CITY OF INDIANOLA COUNCIL STUDY MEETING

January 12, 2026
6:00 PM
City Council Chambers
Agenda

1. **Presentation regarding HF718 from Simpson College Students**
2. **Presentation regarding the Pavement Management Plan**
   A. Pavement Management Program - Report on Findings and Recommendations by HR Green, Inc (Engineer).

MEMORANDUM

To: Mayor and City Council

From: Eric Stevens, Public Works Director

Date: January 12, 2026

Subject: Pavement Management Program - Report on Findings and Recommendations by HR Green, Inc (Engineer).

Introduction: The total monetary value of the City's pavement system is greater than any of its other assets. Also, as a general rule, the condition of a city's pavement is used as a key indicator to judge the viability of the community for economic development. Therefore, the City has a vested interest in developing a robust pavement management plan.

Background: The City contracted HR Green, Inc. to complete a Pavement Management Plan. This project will help the City develop an objective, data-driven, and sustainable approach to managing its roadway assets as well as to budget for future needs. HR Green's effort involved the following actions:

- Audit the inventory of the city's street system.
- Evaluate the system's current roadway conditions using data provided by the Iowa Pavement Management Program (IPMP).
- Determine major rehabilitation and reconstruction alternatives and trigger thresholds for use in the data analysis and projections.
- Create a comprehensive pavement management model using the IPMP data and the pavement management software DTIMS BA™.
- Develop 10-year maintenance/replacement schedules with annualized costs for various funding levels and scenarios.

Discussion: Using standard pavement management methodology, HR Green developed recommendations, with the intent of using the right pavement treatment, at the right time, on the right road. Large amounts of pavement-condition data were collected and analyzed with complex computer models to determine the best use of funds to improve the overall condition of the City's roadway network. This report is the culmination of those efforts and includes a 10-year plan of recommended projects based on optimal annual expenditures on maintenance, rehabilitation, and reconstruction of public streets.

Budget Impact: At this stage, the report of the Pavement Management Plan is included within the current budget. Implementation of the findings and recommendations is the subject of future funding under capital improvement planning and budgeting.

Recommendation: Staff recommends using the resulting pavement management plan to guide the development of the capital improvement plan and associated budgeting. Further, the Council will be asked to adopt the plan at a subsequent, regular council meeting.

Attachments: 1. PavementManagement-HRGreen

City of Indianola

Pavement Management Program

FY 2027-2036

CITY OF INDIANOLA EST. 1849

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Larry Stevens, PE, Project Manager

Caleb Jansen, PE, Project Engineer

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IOWA PAVEMENT MANAGEMENT PROGRAM

Inya Nlenanya, PhD; Technical Support and Data Delivery

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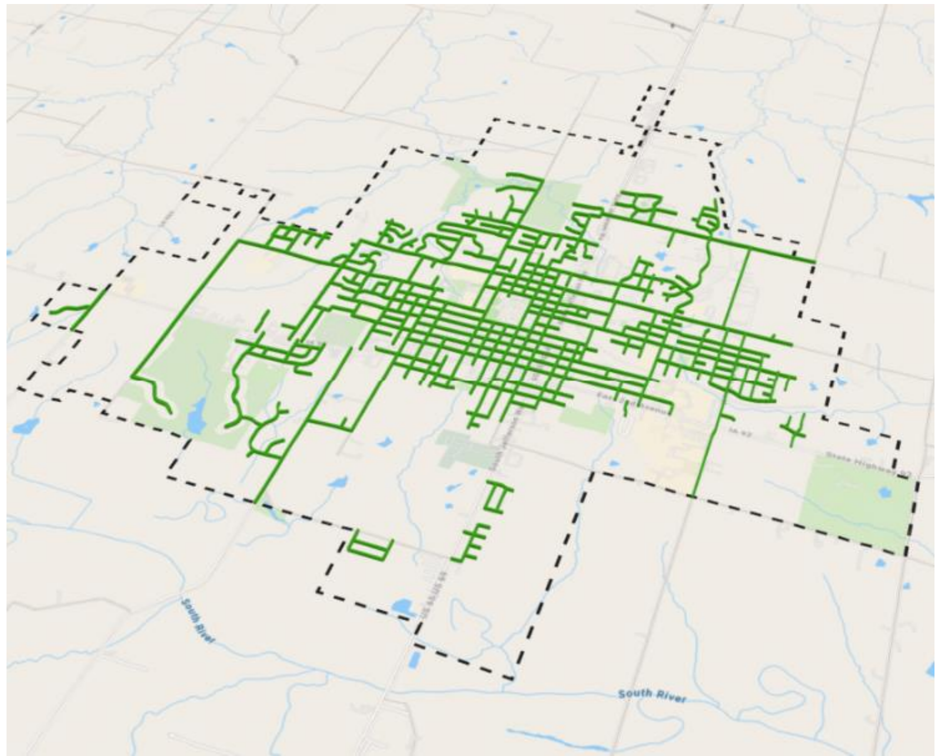
BACKGROUND

Infrastructure, including a City's network of streets, contribute significantly to the City's functionality and quality of life. It is important for the City tasked with maintaining the system to keep their assets in good, working order. Well maintained streets are safer for vehicles and pedestrians, enhance the long-term value of the network, and add to the convenience of the citizens that use the assets every day.

The City of Indianola is responsible for maintaining approximately 70 centerline miles of paved roadways. These roads connect citizens to and from their residences and serve a vital transportation need.

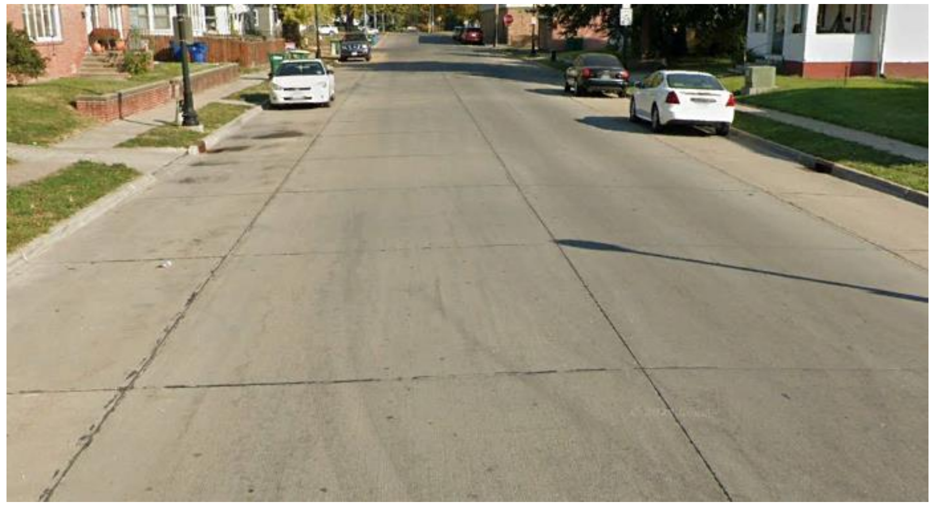
Historically, the City's framework for determining which streets to repair has been governed by the professional judgement of City staff. Staff knowledge is critical to identifying projects and determining the appropriate treatments; but, at a systematic planning level, there are better techniques and powerful software tools to help optimize the process.



INTRODUCTION

The City contracted HR Green, Inc. to complete a Pavement Management Plan. This project will help the City develop an objective, data driven, and sustainable approach to managing its roadway assets as well as to budget for future needs. HR Green's effort involved the following actions:

- **AUDIT THE INVENTORY OF THE CITY'S STREET SYSTEM**
- **EVALUATE THE SYSTEM'S CURRENT ROADWAY CONDITIONS USING DATA PROVIDED BY THE IOWA PAVEMENT MANAGEMENT PROGRAM (IPMP)**
- **DETERMINE MAJOR REHABILITATION AND RECONSTRUCTION ALTERNATIVES AND TRIGGER THRESHOLDS FOR USE IN THE DATA ANALYSIS AND PROJECTIONS.**
- **CREATE A COMPREHENSIVE PAVEMENT MANAGEMENT MODEL USING THE IPMP DATA AND THE PAVEMENT MANAGEMENT SOFTWARE DTIMS BA™**
- **DEVELOP 10-YEAR MAINTENANCE/REPLACEMENT SCHEDULES WITH ANNUALIZED COSTS FOR VARIOUS FUNDING LEVELS AND SCENARIOS.**



WHAT IS PAVEMENT MANAGEMENT?

Pavement Management is a *program* that carries out an important City *policy*. The policy objective is to improve overall street conditions in an efficient manner that maximizes public benefits. This proactive approach is important for a municipality tasked with maintaining roadway infrastructure for Indianola's steadily growing population, currently around 16,000 residents.

Using Pavement Management methodology, HR Green developed recommendations using the right pavement treatment, at the right time, on the right road. Large amounts of pavement condition data were collected and analyzed with complex computer models (further described in **Methodology**) to determine the best use of funds to improve the overall condition of the City's road network. This report is the culmination of those efforts and includes a 10-year plan of recommended projects based on optimal annual expenditures on maintenance, rehabilitation, and reconstruction of public streets.

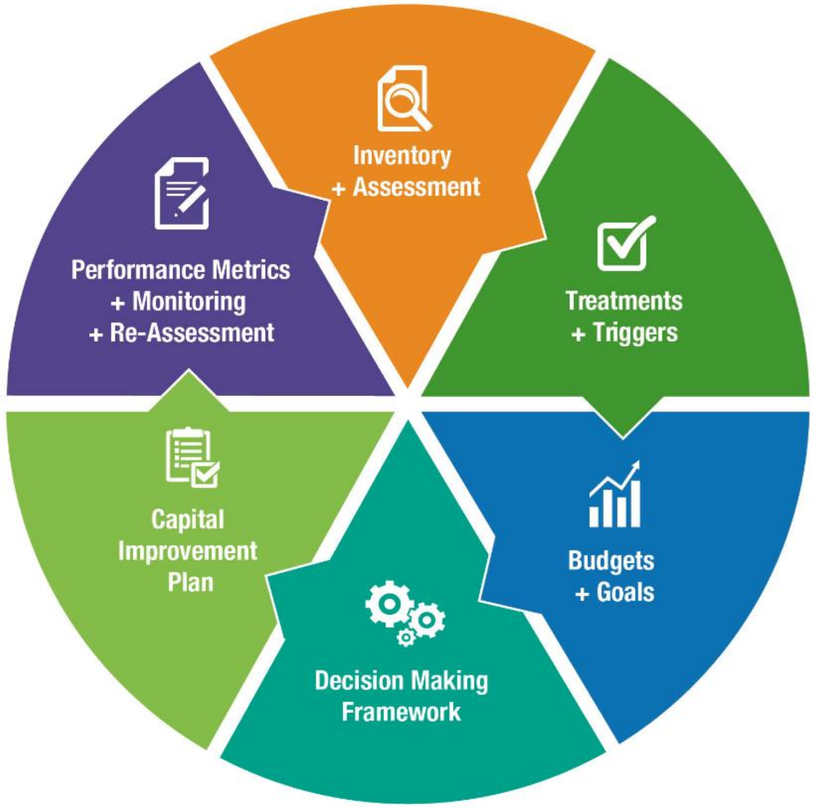


FIGURE 1: PRIMARY COMPONENTS OF PAVEMENT MANAGEMENT
The diagram above illustrates the six primary components of pavement management. Details of the components can be found in the methodology section

PAVEMENT LIFE CYCLES

The life cycle of a pavement is a crucial component of any pavement management plan. The age of pavement plays is a primary factor in how much investment it takes to repair a road back to a serviceable condition. **Figure 2** below shows a generalized pavement performance, or deterioration, curve. As shown in the graph, new pavements typically do not change drastically over the early years of their life. However, sharp declines can occur quickly as the pavement ages. Eventually, without intervention, traffic loading and environmental factors will cause all pavements to reach failing status.

Small investments at appropriate times can drastically improve and extend pavement life. Rehabilitating a pavement in “Fair” condition, for example, will usually cost **less than 25%** of the cost of reconstructing a failing pavement, while extending the pavement life significantly. Consequently, it is important to invest in pavement maintenance wisely and early. This plan sets the City of Indianola on a course towards this practice.

However, to reach an ideal condition level, many of the worst roadways also require reconstruction or significant rehabilitation, costing well into the millions of dollars. For most communities, this amount of work exceeds the available funding. As a result, pavements within the “Poor” condition category often need to be deferred or given light maintenance to get by until the street can be reconstructed at a later time. This effectively squeezes the most life out of the network while still giving the opportunity to practice ideal Pavement Management throughout the community.

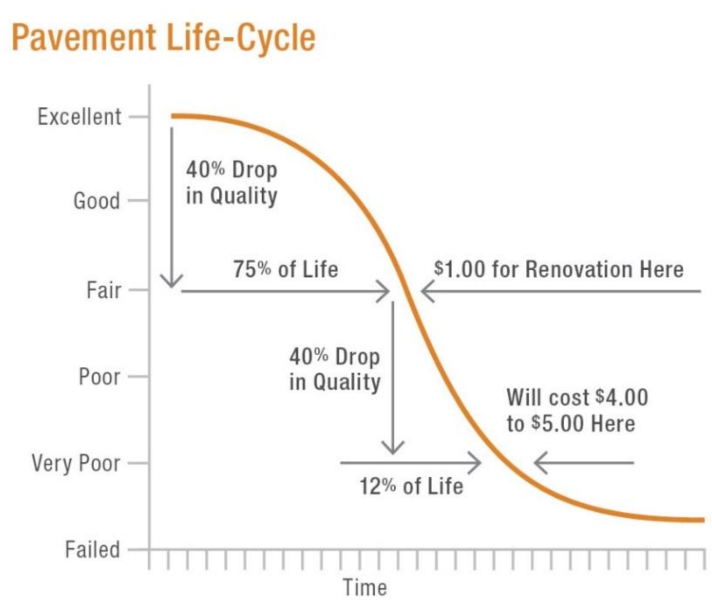


FIGURE 2: PERFORMANCE CURVE

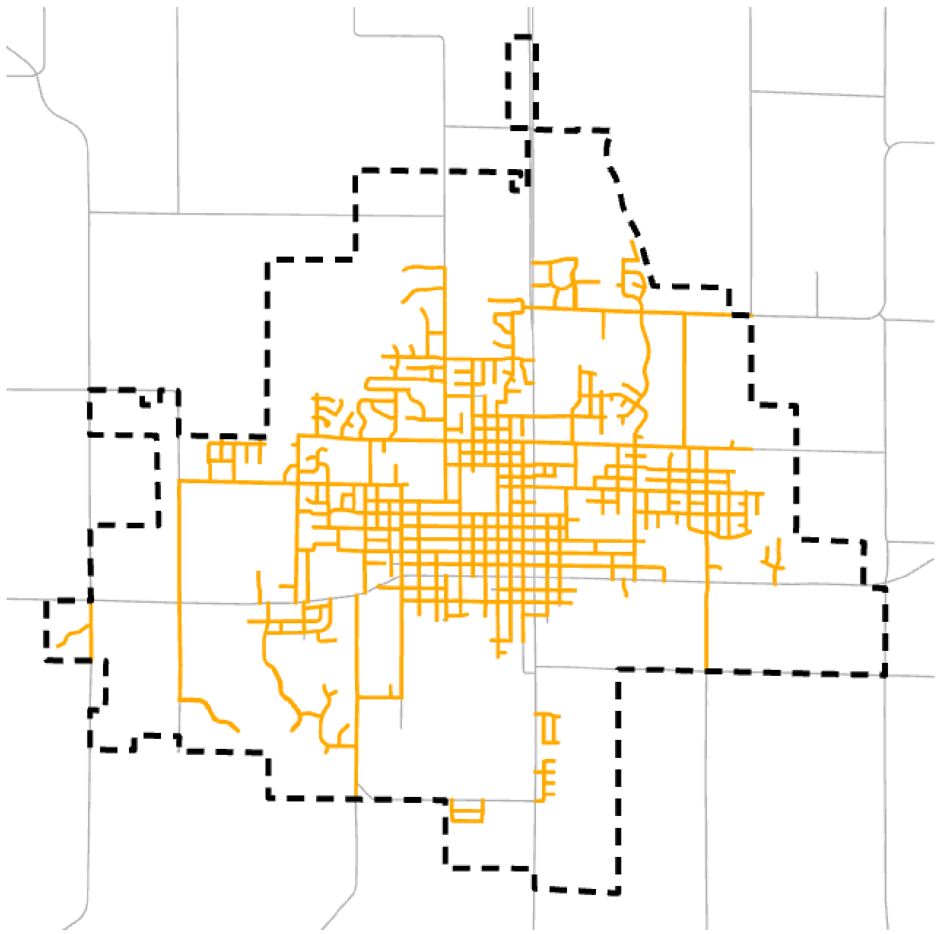
Renovating a pavement in “Fair” condition will usually cost less than 25% of reconstructing a failing pavement.

