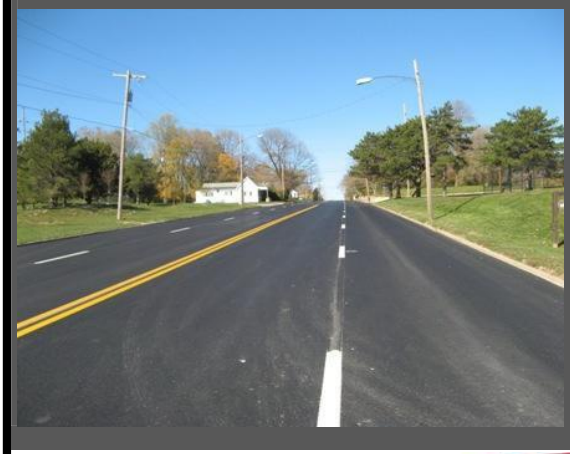
PAVEMENT MASTER PLAN



PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

January 22, 2013

Executive Summary Updated October 25, 2017

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EXECUTIVE SUMMARY
(UPDATED OCTOBER 2017)

The condition of Decatur's streets is declining. With 825 lane-miles of pavement to maintain and the size of the street network expected to grow, a strategy must be developed to address the City's distressed pavement. Street pavement is like any major investment, it needs preventative maintenance to extend its life, and it needs rehabilitation throughout its life to avoid the cost of completely replacing the street. It has been determined that investing more in pavement early on, saves money in the long run.

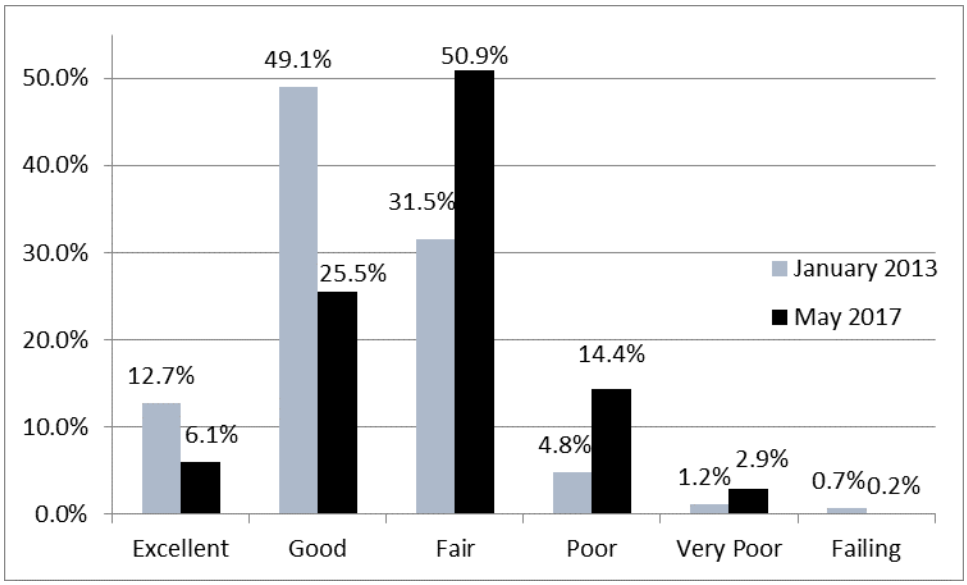
The City of Decatur maintains:

- 696 lane-miles of asphalt streets.
- 93 lane-miles of concrete streets.
- 22 lane-miles of brick streets.
- 14 lane-miles of surface treatment streets.

Between 1990 and 2000 the City was growing at a rate of 0.46 square miles per year with 1.25 miles of road being added to the City each year. These rates have slowed since 2000 with 0.10 square miles of area and 0.80 miles of road added to the City each year.

City staff inspects half of the streets maintained by the City each year, and uses a pavement management system developed by Lucity, Inc. to maintain inspection data and estimate pavement condition resulting from various levels of investment.

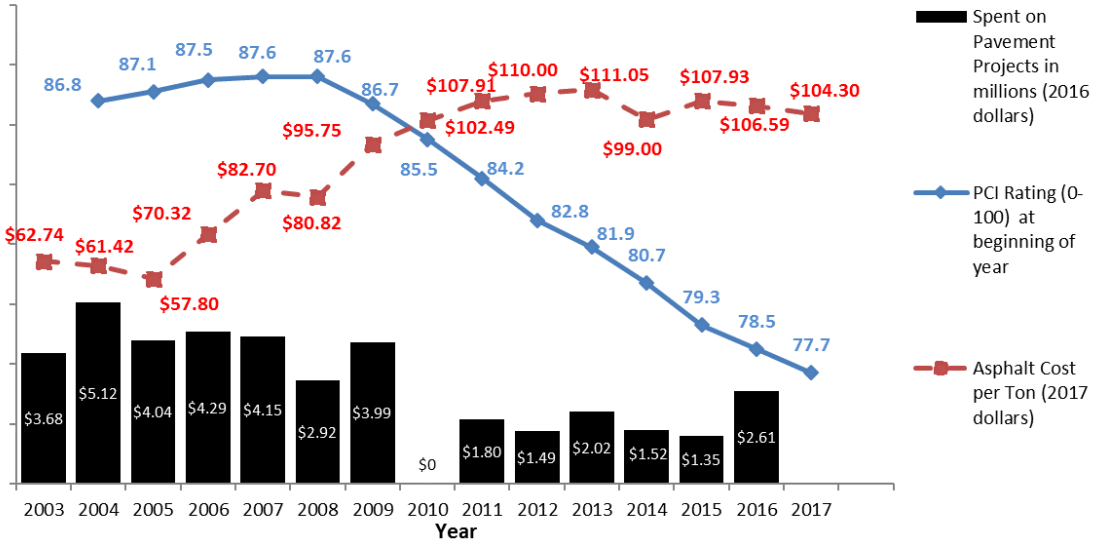
A pavement rating scale called the Pavement Condition Index (PCI) is used to rate the streets. These ratings can be generalized "Excellent", "Good", "Fair", "Poor", "Very Poor", or "Failed". As of January 2013 the fraction of streets in each of these ratings categories is as follows:



The percentage of streets in either "Good" or "Excellent" condition dropped from 62% in 2013 to 31.6% in 2017. As more streets decline into "Poor" to "Failed" condition it is very important to invest in pavement maintenance to prevent any further decline.

The overall pavement condition of the City's streets has been declining since 2007, as the graph below illustrates. Major reasons for the decline include:

- The price of asphalt doubling between 2005 and 2013 with a slightly downward trend since 2013.
- The amount of money dedicated to pavement repairs decreasing since 2009 due to general capital funds being redirected from pavement maintenance, and motor fuel tax funds being distributed to bridge projects and road salt. In 2016 a local option motor fuel tax was established. A loan of $7 million was taken out to increase road work for the 2016, 2017, and 2018 construction years.



New asphalt and concrete pavements are typically built to last 30 to 40 years before reconstruction is necessary if no other maintenance is performed. Regular maintenance is meant to extend pavement's life. Resurfaced streets can last 15 to 20 years.

Pavement maintenance techniques can be classified into three general categories:

- Preventative maintenance: crack sealing, pothole filling, seal coats, etc.
- Major rehabilitation: deep patching and mill & overlays.
- Total reconstruction: total removal of pavement and rebuilding the base.

City crews can perform many of the preventative maintenance activities including some deep patches. Construction contractors perform large patches as well as most other rehabilitation/reconstruction activities. City crews could potentially increase their maintenance activities, at a lower cost than contractors, with the proper resources.

The amount the City spent on pavement maintenance in 2016 calendar year was:

- $597,726 on in-house pavement maintenance activities.
- $2,550,387 on contracted asphalt rehabilitation and reconstruction.

Pavement program deficiencies include:

- The pavement network PCI rating has dropped 5% in the last 5 years, and the decline will continue at the current funding levels.
- Funds from the State Motor Fuel Tax have been decreasing due to declining population and other factors.
- Capital funds being redirected from pavement maintenance and allocated to other priorities.
- Almost no dedicated funds for concrete and brick street maintenance.
- MFT funds are now being used to purchase salt for snow and ice control when before salt was purchased with general funds.
- Dedicated MFT funds are not sufficient to stop the decline of the City's pavement condition.
- Currently, it would cost approximately $25 million to fix the streets in most need of repair.

Pavement program strategies to slow or stop the decline of the City's pavement condition include:

- Performing more preventative maintenance to lengthen pavement's life and save money in the long term.
- Increased funding now can decrease costs in the long term and save money overall.
- Using the new local option motor fuel tax funds to perform more maintenance and rehabilitation now when the cost to do work is lower.

Staff plans to:

- Continue studying maintenance practices to perfect the ability to select the right treatment, for the right pavement, at the right time.
- Investigate whether the City can save money by performing more maintenance activities in-house.
- Seek other funding sources to stop the steep decline of the City's pavement network.
- Continue updating a rolling 5-year plan each year by simulating future pavement conditions and evaluating potential project locations.
- Share 5-year plan with the public via Decatur's Digital Atlas.

