

CITY OF SALINA Pavement Management System August 19, 2013

Public Works Department
Engineering Workgroup



Outline

- ◆ Street inventory
- ◆ Historical perspective and current status
- ◆ Rating system
- ◆ 2011 pavement condition survey results
- ◆ City street photos showing PCI ratings
- ◆ What is the problem?
- ◆ Performance curves and maintenance activities
- ◆ Current approach to pavement maintenance
- ◆ Budget and service level options
- ◆ Life-cycle cost
- ◆ Recommendation

Street Inventory

- ◆ Street infrastructure are most valuable asset the City owns
- ◆ 269 centerline miles of roads*
- ◆ Approximately 5 million square yards
- ◆ \$400,000,000 - \$571,000,000 to rehab or reconstruct at today's costs
- ◆ \$8,500 - \$12,000 investment per citizen of Salina

*Still finalizing exact numbers

Street Inventory

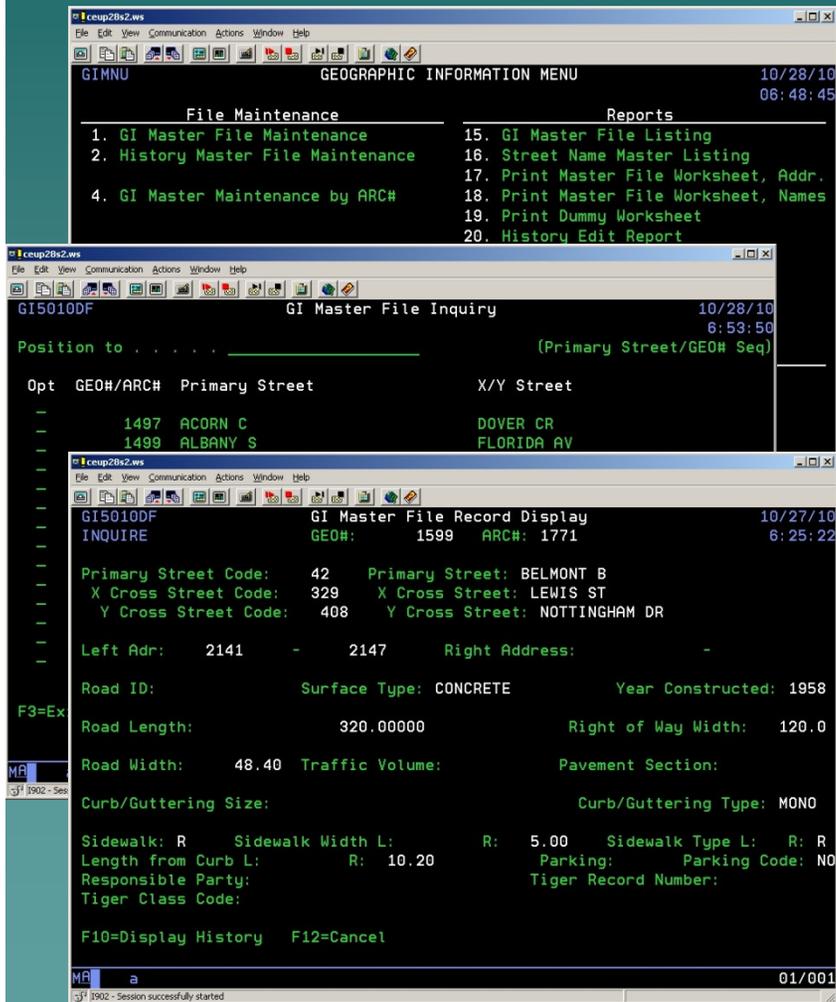
◆ Existing Transportation System

- Classifications (269 total miles)
 - ◆ Arterials (34 miles)
 - ◆ Minor Arterials (14 miles)
 - ◆ Collectors (28 miles)
 - ◆ Locals (186 miles)
 - ◆ Parks (7 miles)
- Street Surfaces
 - ◆ Paved (256 miles 95%)
 - Concrete (107 miles 42%)
 - Asphalt (149 miles 58%)
 - ◆ Brick (8 miles 3%)
 - ◆ Unimproved (5 miles 2%)

Historical Perspective

Prior to 2001: pavement management "system"

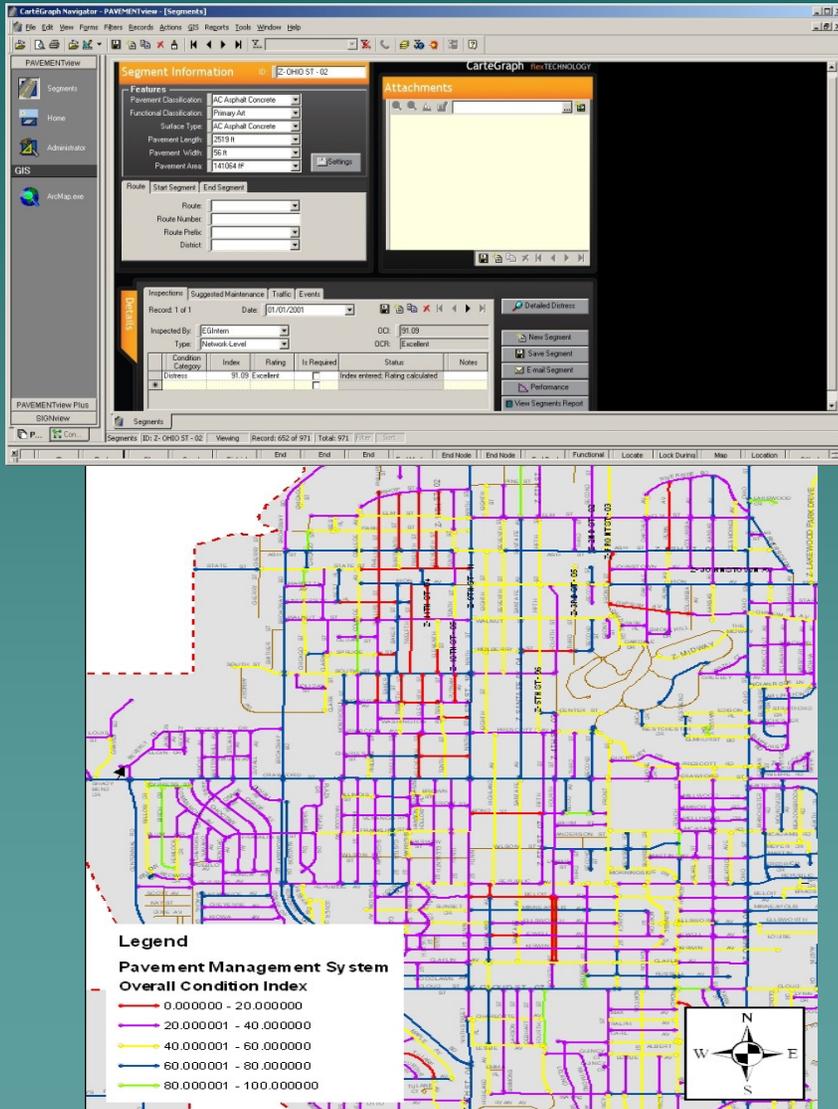
- AS-400 mainframe type pavement inventory system
- A lot of data but difficult to access
- No visual component
- No planning or budget tools
- Not user configurable, requires intervention of IT Department



Current Status

- ◆ 2001 – Pavement condition survey & Cartegraph software purchase
- ◆ 2002 to 2008 – Cartegraph rarely used
- ◆ 2008 – Cartegraph license reinstated and database development progressed
- ◆ 2011 – Citywide pavement condition survey executed by Infrastructure Management Services
- ◆ 2012 – Data finalized and accepted
- ◆ Database now established and being updated
- ◆ Database now being used for project planning
- ◆ Moving toward performance & budget based prediction modeling

Current Status



- ◆ Added visual (mapping) component
- ◆ Two way communication with our Geographic Information System
- ◆ Making it multi-user, multi-office, field ready
- ◆ Collaborative - Users have different interests, roles and responsibilities
- ◆ A lot of data stored in related tables
- ◆ Interface is user configurable requires no outside intervention
- ◆ Includes forecasting, planning & budget tools, condition prediction using industry standard or custom formulas

Rating System

- ◆ Measures the existing extent/severity of road condition surface distresses (19 categories for asphalt and concrete)
 - Asphalt Roads
 - ◆ Cracks, Rutting
 - ◆ Potholes, Utility Patches
 - ◆ Weathering / Raveling (surface defects)
 - Concrete Roads
 - ◆ Cracks, Faulting (tipping)
 - ◆ Patches, Repair Areas
 - ◆ Scaling / Spalling / Polished Aggregate (surface defects)

Rating System

- ◆ A Pavement Condition Index (PCI) is calculated from above distresses
- ◆ PCI provides a surface condition rating
- ◆ Ride ability and structural distresses reflected in surface impact the PCI
- ◆ Rating is from 0-100 (zero poor and 100 excellent) (ASTM D6433-03)
- ◆ PCI helps to determine need and priority of pavement maintenance

Rating System

- ◆ ASTM D6433-03 has many categories (7)
- ◆ Staff simplified to Good, Fair, Poor
- ◆ Arterials should be maintained at a higher level
- ◆ Followed by Collectors and then Locals

