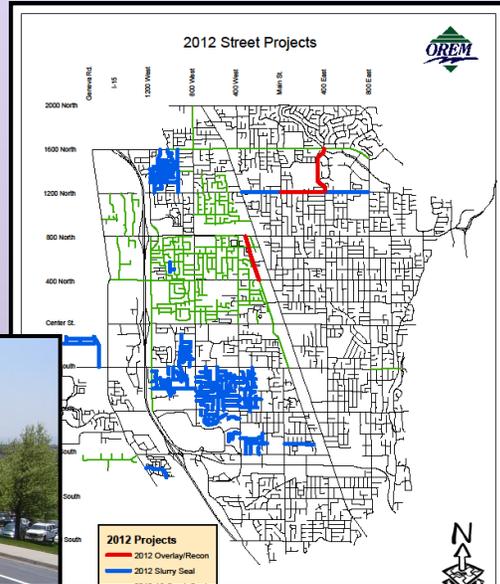


STATE OF THE STREETS 2012



Partnering with the citizens to help create and preserve our community

City of Orem's Pavement Management Program

Public Works Maintenance Division



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Objective

This State of the Streets report is intended to provide information concerning the City of Orem's street network. This report cites the purpose and role of the Pavement Management program, the maintenance and rehabilitation work that has been completed over the past several years, and the current conditions of Orem City streets. Maintenance methods used, analysis, and an aggressive detailed street maintenance plan will be highlighted.

This report is also designed to provide useful street maintenance information to persons who may not be experienced in this area, but are in a position to provide the means and direction in accomplishing a successful maintenance program.

A great investment has been made in our City street network. This report will help outline the steps needed to preserve this investment in a productive, fiscally responsible manner. The Pavement Management Staff and Street Section take great pride and responsibility in helping manage and maintain the City streets.

*"The quality of preservation work performed on streets directly determines the surface life, future maintenance cost, ride quality, and ultimate user cost... Our primary responsibility is to insure the tax-payer gets his moneys worth."
Duane Blank - Forum for Future*

Executive Summary

In the year 2003, Orem's streets were inspected and examined to determine quality, rideability and remaining service life. Each street segment received an Overall Condition Index (OCI) rating determined by its condition. This data was analyzed and a course of action was determined. Through an initial overlay or reconstruction of selected streets as well as a preventative maintenance program, the overall street system could be updated to meet the City's desired needs and level of quality.

Money was allocated, in the form of a General Obligation Road Bond, to help improve the City streets. This money, combined with B&C Road funds, was used to upgrade "Poor" or "Failed" OCI rated streets, through reconstruction and asphalt overlays. Roads with a "Good" OCI rating were maintained with preventative maintenance practices.

The initial work began in 2005. As of August, 2012, a total of 52 of the City's 241 centerline miles have received an asphalt overlay or total reconstruction. A total of 160 centerline miles have received crack seal, and 121 centerline miles have received slurry seal. Over \$22 million has been spent, since 2005, on road rehabilitation and maintenance, and the estimated value of the City streets is approximately \$135 million.

The overall condition of the City streets currently rates as "Good." Maintaining and protecting the investment made to the street system as well as continued street improvement and upgrade are the focus of this report.

Consideration to the most economical and effective approach to street maintenance and repair is of great importance. Planning, continued use of the current preventative maintenance programs, understanding the impacts of delaying needed maintenance, and identifying and implementing other proven maintenance and rehabilitation options can help the City maintain a quality street system.

Facts and Information

The City currently maintains 241 centerline street miles.

There are 187 centerline miles classified as Local streets, 16.5 classified as Arterial and 37.5 as Collector.

The total square footage of maintainable street area is just over 47 million.

The estimated value of the City streets is approximately \$135 million. This estimate includes asphalt and base replacement only, at \$2.85 sf.

Since 2005:

- A total of 52 centerline miles have received an asphalt overlay or have been reconstructed. This includes 30 miles of Local, 16 miles of Collector, and 9 miles of Arterial streets.
- A total of 160 centerline street miles have received crack seal.
- Slurry seal has been applied to 121 centerline miles.

The current Overall Condition Index (OCI) of the City is 83.1.

- The average OCI of Local streets is 83.6
 - ◇ The condition of a Local City street decreases an average of 2.5% each year.
- The average OCI of Collector streets is 83.3
 - ◇ The condition of a Collector City street decreases an average of 3% each year.
- The average OCI of Arterial streets is 81
 - ◇ The condition of an Arterial City street decreases an average of 3.5% each year.

Local streets average 34' in width, equaling 180,000 sf per mile.

Collectors and Arterial streets average 52' in width, equaling 275,000 sf per mile.

Pavement Management Program

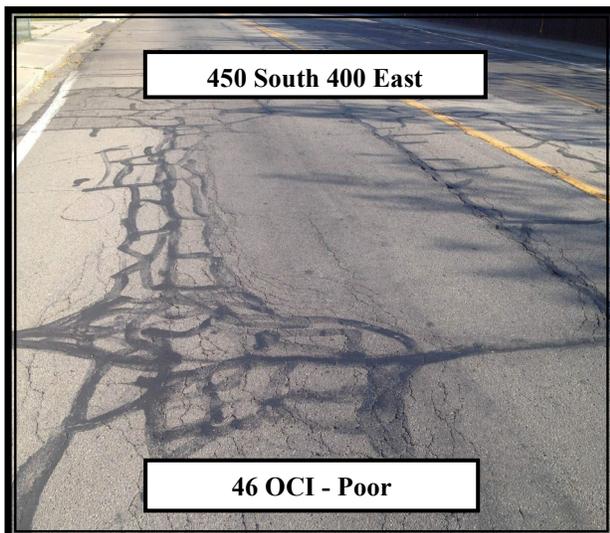
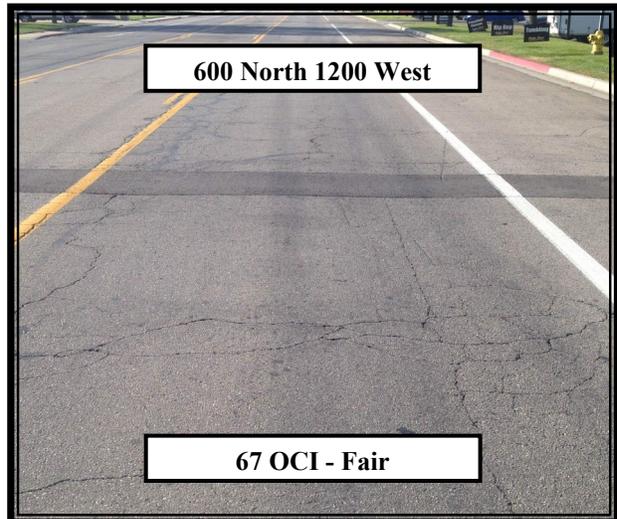
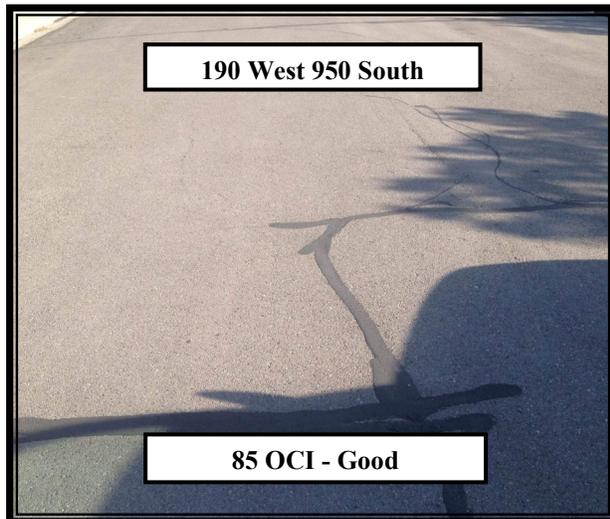
The Pavement Management Program refers to individuals, computer software and available resources working together to determine, recommend and implement the most cost effective course of action concerning the maintenance and repair of the City’s street system. Inspections, analysis, testing, performance and experience, can help determine when to apply the correct, quality maintenance or repair, to the right street at the right time, while remaining fiscally responsible.