METHODOLOGY

DATA COLLECTION

The first step in any Pavement Management Program is to develop an accurate inventory of streets. HR Green compiled detailed GIS information and various historical reference materials to outline the current network.

For this program, publicly available street information maintained by the Iowa DOT Road Asset Management System (RAMS) was used as a starting point for the network. This data included the majority of the information needed for the analysis, including the pavement type, pavement width, and traffic volumes. This information was reviewed against available information maintained by the city to ensure that the network is accurate and up to date. The segmentation of the network, or how streets are split up, was also modified to better align with the needs of the pavement management software.



After the inventory was updated, the new conditions were then determined for each roadway segment. In the State of Iowa, roadway condition data is provided to municipalities by the Iowa Pavement Management Program (IPMP). Since 2013, the IPMP, formed out of a partnership between the Iowa DOT and Iowa State University, began collecting statewide pavement condition data on all public roadways. From 2013-2020, data was collected once every other year, with half the state receiving data in odd years and half the state receiving data in even years. Starting in 2020, the collection schedule was reduced, and data is now provided once every 4 years. However, municipalities are still given the option to opt in for every other year data, provided they pay for the additional data collection. Many planning organizations, such as MPO’s and RPA’s, have decided that bi-annual data is worth the cost, and have opted in to receive the additional data collections. The Central Iowa Regional Planning Affiliation, which includes Indianola, has decided to pay to have pavement data collected every two years.

FIGURE 3: DATA COLLECTION VEHICLE

This is an example of one of the vans that the current data collection vendor uses to collect pavement condition data in Iowa.

Roadway pavement condition data continues to be collected by Pathways Services Inc., the Iowa DOT‘s chosen data vendor. A “Pathrunner” automated data collection vehicle, example shown above, contains an array of data sensors and cameras that identify and quantity distresses on the pavement. Some of these sensors common on data collection vehicles include lidar, inertial profilers, and 3D laser systems. Data is aggregated at roughly 50-foot intervals and is then averaged out for each segment of roadway.

Multiple types of pavement surface distresses are identified and provided in the collected data. The photos on the right show a few examples of the types of distresses that are recorded and quantified. Each distress has a set of unique characteristics that can generally be used to help identify the causes of the failures. This information can then be used during the analysis to ensure treatments are properly selected.

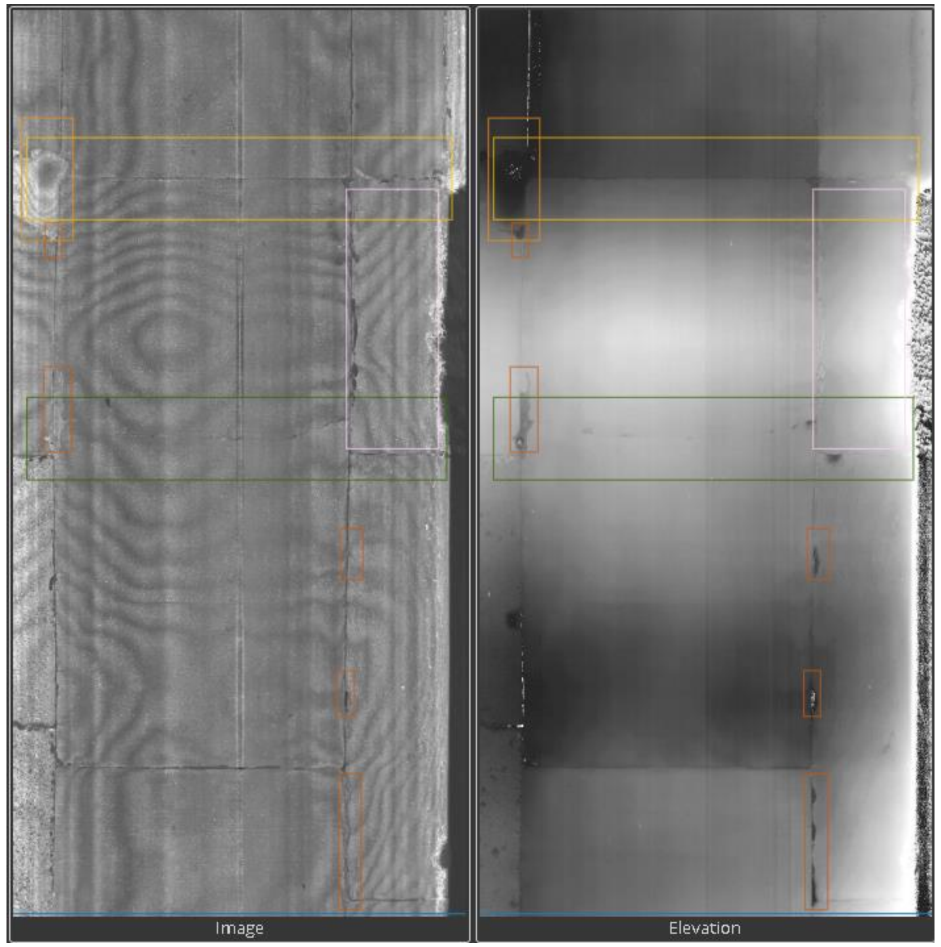


FIGURE 4: PAVEMENT DISTRESS ANALYSIS
This image is a screenshot from actual data collected in Indianola during the 2023 data collection cycle. Using image and lidar data, the vendor and their software can classify and quantify various distresses to be used in the analysis.

FIGURE 5: EXAMPLE OF ALLIGATOR CRACKING (ASTM)
This image is from the ASTM D6433 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys." Alligator Cracks are when pavement breaks into a "scaly" pattern typically caused by fatigue, either from repeated heavy loads, lack of sufficient subgrade support, or weakened material due to drainage issues.

FIGURE 6: EXAMPLE OF BLOCK CRACKING (ASTM)
This image is from the ASTM D6433 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys." Block cracks are when pavement breaks into "chunks" or "blocks" that are roughly rectangular, caused by internal stress from temperature or lack of lateral support.

FIGURE 7: EXAMPLE OF TRANSVERSE CRACK (ASTM)
This image is from the ASTM D6433 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys." A common distress caused by a wide variety of issues.

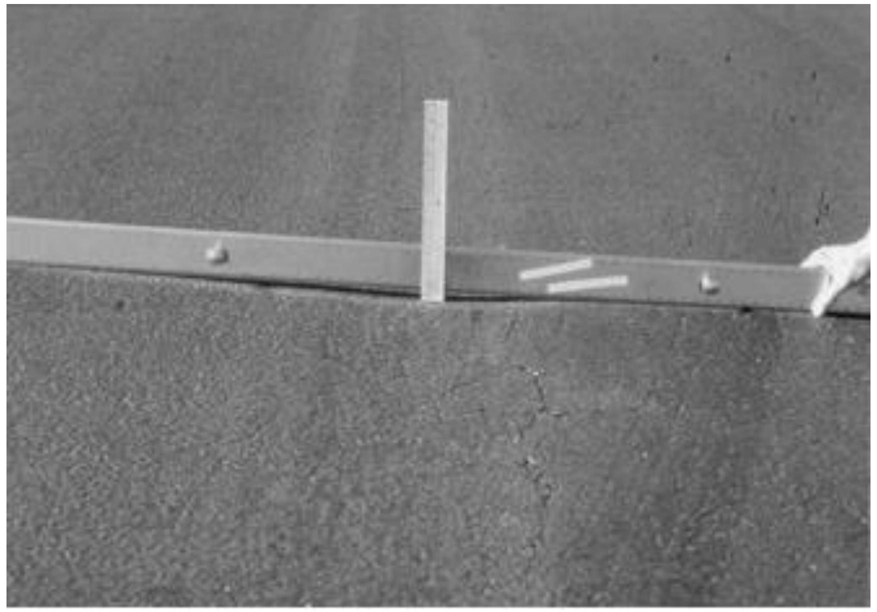


FIGURE 8: EXAMPLE OF RUTTING (ASTM)
This image is from the ASTM D6433 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys." Rutting is a depression along the wheel-path caused by traffic loads.

CONDITION THRESHOLDS

Once the distresses have been identified, a Pavement Condition Index (PCI) can be computed. IPMP utilizes multiple formulas to convert distresses into PCI values. This plan uses the CityPCI method for calculating condition indices, which is the most common PCI calculation for urban areas in Iowa. Each road is assigned a numerical value from 1-100 to help easily rate and compare conditions across the network. For the purposes of this report, “PCI” and “CityPCI” are used interchangeably.

Condition categories are then assigned to each street based on where the value falls on the 1 to 100 scale. For example, pavements with CityPCI ratings at or below 20 are considered to be “Very Poor” while those above 80 would be “Very Good.” This was done to help with understanding and assessment of the ratings, as well as to allow them to be used in a practical sense. The photos on the right show a few examples within Indianola of the different condition categories.

Condition Category	CityPCI Score
Very Good	81-100
Good	61-80
Fair	41-60
Poor	21-40
Very Poor	1-20

TABLE 1: CITYPCI CONDITION CATEGORIES
The table above shows how streets are placed in each condition category based on their recorded CityPCI score.

Due to the sampling methodology, technology limitations, and normal variations in the field, **PCIs should not be interpreted as a 100% accurate,** infallible rating. The difference between a 52/100 rating and a 56/100 could be only a few cracks. Additionally, since the data collection vehicle typically only drives one side of the street, it may occasionally miss a few distresses near the middle or on the other side that could be in better or worse condition. A difference of a few points one way or the other should not be interpreted as a definitive ruling on one street being better than the other. **Changes in PCI of less than 5-10 points are, in most cases, imperceptible to the naked eye.**

FIGURE 9: EXAMPLE OF “VERY GOOD” CONDITION PCC – N E STREET
N E Street, north of Franklin Avenue, has a CityPCI score of 92/100

FIGURE 10: EXAMPLE OF “VERY GOOD” CONDITION PCC – N 9TH STREET
N 9th street, north of E Madison Avenue, has a CityPCI score of 89/100

FIGURE 11: EXAMPLE OF “GOOD” CONDITION PCC – W IOWA AVENUE
W Iowa Avenue, west of N L Street, has a CityPCI score of 66/100

FIGURE 12: EXAMPLE OF “FAIR” CONDITION COM – N BUXTON STREET
N Buxton Street, just south of W Henderson Avenue, has a CityPCI score of 45/100.

FIGURE 13: EXAMPLE OF “POOR” CONDITION PCC – E ASHLAND AVENUE
E Ashland Avenue, west of N 5th Street, has a CityPCI score of 32/100.

FIGURE 14: EXAMPLE OF “POOR” CONDITION COM – W LINCOLN AVE
W Lincoln Avenue, just east of N C Street, has a City PCI score of 39/100.

FIGURE 15: EXAMPLE OF “VERY POOR” CONDITION PCC – S 4TH STREET
S 4th street, just south of E Salem Avenue, has a CItyPCI score of 9/100

FIGURE 16: EXAMPLE OF “VERY POOR” CONDITION COM – N BUXTON ST
N Buxton Street, just south of W Iowa Avenue, has a CityPCI score of 13/100.

PAVEMENT MANAGEMENT SOFTWARE

A Pavement Management Software (PMS) is a decision-making tool that assists a City in making cost-effective decisions related to the maintenance and rehabilitation of roadway pavements. It provides a process or system for projecting pavement conditions, establishing a consistent maintenance and repair schedule, and evaluating the effectiveness of maintenance treatment strategies.

The PMS used by the City of Indianola is “Deighton Total Infrastructure Management System: Business Analytics”, or dTIMS BA. This software was developed by Deighton Limited as an asset management software capable of storing multiple types of physical infrastructure assets. This software specializes in how it uses heuristic algorithms to optimize spending patterns. dTIMS BA is furnished by the IPMP and is commonly used by municipalities in Iowa.

The dTIMS BA model is a collection of the raw distress data, equations, variables, and rules for treatment applications as well as their effects. Each roadway segment is stored within the software and is included in the various analysis scenarios. The specific programming that is set up within the software is described in some of the following sections.

PERFORMANCE CURVES

Different types of pavements behave differently, and different classes of road have different stressors. To accommodate these factors, pavement life cycle curves, also referred to as deterioration curves, were developed for the pavement management program. These curves were calibrated to follow the general assumption that a pavement reaches “Fair” condition at 75% of its design life and “Very Poor” condition at the end of its design life. Using that assumption, the developed curves were compared to the overall historical performance of various pavement types and roadway classifications (See the Existing Condition Analysis section for further discussion on pavement types and functional classification). Over the past 10 years, the IPMP has been able to collect data on pavements over a significant portion of their lifespan. Because there is now a database of segments with multiple data points covering the pavement performance, pavement management plans can take a more refined approach that relies less on assumptions.

The table below shows the average annual rate of deterioration for the roadways located in Indianola. These rates appear to be in line with the typical pavements in Iowa, so the standard Iowa deterioration curves will be appropriate for the analysis.

As the plan progresses and evolves over time, further refinement of the performance curves may be made to increase the accuracy of the analysis. If, for example, any trends arise such as a certain type of pavement deteriorating faster or slower than expected, adjustments can be made to accommodate those factors.

TABLE 2: AVERAGE DETERIORATION BASED ON PAVEMENT CHARACTERISTICS

Pavement Type / Functional Classification	Arterial/Collector	Local
ACC	N/A	-0.58
COM	-0.44	-1.72
PCC	-1.43	-1.62

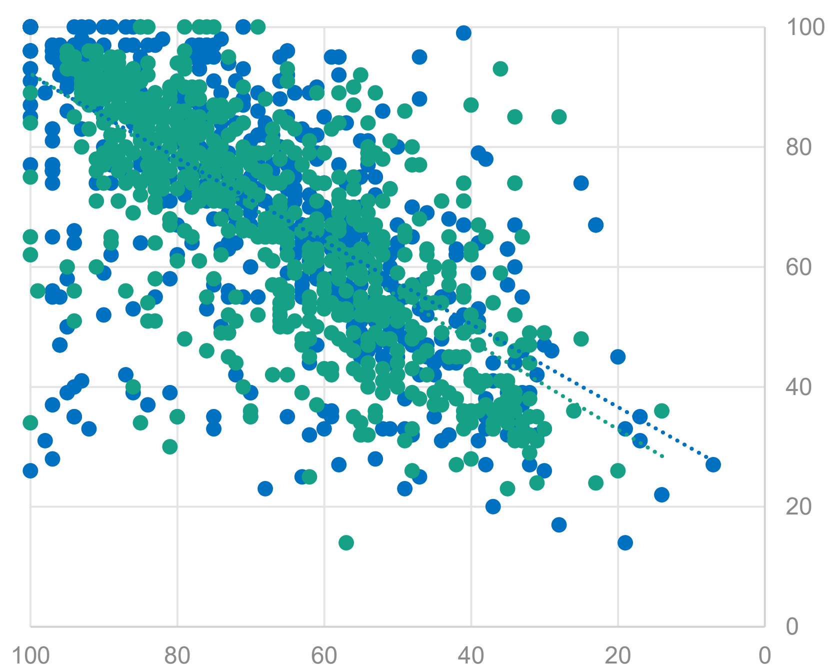


FIGURE 17: REGRESSION ANALYSIS EXAMPLES
Regression Analysis of pavement deterioration between data collections. Different charts are for different pavement types and regression lines represent expected deterioration rates for different functional classes.