1.0 PURPOSE

The purpose of the City of Decatur's Pavement Master Plan is to create a comprehensive source of information about the condition of the City's pavement network. It's also designed to look towards the future and explore plans to improve the pavement network.

2.0 INTRODUCTION

The City's street network is a critically important piece of infrastructure. It facilitates the movement of nearly every person as well as the goods and services that are utilized by the City. Pavement is the surface of the road network that sustains the vehicular, cycle, and foot traffic. Pavement condition can affect safety and the personal cost of traveling throughout the City. According to TRIP, a national nonprofit organization that researches transportation issues, Illinois motorists driving on roads that are in need of repair cost approximately $292 per year, per motorist in extra vehicle repairs and operating costs.

This master plan is necessary to determine an economical course of action that maintains an acceptable level of pavement condition.

3.0 DECATUR'S PAVEMENT NETWORK

3.1. Characteristics of Pavement Network

Decatur has 379 centerline-miles of streets to maintain. This comes out to about 825 lane-miles of streets. Centerline-miles are a measure of the length of each street, while lane-miles are a measure of the length of each lane of the street. Lanes are generally 9 ft to 12 ft wide with 12 ft lanes being most common.

The widest and most highly traveled streets are usually classified as arterial streets. Arterial streets are high volume streets that serve to carry traffic between important centers of activity (such as from city to city, or city to freeway). Other street classifications include collector streets, which carry traffic through residential and commercial areas linking the arterial streets to local streets; and local streets, which carry traffic to their final destination. Local streets include residential, commercial and industrial streets. The amount of lane-miles of each classification of street maintained by the City of Decatur is shown in Table 1.

Table 1. Pavement Area by Functional Classification

Functional Classification	Pavement Area (Lane-miles)	Percentage of Total Network
Arterial	163	20%
Collector	103	12%
Local	559	68%
Total	**825**	**100%**

Examples of arterial streets in Decatur include: Grand Avenue, South Shores Drive, and Martin Luther King Jr. Drive. Examples of collector streets would be Home Park Avenue, Cantrell Street, and Imboden Drive west of Franklin Street Road, Local residential streets include: Summit Avenue, Sandcreek Drive, and King Street.

Of these 825 lane-miles of road, the pavement surface is made up of four types of pavement. A vast majority of the City streets are paved with Asphalt Concrete (AC), commonly just referred to as asphalt. Asphalt pavement streets consist of full-depth asphalt streets, asphalt over concrete, and asphalt over brick. The second most common pavement is Portland Cement Concrete (PCC), commonly referred to as concrete. The other two types of pavements used throughout the City include brick and other bituminous surface treatments (such as a chip seal and microsurface).

Table 2 lists the different pavement types used for City streets and the number of lane-miles of each pavement type.

Table 2. Pavement Area by Pavement Type

Pavement Type	Pavement Area (Lane-miles)	Percentage of Total Network
Asphalt	696	84%
Concrete	93	11%
Brick	22	3%
Surface Treatment	14	2%
Total	**825**	**100%**

The City's pavement network does not include streets which are owned and maintained by others such as the State, County, Park District, or private owners even if they are within the City's corporate limits. Examples of State routes include Oakland Avenue (IL Route 48) from Fairview Avenue to Pershing Road, as well as all numbered Illinois Routes, US Routes, and Interstates. Through agreements with the State, the City does maintain some of the State Routes within city limits; such as Eldorado Street from Fairview Avenue to 27th Street, or Illinois Route 48 from Sunset Avenue to Eldorado Street. An example of a County owned street would be Brush College Road from Faries Parkway northward. Lake Shore Drive from 22nd Street to the US Route 36 overpass is an example of a Park District owned street. In addition to these owners there are several privately owned streets within city limits.

3.2. Pavement Network Growth

In most years the City's street network grows by annexing new territory, jurisdictional transfers between the City and other owners, and from new street construction. Since 1990 the City of Decatur has grown at a rate of 0.27 square miles per year (a 0.64% increase). In that same time period the pavement network has grown in length by 1.38 miles per year (a 0.37% increase). The City's rate of growth has slowed since 1970 as shown in Figure 1. Similarly the pavement network's rate of growth has slowed over the last 20 years.

Figure 1. Area of the City of Decatur since 1830

Since 1990, pavement network increases due to annexation accounts for 38% of the total network expansion within that time. Jurisdictional transfers and new street construction are other ways the pavement network expands. Jurisdictional transfers make up 35% of network increases, with notable jurisdictional transfers including: Mound Road from Illinois Route 121 to Brush College Road, and US Route 51 from Cleveland Avenue to Eldorado Street. New street construction accounts for the remaining 27% with notable new streets including: Martin Luther King Drive from Pershing Road to just south of Interstate 72, and Hubbard Avenue from Illinois Route 48 to Brush College Road.

3.3. Pavement Life Cycle

Pavement doesn't last forever. It degrades over time due to natural weathering and the movement of traffic, especially from heavy vehicles. While how fast a road deteriorates is dependent on several factors, the life of pavement follows a cycle. The typical cycle of pavements' life includes maintenance and resurfacing treatments which rejuvenate the pavement until it's completely replaced and the cycle starts all over again. Figure 2 shows the typical lifespan of pavement. The type of pavement used will affect how long the pavement lasts but all pavements will follow this same basic shape.

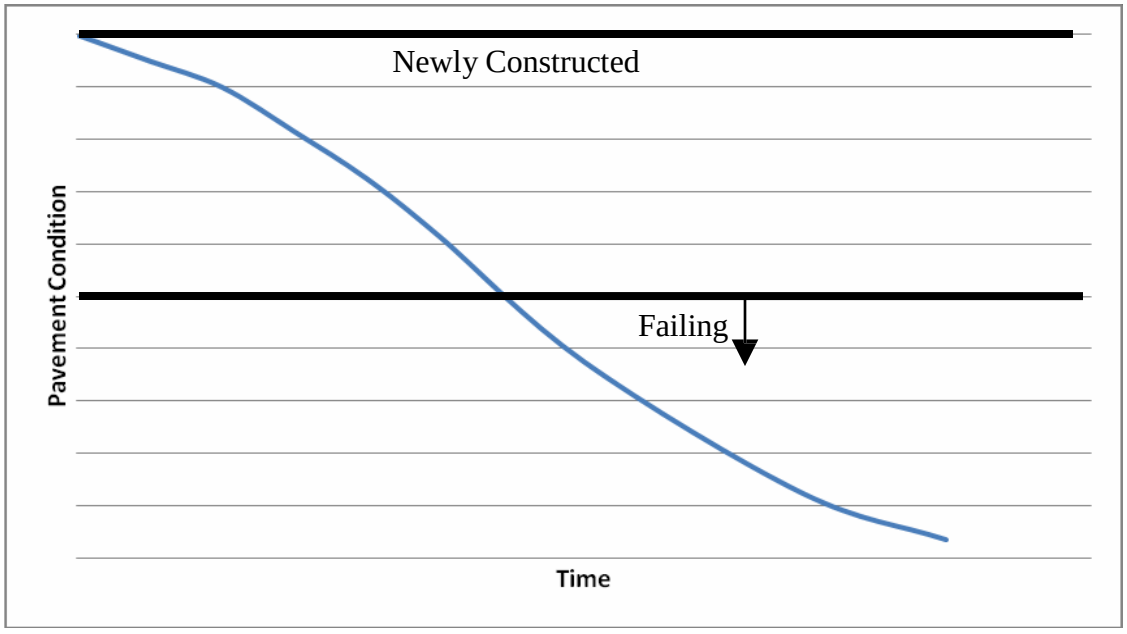


Figure 2. Typical life of pavement

Pavements deteriorate at a faster pace as they age. This is because the more deficiencies that develop the easier it is for water to enter cracks and for vehicle tires to chip away at the surface. Once the pavement reaches a failing condition, the problems with the road are too serious for any surface fixes to remedy. Asphalt and concrete pavements are typically built to last 30 to 40 years, without regular maintenance, before reconstruction is necessary. Regular maintenance helps extend its life.

3.4. Yearly Inspections

In order to monitor the pavement's life cycle, City staff conducts street inspections every year. Typically half of the streets that make up the City's pavement network are inspected annually, which means each street is inspected once every two years.

The City of Decatur currently uses a pavement rating system known as the Pavement Condition Index (PCI) to give a value to the condition of each street. It's a rating system with a 100 point scale with 100 corresponding to a brand new pavement with no defects and 0 meaning the pavement has deteriorated to a point of non-existence. The rating is based on the severity and density of several pavement distress types. To give this rating scale some reference, Table 3 shows what range of values corresponds to pavements that are in good, fair, and poor conditions.

Table 3. General Pavement Condition Ratings

General Rating	Pavement Condition Index (PCI)
Excellent	90-100
Good	80-90
Fair	70-80
Poor	60-70
Very Poor	50-60
Fail	0-50

Examples of asphalt and concrete pavements in these conditions are shown in Figures 3 and 4. City inspectors look for these types of distresses seen in the pictures below and mentioned in their descriptions when performing their yearly inspections.