All City streets are inspected for surface defects and deterioration at least once every three years. Defects and deterioration are recorded, rated and each street receives a value or OCI (Overall Condition Index) rating. The rating system is as follows:

Excellent	Good	Fair	Poor	Failed
OCI 100-90	OCI 89-70	OCI 69-56	OCI 55-40	OCI 39-0
New or almost new pavement. Pavement is structurally sound with little surface wear.	Pavement structure is good. Minor cracking and surface wear.	Cracking, surface wear and depressions. Pavement is generally structurally sound.	Major cracking and surface wear. Pavement is structurally deficient. Base may be unstable.	Major distresses. Pavement is structurally unsound. Base may be unstable.

The OCI is analyzed to determine when and what work is needed. **Preventing deterioration or early detection and repair of defects, is the most effective and economic approach to maintaining quality roads.** Maintenance performed on roads improves the overall condition and adds service life.

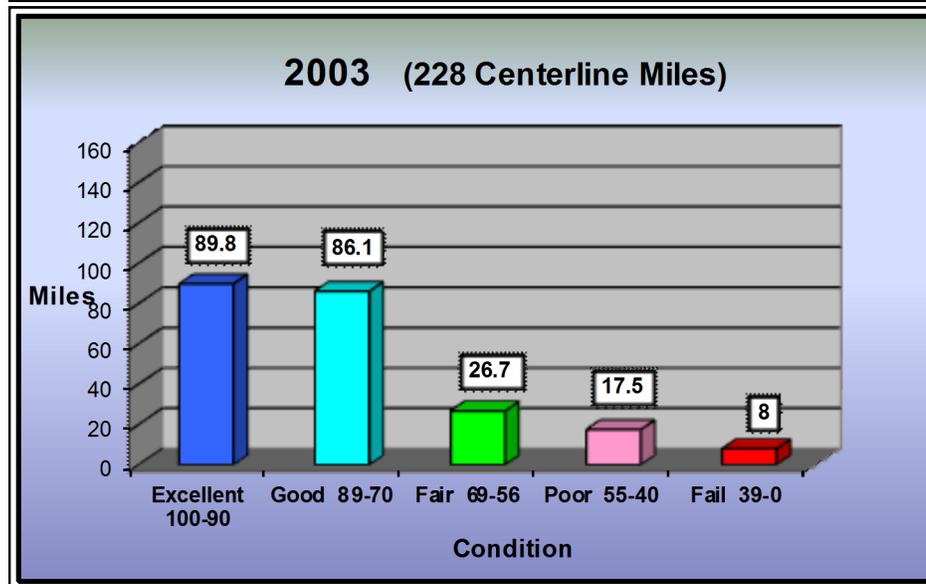
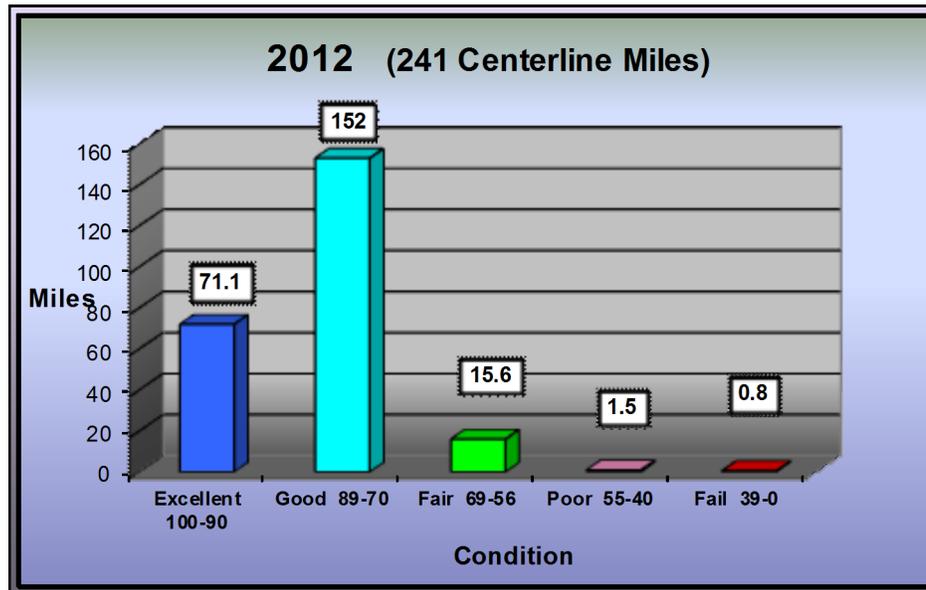
Examples of Street OCI Ratings.