TREATMENT ALTERNATIVES

A single pavement treatment, when properly applied, can extend the life of a roadway by as much 15 years. Before a decision on when and where a treatment can be applied, an agency must know what treatments it will consider. Dozens of potential products and techniques are available; however, not all treatment options are feasible, affordable, or effective. Climate, cost, and capability considerations must be made ahead of time.

The group of treatments available for a given municipality can be thought of as a “toolbox” filled with options appropriate for the tasks they would expect to encounter. The toolbox recommended for the City of Indianola consists of three primary types of treatments often referred to as the 3 R’s of Pavement Management: **Reconstruction**, **Rehabilitation**, and **Restoration**.

Every pavement will eventually deteriorate to a point where it cannot effectively be repaired in an economical fashion, leaving **Reconstruction** as the only viable option. Reconstructing a road from the base up is always an effective treatment, but it is also the most expensive solution. As such, it is important that other treatments are considered at various points in a pavement’s life cycle.

Rehabilitation treatments typically cost significantly less than full reconstruction and can extend a pavement’s life substantially. Rehabilitation treatments in this report are divided into major and minor variations. The former provides structural improvements to help a deteriorated pavement recover, whereas the latter consists of less intensive improvements that are typically more preventative in nature.

Restoration treatments, sometimes referred to as “preservation” or “maintenance”, are those applied regularly to prevent issues from developing or to keep existing problems from spreading.

Construction standards and specifications for the following treatment alternatives should follow the Iowa **Statewide Urban Design and Specification (SUDAS)** manual, where applicable. These research-backed approaches to construction and pavement management techniques will extend pavement life beyond traditional methods.

RECONSTRUCTION

Reconstruction of pavements is often the only way to treat a deteriorated roadway. Unfortunately, these needs usually outstrip available funding. This treatment type should be reserved for pavements that cannot be salvaged through rehabilitation or on high-profile corridors where safety and capacity needs are paramount.

When Reconstructing a pavement, the City can use any material they wish. Most commonly for Indianola, Full-depth PCC is used. However, full-depth HMA may be considered when design constraints warrant. To provide for this option, the City may want to consider using "bid-alternates", where contractors can bid based on the equivalent design of their choice. This tends to lead towards more competitive bids and helps ensure the most cost-effective solution is used.

FIGURE 18: PCC RECONSTRUCTION OF DIVISION STREET
This photo shows a road during a PCC reconstruction project located in Swisher, IA.

FIGURE 19: RECONSTRUCTION OF I-94 (NDDOT)
This photo shows the Construction of a-new asphalt cement concrete pavement

MAJOR REHABILITATION

- Thick Overlay
- Mill and Overlay
- Overlay with Crack and Seat
- Major PCC Restoration

Major rehabilitations suggested herein are all variants of overlays where moderately-thick layers of HMA are placed upon existing pavements, sometimes with special preparations. **"Thick Overlays"** using a minimum of 3 inches of HMA is preferable for each treatment, as any less will not provide significant structural benefit. However, amounts greater than 3 inches can become costly and sometimes may cause logistical difficulties. Overly-thick HMA overlays can affect side street elevations, drainage patterns, driveways, and fill up curbs leaving little remaining to control storm water and delineate the edge of the roadway. A thick overlay is the most common rehab used in most agencies and, for the purposes of this report, is generally recommended to be placed as the pavement approaches the "Poor" to "Very Poor" condition.

FIGURE 20: HMA OVERLAY ON MILLED PAVEMENT (COUNCIL BLUFFS)
This is a picture of an asphalt overlay placed in the City of Council Bluffs following milling of the existing pavement surface.

For full-depth HMA pavement, or on pavement overlaid previously, milling off 2-3 inches of the top can provide significant benefits. It can help smooth the underlying pavement for the final surface, remove harmful defects, help create a more stable bond between pavements, and prevent the overlay from causing the previously referenced logistical difficulties with side streets, drainage, driveways, and curbs. **"Mill and Overlay"** treatments are a very useful tool that can help extend the life of a pavement. As the City increases the number of HMA or Composite streets in the network, this treatment is likely to play an important role in Indianola in the future.

One other major rehabilitation treatment to consider on PCC roads is called a **"Crack and Seat with Overlay."** In this treatment, the existing PCC is intentionally cracked at set intervals using a drop-hammer apparatus, or other devices, to create a flexible base of concrete before placing 3 or more inches of HMA on top of it. This process may require the reconstruction of curbs if the depth of asphalt to be placed would be problematic; however, a milled edge notch may be utilized in some cases to eliminate the need for curb replacement. The new crack and seat pavement is typically a long-lived rehabilitation treatment, since the existing PCC pavement serves as a very effective foundation.

In recent years, **Interlayer**, a polymer modified asphalt, has grown in popularity across the state. Interlayer is often used as a single lift, typically around 1"-1 ½", within a thick overlay. Although more costly than a traditional HMA overlay, Interlayer provides more structural integrity and can reduce reflective cracking from the underlying pavement. When performing an overlay, the City should consider adding Interlayer, especially on the more heavily travelled arterials and collectors.

FIGURE 21: PCC RESTORATION (CITY OF CEDAR RAPIDS).
This is a picture of a city maintenance crew in Cedar Rapids performing a panel replacement as part of a larger concrete restoration project.

The final major rehabilitation treatment recommended is "**Major PCC Restoration"**. This treatment is a "holistic" repair to a PCC pavement street, including any or all the following actions: panel replacement, profiling, repairing utility cuts, full depth patching, and joint repair. PCC Restoration is more than simply pavement patching; it is strategic repair to existing deficiencies and can help save an otherwise stable road. A typical application removes and replaces around 20% of the existing pavement, to address specific localized issues. This type of repair could be performed by either city forces or outside contractors.

MINOR REHABILITATION

- Thin Overlay
- Minor PCC Restoration

Minor Rehabilitations fill a slightly different role than Major Rehabilitations. These treatments are primarily used to prevent moisture and seasonal weather effects like rain and heat from causing too much damage. Minor restoration treatments typically focus on providing a new “wearing surface” for vehicles to drive on, prolonging the life of the underlying pavement.

Thin Overlays are fundamentally the same treatment as a Thick Overlay; except they are 1-2 inches of HMA, instead of 3+ inches used for Thick Overlays. 1 ½ inches is the recommended thickness for Thin Overlay because, if it was thinner, it may be susceptible to cracking or rutting very quickly due to vehicle loads. Thin Overlays are also not appropriate on roadways with significant deformities (such as severe rutting) or structural distresses (such as severe alligator cracking or warping). It is also common to see the use of recycled asphalt and rubber materials in Thin Overlays which can reduce costs and possibly increase durability.

The other minor rehabilitation treatment recommended is **Minor PCC Restoration.** This treatment is essentially the same as Major PCC Restoration, which includes actions such as panel replacement, full depth patching, and joint repair. However, minor PCC Restoration only replaces around 10% of the existing pavement, which means it should only be used on PCC streets with limited distresses. This makes it a cheaper alternative to Major PCC Restoration.

FIGURE 22: CRACK SEALING PERFORMED W/ ROUTING (USAF)
This is an example of crack sealing being performed with special preparation in the form of using a router to clean up the crack profile.

RESTORATION

- Crack Sealing
- Diamond Grinding
- Microsurfacing
- Pavement Patching

Restoration, or preservation, treatments use simple techniques to seal defects from moisture infiltration and prevent them from spreading. Some of these treatments can also give streets a new wearing surface but provide little structural changes to the pavement. **Crack Sealing**, for example, is a standard maintenance practice, recommended to be performed by city forces every 3-5 years on a road. Indianola has an existing crack sealing program for both new and existing streets. This treatment plays an important role in extending the life of pavements in good condition by preventing damage that could be caused by water over time.

Diamond Grinding is not a commonly applied treatment, but due to its low cost should be considered when the conditions are ideal. **Diamond Grinding** is best used when a weathered pavement is beginning to show signs of aggregate polishing to add texture back to it or when settling or warping has caused minor faulting. Diamond Grinding can smooth those faults and leave an otherwise stable pavement intact with its ride significantly improved. It would not, however, be appropriate for pavements with substantial cracking or signs of structural deficiencies such as severe alligator cracking, spalling, or D-cracking.

FIGURE 23: PAVEMENT AFTER DIAMOND GRINDING (JOHN ROBERTS)
This picture shows the texture of PCC pavement after diamond grinding was used on it. The image was taken on a project near Chicago, Illinois.

Microsurfacing consists of a thin application like a slurry seal but uses a polymerized binder with finer aggregate. It can smooth over minor deformities while still adding a small amount of structural durability. It also creates a seal against water and wear. It is a versatile and relatively cheap treatment that can address a wide variety of distresses. A relatively new technique, it is not very common in the state of Iowa, yet. However, a few other larger municipalities in Iowa such as the City of Des Moines has recently invested heavily into this treatment method and begun incorporating it into their regular pavement management practices.

FIGURE 24: MICROSURFACING CREW AT WORK (ERIC PULLEY)
This is picture shows a crew using a Microsurfacing machine to lay a new surface on this street.

Pavement Patching is different from some of the other preservation treatments in that it is typically done by city forces after a pavement distress has already deteriorated to the point of becoming a more substantial issue. Patching is typically done with HMA, sometimes with partial removal of the area around the defect or distress. Patching is not intended to serve as a long-term fix. Instead, patching serves mostly to maintain service and act as a stopgap until a more appropriate rehabilitation treatment can be applied.

FIGURE 25: HMA PATCHING WITH LOCALIZED PAVEMENT REMOVAL
This is an example of an asphalt patch applied with appropriate localized removals and some base repair.

TREATMENT SELECTION

All the treatments in this section may be considered for projects in Indianola, although some are more preferable than others. The recommended CIP will not differentiate between types of projects within the same treatment category, as the actual treatment selection should be performed on a project-by-project basis and reviewed by a Professional Engineer. **Table 3** helps compare the effectiveness of each treatment over time while **Table 4** provides some simple guidance on which types of treatments are appropriate based on the distresses that a pavement presents.

TABLE 3: EXPECTED PERFORMANCE OF MAINTENANCE TREATMENTS

Source: Adapted from Iowa Statewide Urban Design and Specification guide.

Treatment	Expected Performance (Treatment Life), Years
PCC	
Crack Sealing	4 to 8
Joint Resealing	4 to 8
Partial Depth Patches	5 to 15
Full Depth Patches	10 to 15
Diamond Grinding	5 to 15
Pavement Undersealing/Stabilization	5 to 10
HMA	
Crack Filling	2 to 4
Crack Sealing	2 to 8
Pothole Patching	1 to 3
Full/Partial Depth Patches	3 to 15
Fog Seals	1 to 3
Slurry Seals	3 to 6
Microsurfacing	4 to 7
Bituminous Seal Coats	4 to 6
Double Chip Seal	7 to 10
Thin Overlays	7 to 10

The treatments used in the dTIMS model represent those expected to be the most common given certain conditions. These "preferred treatments" will likely comprise the majority of pavement preservation work performed in Indianola. This list, however, is merely a tool to aid in budgeting and planning and not a prescriptive result. Rather, the results from dTIMS are categorical recommendations based on severity and types of surface distresses. These recommendations will then need to be individually assessed for appropriateness against similar treatment alternatives before being designed and constructed.

TREATMENT SELECTION CRITERIA

With the treatment alternatives selected for the toolbox, the criteria for selecting one treatment over another needed to be determined. Cost and funding availability is regularly a primary deciding factor for local agencies, getting the most benefit for the least amount of investment possible. The other main factors in treatment selection are condition and distresses. The overall condition of a pavement should determine when it needs work and what type of work. The types of distresses should then be considered when evaluating treatments based on appropriateness. **Table 5: Toolbox of Treatments** includes a full overview of the treatment toolbox with descriptions, cost estimates, triggers, and the expected effects of each individual treatment alternative. This information is what is used in the dTIMS BA scenario modelling process.

ESTIMATED TREATMENT COSTS

One of the critical components in any financial planning endeavor is accurately predicting costs that will be incurred. In this case, the primary costs of concern are the design, construction, and ancillary costs associated with executing a roadway improvement project. Indianola has historical information about its expenditures on roadway projects throughout the years which were used to estimate costs for each treatment type. Additionally, future increases in costs were accounted for via a 2.1% inflation factor applied to all projects in dTIMS BA.

Table 6 through **Table 15** on the following pages provide the high-level calculations for each of the treatment types. It is important to note, however, that these are **planning-level costs**, only. While based on engineering judgement and historical bid tabulations, they are not a replacement for an engineering opinion of probable cost, and individual projects may differ from the costs provided based on a variety of factors, such as complexity, project timing, and difficulty.

Treatment	Reasons for Use						
	Friction	Raveling	Rutting	Potholes	Cracking		
					Low	Med	High
Crack Treatments							
Crack Repair with Sealing							
Clean and Seal					X	X	
Saw and Seal							
Rout and Seal					X	X	
Crack Filling						X	X
Full Depth Crack Repair							X
Surface Treatments							
Fog Seal		X					
Seal Coat	X	X					
Double Chip Seal	X	X					
Slurry Seal	X	X					
Microsurfacing	X	X	X				
Thin Overlay		X	X				
Pothole and Patching Repair							
Cold Mix Asphalt				X			
Spray Injection Patching				X			
Hot Mix Asphalt				X			X
Patching with Slurring or Microsurfacing Material				X			X

TABLE 4: PRIMARY CAPABILITIES & FUNCTIONS OF HMA TREATMENTS

Source: Adapted from Johnson, Best Practices Handbook on Asphalt Pavement Maintenance, 2000.