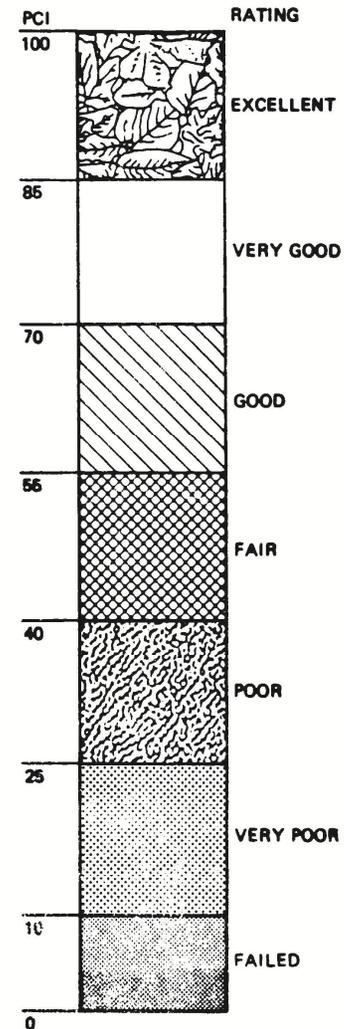
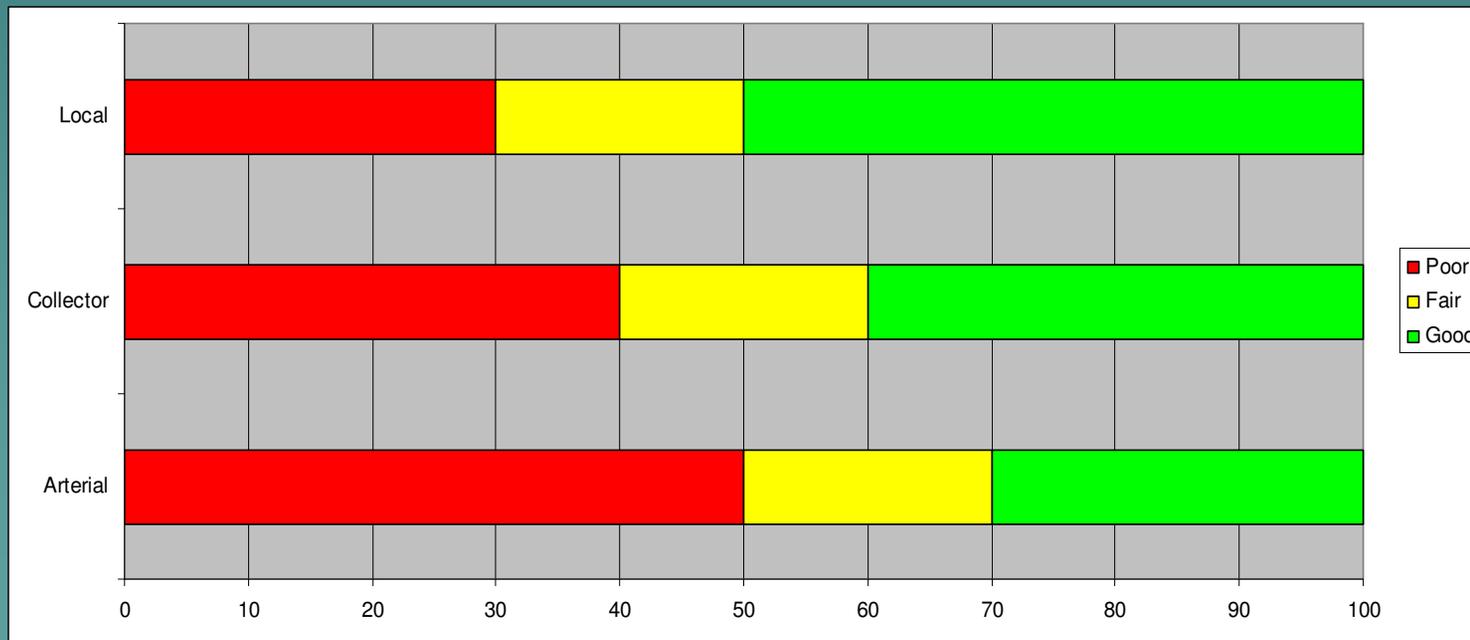


FIG. 1 Pavement Condition Index (PCI) and Rating Scale

Rating System

- ◆ PCI rating to be at least Fair or Good
 - Arterials (rating above 50)
 - Collector (rating above 40)
 - Local (rating above 30)



2011 Pavement Survey Results

- ◆ 2011 IMS survey
- ◆ Over 2800 segments
- ◆ Condition benchmark proposed



Photographs of City Streets showing PCI Ranges

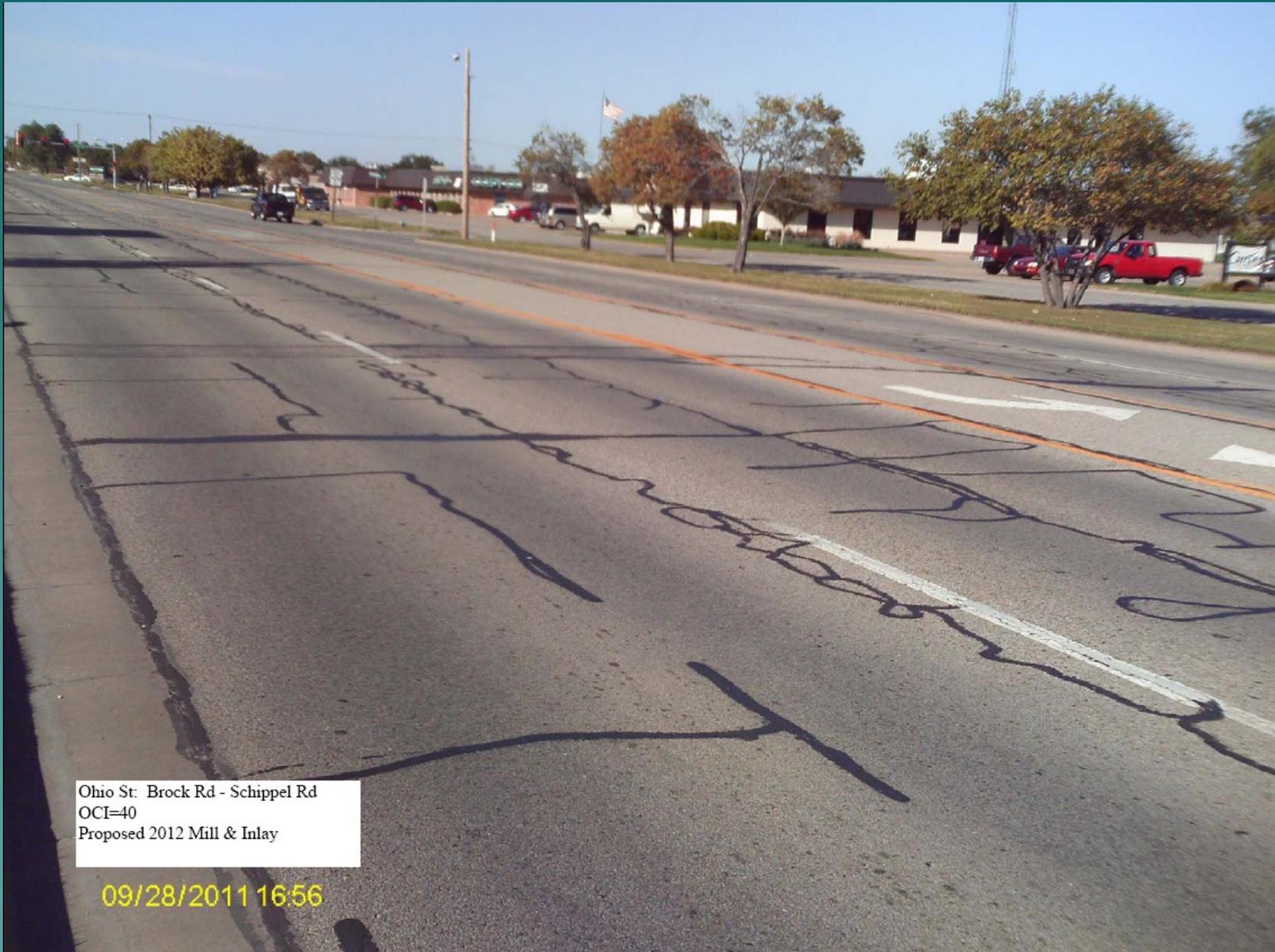
Iron Ave: 10th St – 9th St; PCI=20



Iron Ave: 10th St - 9th St
OCI = 20

09/28/2011 16:09

Ohio St: Brock Rd – Schippel Rd; PCI = 40



Ohio St: Brock Rd - Schippel Rd
OCI=40
Proposed 2012 Mill & Inlay

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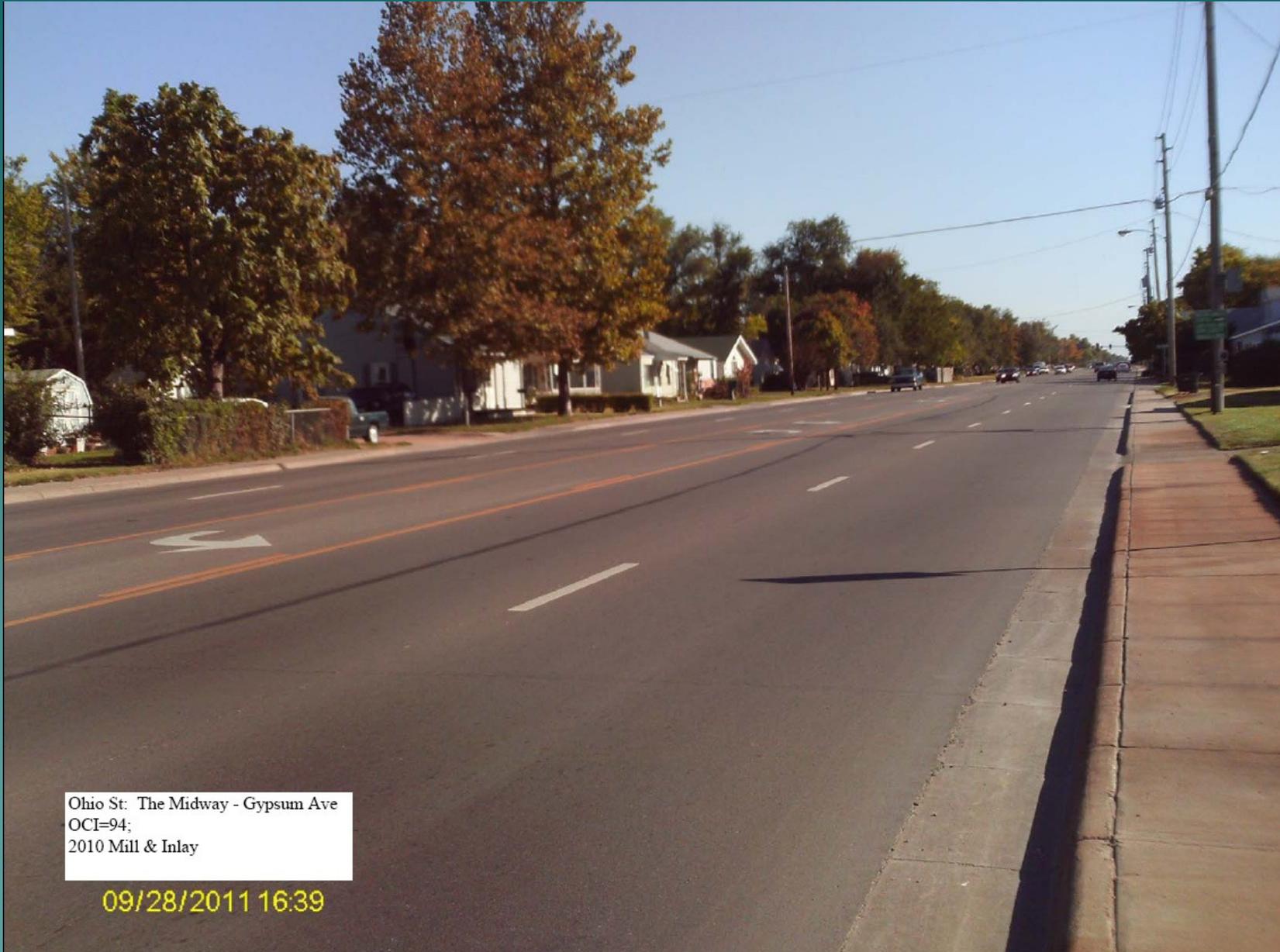
Iron Ave: Santa Fe – 5th; PCI=60