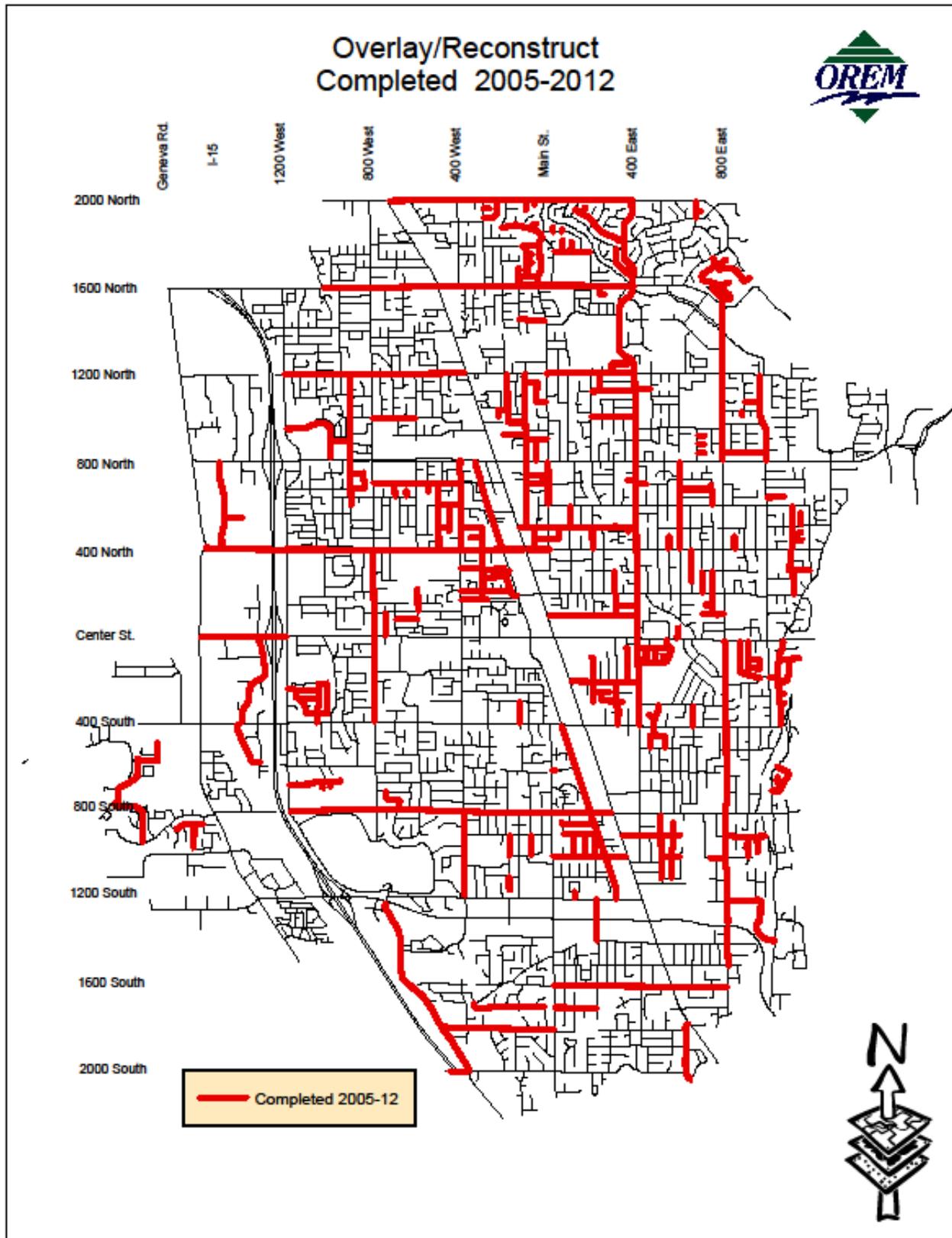
Current Conditions

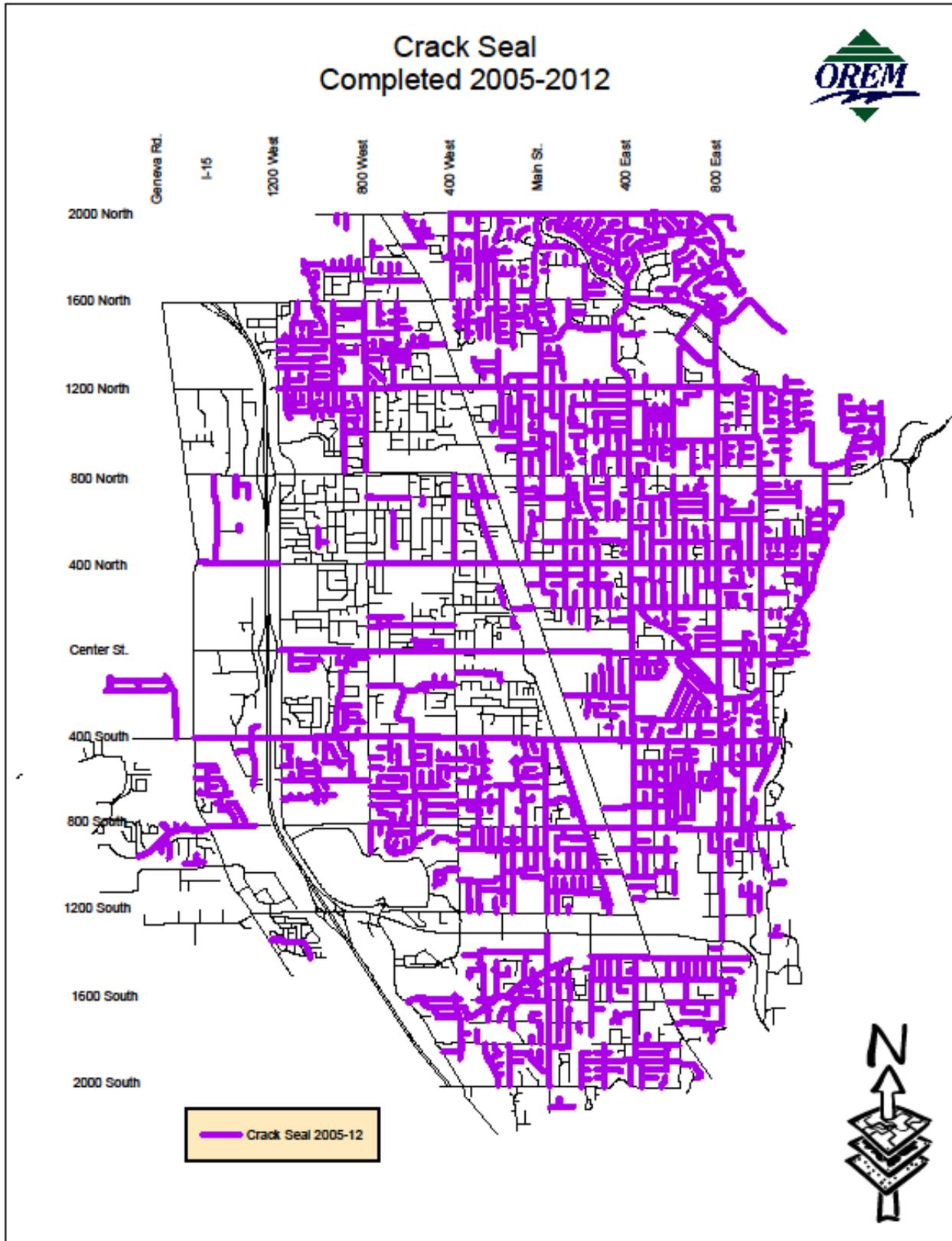
In 2003, the City average OCI was 81. Through the rehabilitation and maintenance performed with the General Obligation Road Bond, and B&C Road funds, the City's average OCI improved to the current 83.1. Approximately 93% of the City street network currently rates as "Good" or "Excellent."

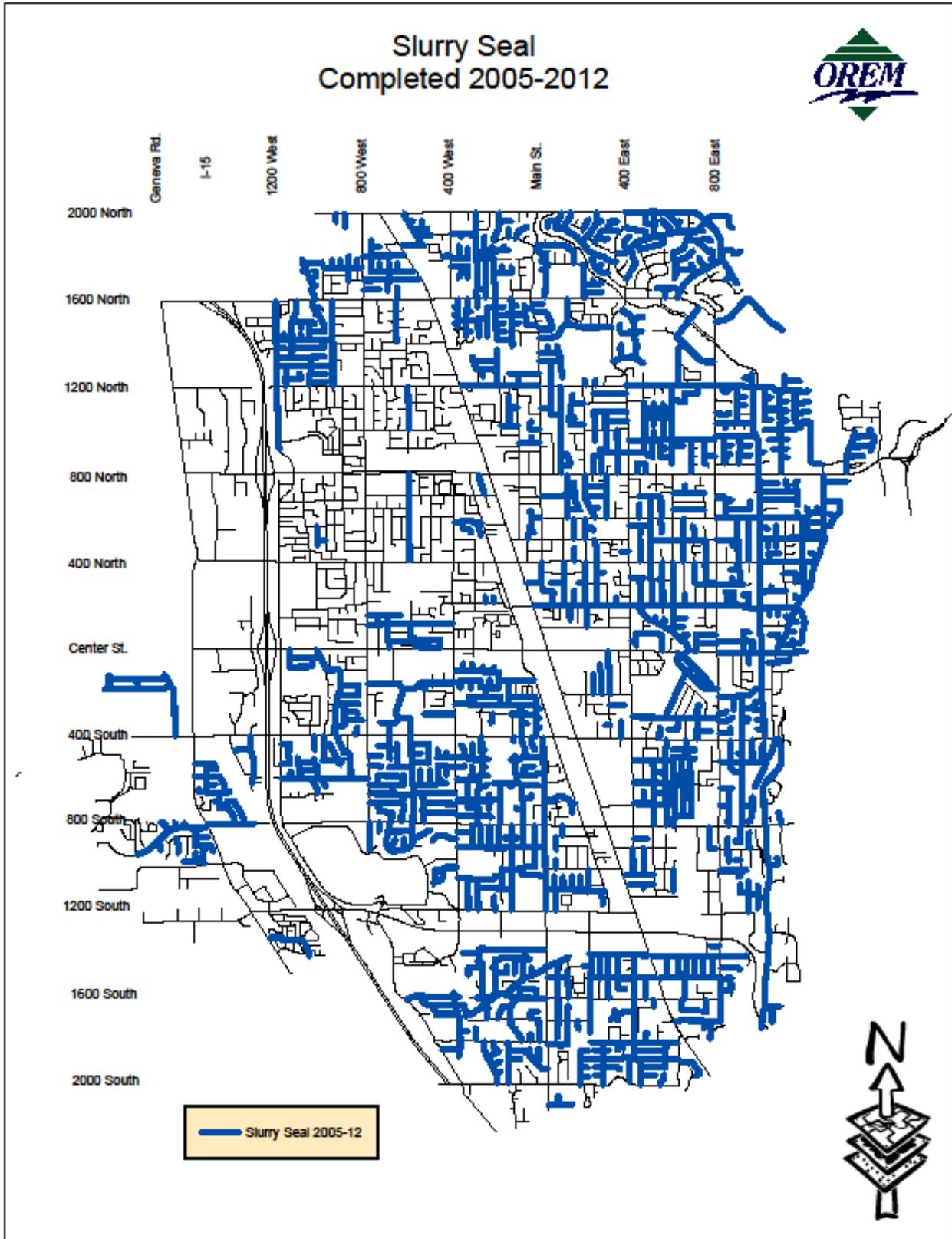
The graphs below illustrate the road conditions in 2012 as compared to 2003