TABLE 5: TOOLBOX OF TREATMENTS

Category	Treatment	Description	Cost	Trigger
Reconstruction	Reconstruction	The complete reconstruction of a roadway and all associated improvements. This assumes new PCC pavement, but full-depth HMA may be considered based on relevant design criteria.	$230/sy	PCI =Poor OR Very Poor
Major Rehabilitation	Crack and Seat with Overlay	Asphalt Overlay, of at least 3 inches thick, with preparation including cracking existing pavement and creating a new structural base for the new asphalt surface.	$80/sy	PCI =Poor OR Fair, Surface = PCC, Low Spalling
	Mill and Overlay	1.5 to 3 inches of asphalt pavement is milled off and then replaced with 3 inches of asphalt. Repairs surface issues and improves structural character.	$70/sy	PCI =Poor OR Fair, Surface = HMA, Moderate Alligator Cracking, Low Patching
	Overlay with Interlayer	Sometimes called a "Structural Overlay." 3 inches of Asphalt that adds enough thickness to increase the durability of the roadway and provides a new wearing surface. Interlayer, a highly polymerized asphalt, is added as an intermediate lift to further increase the structural integrity of the pavement.	$65/sy	PCI =Poor OR Fair, Surface = PCC, Low Spalling, Low Patching
	Major PCC Restoration	Portions of the concrete street in bad repair are torn out and replaced (approximately 20% of a street). This may include patching, full panel replacement, and full depth repairs at joints. Improves overall condition and helps extend life by addressing problem areas before they spread	$60/sy	PCI = Fair, Surface=PCC, Low Patching
Minor Rehabilitation	Thin Overlay	A "non-structural" overlay". Laid on top of existing pavement, typically, 1-2 inches of asphalt. Improves smoothness and extends the life of roads in good to fair condition.	$34/sy	PCI = Fair OR Good, Low D Crack, Low Spalling, Low Alligator Cracking, Low Patching, Low Rutting, Local only
	Minor PCC Restoration	Portions of the concrete street in bad repair are torn out and replaced (approximately 10% of a street). This may include patching, full panel replacement, and full depth repairs at joints. Slightly improves overall condition and helps extend life by addressing problem areas before they spread	$30/sy	PCI = Good, Surface=PCC, Low Patching
Restoration/ Preservation	Diamond Grinding	Top ¼" to ½" of PCC pavement is ground off and textured. This is only done on rough pavements with good structure to improve ride smoothness and increase vehicle traction. Can be used following PCC Restorations to further enhance the effectiveness of the treatment.	$8/sy	PCI = Good or Very Good, Surface = PCC, Low Patching
	Surface Treatment (Microsurfacing/ Seal Coat/ Slurry Seal)	Seal Coat – Slurry seals, chip seals, cape seals, etc. Applications of finer aggregate and binder to affordably extend life of existing pavements. Type is condition and location specific	$8/sy	PCI = Good or Very Good, Surface = HMA, Low alligator cracking, Low Patching, Low Rutting. Local Only
		Microsurfacing - Thin asphalt polymer that seals the pavement from weather effects and corrects for minor irregularities. Typically used as a preventative measure, rather than a corrective one.	$8/sy	
	Pavement Patching	Asphalt placed at spot locations. Used primarily on good pavements with minor failures, or as a stopgap on poor pavements until a better, more permanent, solution is applied.	$8/sy	No trigger assigned

TABLE 6: RECONSTRUCTION COST CALCULATION

Reconstruction ($/SY)	Current Costs:	
Excavation/Topsoil	$	17.00
Subgrade	$	4.00
Subbase	$	14.00
Subdrain	$	6.00
Storm Sewer	$	30.00
Pavement Removal	$	9.00
Pavement (PCC)	$	76.00
Driveways/Sidewalks	$	17.00
Seeding/Paint Markings, etc.	$	8.00
Mobilization, Traffic Control, Survey (15%)	$	29.00
Contingency (10%)	$	20.00
Total (Rounded Up)	**$**	**230.00**

TABLE 7: CRACK AND SEAT WITH OVERLAY COST CALCULATION

Crack and Seat w/ Overlay ($/SY)	Current Costs:	
Crack and Seat	$	7.00
3" HMA Overlay @ $110/Ton	$	18.00
HMA Interlayer@ $150/Ton	$	8.00
Tack and Patch @ $250/Ton	$	5.00
Curb and Gutter/Patching	$	10.00
Driveways/Sidewalks	$	8.00
Mobilization, Traffic Control, Survey (15%)	$	15.00
Contingency (10%)	$	9.00
Total (Rounded Up)	**$**	**80.00**

TABLE 8: MILL AND OVERLAY COST CALCULATION

Mill and Overlay ($/SY)	Current Costs:	
3" HMA Overlay @ $110/Ton	$	18.00
HMA Interlayer @ $150/Ton	$	8.00
Tack and Patch @ $250/Ton	$	5.00
Milling	$	5.00
Curb and Gutter/Patching	$	10.00
Driveways/Sidewalks	$	8.00
Mobilization, Traffic control, survey (15%)	$	9.00
Contingency (10%)	$	7.00
Total (Rounded Up)	**$**	**70.00**

TABLE 9: OVERLAY WITH INTERLAYER COST CALCULATION

Overlay with Interlayer ($/SY)	Current Costs:	
3" HMA Overlay @ $110/Ton	$	18.00
HMA Interlayer	$	8.00
Tack and Patch @ $250/Ton	$	5.00
Curb and Gutter/PCC Patching	$	10.00
Driveways/Sidewalks	$	8.00
Mobilization, Traffic control, survey (15%)	$	10.00
Contingency (10%)	$	6.00
Total (Rounded Up)	**$**	**65.00**

TABLE 10: MAJOR PCCR COST CALCULATION

Major PCC Restoration ($/SY)	Current Costs:
20% Remove and Replace	$35.00
Crack Fill/Seal	$5.00
Profiling	$5.00
Mobilization, Traffic control, survey (15%)	$9.00
Contingency (10%)	$6.00
Total (Rounded Up)	**$60.00**

TABLE11: THIN OVERLAY COST CALCULATION

Thin (1.5 In.) Overlay ($/SY)	Current Costs:	
1.5" HMA Overlay @ $110/Ton	$	9.00
Tack and Patch @ 250/Ton	$	2.00
Curb and Gutter/PCC Patching	$	9.00
Driveways/Sidewalks	$	8.00
Mobilization, Traffic control, survey (10%)	$	3.00
Contingency (10%)	$	3.00
Total (Rounded Up)	**$**	**34.00**

TABLE 12: MINOR PCCR COST CALCULATION

Minor PCC Restoration ($/SY)	Current Costs:	
10% Remove and Replace	$	16.00
Crack Fill/Seal	$	2.00
Profiling	$	4.00
Mobilization, Traffic control, survey (15%)	$	5.00
Contingency (10%)	$	3.00
Total (Rounded Up)	**$**	**30.00**

TABLE 13: DIAMOND GRINDING COST CALCULATION

Diamond Grinding ($/SY)	Current Costs:	
Diamond Grinding/Profiling	$	8.00
Total (Rounded Up)	**$**	**8.00**

TABLE 14: MICROSURFACING COST CALCULATION

Microsurfacing ($/SY)	Current Costs:	
Polymerized Surface Treatment	$	4.00
Tack and Patch @ 250/Ton	$	2.00
Mobilization, Traffic control, survey (10%)	$	1.00
Contingency (10%)	$	1.00
Total (Rounded Up)	**$**	**8.00**

TABLE 15: PATCHING COST CALCULATION

Patching ($/SY)	Current Costs:	
Patch @ $250/Ton	$	8.00
Total (Rounded Up)	**$**	**8.00**

EXISTING CONDITION ANALYSIS

FUNCTIONAL CLASS AND PAVEMENT TYPE

The City of Indianola currently maintains a roadway network consisting of approximately 70 centerline miles of paved streets. There are many ways to divide up a network for analysis, but a primary method is to split the network by Federal Functional Classification. This classification assigns roads to different categories based on their use and amount of traffic. Roads are placed in one of seven categories, ranging from Interstates to Local Streets. In Indianola, all streets that the city is responsible for maintaining can be assigned to one of three categories: **Local Streets, Collector Streets, and Arterial Streets.**

Local Streets, also referred to as "residential", serve low levels of traffic at the beginning or ending of vehicle trips. These streets often have many points of direct access from driveways, have lower speed limits, and often have on-street parking. Local Streets make up the majority of any transportation network.

Collector Streets are those that connect Local Streets and concentrate traffic to help move vehicles efficiently between adjoining neighborhoods or provide access to the primary street network, namely Arterial Streets. These Collector Streets are generally wider and have slightly higher speed limits than Locals.

Arterial Streets carry the most traffic. These trunk roads travel at higher speeds and efficiently move traffic from one end of town to the other. They are also the gateway routes into and out of the City.

The importance of this distinction is that Arterial and Collectors are designed for higher volumes of traffic and heavier vehicles such as semi-trucks. As such, they are designed differently, costing more per square yard of pavement than Local streets. They also perform differently, by comparison. The higher traffic loads cause Arterials and Collectors to wear out faster on average than Locals, and motorists are more sensitive to surface distresses due to the higher speeds. That said, because Arterials/Collectors carry most of the vehicle-miles travelled in cities, they are more valuable to maintain in good condition. As such, for the purposes of modelling and planning using dTIMS BA, Arterial and Collector streets are considered separately from Local Streets.

Most urban systems contain 60%-75% local streets with Arterial and Collectors being split roughly even in the remainder. Indianola's network is close to this distribution, with 78% of the network being made up of local streets, as shown in **Figure 26**.

Another primary way to categorize streets is by type, or material, of pavement. In Indianola, the majority of pavement in the City is constructed of PCC (concrete) as shown in **Figure 26**, making up nearly 93% of the network by length. The remaining streets are comprised of HMA (asphalt) or COM (composite, or HMA overlaid on PCC). Most municipalities in Iowa use PCC as the default paving type for reconstruction projects, and as such, PCC typically makes up the majority of pavement. PCC, although often more expensive than HMA, typically has a longer life than HMA. Even so, Indianola does have a notably small number of composite streets in the network. Many similar cities generally have larger percentage of composite streets as they perform HMA overlay treatments on PCC streets to extend the life of those pavements.

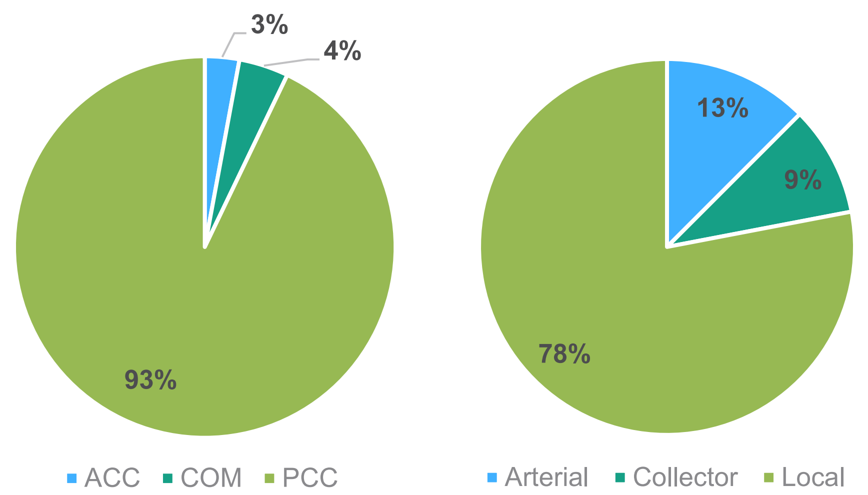


FIGURE 26: PAVEMENT NETWORK CLASSIFICATIONS BY LENGTH

The graphs above show the distribution of existing roadway miles in the network by both pavement type and roadway classification.

PAVEMENT CONDITIONS

For most communities in Iowa, average pavement condition scores range around the "Fair" to "Good" condition categories, with a statewide average CityPCI score currently being around 61.

> **According to the most recent data collection, the average CityPCI in Indianola is 59.5.**

The most recent data collection in Indianola was collected in 2023. This data provides a detailed look at the network and is vital to being able to identify important trends and statistics within the pavement system.

The first two charts, shown in **Figure 27**, show the distribution of CityPCI scores within the network. On the positive, Indianola currently has a large number of streets in the "Very Good" category, and roughly 50% of the network ranks in the "Good" or "Very Good" category. On the flip side, there is also a relatively large proportion of streets in the "Poor" condition category. Ultimately, the City will want to focus significant attention to the streets in this category to prevent further condition declines into the "Very Poor" category.

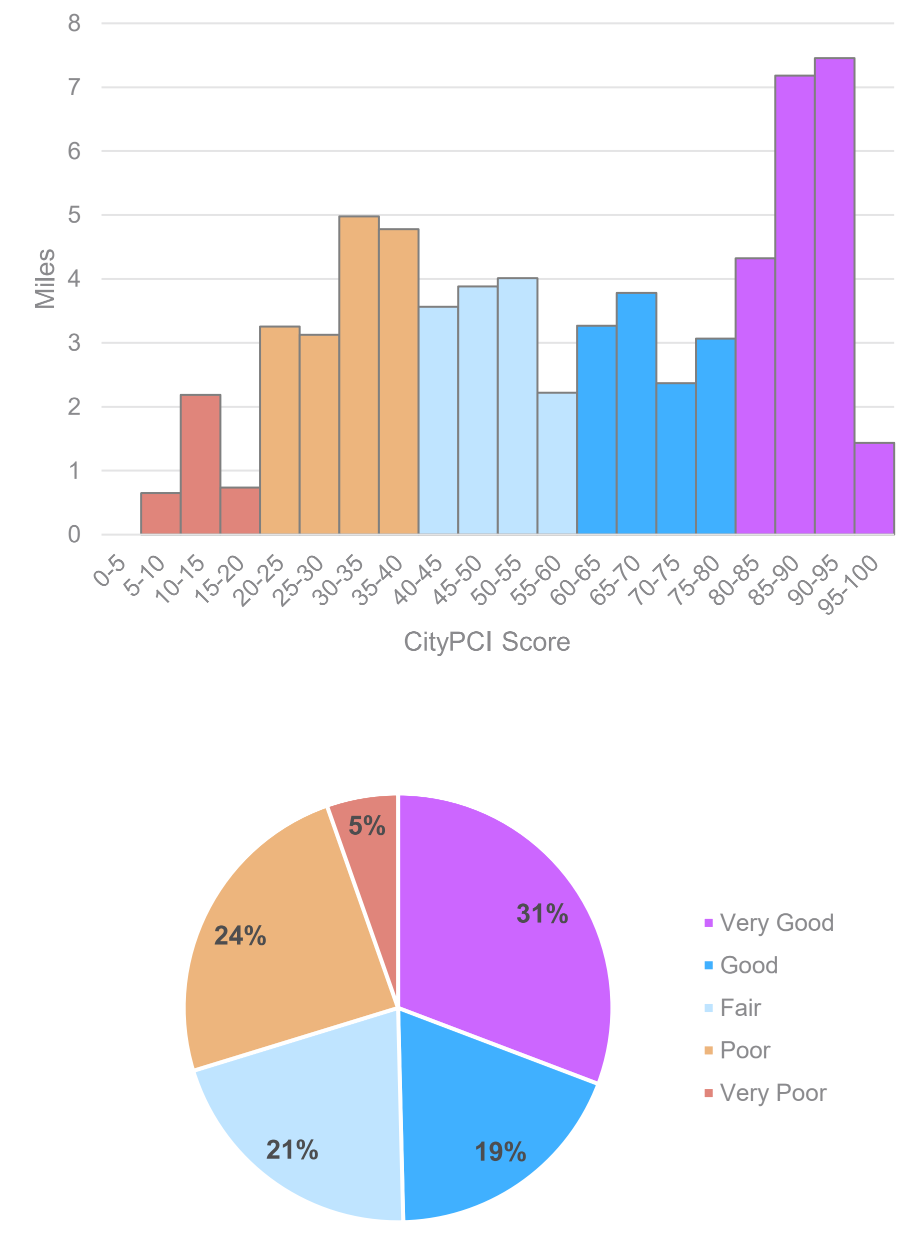


FIGURE 27: OVERALL CONDITION DISTRIBUTIONS

The histogram and pie chart above show the distribution of CityPCI scores across the entire Indianola network.

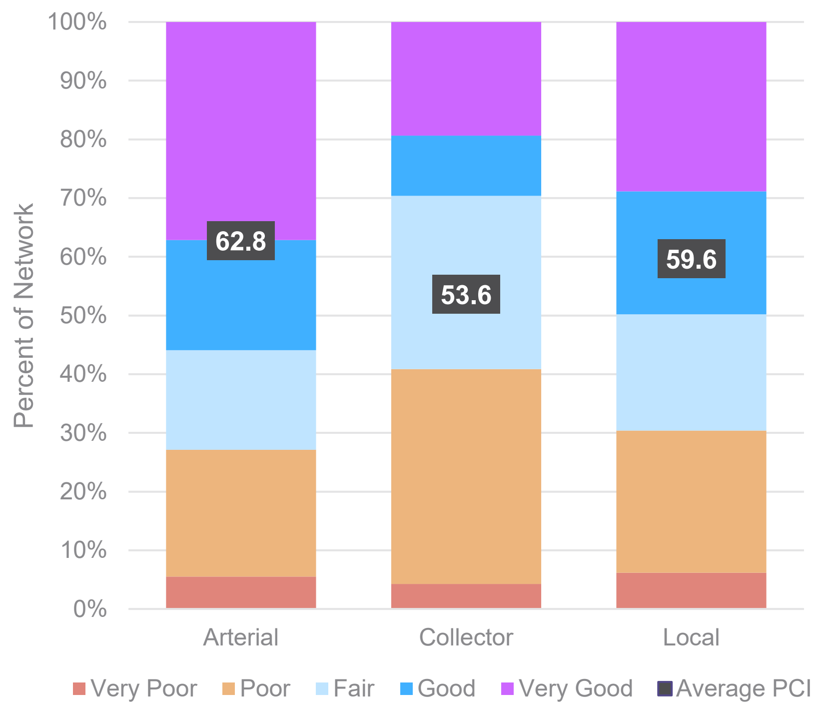


FIGURE 28: CONDITION DISTRIBUTION BY FUNCTIONAL CLASS

This figure shows the distribution of pavement conditions for each functional classification, as well as the average for each classification.