Iron Ave: Santa FE Ave to 5th St
OCI = 60

09/28/2011 16:17

Ohio St: The Midway – Gypsum Ave; PCI = 94



Ohio St: The Midway - Gypsum Ave
OCI=94;
2010 Mill & Inlay

09/28/2011 16:39

Grand Ave: 12th St- 11th St; PCI = 25



Morningside Dr: Sunrise Dr – Kenison Rd; PCI = 38



Morningside Dr: Sunrise Dr - Kenison Rd
OCI=38
Built:1956

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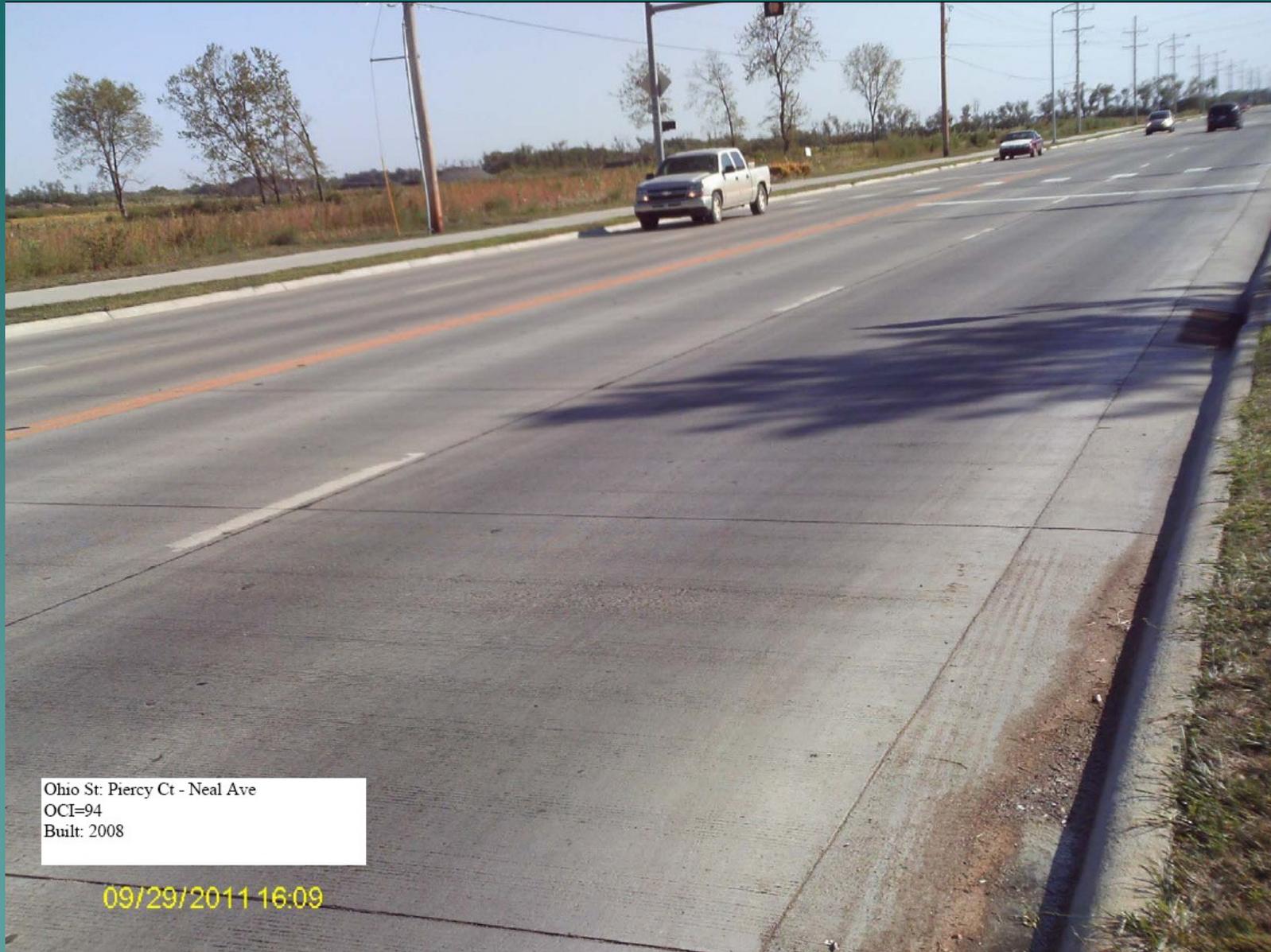
Kirwin Ave: Rush St – Pershing St; PCI = 71



Kirwin Ave: Rush St - Pershing St
OCI=71

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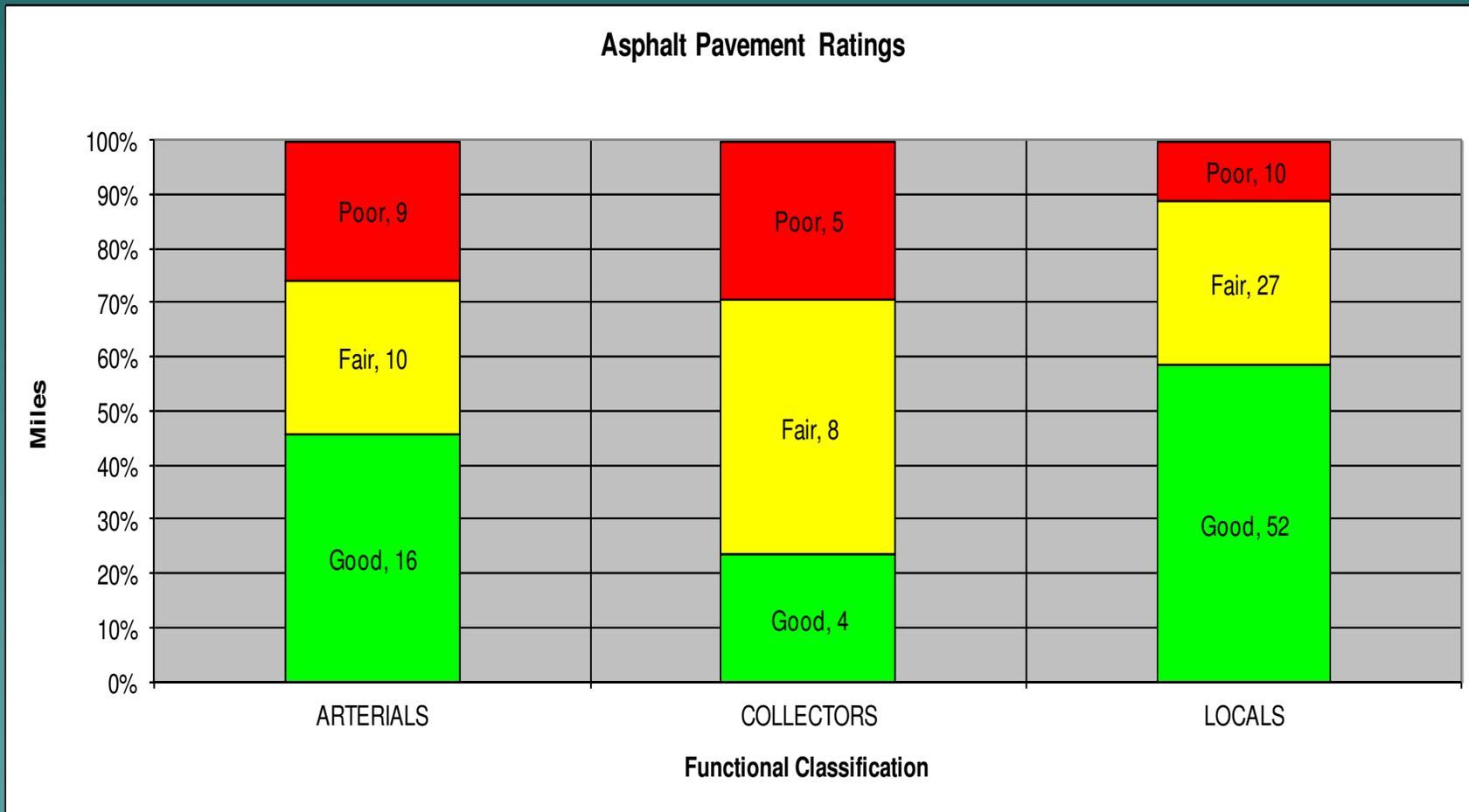
Ohio St: Piercy Ct – Neal Ave; PCI = 94