Figure 3.1. Example of asphalt street in excellent condition

Excellent (PCI 90-100)
Near perfect condition. Very minor defects may be present. Comfortable to drive.
Photo of Martin Luther King Jr. Drive near Garfield Avenue. (Nov. 2012)

Figure 3.2. Example of asphalt street in fair condition

Fair (PCI 70-80)
Structural damage may be present. Cracking and other minor distresses are extensive. Road may feel rough.
Photo of Eldorado Street near Fairview Avenue. (Nov. 2012)

Figure 3.3. Example of asphalt street in very poor condition

Very Poor (PCI 50-60)
Structural damage is extensive. The road is very rough.
Photo of Grant Avenue near Walnut Grove Avenue. (Nov. 2012)

The condition of Good and Poor pavements can be interpolated from these pictures. Failed pavements have a range of appearances and are categorized by an inability to safely drive on them at the designed speed. Failed pavements usually have large sections that have disintegrated or experience extreme faulting.

Figure 4.1. Example of concrete street in excellent condition

Excellent (PCI 90-100)
Near perfect condition. Very minor defects may be present. Comfortable to drive.
Photo of Augusta Avenue near Avalon Avenue. (Nov. 2012)

Figure 4.2. Example of concrete street in fair condition

Fair (PCI 70-80)
Cracking is extensive. Surface is wearing away and popping off. Road may be noticeably rough.
Photo of Kenwood Avenue near Church Street. (Nov. 2012)

Figure 4.3. Example of concrete street in very poor condition

Very Poor (PCI 50-60)
Concrete around cracks and joints is breaking up. Faulting is extensive. The road is very rough.
Photo of Westlawn Aveenue near Macon. (Nov. 2012)

3.5. Pavement Management System

The yearly street inspections generate a large amount of data. The City stores and organizes the information obtained using a pavement management system. The pavement management system also projects future conditions of pavements and what treatments should be applied to maximize the quality of the pavement network with the available funding. The pavement management system is an invaluable tool for determining the most cost effective way to maintain the pavement network.

The City of Decatur uses pavement management software developed by Lucity, Inc. (formerly GBA Master Series, Inc.) The City has been using this software since 2003 to manage the street network and collect pavement condition data. In 2012 the City purchased an extension to the Lucity software which enabled the pavement network to be represented spatially using a geographic information system (GIS) program called ArcGIS. The capabilities of the Lucity software can be extended to include management systems for other public infrastructure such as sidewalks, sewers, and traffic signals if the corresponding extensions are purchased. Currently the City only uses it for pavement management and there are no plans to expand it at this time.

4.0 PAVEMENT CONDITION AND MAINTENANCE

4.1. Current Pavement Condition

As mentioned above, pavement condition is determined through yearly inspections with each street being inspected once every two years. The pavement management system uses formulas based on past data to estimate the current pavement condition for any street that wasn't inspected in the current year. This allows the City to keep track of the current pavement condition at any time without needing to inspect all of the roads at once. Pavement condition typically won't change much from month to month but over the course of a year pavement condition has been observed to drop 1 to 3 points per year on the PCI scale.

As of January 2013, the average rating of the City's entire pavement network is 81. This falls in the low end of the "Good" category of the general rating scale. Another way to look at the pavement network's condition is to look at how the City's streets are distributed into the general rating categories as shown in Figure 5.

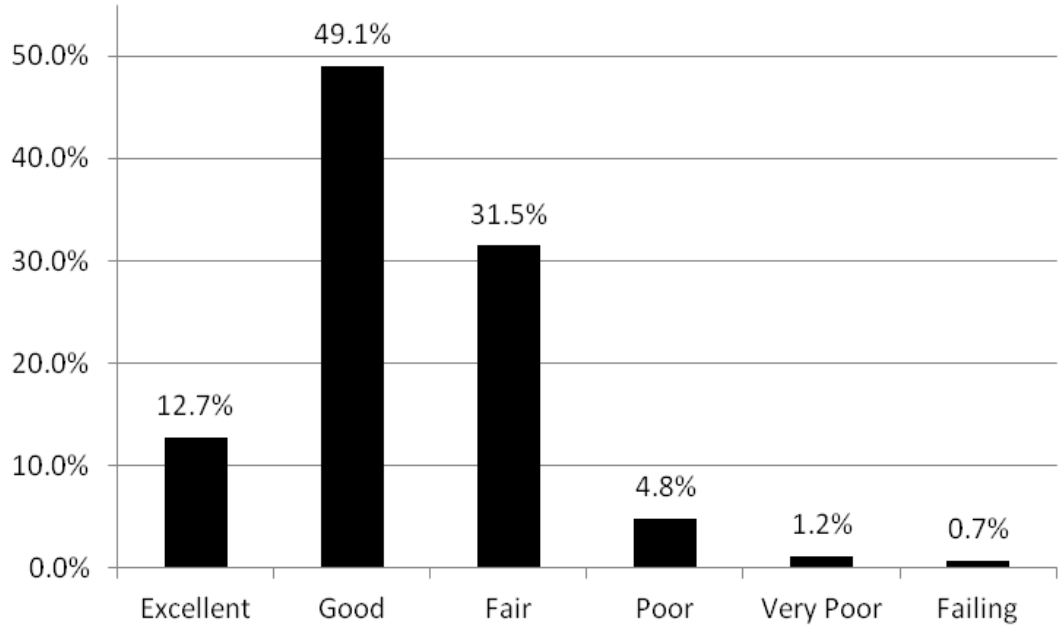


Figure 5. Percentage of pavement area which fall into each general rating category

Nearly 62% of the City's pavement falls in the "Excellent" to "Good" category, with about 38% rated "Fair" or below.

With a large majority of City streets having asphalt pavements it would be logical to look at whether or not asphalt streets rate lower or higher than other types of pavement. Table 4 breaks down the pavement ratings by the different pavement types.

Table 4. Pavement ratings by pavement type

Pavement Type	Average Weighted PCI	General Rating
Asphalt	82.12	Good
Concrete	78.36	Fair
Brick	72.29	Fair
Chip Seal	68.48	Poor
Micro/Slurry Seal	88.40	Good

Since 84% of City streets are paved with asphalt, the condition of asphalt streets mirrors the condition of the overall network. Concrete and brick streets tend to rate lower than asphalt since most of the concrete and brick streets in the City are very old. Chip seals and micro/slurry seals refer to surface treatments that tend to last only a few

years. Micro/slurry seals are designed to maintain a "Good" pavement condition for about 5 years before the street returns to its previous condition. Chip seals are designed to protect the pavement and give a short term riding surface. Chip seals can suffer from several distresses after only a few years which can explain the "Poor" rating.

It's also worth looking at the average weighted PCI for each of the street's functional classifications to see if high traffic arterials are in better or worse condition than low traffic local streets. Table 5 shows the rating differences of each functional classification.

Table 5. Pavement ratings by functional classification

Functional Classification	Average Weighted PCI	General Rating
Arterial	80.65	Good
Collector	81.45	Good
Local	81.63	Good

The difference between the ratings of the different street classifications is insignificant. Arterials do deteriorate faster than other classifications of streets due to higher volumes of traffic and heavy vehicles such as trucks and buses; however each street is maintained to the same standard. Arterials may need more frequent attention to maintain a "Good" condition.

With the majority of City streets falling into the "Good" category, what does this mean? "Good" streets have a PCI value between 80 and 90 and generally have several cracks but would still have a smooth ride. With a score of 81, there may be a few structural defects present.

4.2. Pavement Condition History

Currently the pavement network's rating is below 85 but it wasn't that long ago that the City was maintaining a rating above that mark. The pavement network's rating has been dropping steadily since 2007 as illustrated in Figure 6.

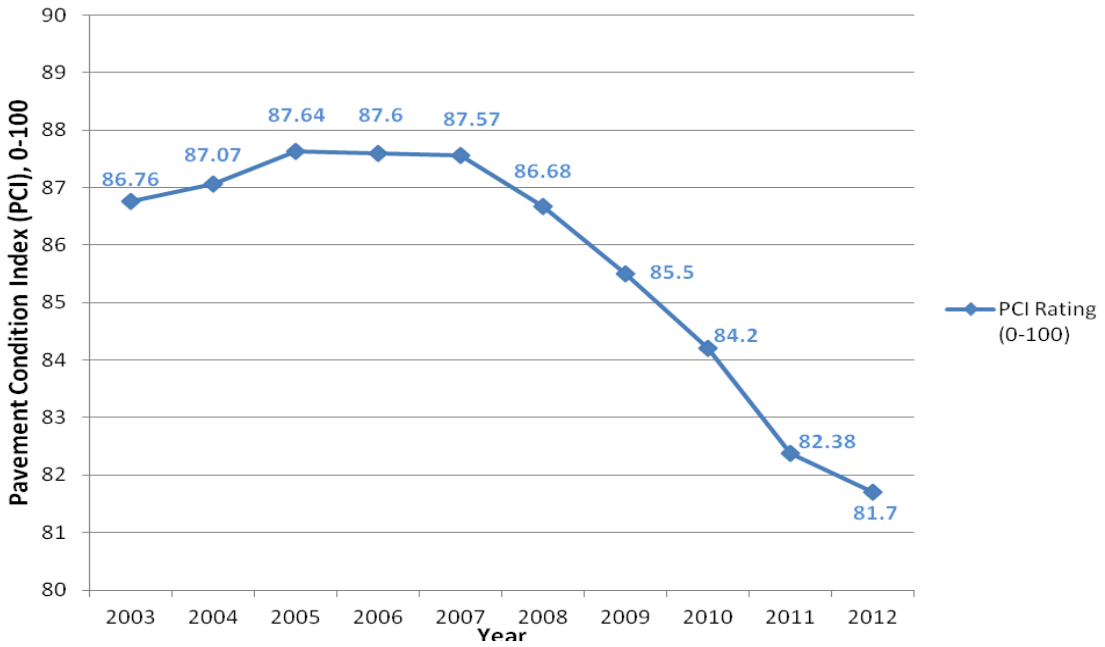


Figure 6. Overall pavement network PCI rating since 2003

Between 2003 and 2007 the condition of the pavement network was holding steady near a rating of 87 with a high of 87.64 in 2005. In the last 5 years the PCI rating has fallen nearly 6 points. While that may not seem dramatic, the downward trend will continue without major changes. What's causing this decline? The next two figures tell part of the story.