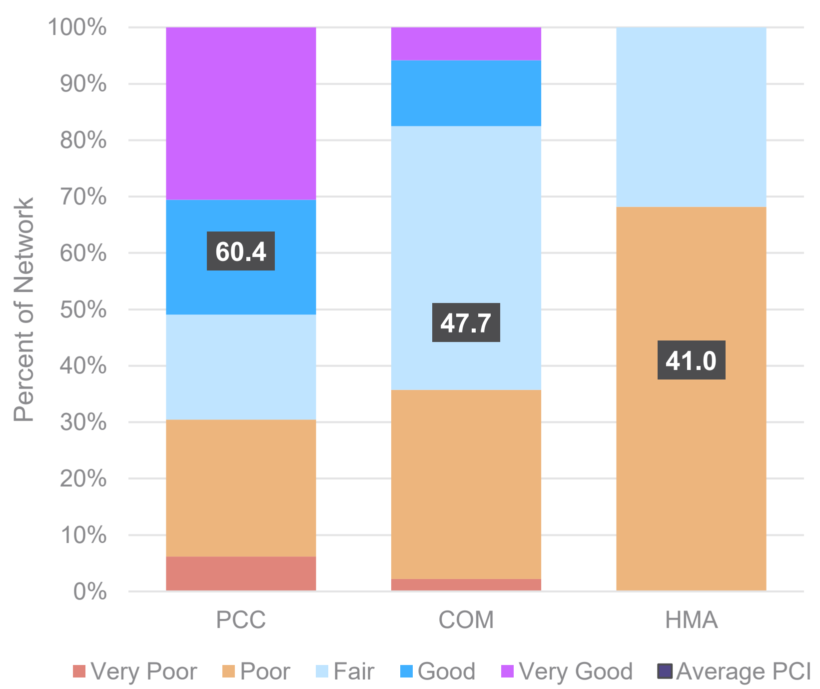
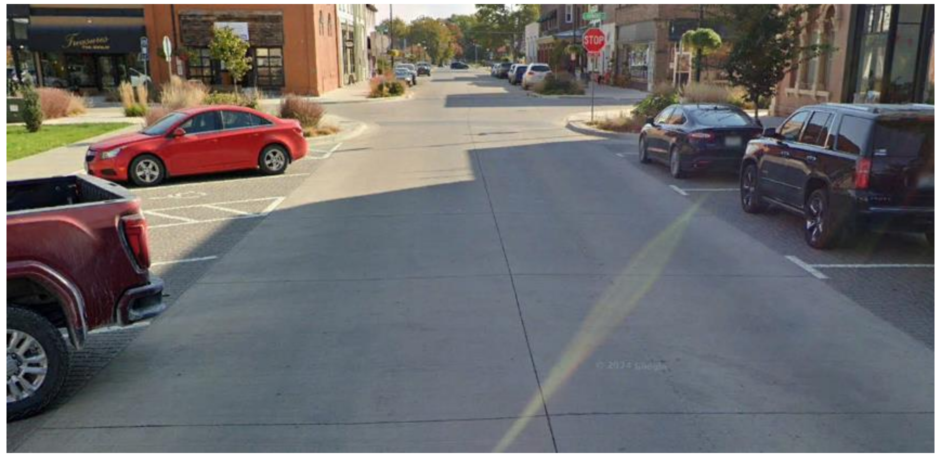


FIGURE 29: CONDITION DISTRIBUTION BY PAVEMENT TYPE

This figure shows the distribution of pavement conditions for each of the three pavement types in Indianola. PCC makes up around 93% of the total network by length.

Figure 28 shows the breakdown of condition by functional classification. Arterial and Local streets contain similar roadway conditions, while the collector streets contain higher percentages of streets in "Poor" condition and are overall in worse condition than the other two classifications.

When looking at the distributions by pavement type, shown above in **Figure 29**, PCC continues to perform significantly better than the other pavement types. However, with over 90% of the network being constructed of PCC, Composite and HMA pavement have much less effect on the average network score. With implementation of the pavement management plan, it can be expected that the City will invest more in overlays, adding more composite pavement to the network with the intention of raising scores in that category.



PAVEMENT CONDITION TRENDS

One of the biggest values of the IPMP Program and the data it provides is the fact that there are multiple years of data to work with. Indianola now has access to 10 years of historical data, increasing the statistical relevance of the data due to the higher volume of data points.

Looking at the average condition of the network over time shows a notable decline in the average condition since collections began in 2013. Over the past 10 years, the average rate of change has been around -0.9 points per year. Across the last four collections, the average CityPCI score has been steadying around a score of 60. One trend to note, shown in **Figure 31**, is the apparent increase of pavement in the "Very Poor" and "Poor" condition streets over the last four collections. This trend will continue to be important to monitor moving forward.

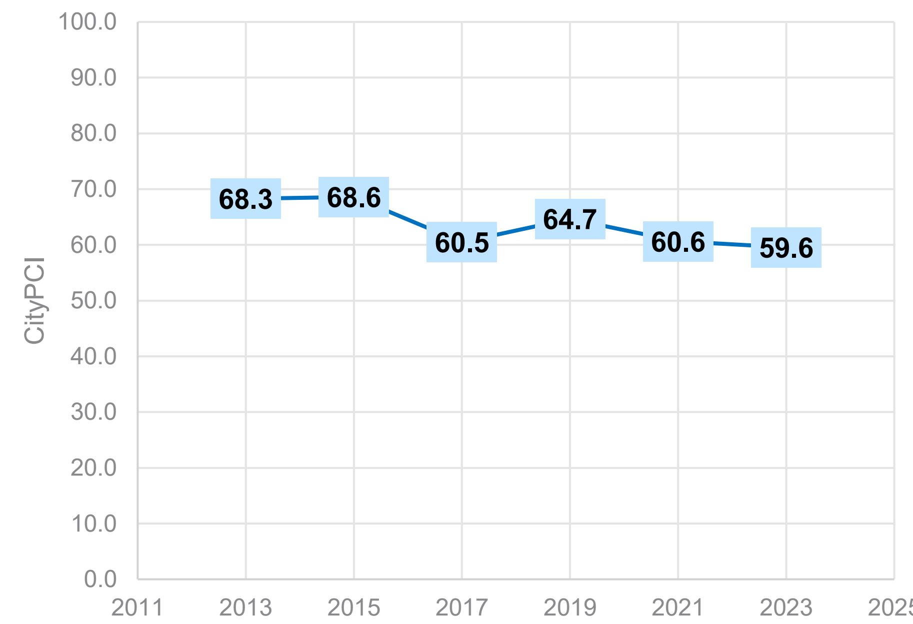


FIGURE 30: NETWORK-LEVEL PAVEMENT CONDITION TREND

This figure demonstrates the decline the overall network has experienced since 2013.

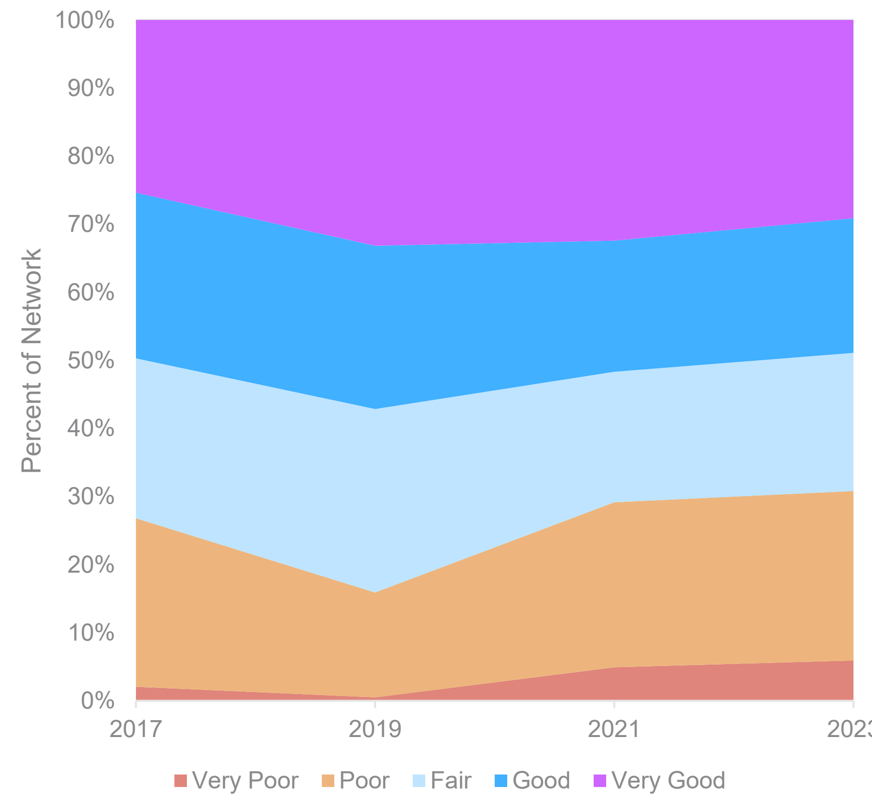


FIGURE 31: NETWORK-LEVEL CONDITION DISTRIBUTION

This figure demonstrates the distribution of pavement condition categories over the past 4 years.

When looking at the pavement condition trends over time, we can identify a few changes worth noting. First, in **Figure 32**, we can see that, particularly in the past two collections, Arterial and Collector streets experienced a slight increase in average score. However, Local streets saw a continued decline in condition, which has a larger effect on the overall City average. Similarly, in **Figure 33**, both composite and HMA pavements have experienced rising conditions over the past few years. However, PCC pavements, which make up the majority of the network, continue to decrease in condition.

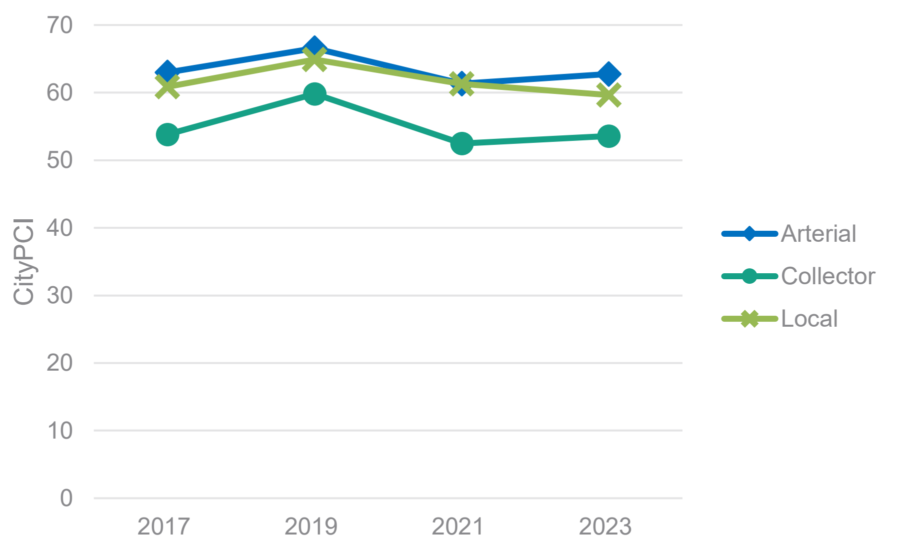


FIGURE 32: CONDITION TREND BY ROAD CLASSIFICATION

This figure demonstrates the slight decline across Indianola by Road Classification

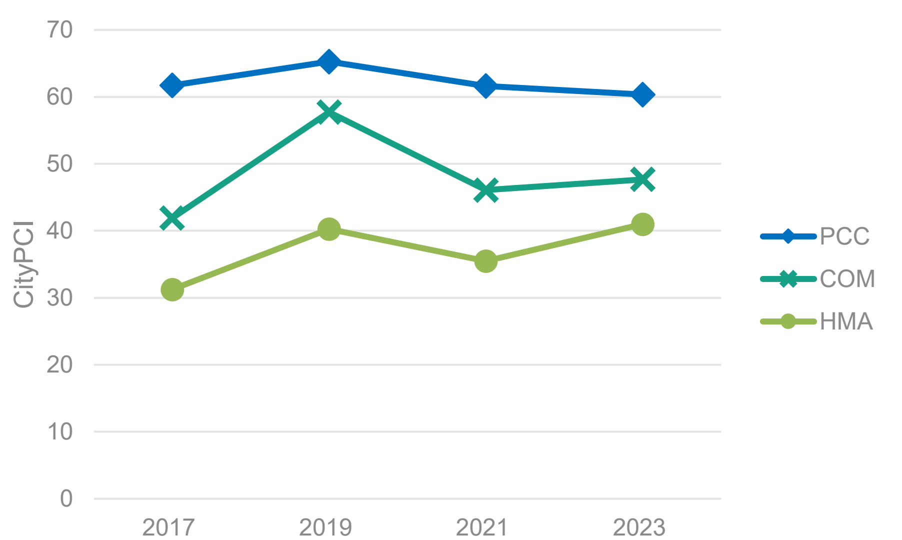


FIGURE 33: CONDITION TREND BY PAVEMENT TYPE

This figure demonstrates the slight decline across Indianola by Pavement Type

PAVEMENT CONDITIONS ACROSS THE STATE

Shown below is a list of 10 cities in Iowa and their average pavement condition scores. This list was selected to represent a mix of cities in both the surrounding area and cities with similar sized roadway network to Indianola throughout the state.

Many of the rapidly growing cities in Iowa frequently experience high scores due to the influx of new pavements into the network. Indianola has also experienced steady growth in recent decades, but not quite at the same level as some of the other cities with higher PCI scores shown in the list below. Nevertheless, each City faces a unique set of challenges and advantages and must identify ways to maximize pavement life and efficiently use public funds.