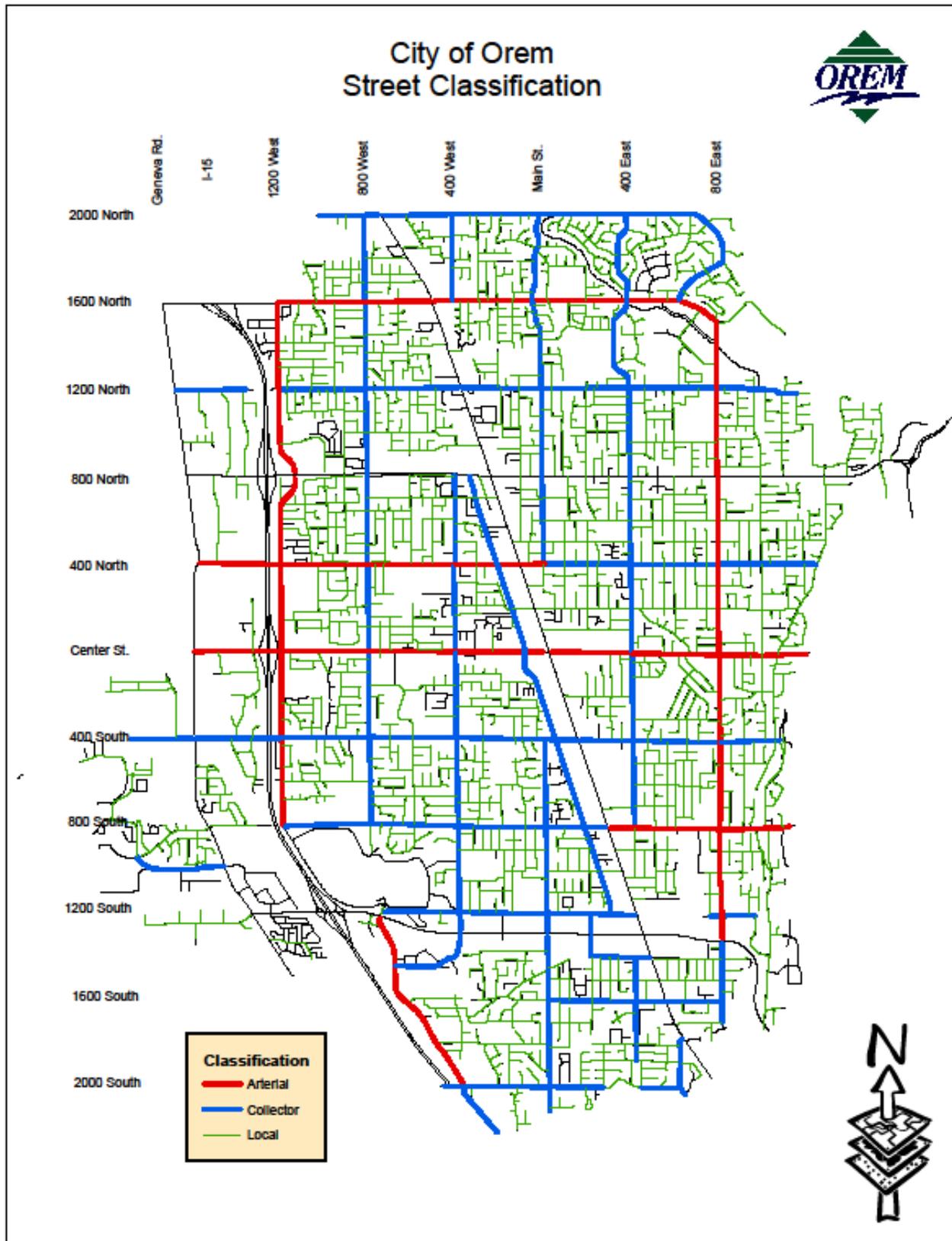
The following maps illustrate the maintenance and rehabilitation activities completed from 2005-2012.







The following map illustrates the City street classifications.

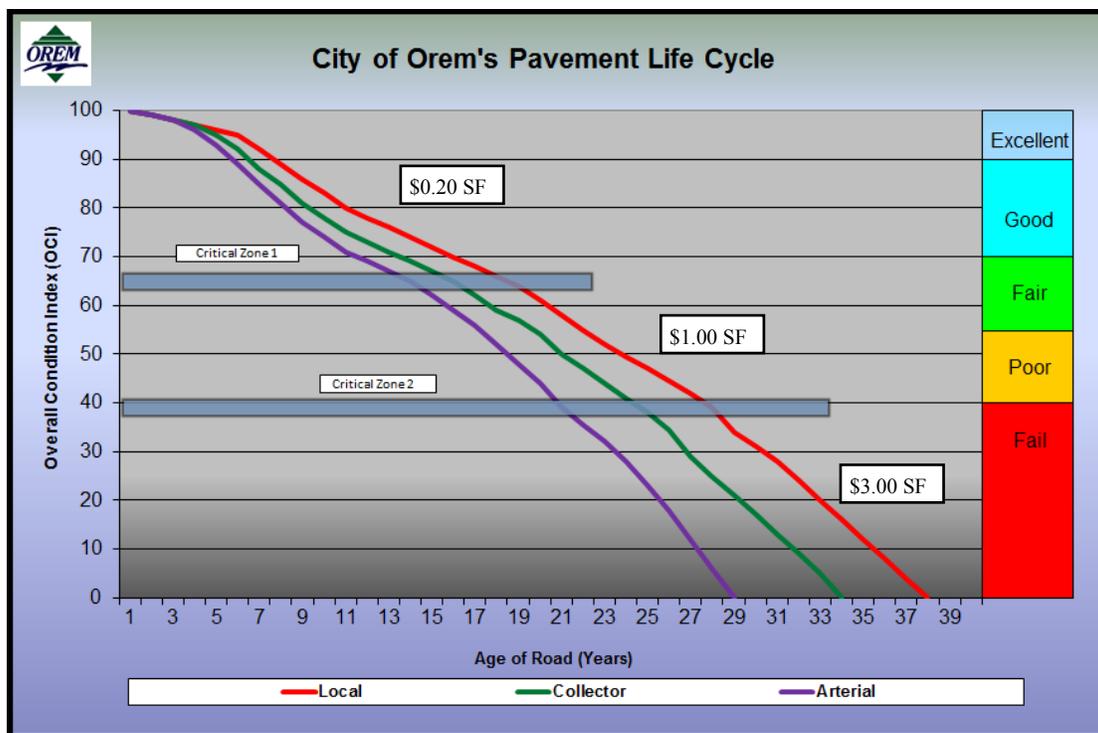


City of Orem's Pavement Life Cycle

Understanding the service life of a street enables the correct treatments to be applied at the optimal time. The average life cycle of each of the City's street classifications is represented in the chart below. These life cycles illustrate the life of a street if maintenance is not performed.

Due to the amount of traffic and traffic loads, Arterial streets have the shortest life cycle. On average, Local streets last 30% longer than Arterial streets, and approximately 15% longer than Collector streets. Arterial streets lose approximately 3.5% service life per year. Collector streets lose 3%, and Local streets 2.5%.

Critical zones represent transitional points in a street's life cycle. If the proper preventative maintenance treatment is performed before passing through these zones, the costs are substantially less. If maintenance is delayed or not performed, the street is likely to deteriorate to a condition that requires more costly repairs.