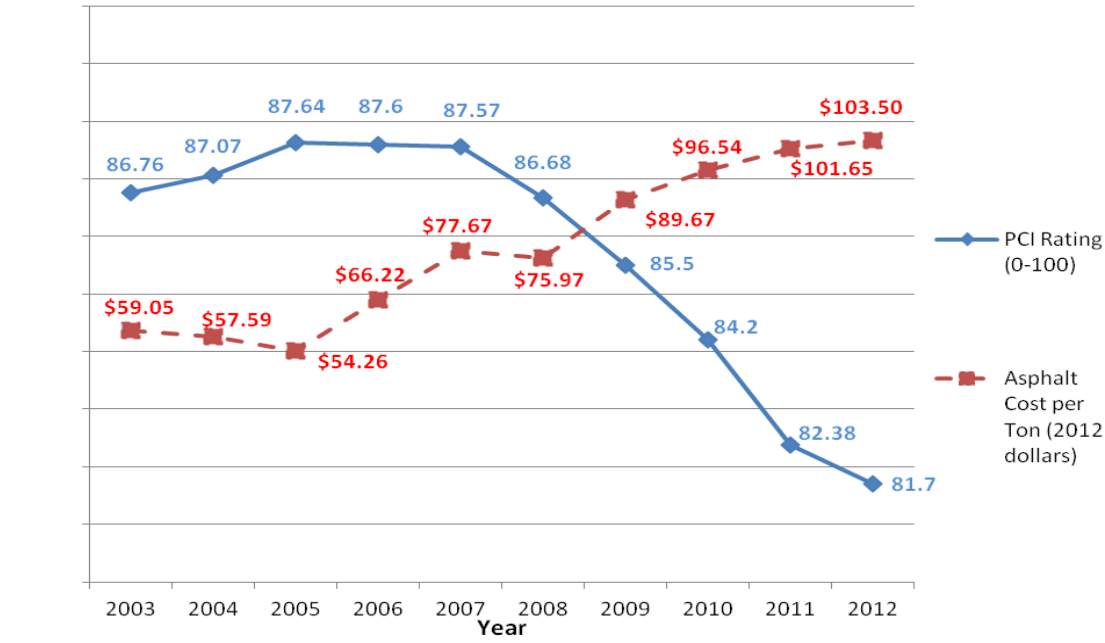


Figure 7. Network PCI compared with cost of asphalt

Figure 7 above shows the cost per ton of asphalt alongside the PCI rating for the same period of time. It also adjusts each of the prices for inflation by displaying the cost of asphalt in constant 2012 dollars. The cost of asphalt, which is directly related to the cost of oil, has been increasing faster than the rate of inflation, a 91% increase since 2005. This is a factor for the pavement condition's decline but it's not the whole picture. Another factor is the funding level for street rehabilitation/reconstruction each year. This is shown as columns at the base of Figure 8.

Figure 8. Network PCI compared with cost of asphalt and amount spent on asphalt rehabilitation/reconstruction

Spending for each year's street rehabilitation/reconstruction project remained relatively steady from 2003 to 2009. Starting in 2006 because of the rapid increase in asphalt cost, the City placed 19,000 tons of asphalt compared with 29,700 tons the year before. The amount of asphalt placed has been declining ever since. Less asphalt being placed means fewer streets are repaired each year. In 2010 no asphalt or concrete street projects were conducted, bringing a steeper decline in pavement condition. After 2010, due to limited funding, the amount spent is less than half of what was spent before 2010, while the cost of asphalt continues to increase.

4.3. Pavement Maintenance

Good maintenance practices are essential to extending the service life of pavement. There are several tools at the City's disposal to maintain the pavement network. Choosing which tool is right for the job at the right time is the key to wisely using the City's limited resources. Pavement management techniques can be grouped into three categories: **Preventative maintenance**, **rehabilitation**, **and reconstruction**.

Preventative maintenance techniques include crack sealing, pothole filling, bump milling, and surface treatments such as slurry seals and microsurfacing. Preventative maintenance treatments are used to slow the rate of deterioration. They are most effective when used on "Excellent" or "Good" pavements to slow the formation of distresses that would require major rehabilitation. Occasionally pavements in "Fair" condition can benefit from surface treatments if the underlying pavement structure is still in good condition. Preventative maintenance is the least costly form of maintenance and typically has the best value.

Rehabilitation techniques include patching and resurfacing the street to restore its condition by repairing or replacing deteriorated sections. Rehabilitation is most effective on "Fair" or "Poor" pavements. Some better pavements may only need an occasional patch but pavements with a PCI rating between 75 and 60 are generally good candidates for resurfacing.

When pavements are approaching the end of their service life and no form of preventative maintenance or rehabilitation will be cost effective, they become candidates for full reconstruction. **Reconstruction** is the most costly form of maintenance. The City's goal is to use the less costly forms of maintenance at the right times to avoid total reconstruction.

Figure 9 and Table 6 summarizes what maintenance techniques are suitable at different pavement conditions.

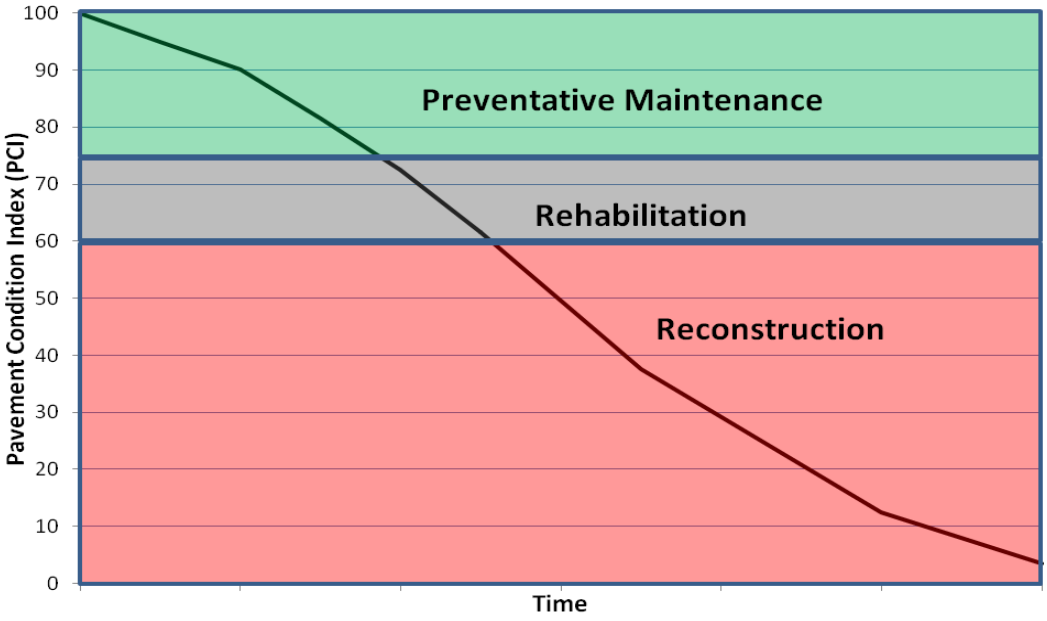


Figure 9. Typical maintenance activities during pavement life cycle

Table 6. Typical maintenance activity based on pavement rating

General Pavement Rating	PCI	Maintenance Activity	Types of Activities
Excellent	90-100	Preventative Maintenance	Crack seals
Good	80-90	Preventative Maintenance	Crack seals, pothole filling, bump milling, microsurfacing
Fair	70-80	Preventative/ Rehabilitation	Microsurfacing/slurry seals, mill & overlay, occasional patching
Poor	60-70	Rehabilitation	Mill & overlay, significant patching
Very Poor	50-60	Reconstruction	Full reconstruction
Fail	0-50		

4.3.1. Public Works Department

For the City of Decatur, the Public Works Department manages the maintenance tasks for the City owned streets. Some tasks are performed in-house by the Streets & Sewers Section, while other tasks are performed by construction contractors. The decision to perform the maintenance in-house or through a contractor is made based on the efficient use of City resources.