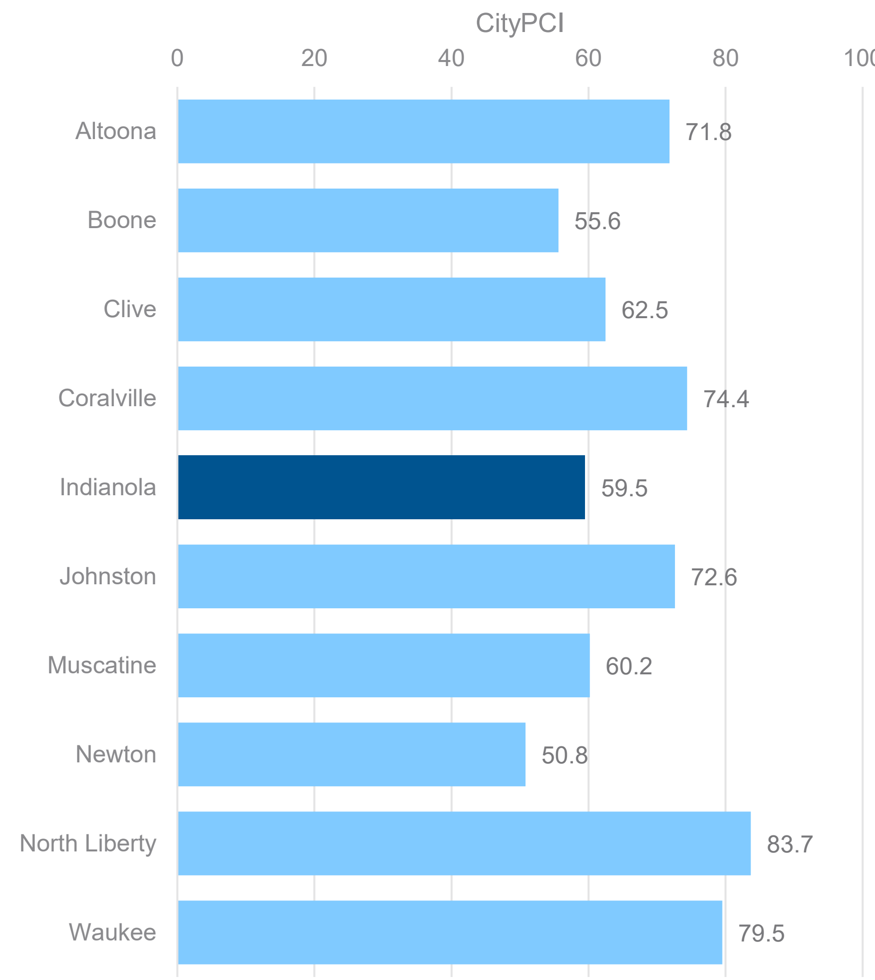


FIGURE 34: IOWA URBAN AGENCY COMPARISON

This figure lists 10 similar sized cities and compares their network level PCI score

NETWORK MAPS

The maps on the following pages reflect the results of the latest data. Each map shows an important characteristic of the pavement network and can be used to identify problem areas within the system. It should be noted that the map does not include information on roadways not maintained by the City, notably highways US 65 and IA 92, both of which are maintained by the Iowa DOT. Additionally, the maps do not include information on gravel roads within City limits, which currently amounts to around 3 miles. Gravel roads do not receive any data collection and are maintained separately from other paved streets.

The maps included in the report show:

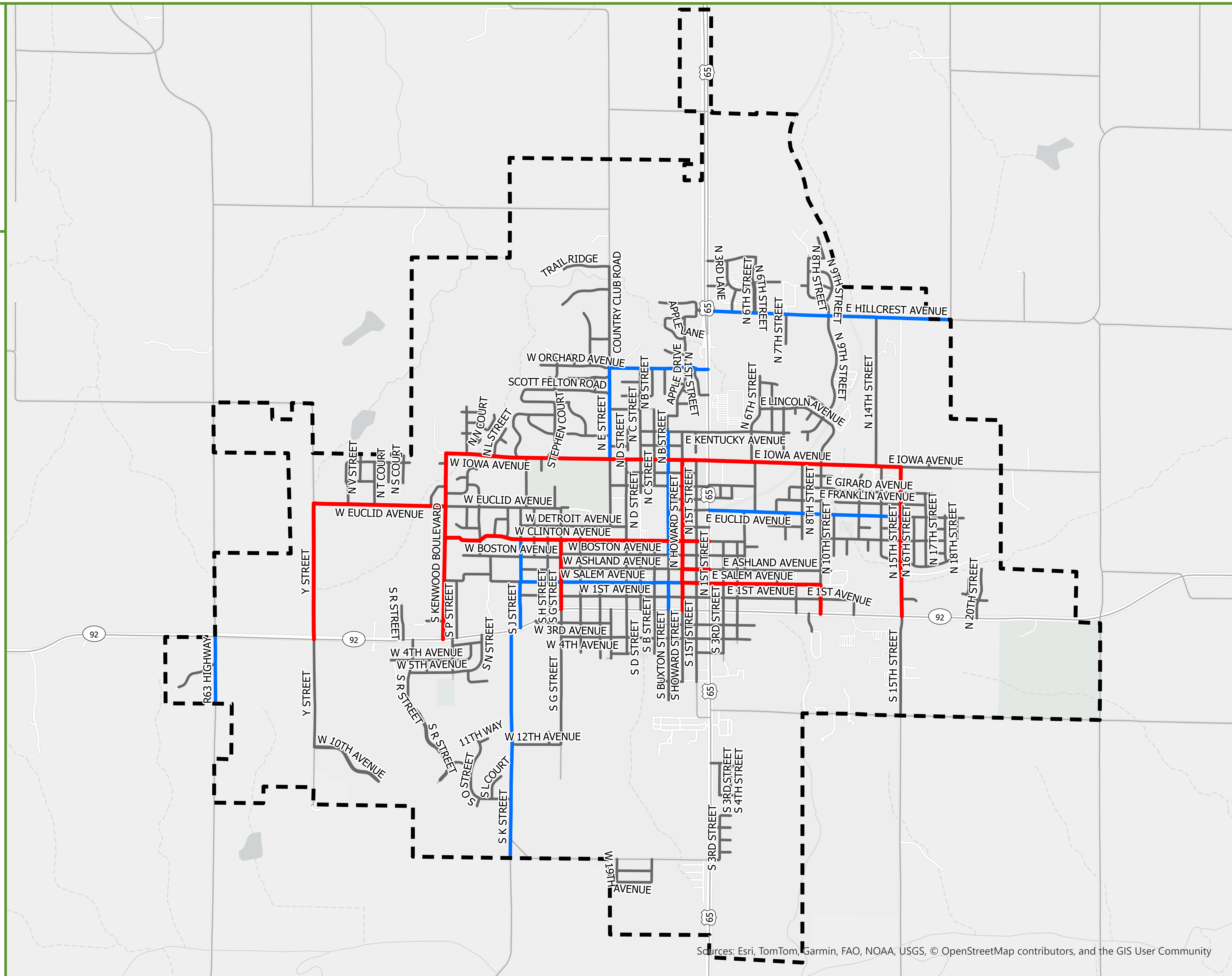
- Federal Functional Classification
- Pavement Type
- Pavement Condition Index
- Pavement Roughness
- Deterioration Rate
- Spot Distresses

Map 1
Functional Class

Legend

Federal Functional Classification

- Arterial
- Collector
- Local
- No Data
- Indianola City Limits



* Does not include roads not maintained by City, such as State and Federal highways

1 inch equals 2,500 feet

HRGreen

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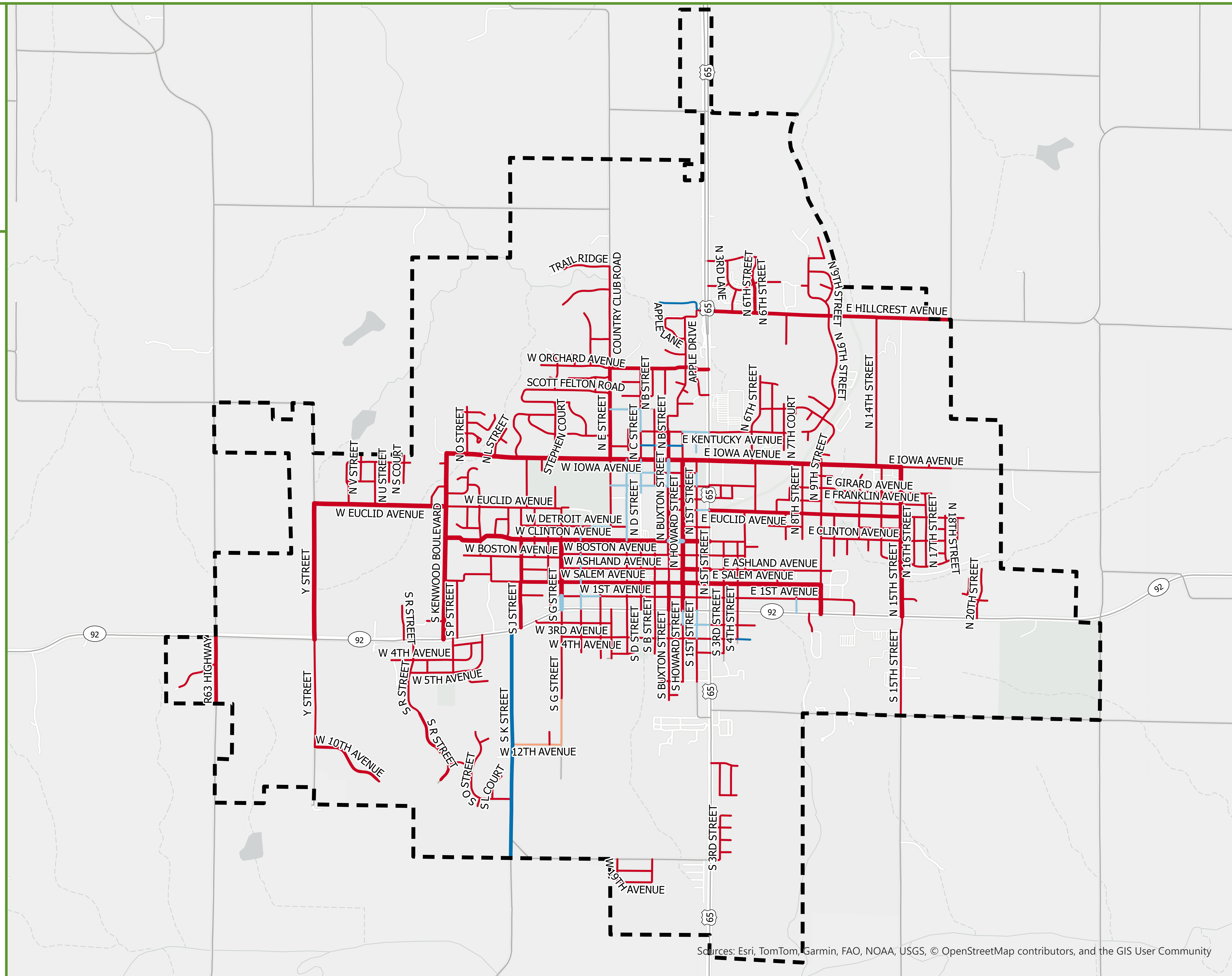
Map 2
Pavement Type

Legend

Pavement Type

- PCC
- ACC
- Composite
- Seal
- No Data/Gravel
- Indianola City Limits



* Does not include roads not maintained by City, such as State and Federal highways

1 inch equals 2,500 feet

HRGreen

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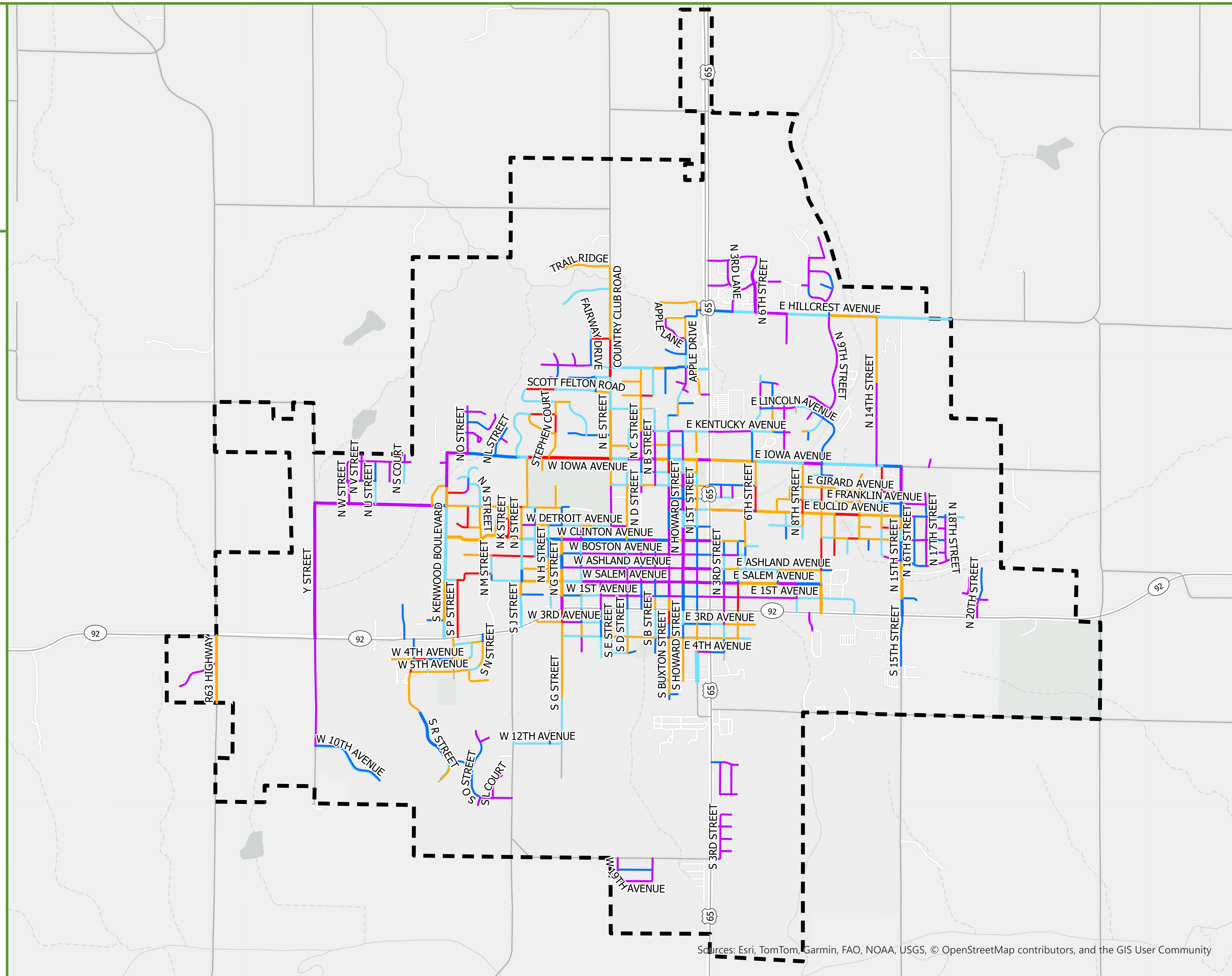
CITY OF INDIANOLA EST. 1849

Map 3
Pavement Condition

Legend

2023 CityPCI Score

- Very Good (81 - 100)
- Good (61 - 80)
- Fair (41 - 60)
- Poor (21 - 40)
- Very Poor (1 - 20)
- No Data/Gravel
- Indianola City Limits



* Does not include roads not maintained by City, such as State and Federal highways