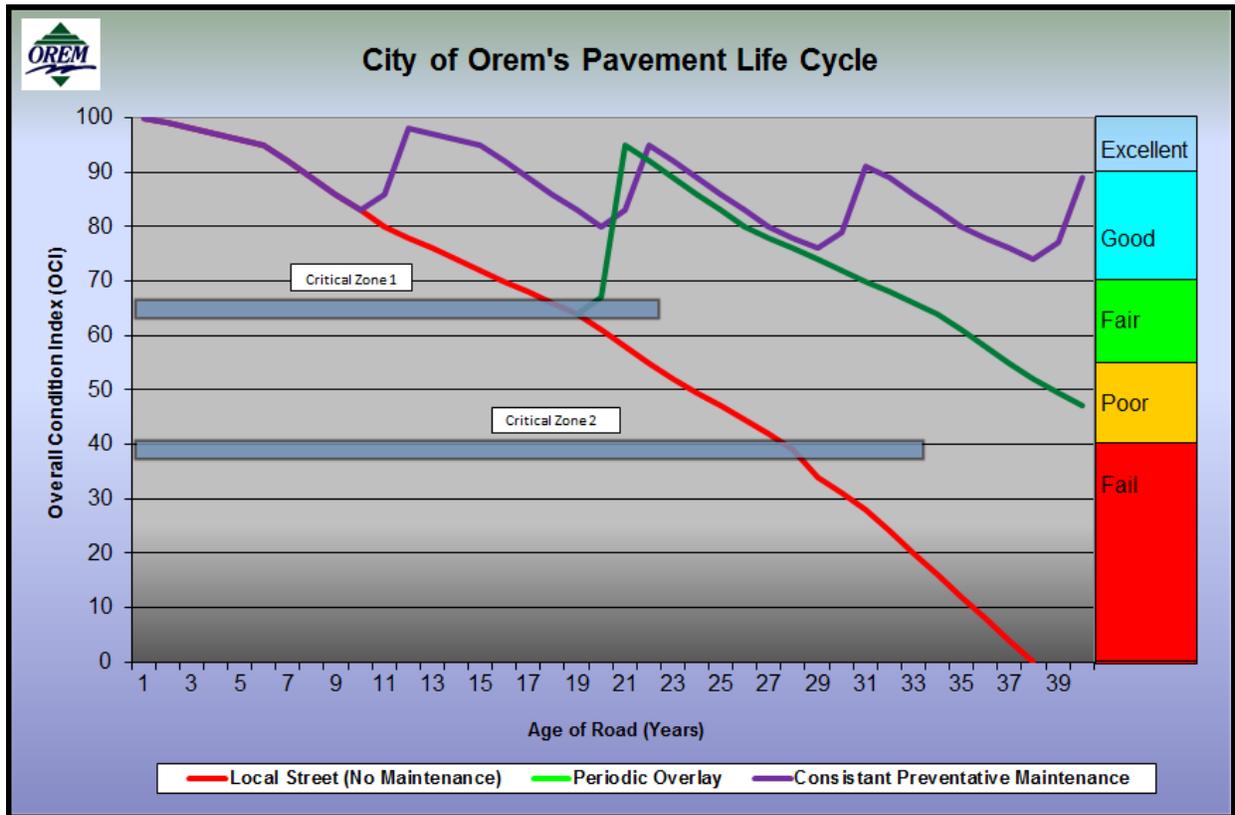


Maintenance performed before critical zone one is approximately **\$0.20** sf.

Maintenance performed between critical zones one and two is approximately **\$1.00** sf.

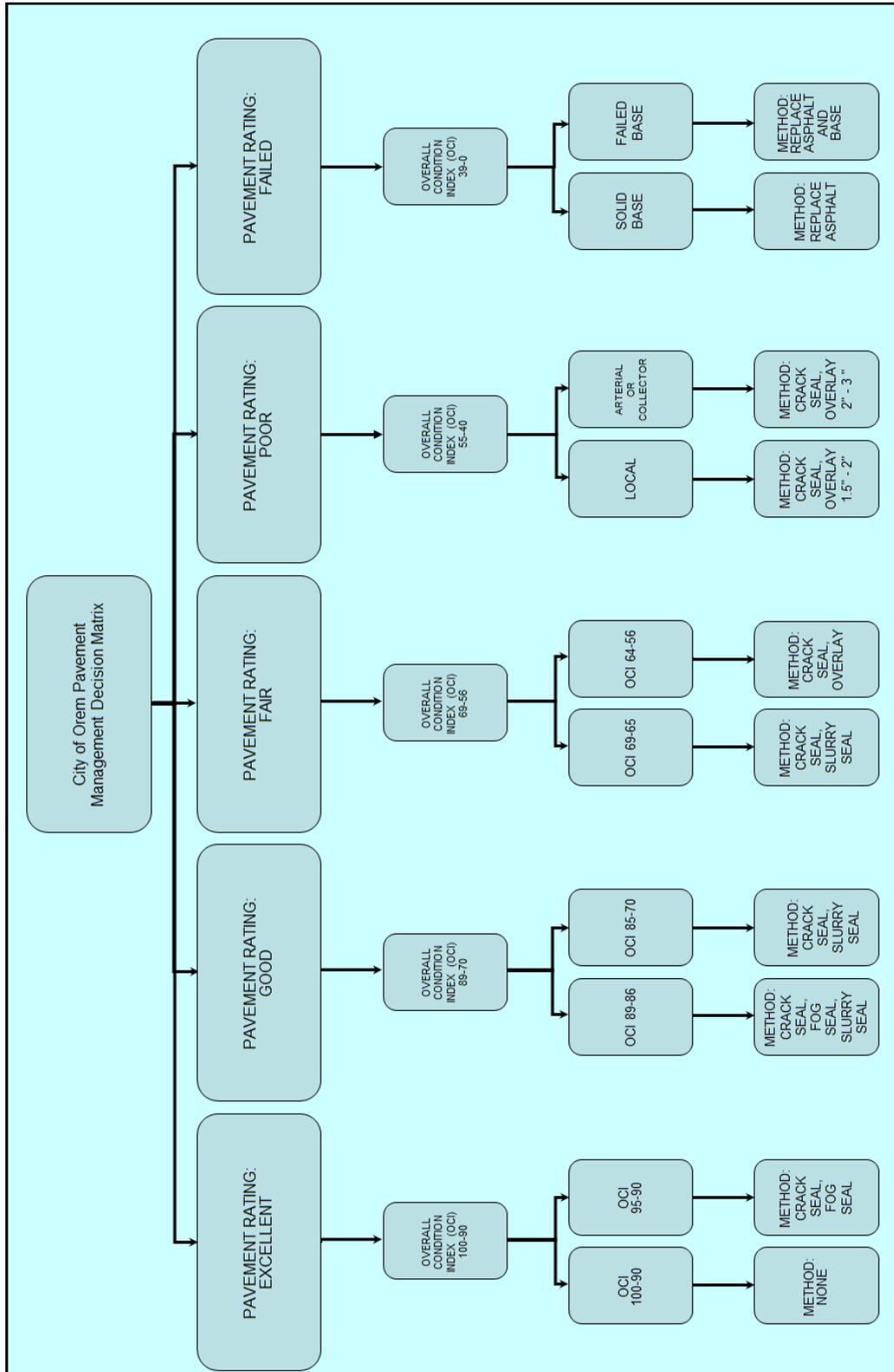
Maintenance performed after zone two is approximately **\$3.00** sf. Performing the right treatment, on the right road, at the right time, can reduce costs significantly.

The following chart illustrates the basic life cycle of a Local (**RED**) street in Orem when maintenance is not performed. The **PURPLE** line represents the consistent use of preventative maintenance and the service life gained. The **GREEN** line represents postponing maintenance until major deterioration has occurred.



Performing consistent preventative maintenance, beginning early in a life cycle, can keep a street in the "Good" condition rating, and add indefinite service life. Performing periodic, more costly maintenance can increase service life approximately 15 additional years, but the road may fall into a "Fair" or "Poor" condition. Streets left untreated can remain in a "Poor" or "Failed" condition for over 50% of their life cycle and require more costly rehabilitation.

The City of Orem's Pavement Management Decision Matrix illustrates the proposed maintenance and rehabilitation of streets as determined by their OCI.



Preventative Maintenance and Rehabilitation

CRACK SEAL:

Crack seal is used to fill and seal pavement surface cracks and gutter lines. This treatment is used on all pavement to help minimize the penetration of water to the base and sub grade which can cause structural breakdown. It also slows crack deterioration. Crack seal is placed before streets receive a slurry seal or asphalt overlay treatment. On average, six to seven tons of crack seal has been used per one centerline street mile. 160 miles have been completed since 2005 at an approximate cost of \$1.75 million or \$10,500.00 per mile. Crack seal has a service life of 5+ years.

SLURRY SEAL:

Slurry seal is used as an asphalt sealant, rejuvenator, protector and surface course for all Local and some Collector streets. Slurry consists of an asphalt emulsion, aggregate, fillers and polymers. Type II Slurry is approximately 1/4" thick and is placed on low to moderate traffic streets. Type III Slurry is approximately 3/8" thick and is placed on moderate to high traffic streets. Since 2005, 121 centerline street miles have received slurry at a cost of \$2.5 million, or \$20,500.00 per mile. Slurry Seal can add an additional 5-10 years of street service life.

MICRO-SURFACING:

Micro-Surfacing, like slurry seal, is used as an asphalt sealant, protector and surface course. Micro-surfacing can be applied to Local streets but is best used for Collector and Arterial street maintenance. Micro-surface consists of polymer modified emulsion, water, cement and additives, applied approximately 3/8" thick. The benefits of micro-surfacing include: continuous lay down, some leveling capabilities, higher poundage per square yard than slurry, quick traffic return, and can be applied at night. Approximate cost if applied to all City roads is \$50,000.00 per mile. Micro-surface can add an additional 5-10 years of road service life.