The Streets & Sewers section is a part of the Municipal Services Division and is separated into two subsections: Asphalt and Concrete. Asphalt crews perform small asphalt patching, pothole repairs, bump milling, and crack sealing. Concrete crews perform concrete utility cuts and concrete patches.

In general the type of pavement maintenance performed by City crews are completed at a lower cost than if they were performed by a contractor. Limitations exist which prevent City crews from performing larger maintenance activities. Large asphalt patches are typically performed by construction contractors because of the need for an asphalt paver and roller. Time is also a factor as the number of patches that can be performed, whether they're asphalt or concrete, are limited by the amount of staff available for street maintenance.

Typically a "worst-first" approach is used where pavement problems needing the most immediate attention are dealt with first. The number of maintenance activities can vary from year to year based on the number of issues that arise as well as other outside factors.

4.3.2. Annual Asphalt Restoration

Generally, large asphalt restoration projects are contracted out. Nearly every year, the City identifies streets that are in need of rehabilitation or reconstruction. Selected asphalt streets are added to the annual asphalt restoration project which is bid by contractors and paid for using Motor Fuel Tax (MFT) and General Capital funds. Typically, the rehabilitation work performed for these projects include milling old pavement and overlaying with asphalt, patching, curb and sidewalk repairs, and other miscellaneous repairs needed. Total reconstruction work involves removing and replacing the entire depth of pavement and base material.

A few of the streets that were a part of recent asphalt reconstruction projects include:

Table 8. Example locations of past street restoration projects

Street	From	To	Type of Maintenance	Year
S Martin Luther King Jr. Dr.	E. Lake Shore Dr.	E Wood St.	Mill & Overlay	2012
E. Kenwood Ave.	N. Main St.	N. Water St.	Reconstruction	2012
N Martin Luther King Jr. Dr.	E. Grand Ave.	E. Garfield Ave.	Mill & Overlay	2011
E. Prairie St.	N. Jasper St.	N. 22nd St	Mill & Overlay	2009
E. Curtis Ave.	N. Railroad Ave	N. Jasper St.	Reconstruction	2009

Table 9 shows the number of miles restored and the amount spent to complete each year's project since 2003.

Table 9. Annual Asphalt Restoration Projects since 2003

Year	Lane-miles Restored	Cost in current dollars	Cost in constant 2012 dollars	Cost per lane – mile
2012	5.53	$1,398,072	$1,398,072	$252,816
2011	4.84	$1,358,565	$1,391,420	$287,483
2010	0	$0	$0	-
2009	11.50	$2,744,291	$2,946,936	$256,255
2008	18.23	$2,568,138	$2,747,965	$150,739
2007	20.53	$3,009,656	$3,344,047	$162,886
2006	20.33	$2,738,546	$3,129,481	$153,934
2005	27.27	$2,587,624	$3,052,402	$111,933
2004	36.52	$3,089,220	$3,767,556	$103,164
2003	25.47	$2,765,358	$3,462,394	$135,940

The amount spent between 2003 and 2009 stayed around $2.5 million to $3 million, while the amount of pavement restored gradually decreased. In 2010 there was no asphalt restoration project.

4.3.3. Other Projects

Typically, the annual asphalt restoration project only repairs streets which require a surface replacement. Reconstruction projects are occasionally included with the asphalt project but they are usually contracted separately when practical. Microsurfacing and concrete repairs are typically contracted under different projects.

Other examples of recent projects include:

US 51 from Cleveland Avenue to Wood Street partially reconstructed and milled & overlaid using motor fuel tax funds from the Illinois Department of Transportation (IDOT) as part of the jurisdictional transfer in 2012-2013.
Water Street from Wood Street to William Street milled & overlaid using project funds established in 2010 as part of Phase II of the Downtown Streetscape project in 2012.
Several streets in the Fairlawn neighborhood were treated with a microsurface using capital street funds in 2012.

4.3.4. Brick Streets

According to Administrative Policy E-130, it is the policy of the City of Decatur to not alter the integrity of brick streets or sandstone curbing unless it would be hazardous to remain in their historic condition. Any maintenance done to or under a brick street must be patched with bricks. If major rehabilitation is needed, brick streets will likely need to be reconstructed with new bricks. The last brick street reconstruction occurred on the 1500 block of West Macon Street in 2010 when a water main broke requiring a section of the road to be replaced.

Brick streets are very costly to replace. Maintenance on brick streets is also labor intensive as bricks need to be removed and replaced by hand. For these reasons very little maintenance is performed on brick streets and there have not been funds allocated to general brick street rehabilitation since 2006.

5.0 PAVEMENT MASTER PLAN

5.1. Pavement Program Deficiencies

The City of Decatur has declining pavement conditions. The average network pavement condition rating is the primary gauge used to monitor the health of the entire City's pavement. If the network PCI is dropping the City is not keeping up with street repairs. As referenced in Figures 6, 7, and 8, the network PCI rating has dropped nearly 7% in the last 5 years. The cost of asphalt, which is used to maintain at least 84% of the City streets, continues to rise and isn't expected to decrease. After 2007 the decline in pavement condition started to reflect the increase in costs. This started a steep decline that brings us to the pavement condition seen at the end of 2012.

In order to fix all of the streets that are in critical need of repair in 2013, the City would need to spend approximately $10 million. Streets in critical need are defined as streets that will need much more costly repairs within the next 2 years if no maintenance is carried out before then. The cost to fix these critical streets is defined as the backlog cost.

The decline of pavement condition, as well as the increase of backlog cost, will continue with current funding levels, even if the cost of materials never increases (shown in Figure 10). The longer pavement is left to decline, the more difficult it is to fix. This applies to the whole pavement network as well. In general the lower the PCI for the pavement network, the more it will cost to maintain at a constant level. The concept is similar to maintaining a car. With cars, it's generally more cost effective to replace fluids at regular intervals and replace parts before they fail. As a car ages, more parts approach failure and if one part is replaced, it will still take much more work to keep the car running. With streets, if the pavement network is left to age, rehabilitating or reconstructing one percent of the pavement network still leaves a lot more work to be done.

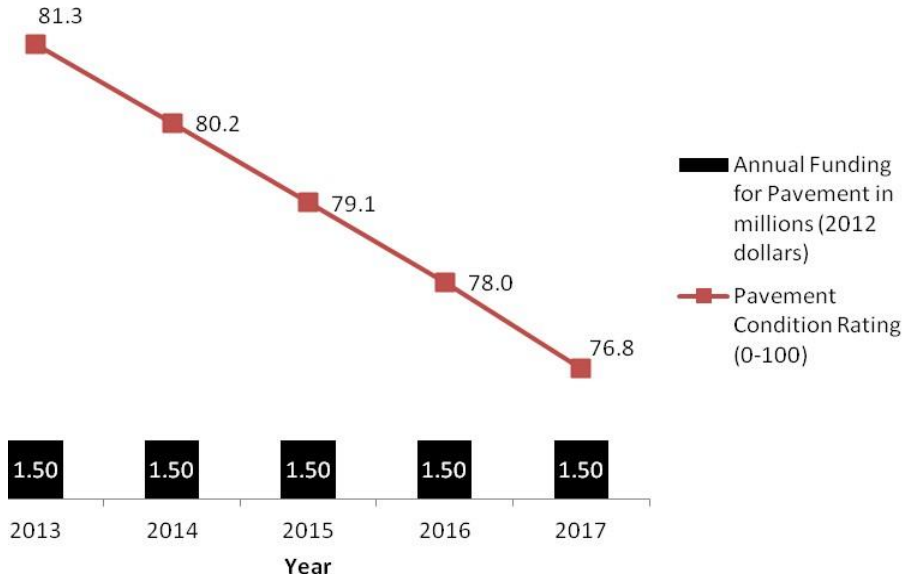


Figure 10. Five year pavement condition with spending fixed at $1.5 million

5.2. Maintenance Strategies

Of course, one easy answer to improve pavement condition is to acquire more funds, but it is necessary to first explore ways to reduce costs by rethinking old maintenance strategies and understanding how to get the greatest value. A common maintenance strategy used by local governments is to take a "reactive" approach to pavement maintenance. This means that pavement deficiencies that are severe and visible will likely get treated first. The advantage of this strategy is that it is inherently utilitarian in that it will likely benefit a large number of people as the more visible the problem

street is, the higher its maintenance priority. The downside to this approach is that less preventative maintenance is performed since limited funding will likely go towards fixing issues that receive the most complaints.

The City of Decatur's strategy has been to treat the streets that are most in danger of needing full replacement if they were to be left alone. This strategy is very advantageous because it avoids costly reconstruction by resurfacing streets before they need reconstruction, and patching streets before they need resurfacing. This strategy is known as finding "the right fix at the right time". It's a strategy that has been very effective and it would be beneficial to expand the use of this strategy by performing more preventative maintenance which will extend the life of pavement, thus reducing the number of streets needing repair.

Preventative maintenance techniques are the least costly compared to the other forms of pavement maintenance and they usually give more years to the pavement's life per dollar spent than any other form of maintenance. This would suggest that treating pavement in the "Good" to "Fair" range is more cost effective than treating "Poor" pavements. Figures 11 and 12 illustrate this by comparing the cost per year when using preventative maintenance and rehabilitation with just using rehabilitation techniques. These examples are for asphalt streets using a microsurface as a form of preventative maintenance and a mill & overlay as an example of rehabilitation. The same concept applies to other types of pavements.