1 inch equals 2,500 feet

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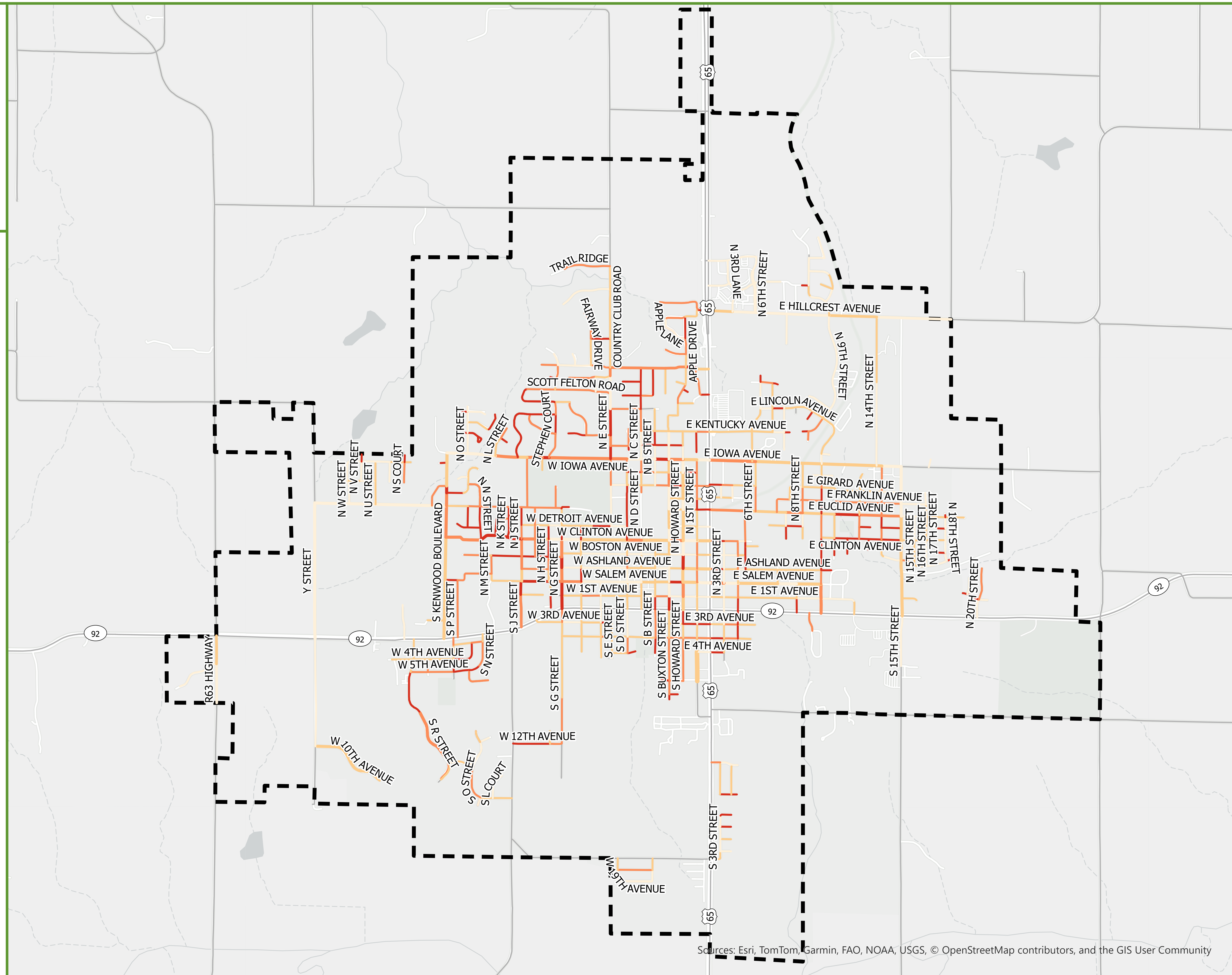
CITY OF INDIANOLA EST. 1849

Map 4
Roughness

Legend

International Roughness Index (IRI)

- Smooth (<250 in/mi)
- Slightly Rough (250-350 in/mi)
- Rough (350-450 in/mi)
- Very Rough (>450 in/mi)
- No Data/Gravel
- Indianola City Limits



* Does not include roads not maintained by City, such as State and Federal highways

1 inch equals 2,500 feet

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Map 5
Deterioration Rate

Legend

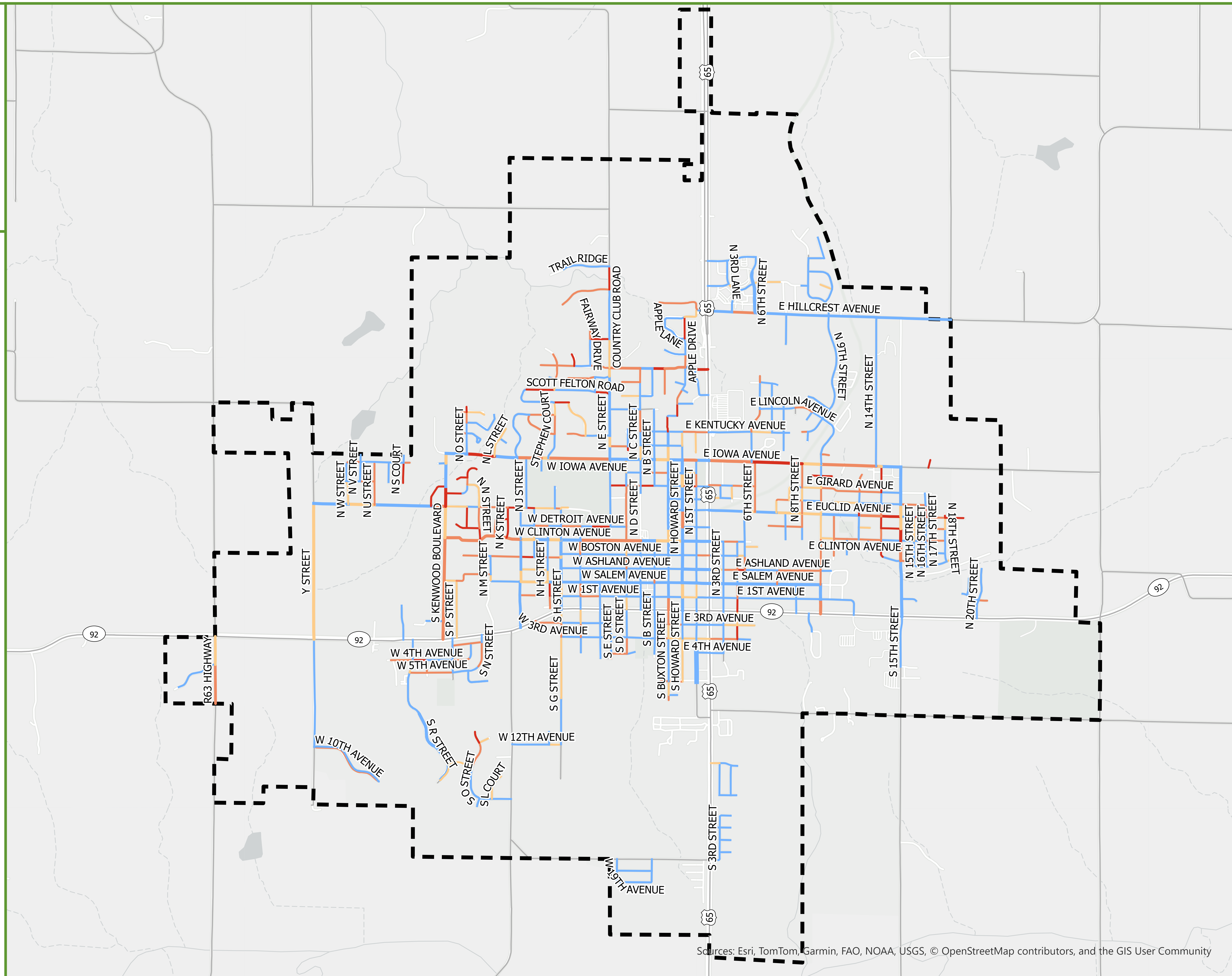
Deterioration Rate (Average Change in CityPCI per year)

- Stable (0-1)
- Normal (1-2)
- Fast (2-5)
- Rapid (>5)
- No Data/Gravel
- Indianola City Limits

* Does not include roads not maintained by City, such as State and Federal highways

1 inch equals 2,500 feet

HRGreen



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Map 6
Spot Distresses

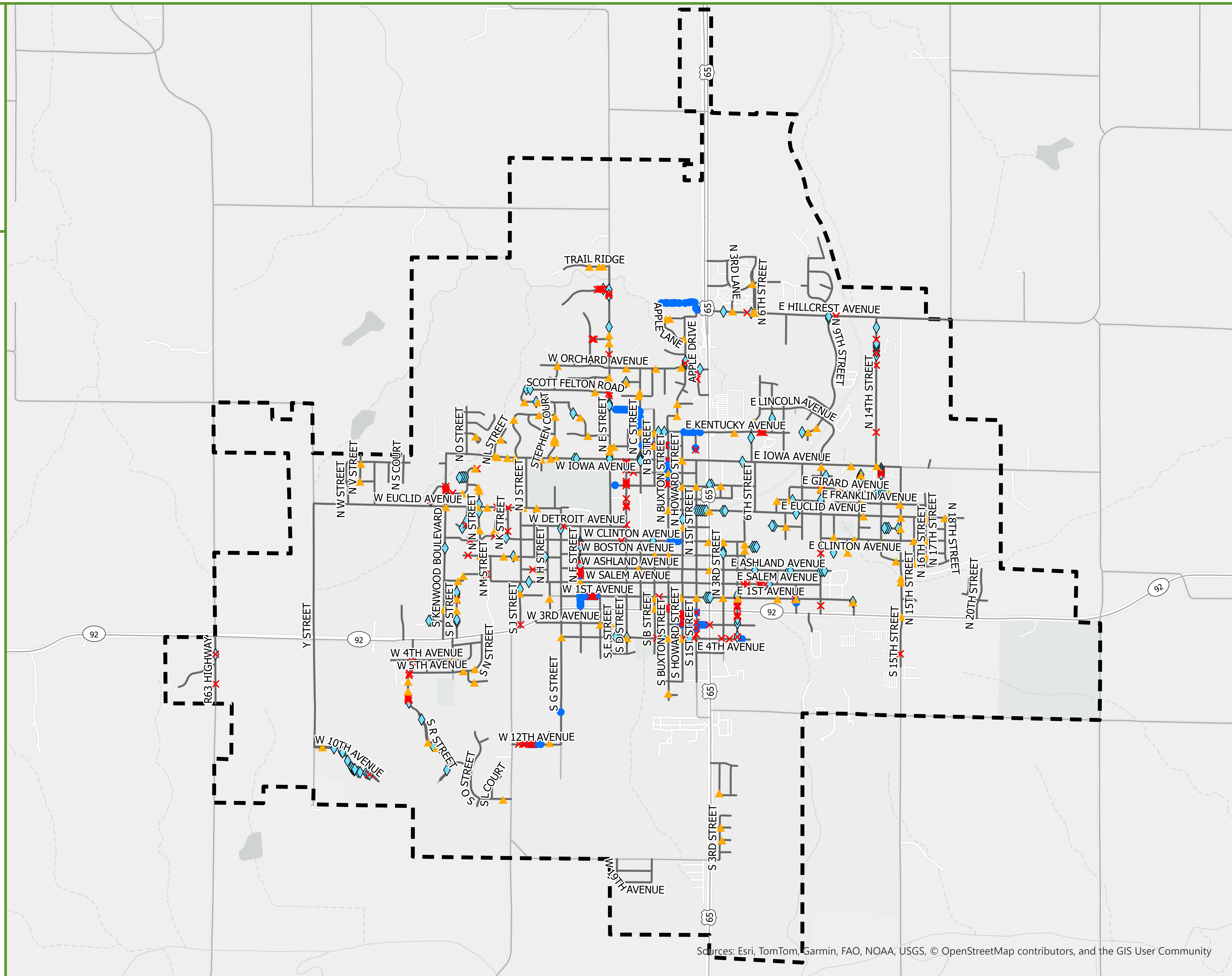
Legend

- Severe PCC Faulting
- Severe Spot Failure
- PCC Spalling or D-Cracking
- Severe Alligator Cracking
- No Data/Gravel
- Indianola City Limits

* Does not include roads not maintained by City, such as State and Federal highways

1 inch equals 2,500 feet

HRGreen



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HRG

UPDATED PROJECTIONS

To create recommendations on spending strategies and setting performance goals, a number of different scenarios were created using the Pavement Management Software. Each scenario was designed to address a variety of "what-if?" type questions. These projections were performed using Deighton Limited's dTIMS BA software, for a 15-year period, from 2026 to 2040. Each scenario investigates the effects of different budgets and is able to project the overall condition of the network based on a variety of different factors.

DETERMINING NEED

The first step in running various scenarios in dTIMS BA is to determine the "Need." Need is defined as all outstanding work and forthcoming work in the analysis period, otherwise considered as a Pavement Management Program operating at 100% efficiency with complete funding. Some agencies may consider this as a "Backlog" projection. In other words, the current Need is the total cost needed to address every roadway distress in the City, bringing the network to "Very Good" condition.

The current Need for Indianola necessary to bring the network to "Very Good" condition, is currently estimated at $80 Million. Following that initial investment, the network would require an additional $65 Million to sustain that level of service.

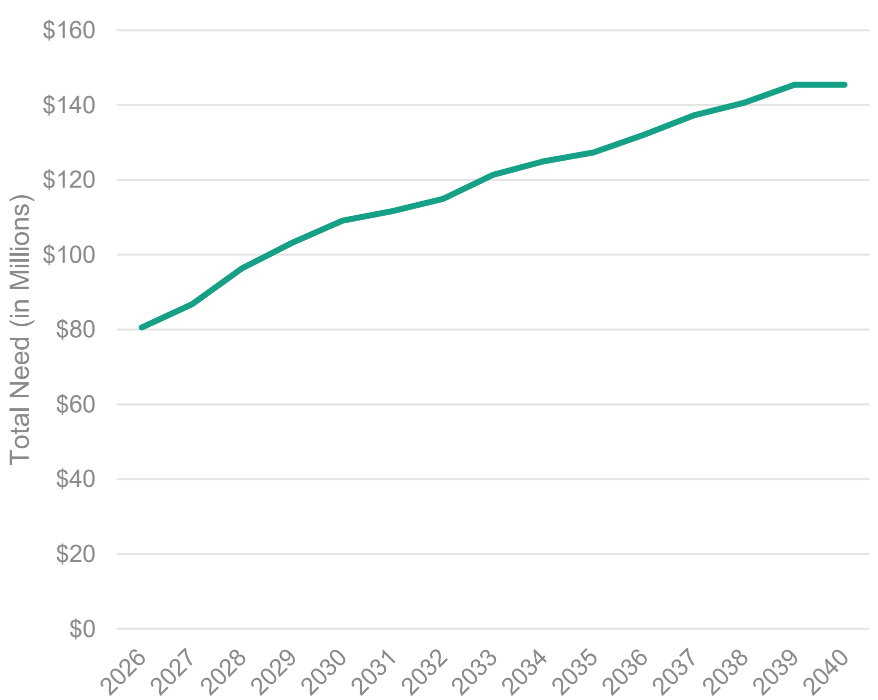


FIGURE 35: PROJECTED "NEED"
This figure displays the existing funding required to bring every pavement up to "Very Good" condition, i.e., "Need" as well as its projected Growth over the next 15 Years.

SCENARIO RESULTS

To address the existing backlog (Need), the City will need to commit substantial funding to maintain or improve the average roadway condition in the City. To determine how best to approach the pavements in Indianola, multiple dTIMS scenarios were run to predict how the network will behave over time. Different budget scenarios were created to simulate the network over a 15-year period to see how different funding levels will affect the network at a high level. The funding scenarios performed looked at answering the following questions:

- What happens if funding is maintained at the current level?
- What happens if funding increases?
- What happens if funding decreases?
- How much would it cost to maintain the current average PCI?
- What PCI targets are appropriate, and how much would it cost to reach those targets for Local, Collector, and Arterial Streets?

Regular funding is a crucial component of successfully maintaining pavements, and this plan investigates how different funding levels can influence conditions at a network-wide level. Currently in Indianola, a primary funding source for infrastructure improvements comes from Road Use Tax funds (RUTF), which in total amounts to approximately $2.25 Million for the City annually. Out of that amount, approximately $500,000 is budgeted for general street improvements. This amount is then further supplemented with funding from STBG grants and bonding for larger projects. There is not a fixed annual budget for roadway improvements in Indianola, though the recent historical spending has averaged out to approximately $1.25 Million each year.

BUDGET-BASED SCENARIOS

To predict the effects of various budgets on the network, budget-based scenarios were the first to be investigated. These scenarios predict the average PCI across the entirety of the network based on a variety of funding levels. For Indianola, scenarios were explored ranging from the current funding level, $1.25 Million, all the way up to $4 Million in annual funding. **Figure 37 on the next page** shows the results.

The "Do Nothing" scenario points out the value of Pavement Management and routine investment in pavement treatments. Modeling results show that if the City were to stop all investments towards pavements, the network condition would immediately start to experience a steady decline and would likely enter the "poor" condition category by the end of the 15 year scenario.

The remaining scenarios in the chart depict that **annual budgets under $3 million dollars are likely not enough to prevent the decline of the average network condition**. Conversely, budgets above $3 million begin to raise the average network conditions. The $1.25 million budget scenario, the scenario based on the currently available funds, demonstrates that the current funding level is likely unable to maintain the average condition of roads and will not be enough to address a growing backlog of work.