BONDED WEARING COURSE:

A Bonded Wearing Course (BWC) is a gap or open graded, thin hot-mix asphalt mixture, applied over a thick polymer modified asphalt emulsion membrane. It can be placed, 5/8" to 1.5" thick, over structurally sound pavements as a maintenance treatment, and may also be used in new construction and rehabilitation projects as the final wearing course. The cost to apply a BWC on a collector or arterial street surface is approximately \$125,000.00 per mile. The life expectancy for a BWC is 7 to 12 years.

OVERLAY:

Overlays are the placement of 1.5"+ of asphalt over existing asphalt. Overlays are used when the pavement has deteriorated to a point that a slurry seal will not bring the pavement back to an acceptable level due to loss of structural and pavement properties. Costs for a 1.5" overlay is approximately \$145,000.00 per mile on an average 34' wide Local street, and \$275,000.00 per mile for a 2" overlay on an average 52' wide Collector or Arterial street. Overlays have a service life of 15+ years.

RECONSTRUCT:

A reconstruct consists of removing the existing asphalt and replacing with new asphalt. In many cases, base and sub grade material will be removed and replaced. Reconstructs are performed when the asphalt has lost its structural properties and/or base and sub grade material has failed. Reconstruction of Local streets is approximately \$450,000.00 per centerline mile. Reconstructing Arterial and Collector streets increases to approximately \$960,000.00 per mile. Reconstructs have a service life of 28+ years.

CITY CREW MAINTENANCE AND PREPARATION WORK:

City crews are an important part of the City’s street maintenance program. Their knowledge and abilities are a valuable asset to the City. They are responsible for multiple maintenance activities, including preparation work for contracted slurry seals and asphalt overlays. Patching utility trenches, removing and replacing failed sections of streets, leveling depressions for improved ride and safety, pothole patching, and smaller overlay and reconstruction projects are some of the activities they perform.

Since 2005, City crews have placed over 36,000 tons of asphalt on City roads. This amount of asphalt equates to approximately 16 miles of 2” thick asphalt. Through the work performed by City crews, street condition and service life is increased and the total cost of contracted work is reduced.



Current Maintenance

Local Streets:

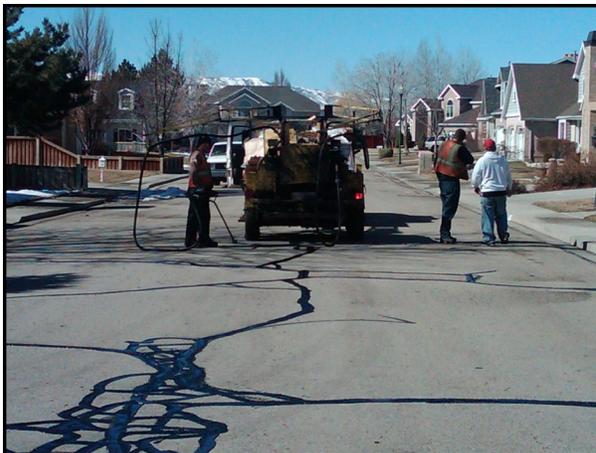
All 187 centerline miles of Local City streets currently receive preventative maintenance in an 8-year rotation. This is equal to just over 23 centerline street miles per year. This maintenance includes the replacement of localized failure, depression leveling, and crack and slurry seal. Failure to maintain the local roads each year could result in poor road conditions and large rehabilitation costs.

*NOTE: Over 31 miles of local streets could fall into an overlay category if maintenance is not performed consistently through the next five years. Maintaining these streets through two crack and slurry seal treatments at **\$1.9 million**, could add an additional 16 years of service life. Allowing these roads to decrease to the point of overlaying could cost approximately **\$4.8 million**, and may add 15+ years.*

Both a crack seal and slurry seal can be performed almost five times before they equal the cost of an overlay. Adding between 5-10 years of service life per treatment, streets can more than double their service life at approximately 80% of the cost.

One Centerline Street Mile

TREATMENT	APPLICATIONS	COST	SERVICE LIFE
Crack and Slurry Seal	4 applications	\$124,000.00	32+ years
Crack Seal and Overlay	1 application	\$155,500.00	15+ years



Collector and Arterial Streets:

Maintenance for all 54 centerline miles of collector and arterial streets has consisted of crack seal in an 8-year rotation and an asphalt overlay when funding is available. Increased traffic loads, original pavement depth, utility cuts and overall condition are some of the challenges the City faces with these high volume, lower life cycle streets.

Local streets may last 20%-40% longer than Collector and Arterial streets.

*NOTE: If no rehabilitation occurs on our Collector or Arterial streets over the next five years, 20% of these roads may need reconstruction, with another 20% needing an overlay. This would require nearly **\$14 million** to complete. Maintaining Arterials and Collectors through crack sealing and overlays, requires completing nearly three street miles per year, totaling **\$4.5 million**.*

One Centerline Street Mile

TREATMENT	APPLICATIONS	COST	SERVICE LIFE
2" Overlay	2	\$550,000.00	30+ years
6" Asphalt Reconstruct	1	\$960,000.00	28+ years

Beginning the use of maintenance treatments such as slurry seal and micro-surfacing, where applicable, may add additional service life at less cost.



Recommended Maintenance/Budget Information

The City’s current OCI is 83.1. Due to the decrease in a streets service life each year, maintaining at or near this OCI requires a certain amount of work to be performed.

The following chart illustrates the determined amount of street maintenance and rehabilitation, needing completion each year, to maintain at or near the current street quality. This includes the preventative maintenance on all Local streets and asphalt overlays for Collector and Arterial streets. In addition, a limited number of Local streets were not originally built to sustain their current traffic loads or did not receive the final asphalt lift required. These areas will need rehabilitation and are included in the yearly maintenance chart.

Maintenance	Yearly Total
Crack Seal All Streets	30 Miles
Slurry Seal All Local Streets	23 Miles
Overlay/Reconstruction Arterial, Collector and Selected Local Streets	3 Miles

"Apply the right treatment, to the right road, at the right time, while remaining fiscally responsible."

Current Budget:

Type	Annual Budget
Crack Seal	\$300,000.00
Slurry Seal	\$500,000.00
Overlay/Reconstruction	\$500,000.00
Total	\$1,300,000.00

Current funding enables the City to perform the needed 30 centerline miles of crack seal and 23 miles of slurry seal each year. This funding allows for only 60% of the needed overlays. The remaining 40% would not receive the needed overlay each year, decreasing the City’s average OCI. In ten years the City’s average **OCI would most likely drop below 80**, with approximately 12 centerline miles of Arterial and Collector streets rated as “Poor” or “Failed.”