These figures use a deterioration rate of asphalt streets observed from the yearly inspections. Since only 6.7% of the City's pavement network is below a PCI rating of 60, there is insufficient data to determine the bottom half of the deterioration curve without extrapolating. This is done by using generally accepted deterioration curves for pavement.

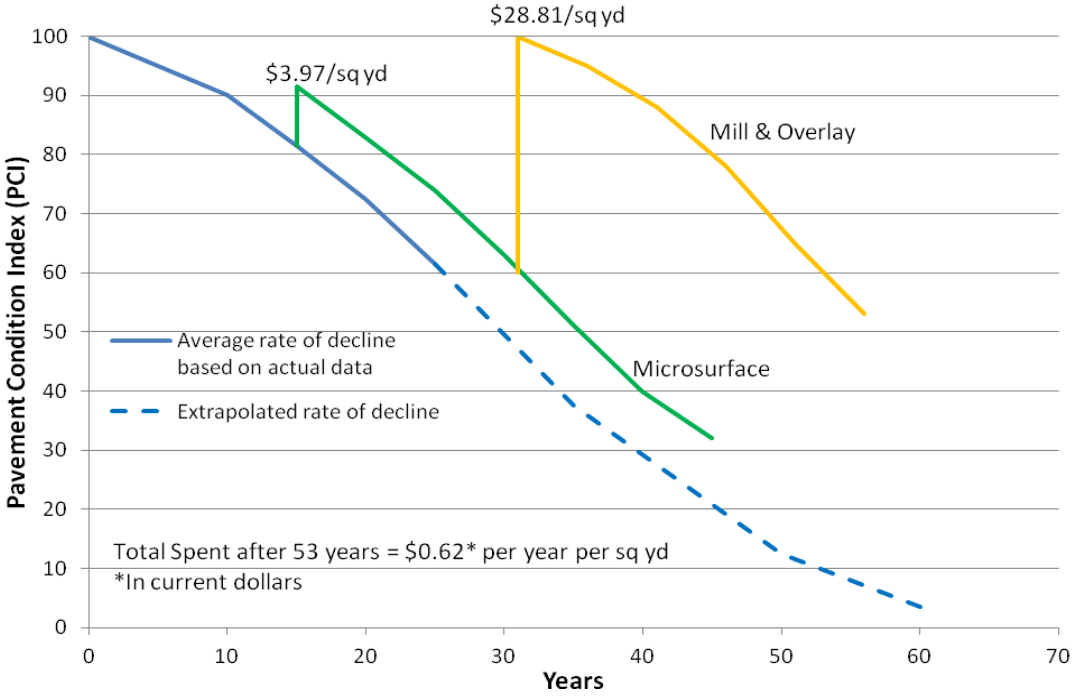


Figure 11. Microsurface treatment followed by mill & overlay

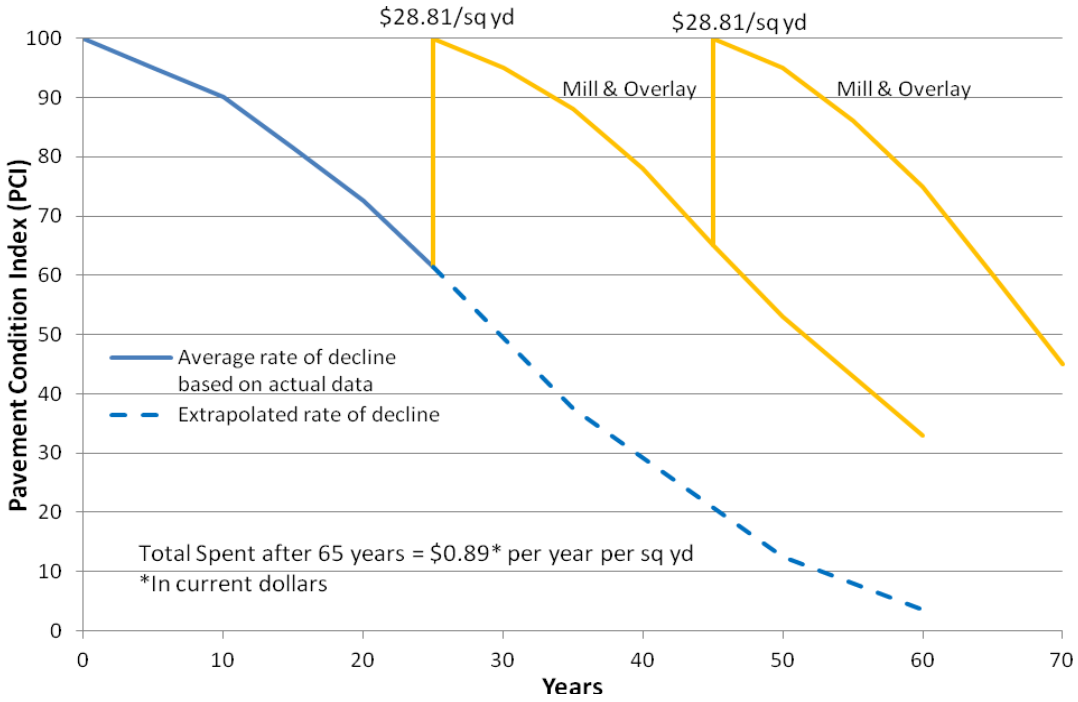


Figure 12. Two mill & overlay treatments

A strategy that involves reconstruction within the pavement's first 60 years of life also results in greater costs, as shown in Figure 13.

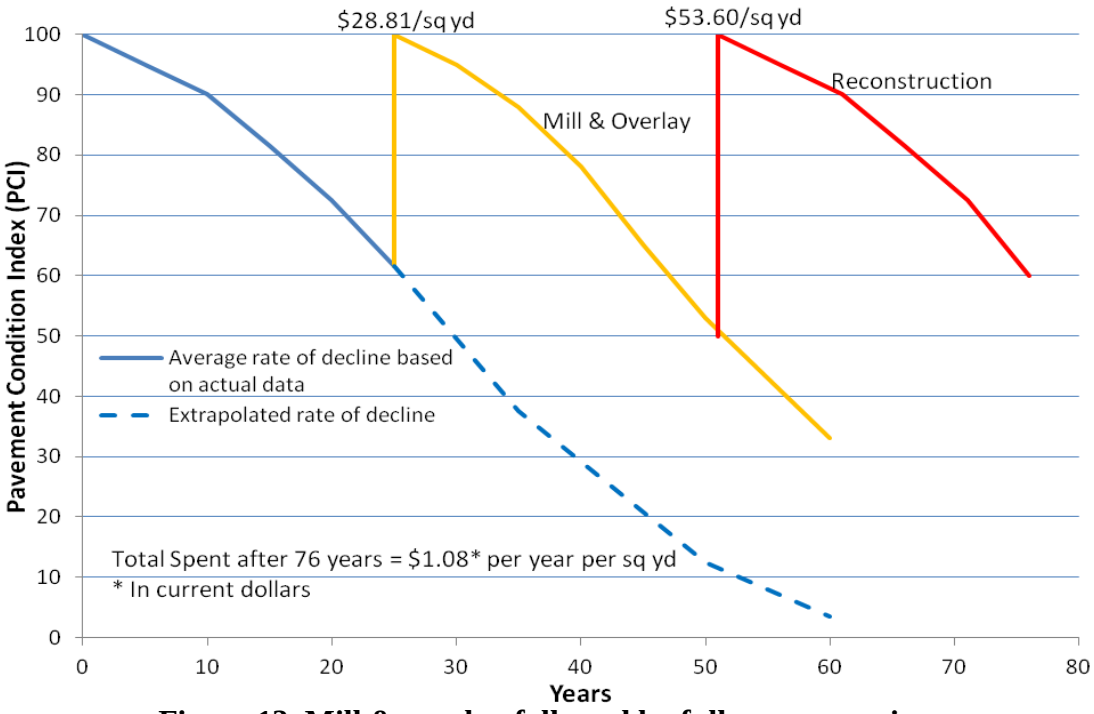


Figure 13. Mill & overlay followed by full reconstruction

With the first 60 years of asphalt's life, it will usually need treatment at least twice. Using preventative maintenance delays the need for rehabilitation and by the time the street needs reconstruction, $0.62 per year have been spent to maintain that street on average. If you forego preventative maintenance and just wait to rehabilitate it twice, $0.89 per year will be spent on avereage for that square yard of asphalt. The cost per year goes up to $1.08 per square yard if the street is only rehabed once before being reconstructed.

Microsurfacing and mill & overlays are only examples of their respective maintenance activity. Microsurfacing works effectively with only a narrow range of streets. It is highly versatile however, since it can be used in conjunction with other maintenance activities. Crack sealing and chip seals are also examples of preventative maintenance that if used for the right road at the right time can help extend its life. Mill & overlay is also only one example of pavement rehabilitation. Another example is hot-in-place (HIP) recycling which is a rehab technique that heats the existing asphalt and mixes in more oil to rejuvinate the existing pavement.