Condition distributions were then able to be created based on the scenarios. These charts predict the makeup of the network over time, as shown in **Figure 36**. This chart shows that with a $3 million annual budget, the City should be able to maintain the current distribution of pavements in the Very Good and Good categories. However, the proportion of pavements in the Poor and Very Poor category is still projected to steadily grow over time. It should be noted that this chart could vary over the long term, particularly based on the proportion of different projects the City is able to complete. More reconstruction projects will result in a lower number of streets in Very Poor condition, but that will come at the expense of rehabilitation projects that would keep a higher volume of streets in the Good or Very Good condition.

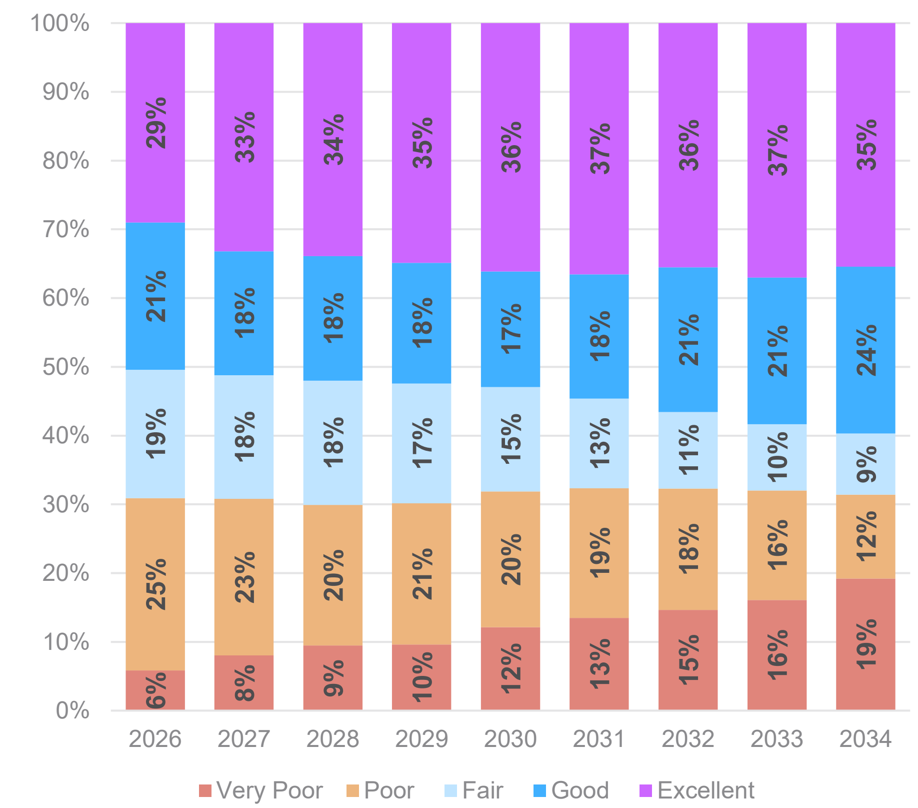
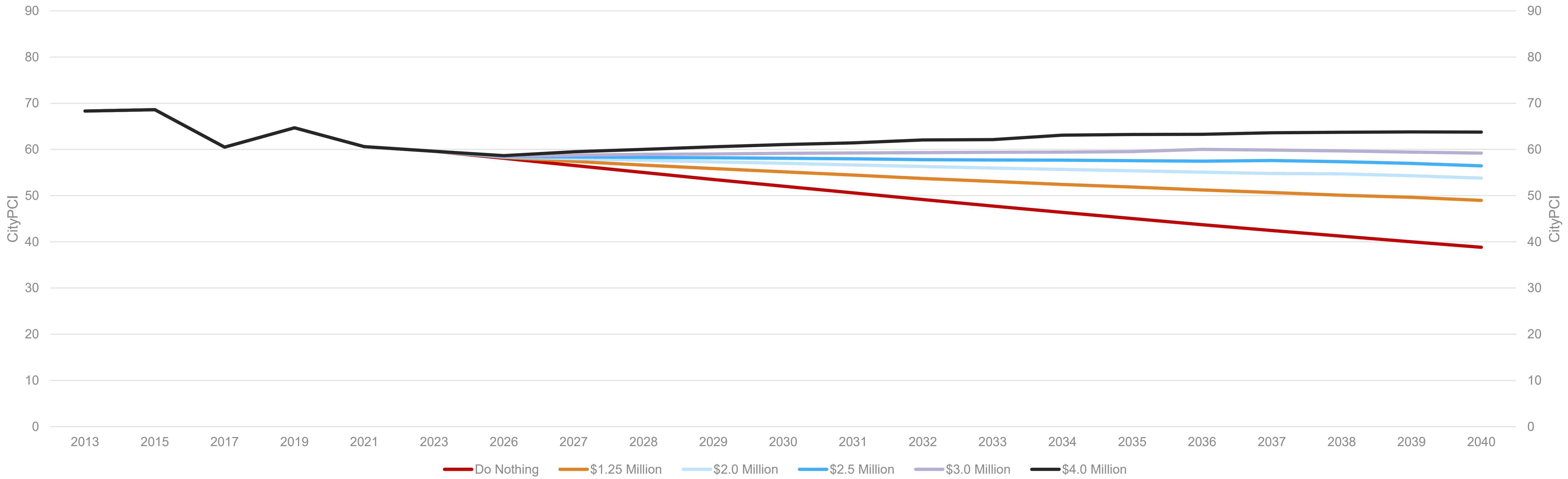


FIGURE 36: PROJECTED CONDITION DISTRIBUTION - $3.0M BUDGET
The chart above shows the projected results from a $3.0 Million annual budget.



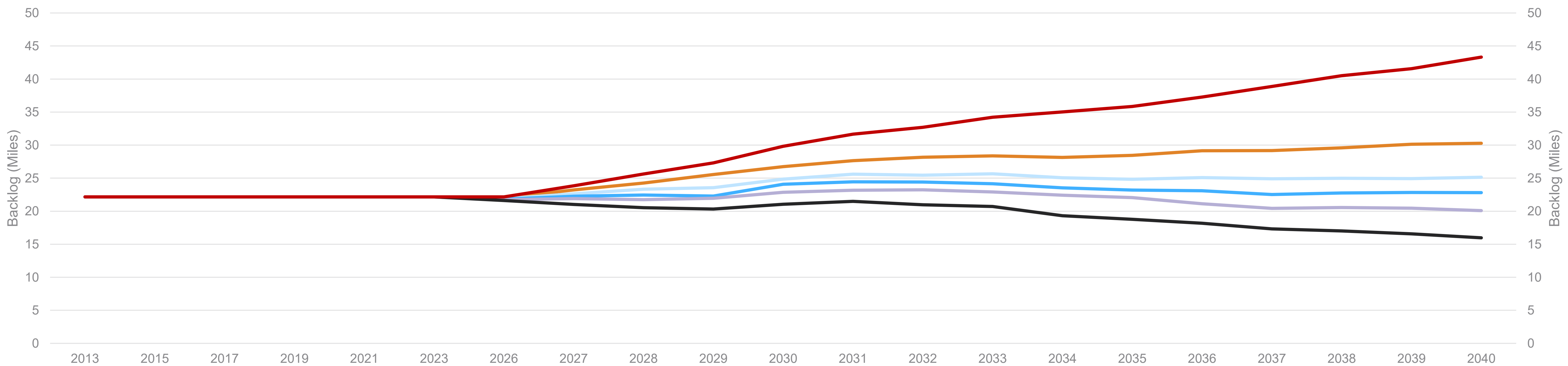


FIGURE 37: BUDGET-BASED PROJECTIONS

These two charts show the budget-based scenario results from dTIMS. The top graph shows the projected average Pavement Condition Index (CityPCI), and the lower graph represents changes to the Backlog in miles over the next 15 years based on a variety of budgets.

TARGET-BASED SCENARIOS

Following the analysis of the budget-based scenarios, an additional range of options was explored within dTIMS BA, referred to as target-based scenarios. To accomplish this analysis, a range of budgets were programmed to test which ones would result in a certain average PCI at the end of the analysis period. This approach is more realistic than immediately jumping to the target and holding it and can result in reduced costs for both the higher and the lower goals.

PCI targets were tested ranging from 50 to 70 in 5 PCI increments and the average annual costs were rounded to the nearest $100,000. As shown below, in **Figure 38**, each jump in 5 PCI points is projected to require roughly an additional $1 Million annually. When considering target-based scenarios, it should be noted that reaching these performance levels often takes multiple years of consistent funding before reaching the targeted goal. Additionally, these scenarios and their costs are heavily influenced by the current condition of streets in Indianola. Should the City reach their desired PCI level, it is possible that the annual costs may decrease as the pavement scores start to stabilize.

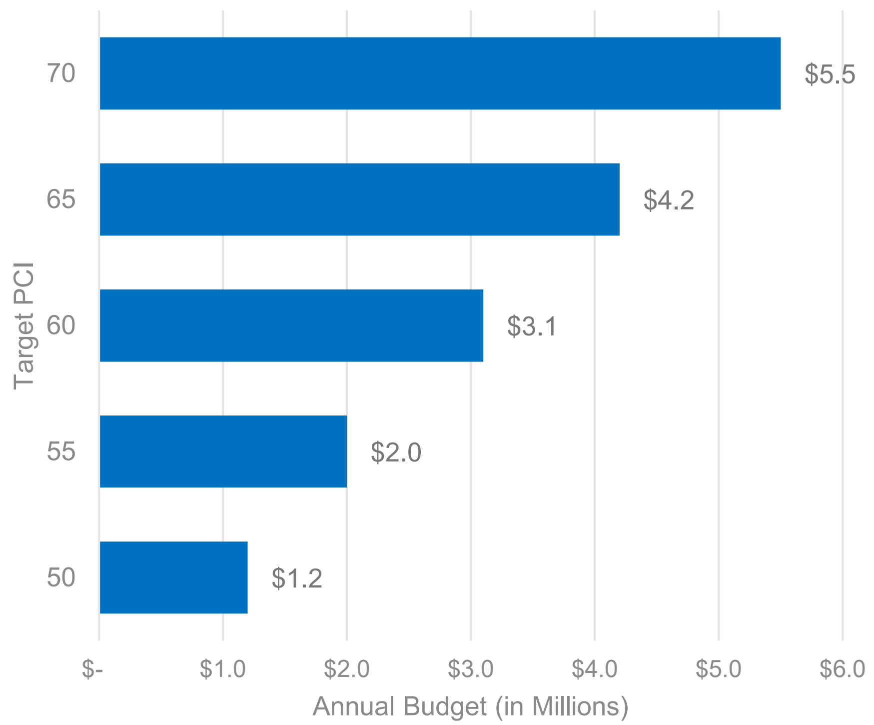


FIGURE 38: TARGET-BASED SCENARIO
The chart above shows the results from the target-based scenario which estimates the amount of funding needed to maintain the network average at a certain PCI Score

"HYBRID" GOAL SCENARIO

Different functional classifications are generally used by vastly different amounts of traffic and are traveled at different speeds. Local roads make up the largest percentage of streets for most municipalities, and as such, require the majority of the costs required to maintain a certain PCI score. However, these roads often see a minority of the traffic when compared to arterials and collectors. Additionally, vehicle speeds on local roads are typically much less than that of collectors and arterials. As a result, distresses on a local road may be less noticeable than if the same distress was located on a higher speed roadway. This provides an opportunity to explore alternatives for local road performance that can give the City more flexibility in their budget. Setting a "hybrid" goal where local streets are held to a different standard than arterials and collectors may present a cost savings opportunity.

Some municipalities have found it to be cost effective to set a slightly lower PCI goal for local streets than arterials or collectors. This frees up more funds to be spent on roads with higher traffic volumes, while still maintaining acceptable conditions for local streets. Shown below in **Figure 39** are the different annual budgets Council Bluffs would need to spend to maintain the different roadway classifications at different CityPCI Scores.

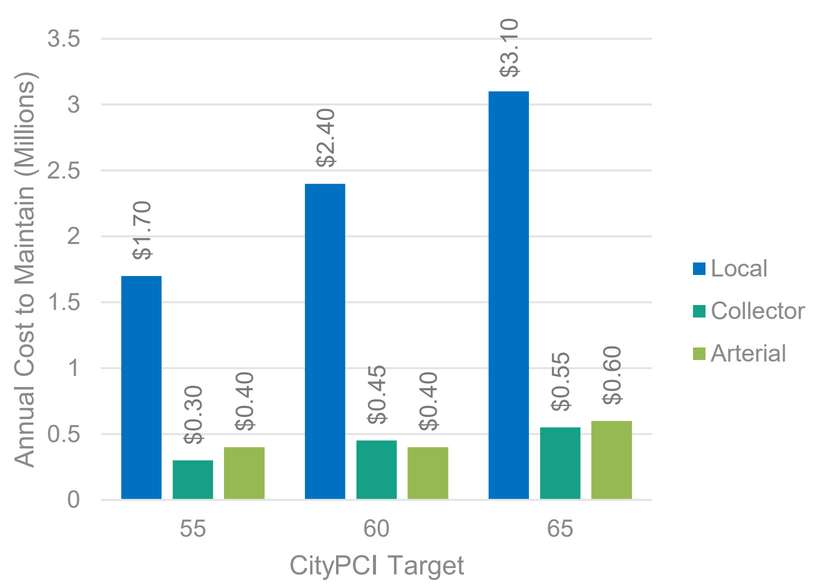


FIGURE 39: TARGET-BASED SCENARIO BY FUNCTIONAL CLASSIFICATION

The chart above shows the results from the target-based scenario which estimates the amount of funding needed to maintain each roadway classification at a certain PCI Score

IDEAL SPENDING PROPORTIONS

When looking at the types of treatments applied, there is an optimal balance unique to each city. Too much reconstruction can use up large portions of an annual budget quickly on a small percentage of the network, leaving fair conditioned roadways untouched leading to more early failures. Too much rehabilitation means maintaining the ideal candidates well, but streets considered to be "lost-causes" go ignored for extended periods of time waiting for funds for reconstruction. Both cases can result in a lopsided distribution of pavement conditions that is heavy on either extreme.

> **It is of vital importance for the City to pay attention to the roadways that are currently in the fair-good category to prevent them from dropping further in condition, while also not neglecting the Poor-Very Poor roads that also need addressed.**

The dTIMS BA model provided insight for splitting the funding, indicating an **ideal funding distribution of approximately 50/45/5** between Reconstruction, Rehabilitation, and Restoration. This funding distribution will provide the best opportunity for the City to balance extending the life of pavement in moderate conditions with reconstructing pavement that has already failed.

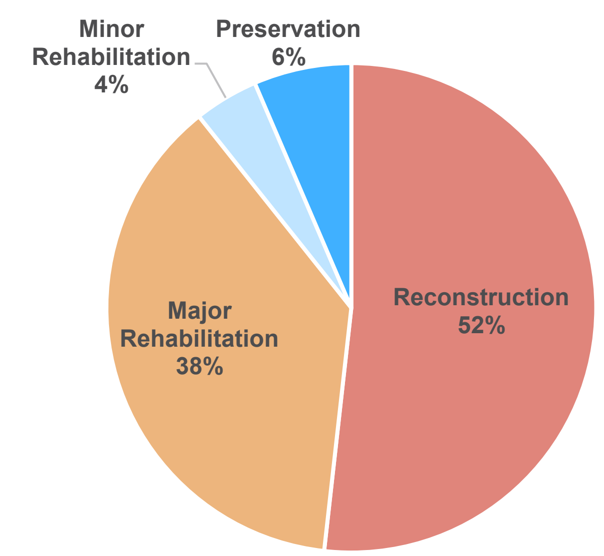


FIGURE 40: RECOMMENDED BUDGET PROPORTIONS
This figure shows the recommended percentages of each treatment category based on the dTIMS BA results.