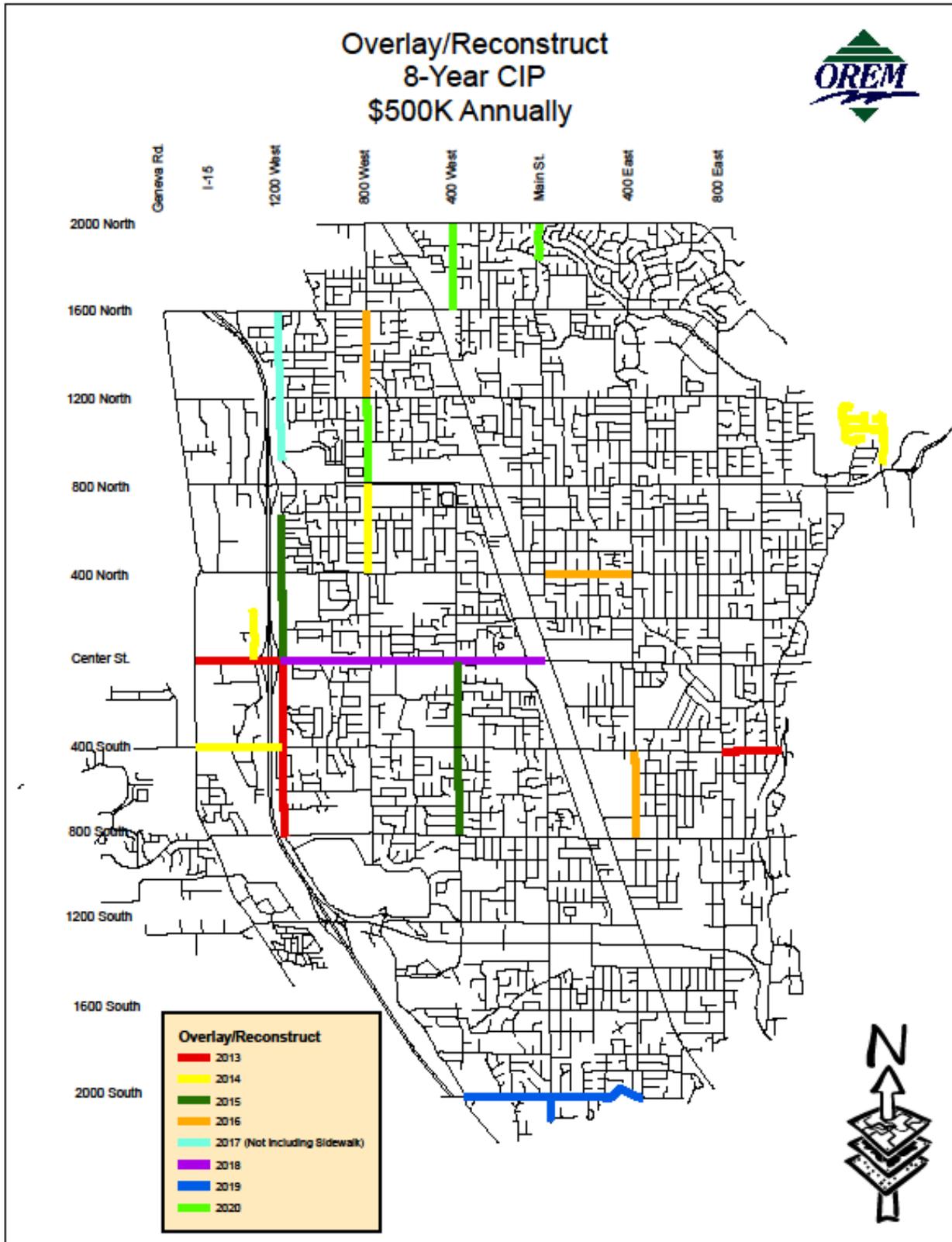
Increased Funding:

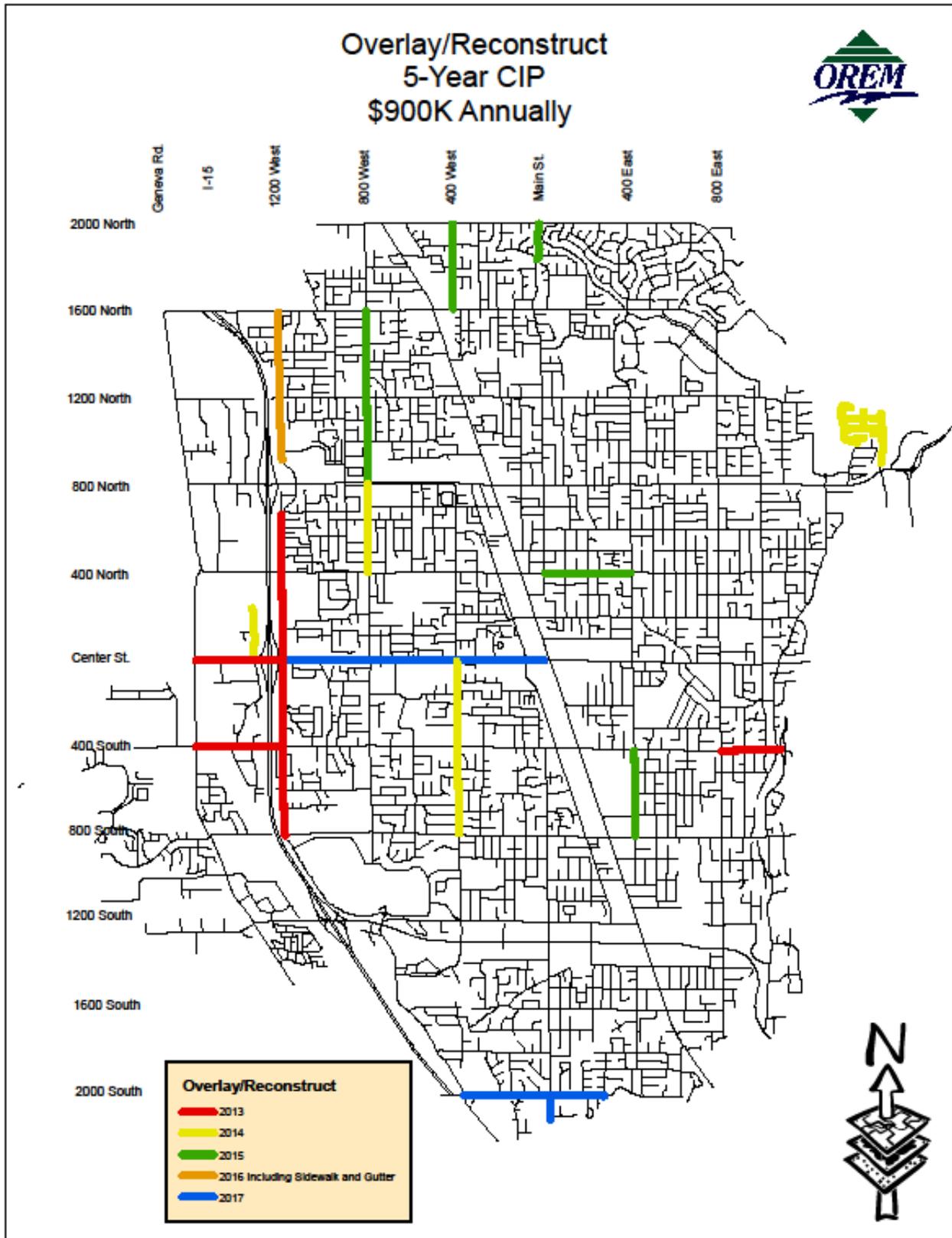
The following illustrates the impact increased funding can have on our street quality.

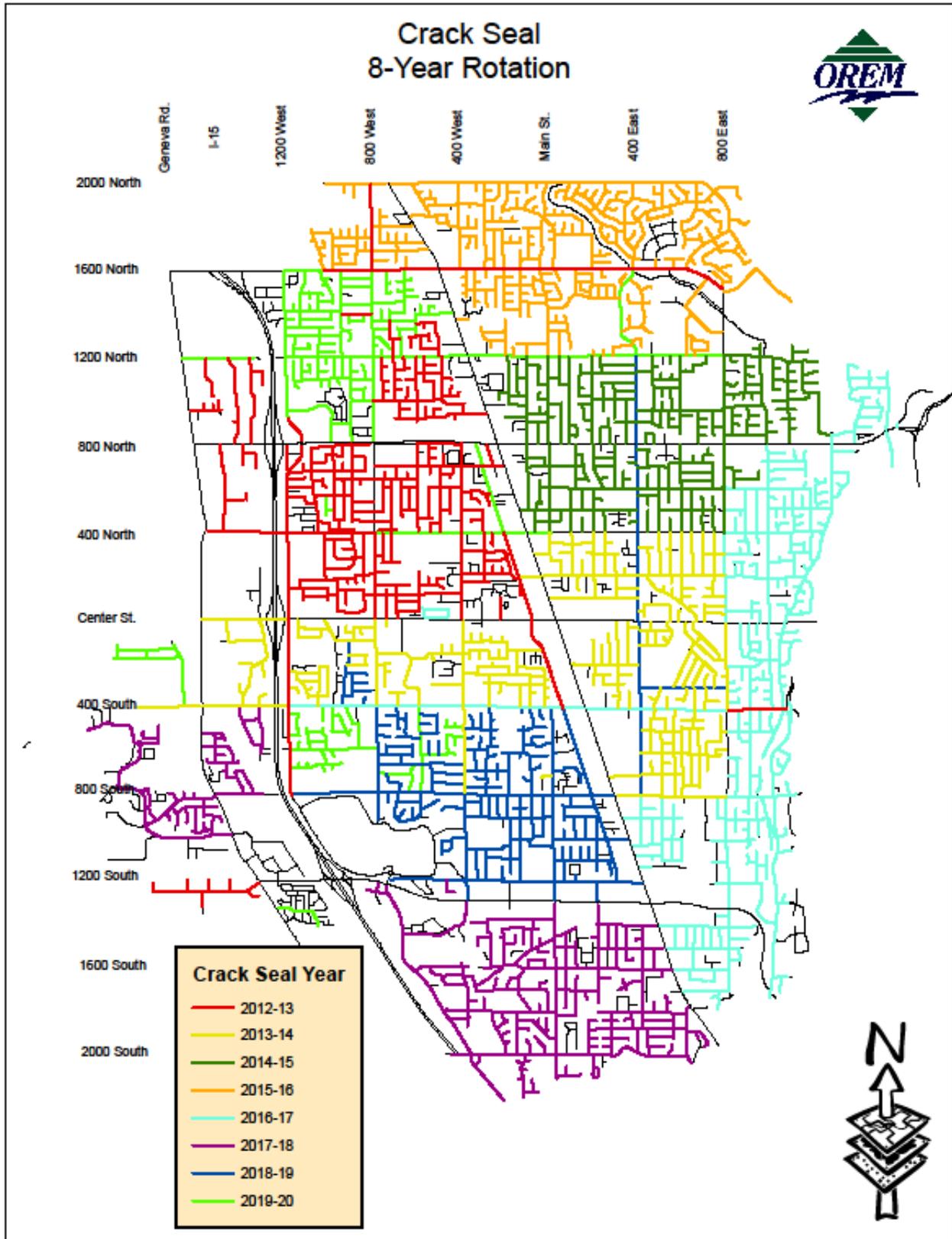
Type	Current Funding	Increased Funding
Crack Seal	\$300,000.00	\$300,000.00
Slurry Seal	\$500,000.00	\$500,000.00
Overlay/Reconstruction	\$500,000.00	\$900,000.00
Total	\$1,300,000.00	\$1,700,000.00