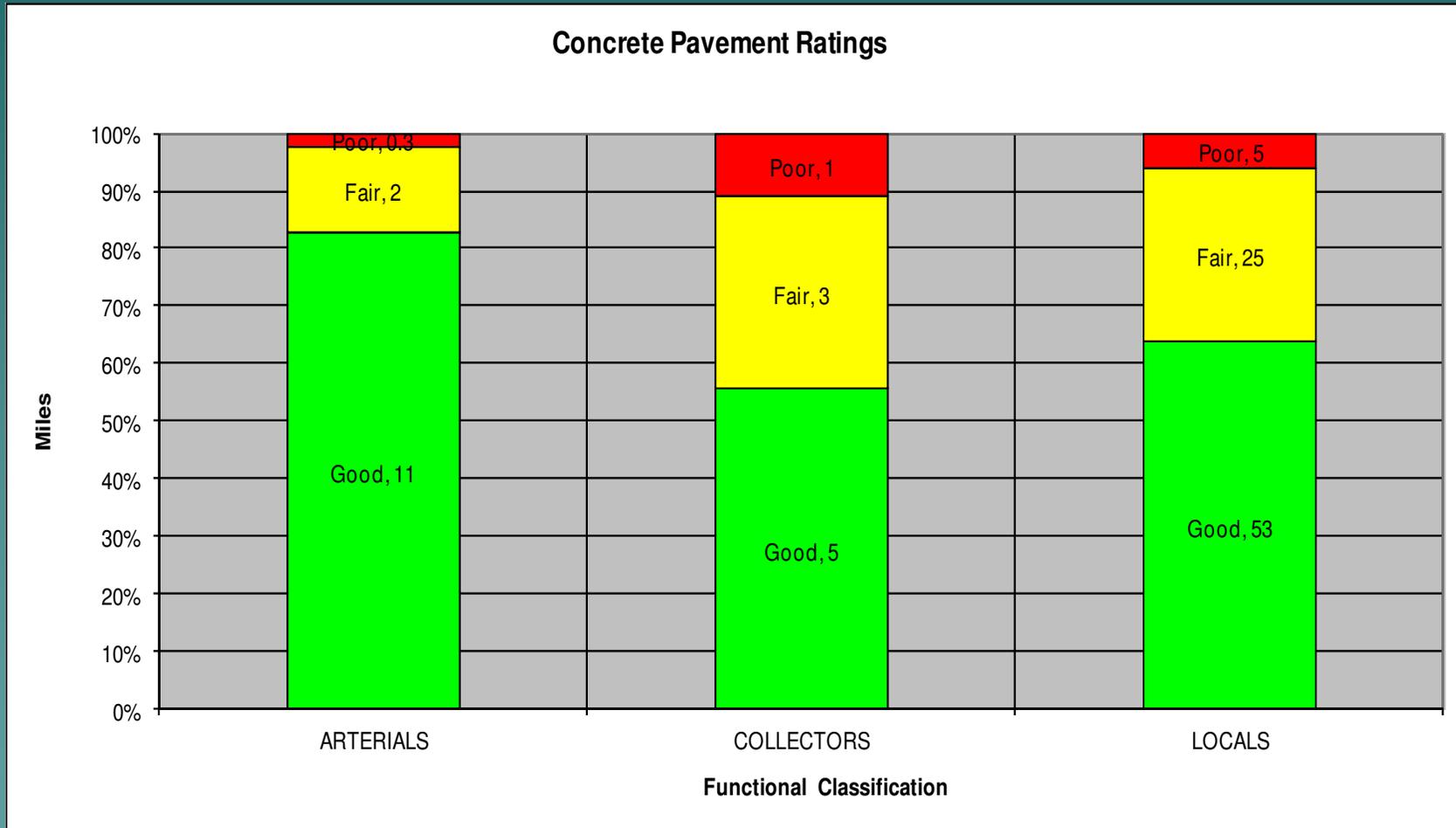
Ohio St: Piercy Ct - Neal Ave
OCI=94
Built: 2008

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2011 Pavement Survey Results



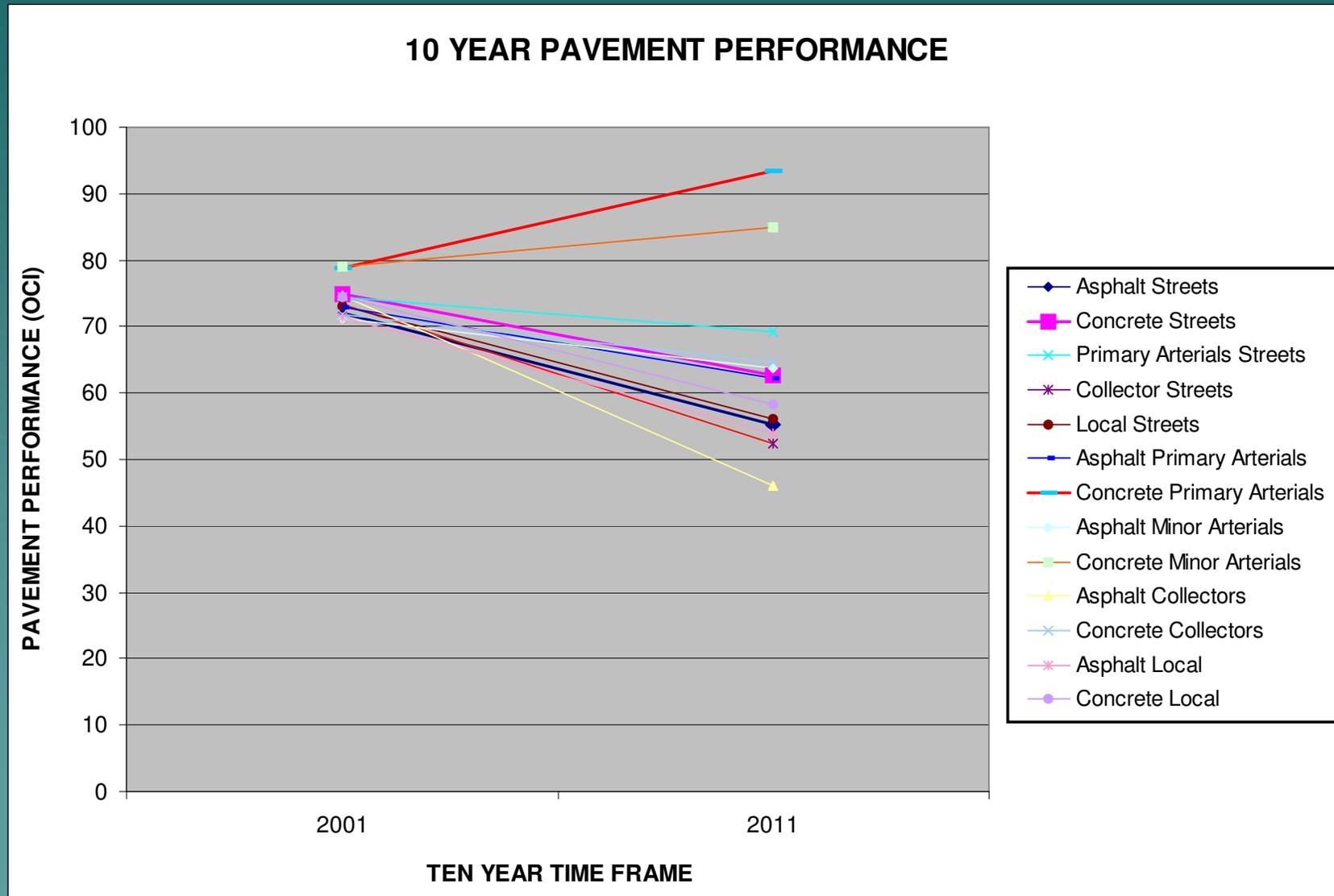
2011 Pavement Survey Results



2011 Pavement Survey Results

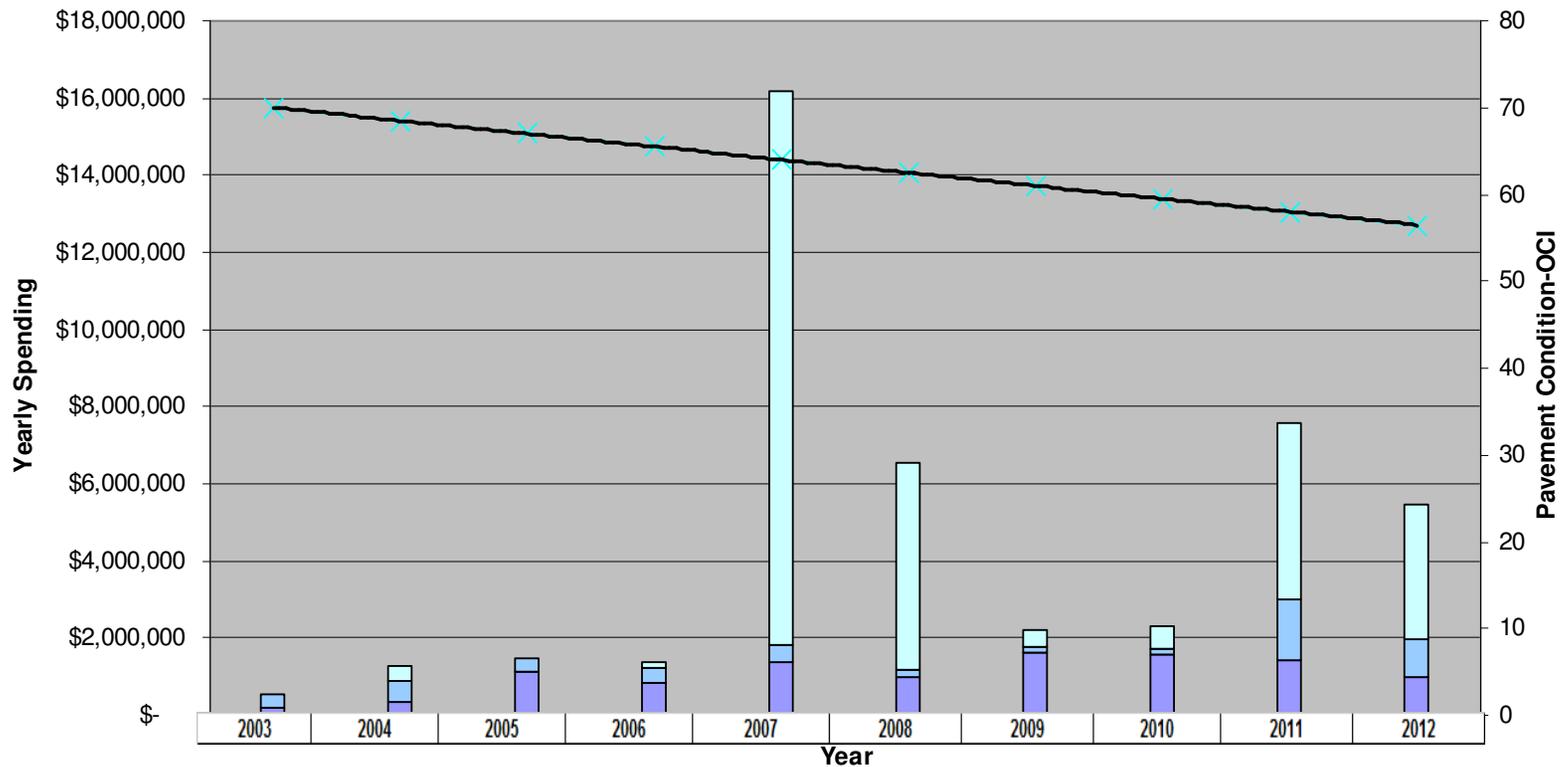
- ◆ Current overall condition index (PCI) average rating for all streets
 - Primary Arterial 69
 - Minor Arterial 72
 - Collector 52
 - Local 56
- ◆ From 2001 to 2011, the street condition PCI ratings decreased an average of 1.5 points per year
- ◆ The chart below shows 10 year pavement performance based on past funding levels