Concrete streets should also receive maintenance prior to reaching a failed condition. There are not as many options for preventative activities that work for concrete streets, but when permorming rehab activities such as diamond grinding and concrete

patching, the goal is to extend the life of the concrete before it needs to be overlaid with asphalt or completely reconstructed.

5.3. Funding Strategies

Funding for street rehabilitation and reconstruction projects over the past 20 years primarily comes from two sources: Capital Improvement Funds, and the Motor Fuel Tax (MFT) which is levied by the State of Illinois on each gallon of fuel sold. State Motor Fuel Taxes are dedicated to projects involving street repairs or improvements. It is valuable to have a dedicated source of funding for street maintenance; however, MFT revenue has failed to increase over the past few years to meet the increases in material costs. Municipalities receive a percentage of MFT funds based on population. According to the 2010 U.S. census, the City of Decatur has a population of 76,122. This is a 7% decrease from the 2000 census population of 81,860. Statewide MFT revenue hasn't increased due to less fuel being sold. The City is receiving a smaller piece of the smaller revenue pie. To overcome this, new strategies should be devised to help the City return to earlier funding levels and compensate for increases in material costs.

5.3.1. Funding Distribution

Performing more preventative maintenance and rehabilitating streets before they need full reconstruction is only part of the strategy that must be utilized to help stop the decline of the pavement condition. For instance, the proper distribution of funds to the various maintenance activities is important to maximize the effectiveness of those funds. As already mentioned, taking the funds we have and performing only reconstruction activities would not be very efficient because the streets that need to be rehabilitated will be neglected and will become reconstruction candidates in only a few years. However, a percentage of funds should always go towards pavement reconstruction, so the backlog of "Very Poor" to "Failed" streets can be reduced.

There's no fixed distribution of funds that would work for every year, but for planning purposes, an average distribution will give an idea of what needs to be spent each year on preventative maintenance, asphalt and concrete rehabilitation, and reconstruction respectively.

The City's pavement management system, Lucity, was used to simulate several different scenarios to find an optimal distribution of funds. If the desire is to stop the decline of the City's pavement network condition and hold the PCI rating at its 2012 level, then a distribution of funds, as shown in Figure 14, should achieve an efficient allocation. This distribution should be used as a guide and not as a definitive optimization of fund allocation. For example, more funds may need to be allocated to reconstruction projects initially to help reduce the reconstruction backlog and increase the number of new streets. In later years, more preventative maintenance will need to be performed to keep those new streets from declining rapidly. Another example would be, that there may be some years that microsurfacing may not need to be performed at all because there may not be any streets that qualify for it in that year.

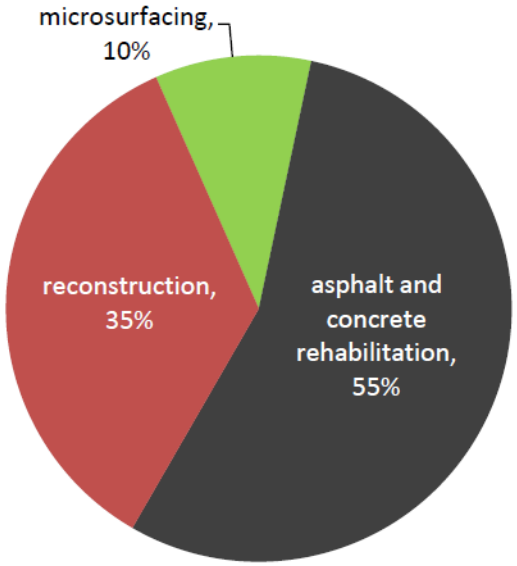


Figure 14. Proposed distribution of pavement project funds

The largest percentage of funds should go to rehabilitation activities because it is very important to repair streets before they need reconstruction. The largest increase in cost is between rehabilitation repairs and total reconstruction. Reconstruction candidates have issues with the base under the pavement surface. Pavement rehabilitation is meant to repair the pavement before its problems transfer to the base underneath. If the base was well constructed and the pavement on top is kept in good condition, reconstruction will theoretically never be needed.

5.3.2. Funding Scenarios

Fund allocation is only a part of the funding strategy. The proposed distribution is a guide to efficiently use the funds that are available, but the amount of funds available will still need to increase to return the City's pavement condition to a steady state. The question is, how much will it need to increase and what is the condition that will be achieved?

The City's pavement management system makes it relatively easy to answer that question. Having an inventory of the City's streets and their current condition allows the City to calculate how much it may cost to repair streets that are in critical need. To understand how much money is needed, a few different scenarios should be looked at to see what type of affect each has on pavement condition. Four different scenarios were tested:

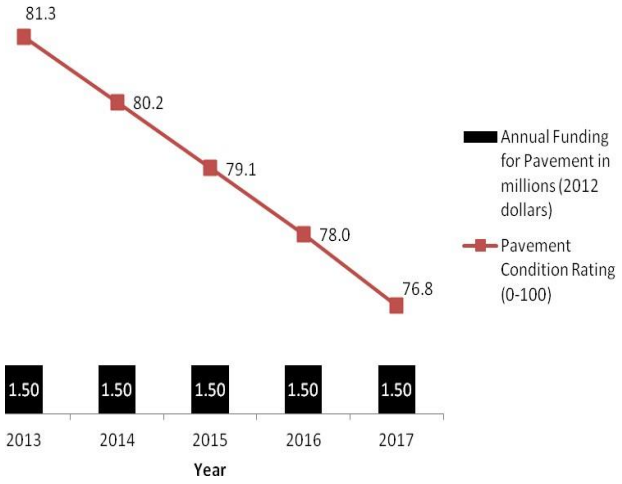


Figure 15.1
Pavement condition over the next 5 years if funding levels are maintained at the current $1.5 million per year.

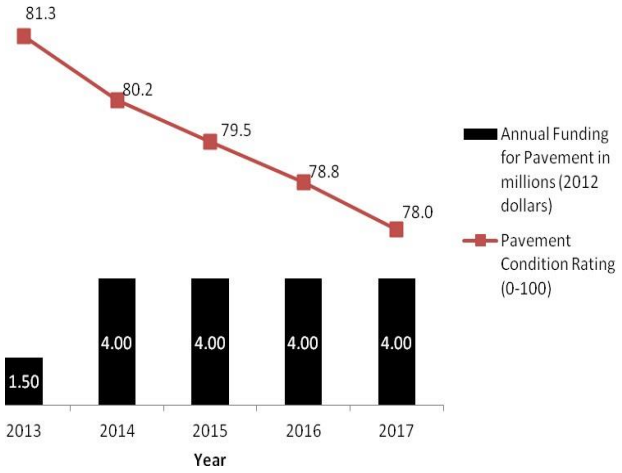


Figure 15.2
Pavement condition over the next 5 years if funding is increased to $4.0 million per year, which was roughly the funding prior to 2008.

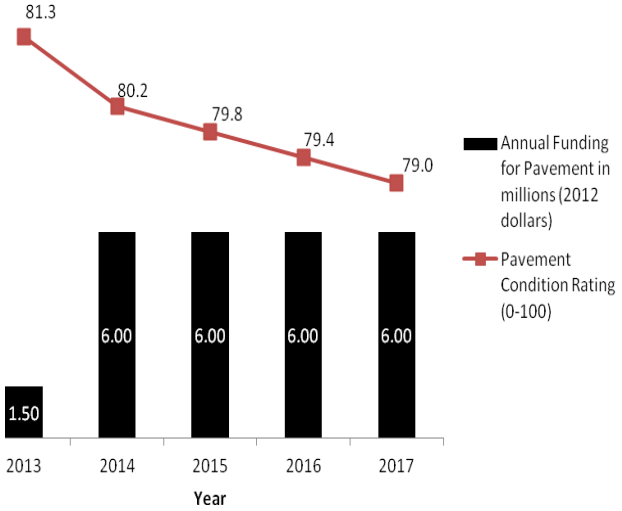


Figure 15.3
Pavement condition over the next 5 years if funding is increased to $6.0 million per year.

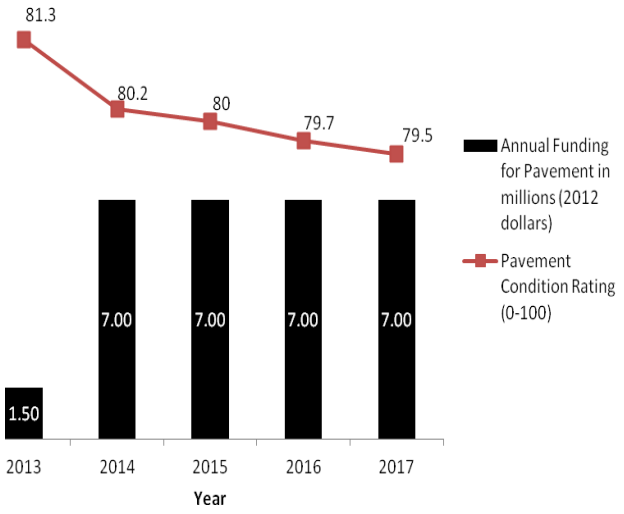


Figure 15.4
Pavement condition over the next 5 years if funding is increased to $7.0 million per year.