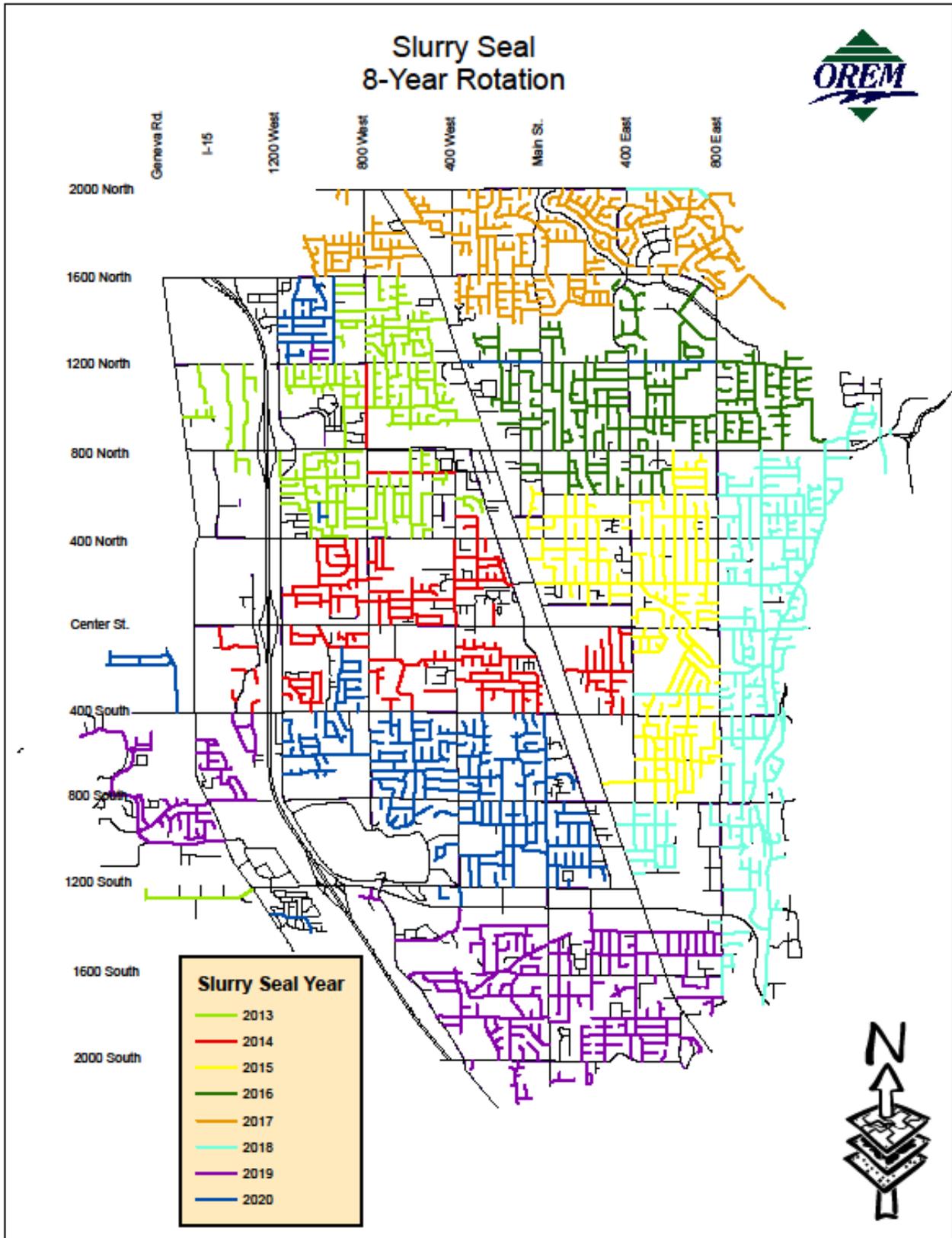
This funding could provide for the minimum maintenance and rehabilitation needing completion each year. All City streets could receive crack seal in the 8-year cycle and all Local roads could receive slurry seal in this same cycle. This could also provide for the three centerline miles of Arterial and Collector and selected Local overlays each year. The work performed each year with this amount of funding could enable the City OCI average to **remain at or near the current 83.1**.

The following maps illustrate the maintenance and rehabilitation schedule for the next eight years, including a 5-Year Overlay/Reconstruct CIP with \$900k annually.









Other/Future Maintenance and Budget Options:

With the current budget concerns, future funding may be limited. City crews are a valuable resource, and the work they perform enables streets to increase service life at a minimal cost. Their impact opens the door to expanding maintenance activities such as slurry seal, micro-surfacing and bonded wearing courses to higher volume (Arterial and Collector) streets. Currently, these maintenance activities have only been performed on higher volume streets on a limited basis. Streets that have received these treatments are responding favorably. As we continue to apply and monitor the effects these treatments have on higher volume streets, we may be able to more fully incorporate them into our yearly maintenance.

The chart below illustrates a maintenance scenario that includes many of these surface treatments, performed on all City streets, in an 8-year cycle.

Type	Annual Budget
Crack Seal - All	\$300,000.00
Slurry Seal - Local and Collector	\$600,000.00
Micro-Surface Arterial	\$100,000.00

Incorporating these treatments, with the use of overlays, could be the most effective program.

Example of a possible future budget:

Type	Annual Budget
Crack Seal - All	\$300,000.00
Slurry Seal - Local and Collector	\$600,000.00
Micro-Surface Arterial	\$100,000.00
Overlay Arterial, Collector and Selected Local	\$700,000.00
Total	\$1,700,000.00

Summary and Recommendations

Due to the rehabilitation and maintenance activities performed since 2003, approximately 93% of the City street network rates as “Good” or “Excellent.”

Maintaining the 187 centerline miles of Local streets through preventative maintenance has proven effective. Applying a crack seal and an asphalt overlay to all 54 miles of Arterial and Collector and selected Local streets at three miles per year, can help the City maintain quality streets and prevent high future costs.

The Pavement Management Staff recommends the City maintain an **80** or above OCI average on all street classifications, with **NO** failed roads in the City.

The chart below outlines the annual projected costs to maintain these recommended levels through the next eight years.

Type	Recommended Annual Budget
Crack Seal	\$300,000.00
Slurry Seal	\$500,000.00
Overlay/Reconstruction	\$900,000.00
Total	\$1,700,000.00

A great investment has been made in the City street network. The Pavement Management Staff and Street Section are committed to make it the best it can be. The continued planning and execution of street maintenance and rehabilitation, and the analysis and implementation of other preventative maintenance practices can help make it possible.