2011 Pavement Survey Results



2011 Pavement Survey Results

Historical Pavement Maintenance



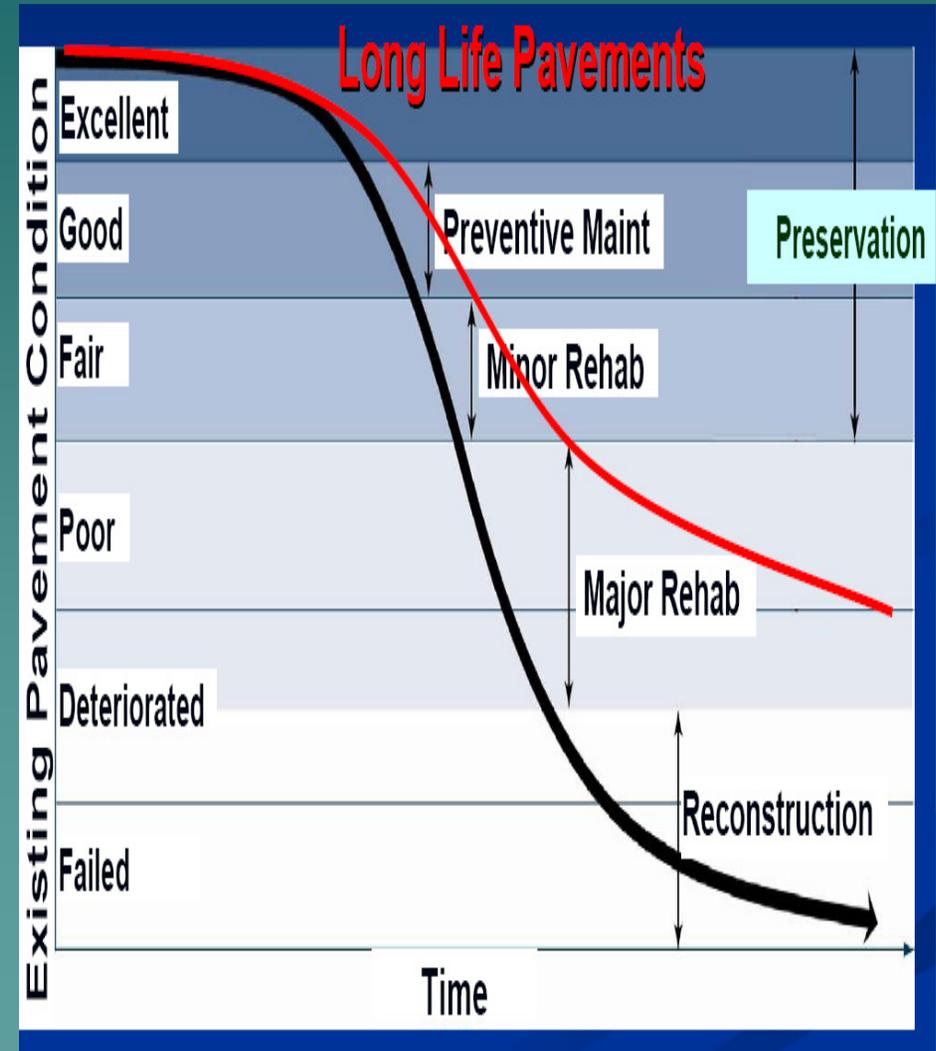
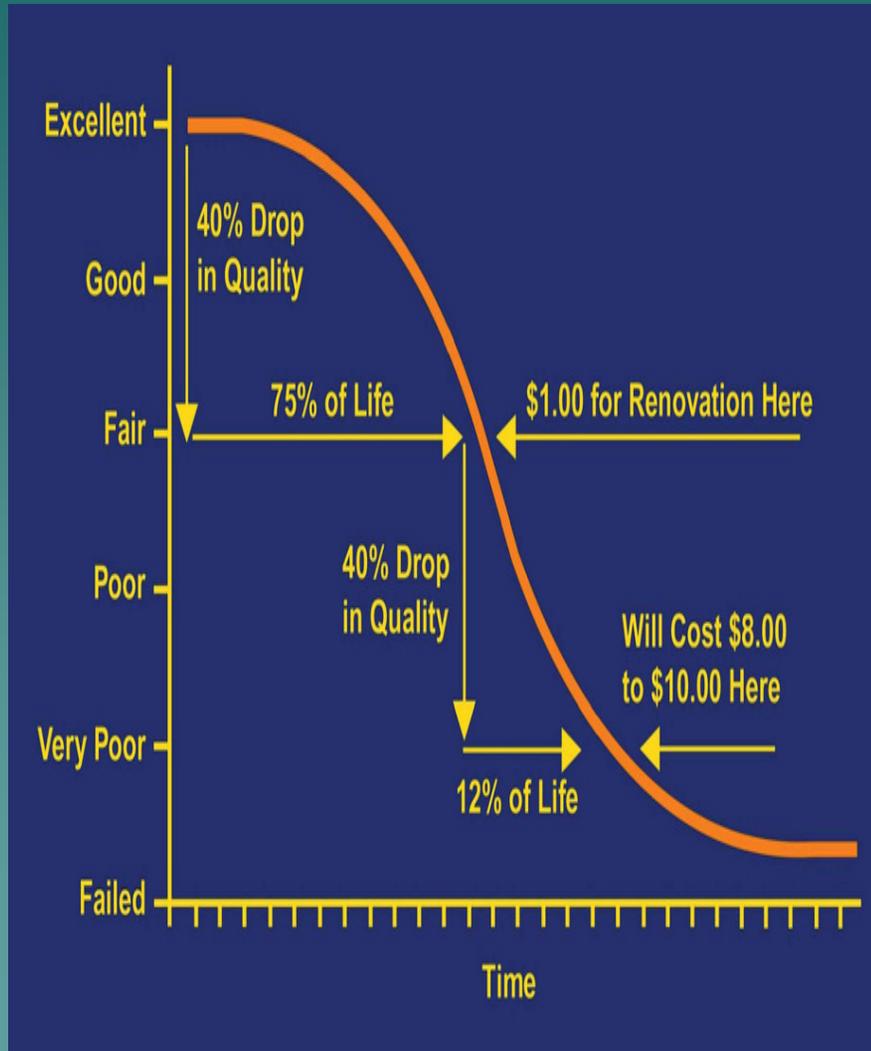
\$	516,589	\$	1,285,625	\$	1,462,464	\$	1,362,986	\$	16,157,274	\$	6,520,944	\$	2,224,008	\$	2,301,550	\$	7,596,645	\$	5,473,477
	70		68.5		67		65.5		64		62.5		61		59.5		58		56.5

What is the problem?

- ◆ “Delayed and deferred maintenance leads to higher repair and reconstruction costs—pay me now or pay me more, lots more, later. Michigan DOT Director Kirk L. Steudle said, “It is important to slow the rate of decline in the good road so that it stays in good shape rather than slipping into fair or poor condition.” Spending \$1 to keep a road in good condition prevents spending \$7 to reconstruct it once it has fallen into poor condition, he added. But soaring construction costs, tight budgets, and increasing needs make it hard for states to sustain preservation programs.” (Rough Roads Ahead – 2009 AASHTO)