The current funding level for pavement maintenance related projects is projected to remain steady at roughly $1.5 million per year over the next 5 years. This is a combination of money from the General Capital Fund and the MFT Fund. Before 2008 the city spent roughly $4 million per year on asphalt, concrete, and brick street projects. After 2009 the City has primarily focused on asphalt streets. Concrete and brick streets deteriorate slower than asphalt, so almost no concrete or brick street project have been carried out since 2009 with hopes that funding would return.

Prior to 2008 the City's pavement network maintained a PCI rating above 87 with annual spending of about $4 million on pavement projects. In addition to the pavement project contracts, the City was spending over $350,000 per year on pavement maintenance performed in-house by the Streets & Sewers Section. As shown in Figure 15.1, the current funding level cannot sustain a "Good" pavement condition. Figure 15.2 shows that returning to the funding levels prior to 2008 will also fail to maintain an acceptable pavement condition. This is because of rising material costs and an increasing backlog of streets in need of repair due to inadequate funding during the past 3 years.

Figure 15.3 and 15.4 show two scenarios with increased funding that may adequately sustain a "Good" average rating (PCI 80 or above) for the City's pavement network for the next 5 years. Spending $6 million per year still projects a decline of the pavement rating by a PCI of 0.4 per year. This is without factoring in-house maintenance activities which will likely raise the pavement rating above what is being projected. $7 million per year is even more likely to achieve a steady pavement rating for the next 5 years.

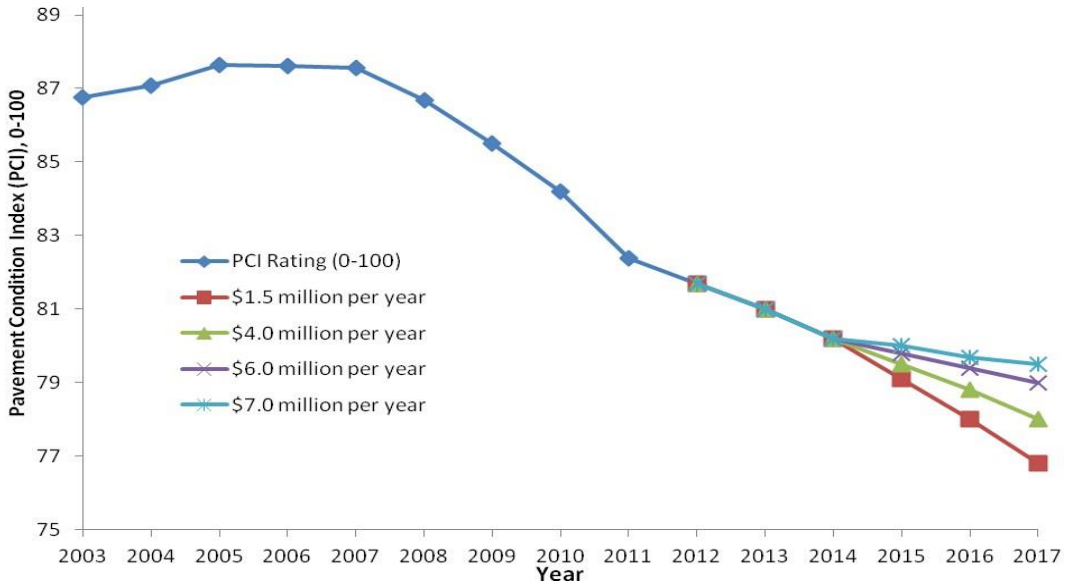


Figure 16. Network pavement condition projection scenarios

The aforementioned scenarios make an assumption that material costs will not increase over the next five years. This assumption is clearly unlikely based on the material costs of past years. On average, the costs of pavement related construction has increased by 7.8% each year during the past 5 years. While establishing a funding strategy of six or seven million dollars per year would have a tremendously positive impact on the City's pavement condition, regular funding increases should be considered to compensate for material cost increases. Figure 17 shows a scenario with cost and funding increases of 7.8%.

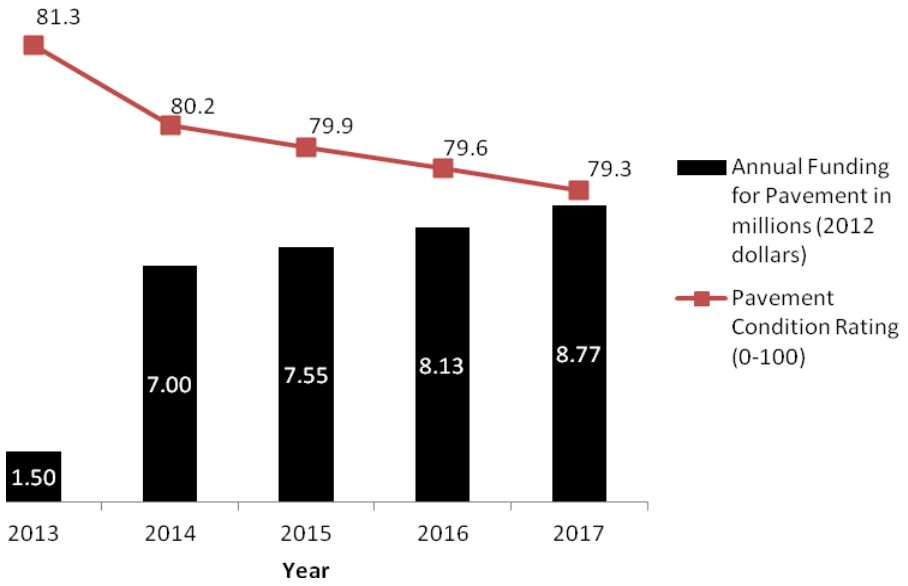


Figure 17. Pavement condition over the next 5 years if funding is increased to $7.0 million with increases at 7.8% per year

5.3.3. Local Option Motor Fuel Tax

To stabilize the decline and hold the current pavement condition, more funding will need to be devoted to pavement maintenance.

One way to obtain a dedicated source of funds for pavement maintenance is through the local option motor fuel tax. Currently the State taxes motor fuel and distributes a certain percentage of the revenue to the many municipalities within the State of Illinois. Current State motor fuel tax is at $0.19 per gallon for regular gasoline and $0.215 per gallon for diesel. In order to protect their pavement investment, many municipalities across the State of Illinois have enacted a local option motor fuel tax. All of the revenue generated by the local fuel tax goes to the municipality in which the fuel was purchased. Most municipalities dedicate all of the revenue generated to street maintenance. Municipalities that have enacted a local motor fuel tax include:

City of Champaign at $0.04 per gallon
City of Urbana at $0.04 per gallon
City of Peoria at $0.02 per gallon
City of Danville at $0.063 per gallon with annual increases
City of Chicago at $0.05 per gallon

5.4. Rolling 5-year Plan

Traditionally the City of Decatur has chosen the streets to be included in the street maintenance projects on a year-by-year basis. As part of the City's goals to improve maintenance techniques and increase public awareness of street projects, the City will now consider which streets to repair over a 5 year period. The City will perform this 5-year review every year creating a rolling 5-year plan outlining the proposed streets to be worked on in year 1, the possible streets to be worked on in year 2, and possible locations that may need attention in years 3 through 5. The streets highlighted in the 5-year plan will carry no guarantee that work will start on streets in the year they are selected. It will be a tool to highlight streets that may need attention within the next 5 years. It will also be a tool to aid the Public Works Department to more effectively plan their annual in-house maintenance activities.

The 5-year plan is a product of the pavement management system. It simulates the condition of each street segment and suggests streets that need work within a certain budget. The product of the simulation is a list of streets and a map of Decatur showing the recommended streets chosen. The list is refined after an engineering review. A 5-year plan map is shown in Figure 18.

RESERVED FOR 5-YEAR PLAN MAP

(Current year's plan has not been finalized)

Figure 18: City of Decatur 5-year Master Plan

5.5. Recommendations and Future Plans

A combination of changes to the ways the City maintains pavement and changes to how money is budgeted towards pavement maintenance is needed to reverse the decline of City streets. The City is not too far in the hole to get out, but it is slipping fast. The streets are still in "Good" condition and only a few years ago the City was maintaining a very healthy level of pavement condition. By 2015 the street network rating will likely fall to a "Fair" rating and will continue to decline without any action. The longer this action takes the more costly it will be to pull the pavement condition back to where it is currently.

Performing more preventative maintenance such as microsurfacing, crack sealing, and patching; as well as finding a source of funds dedicated to maintaining the City's pavement network are the City's goals to stop the decline. The pavement network is too important to the economy of Decatur for the City to ignore this issue.

Investigating whether the City can perform more maintenance in-house could result in a more efficient use of funds.

In the near future the City will continue to rate pavement condition annually and will continue to update and refine the 5-year plan. The goal is to make the plan public by adding to Decatur's Digital Atlas. This way, residents will have an easy way to find out when the streets that they frequently travel may be repaired.

The Pavement System Master Plan will not end with this report. All of the statistics found in this report will be updated regularly so that the City can stay ahead of future trends and monitor how changes made to pavement maintenance and funding strategies affect the health of the pavement network.