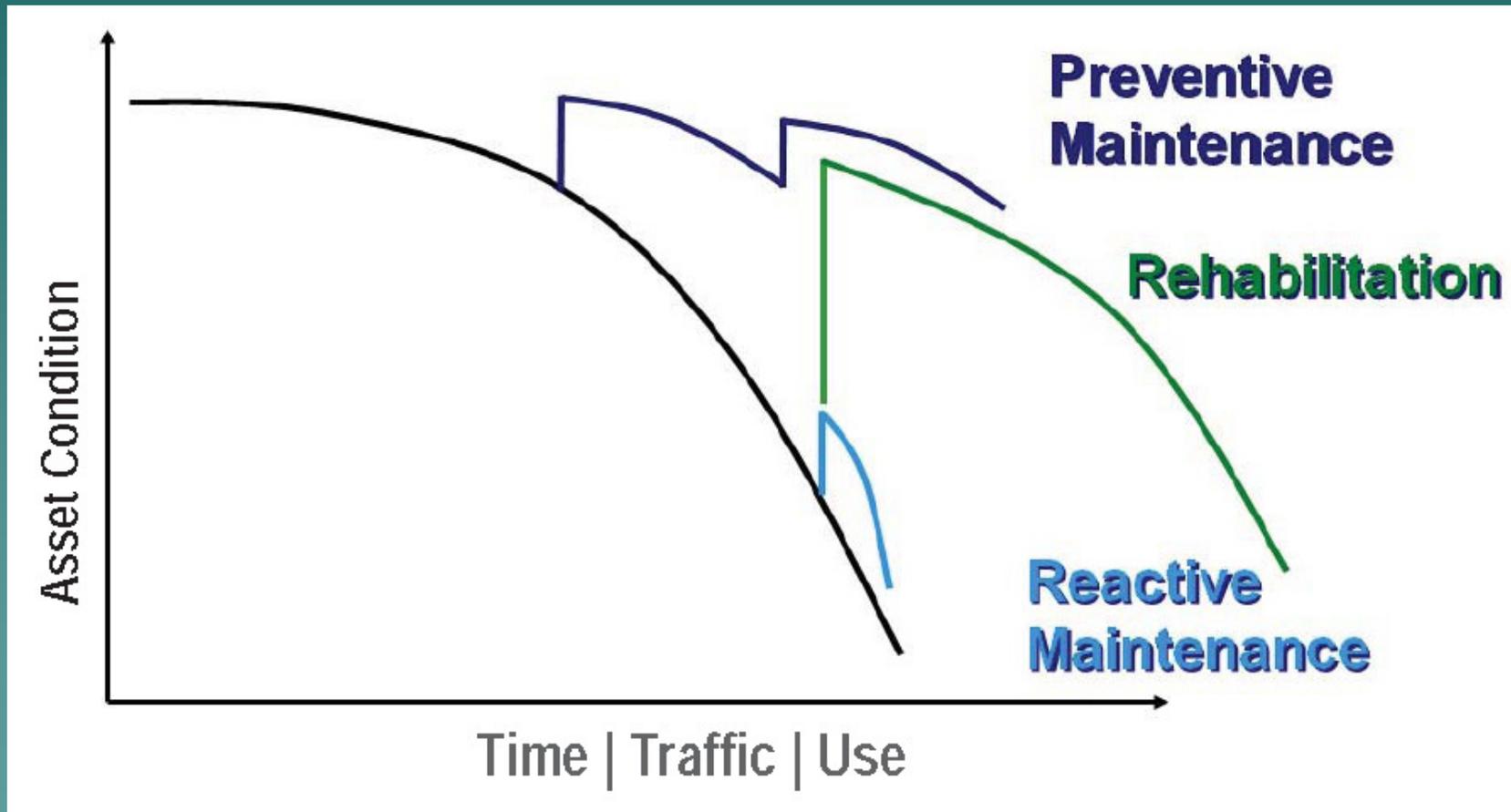
What is the problem?

PERFORMANCE CURVE



What is the problem?

PERFORMANCE CURVE WITH IMPACTS



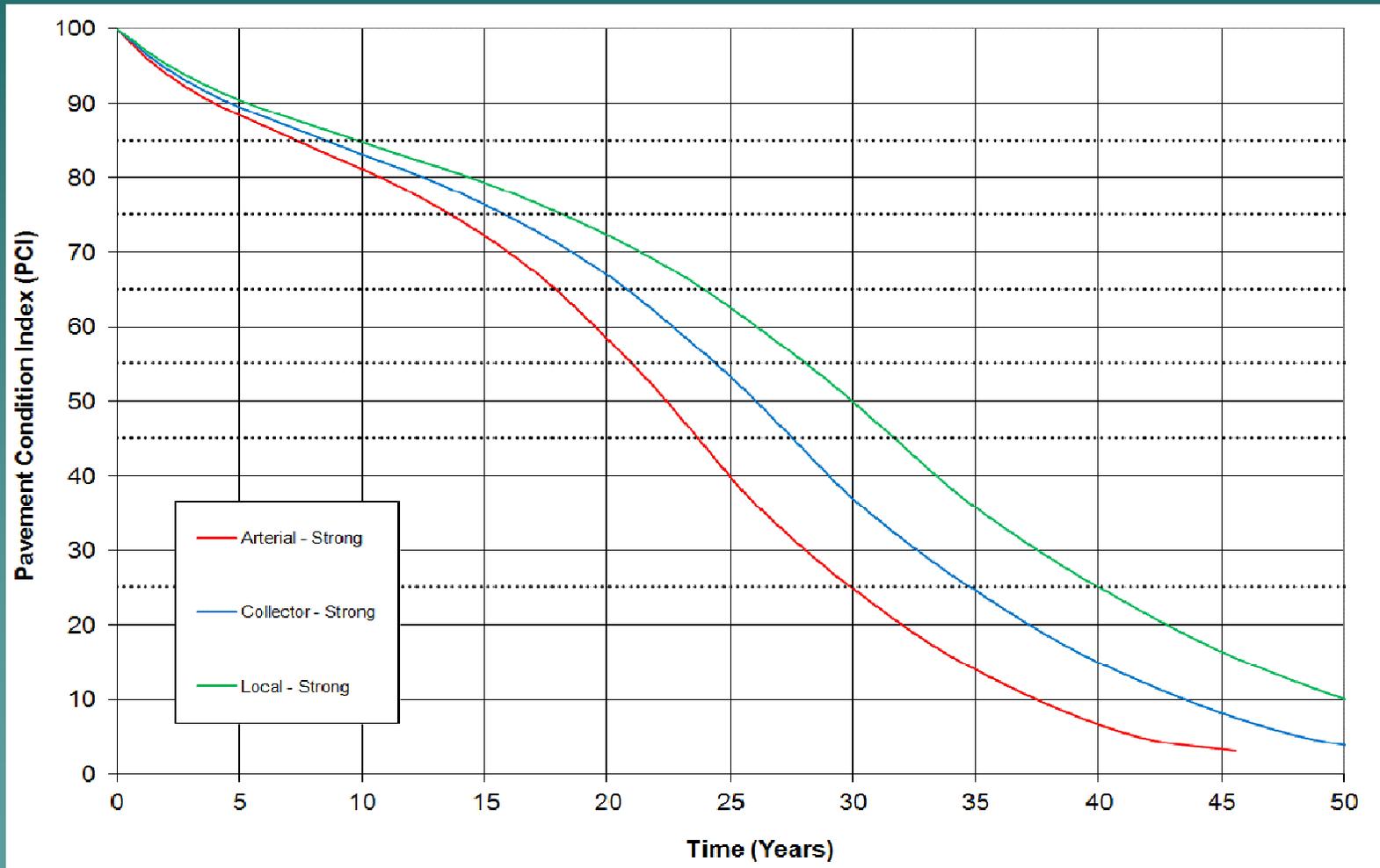
Deterioration Curve

What is the problem?

- ◆ Key to good pavement management: applying the right maintenance treatment to the right road at the right time
- ◆ Asphalt Maintenance (frequency) (cost)
 - Joint and Crack Sealing (3-5 years) (\$0.75/sy)
 - Microsurfacing (6-10 years) (\$5.00/sy)
 - Mill and Inlay (12-34 years) (\$12.00/sy)
 - Patching (depending on the need)
- ◆ Concrete Maintenance (cost)
 - Rehab / Panel Repair (\$75/sy)
 - White Topping (\$50/sy)
 - Diamond Grinding (\$5/sy)
 - Patching (depending on the need)

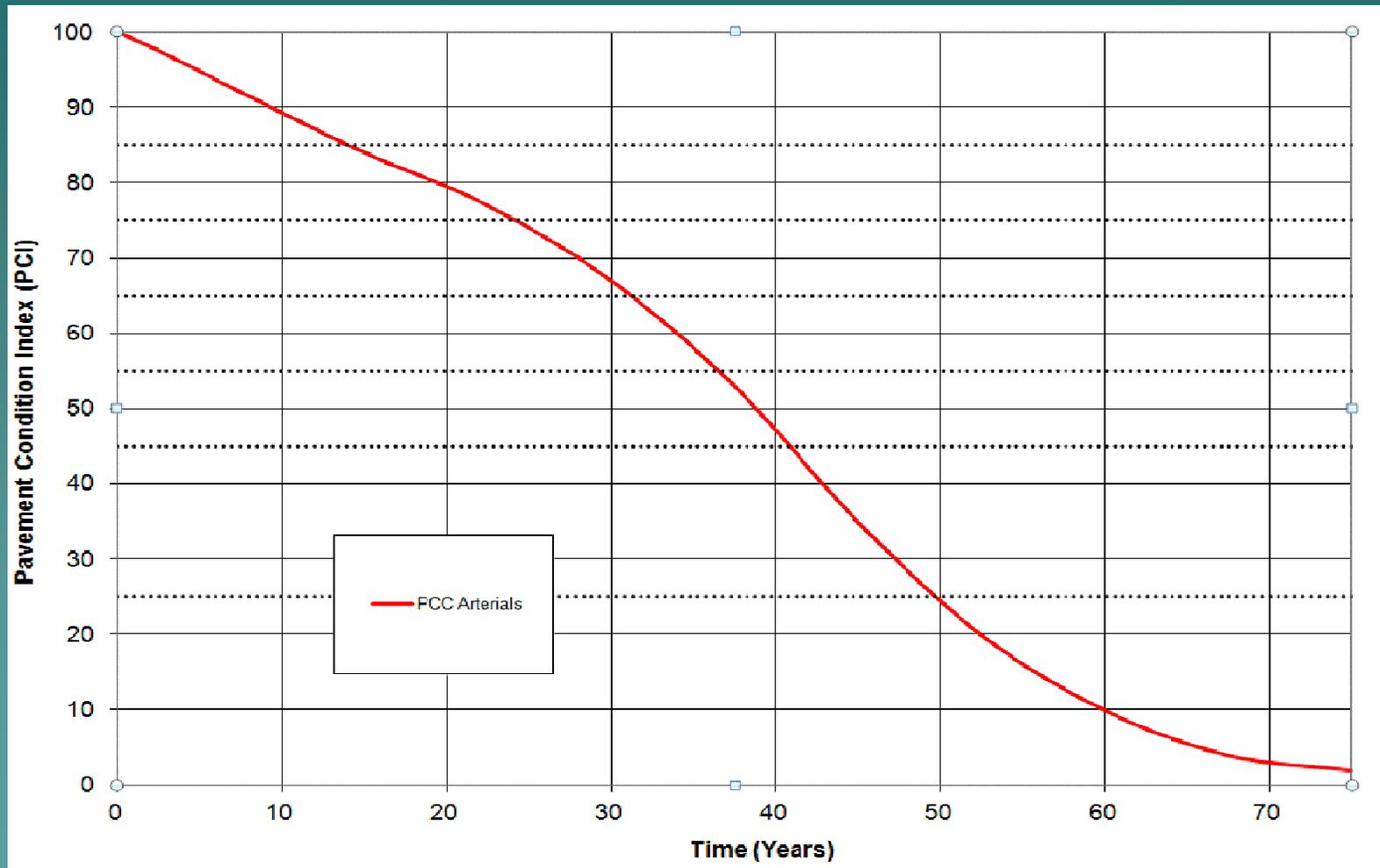
Performance Curves

Asphalt performance curves for Hays



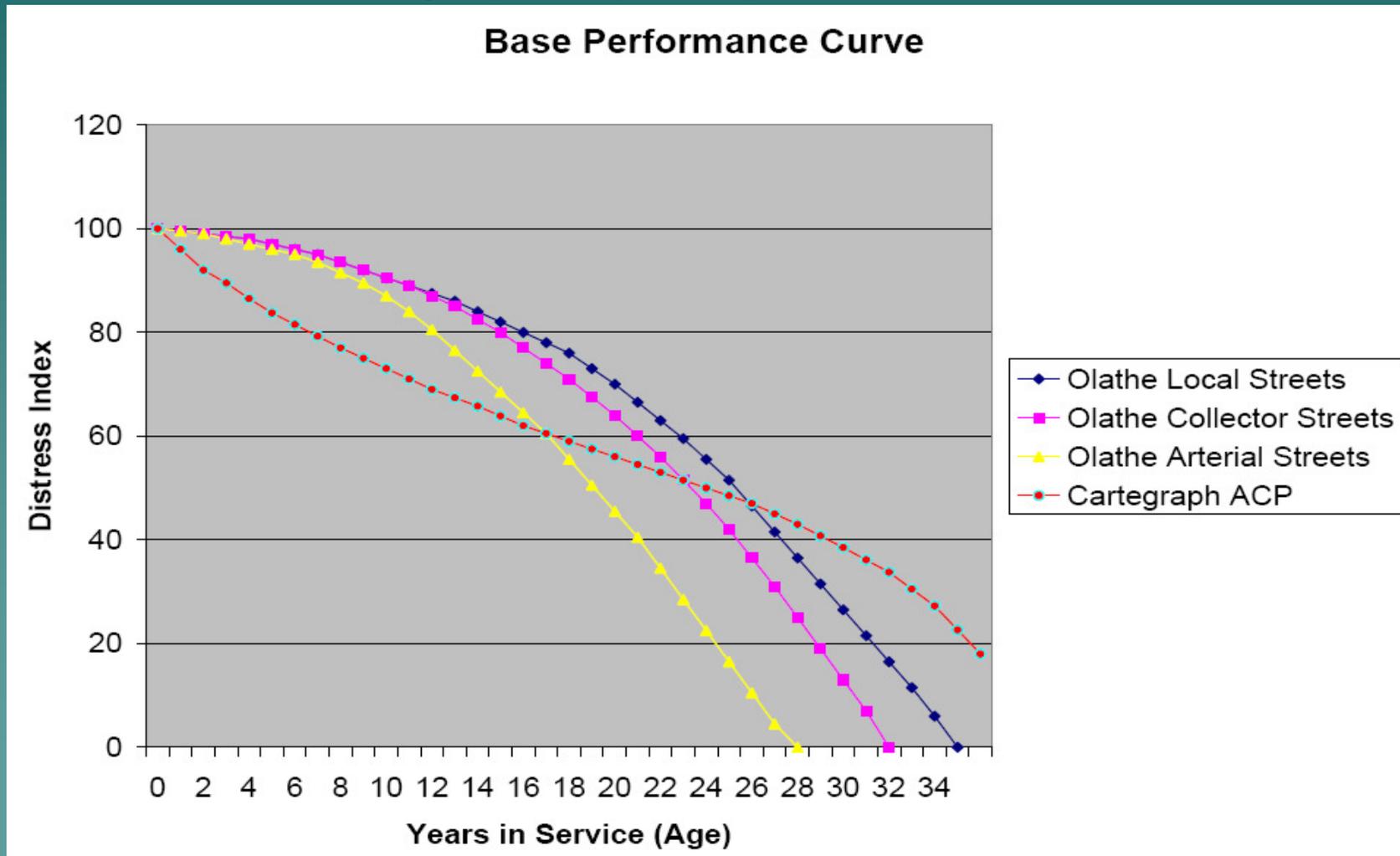
Performance Curves

Concrete performance curve for Hays

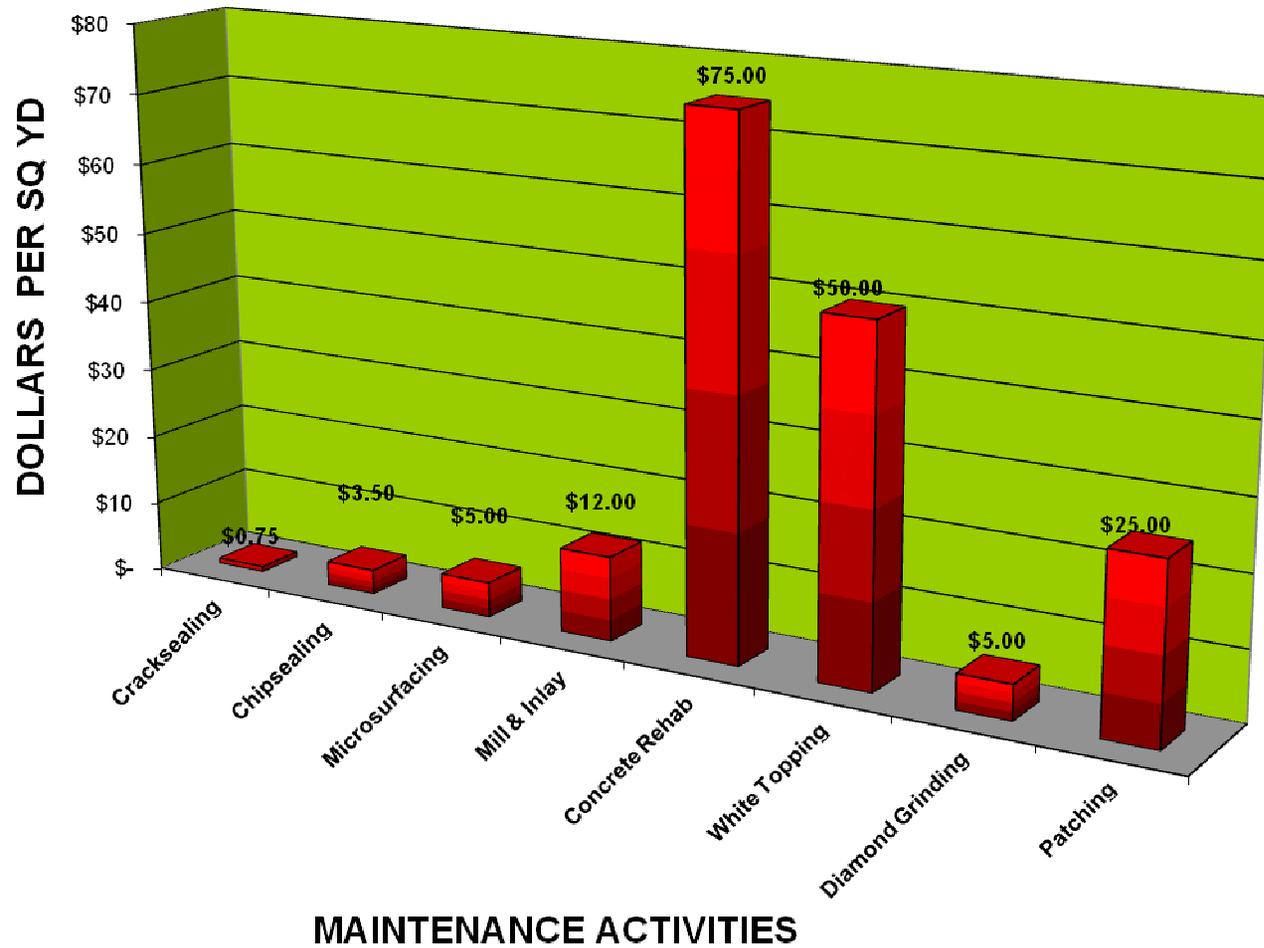


Performance Curves

- ◆ Olathe vs Cartegraph Asphalt performance curves



MAINTENANCE COSTS PER SQ YD



Maintenance Activities

Currently used in Salina

Crackseal (asphalt pavement only)

Micro surfacing

Mill & inlay

Asphalt overlay (no curbs to match)

Concrete patching

Concrete diamond grinding

Concrete white topping

Not Yet Used in Salina

Chip sealing

Fog Sealing

Cold-In-Place Recycle (CIPR)

Hot-in-place recycle (HIPR)

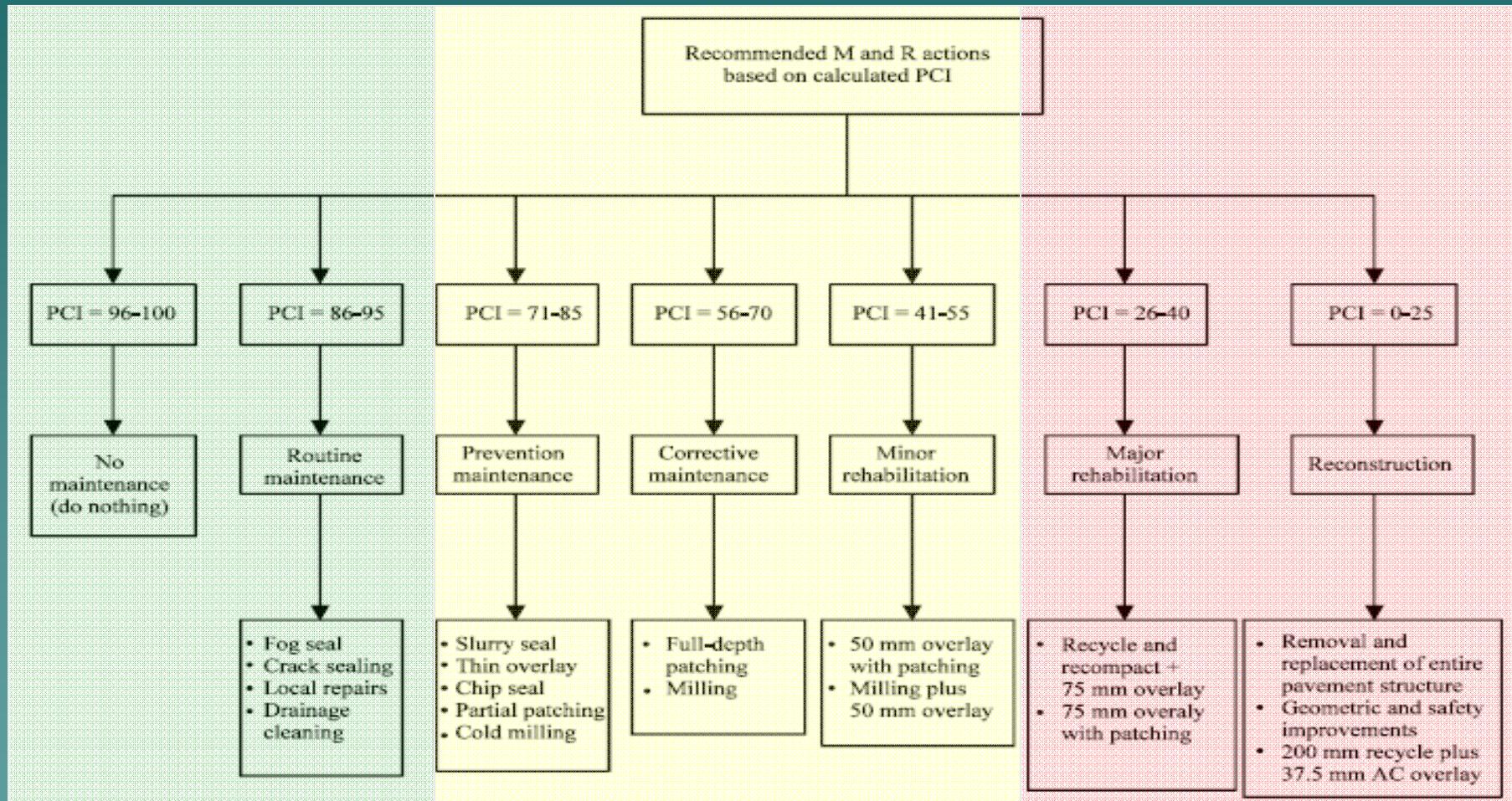
Slurry Sealing

Ultrathin bonded asphalt overlay

Maintenance Activities

- ◆ IF PCI = X then do Y
- ◆ Typical scenario is:
 - Perform Microsurface when PCI is 70-85
 - Perform Mill & inlay when PCI is 50-70
- ◆ These treatments result in a PCI impact or increase as follows:
 - Microsurface impact is at least 20%
 - Mill & inlay impact is at least 75%
 - Reconstruction impact is 100 absolute

Maintenance Activities



Maintenance Impacts

<u>Activity</u>	<u>Olathe's PCI Impact</u>	<u>Salina's PCI Impact</u>
Crackseal	10%	10%
Micro surfacing	15%	20%
Mill & Inlay	98 Absolute	75%
Concrete Rehabilitation	100 Absolute	100 Absolute

Crack Sealing



03/17/2011 11:02

Microsurfacing



Mill & Inlay



10/10/2011 11:01

Mill & Inlay



Concrete Pavement Repair



Concrete Diamond Grinding



Current Approach

- ◆ Public Works current approach to pavement maintenance
 - Current CIP budgeting of projects
 - ◆ City Finance establishes available funding
 - ◆ City Commission approves priorities and gives direction
 - ◆ City staff discusses needs and options and makes recommendations
 - ◆ City Commission approves the CIP projects

Current Approach

- ◆ Prioritization of maintenance
 - Ranking of repairs utilizing last maintenance date and PCI numbers
 - Street classification and/or traffic counts
 - Special situations that require accelerated action
 - Funding (budget limitations)
- ◆ Funding options
 - Special gas tax
 - Sales tax
 - KDOT federal funding (i.e. HSIP, Federal Fund Exchange, etc.)
 - Bonding

Current Approach

- ◆ Street preservation strategies
 - Asphalt Maintenance (frequency) (cost)
 - ◆ Joint and Crack Sealing (3-5 years) (\$0.75/sy)
 - ◆ Microsurfacing (6-10 years) (\$5.00/sy)
 - ◆ Mill and Inlay (12-34 years) (\$12.00/sy)
 - ◆ Patching (depending on the need)
 - Concrete Maintenance (cost)
 - ◆ Rehab / Panel Repair (\$75/sy)
 - ◆ White Topping (\$50/sy)
 - ◆ Diamond Grinding (\$5/sy)
 - ◆ Patching (depending on the need)
 - Street reconstruction (\$100/sy to \$150/sy)

Service Level Options

- ◆ The average annual contract street maintenance sub-CIP budget for the past 5 years has been \$1.87M (includes both asphalt and concrete) and the PW field operations gas tax budget has been \$294,704 (includes concrete and asphalt materials)
- ◆ Other related items funded by gas tax (totaling about \$325,000) that are not directly helping our existing street conditions
 - Railroad crossings (\$100k/yr)
 - Bridge maintenance (\$25k/yr)
 - ADA ramps (\$50k/yr)
 - Arterial sidewalks (\$50k/yr)
 - Curb & gutter repairs (\$25k/yr)
 - Pavement marking (\$25k/yr)
 - Traffic signal related items (\$50k/yr)

Service Level Options

Funding Level I

- ◆ Continue current funding of \$1,870,000 per year
- ◆ Between 2003-2012, \$44,901,562 or 11% of replacement value was repaired assuming a rehab value of \$400,000,000
- ◆ Focused on asphalt arterials and collectors for major asphalt maintenance treatments (mill & inlay, microsurfacing, etc.)
- ◆ Asphalt locals receive crack seal and minor pavement repairs by contractor and PW field operations crews
- ◆ About \$1,570,000 spent on asphalt and \$300,000 spent on concrete streets

Service Level Options

Funding Level II

- ◆ 20% or \$400,000 total increase
- ◆ To maintain the asphalt streets in the Good and Fair condition categories we would need to budget at least \$2.02 M per year for CIP asphalt maintenance projects
- ◆ Continue \$250,000 per year to rehabilitate concrete streets since concrete does not deteriorate as fast
- ◆ Continue the PW field operations gas tax budget at \$300,000
- ◆ The philosophy for maintaining concrete streets is different from asphalt streets because the maintenance is usually not as urgent and is much more expensive
- ◆ Strive to maintain the condition index of our Good and Fair streets
- ◆ Poor streets are addressed through minimal repair such as pothole patching and large patching on a complaint basis by PW field operations personnel

Service Level Options

Funding Level III

- ◆ 80% or \$1,400,000 increase
- ◆ To maintain the asphalt streets in the Good and Fair condition categories and to improve asphalt arterial streets in the Poor condition category we would need to budget at least \$2.8M per year
- ◆ Rehabilitate concrete streets at an arbitrary \$500,000
- ◆ Continue the PW field operations gas tax budget at \$300,000
- ◆ Strive to maintain the condition index of our Good and Fair streets and improve our Poor arterials to the Good condition category

Service Level Options

- ◆ Other funding level considerations
 - 25 miles of asphalt streets are below the Fair Level (9 miles of poor arterials were considered in funding level III above)
 - ◆ The projected cost to upgrade to a level above poor is *\$8,300,000 (based on 25 miles at \$16/sy)*
 - ◆ The cost would be *\$1,660,000* per year spread over 5 years or *\$829,000* per year spread over 10 years
 - 16 miles of asphalt collectors and local streets in Poor category were not addressed in funding levels I – III above
 - ◆ 6 miles of Collectors and 10 miles of Locals
 - ◆ These Streets are drivable now, but vulnerable to deterioration (loss of base integrity with water infiltration)
 - ◆ To improve these streets at \$16 per square yard rehabilitation cost it would cost *\$5,000,000* or *\$1,000,000* annually for 5 years

Service Level Options

- 6 miles of concrete streets are below the Fair Level
 - ◆ The projected cost to upgrade to a level above poor is \$8,170,000 (based on 6.2 miles at \$75/sy)
 - ◆ The cost would be \$1,634,000 per year spread over 5 years or \$817,020 spread over 10 years
 - ◆ These streets are drivable now, not deteriorating rapidly, and can be fixed primarily on a complaint basis for awhile
- 8 miles of Brick Streets would likely fall into the Poor condition category and were not addressed in funding levels I – III above
 - ◆ These Streets are drivable and not deteriorating rapidly
 - ◆ To improve these streets at \$80 per square yard rehabilitation cost it would cost \$13,000,000

Recommendation

Asphalt Arterials (12 Year Maintenance Cycle)			
Maintenance Activity	Maintenance Year	Cost per SY	Years Between Activities
New Asphalt or Mill & Inlay	0	\$ -	
Crackseal	3	\$ 0.70	3
Crackseal	6	\$ 0.70	3
Microsurface	6	\$ 5.00	0
Crackseal	9	\$ 0.70	3
Mill & Inlay	12	\$ 12.00	3
12 Year Total		\$ 19.10	
Total Area Asphalt Arterials	692,349	SY	
12 Year Maintenance Cost	\$ 19.10	\$1.59	per sy/yr
12 Year Maintenance Budget	\$ 13,223,866		
Per Year Maintenance Budget	\$ 1,101,988.83		

Recommendation

Asphalt Collectors (24 Year Maintenance Cycle)			
Maintenance Activity	Maintenance Year	Cost per SY	Years Between Activities
New Asphalt or Mill & Inlay	0	\$ -	
Crackseal	4	\$ 0.70	4
Crackseal	8	\$ 0.70	4
Microsurface	8	\$ 5.00	0
Crackseal	12	\$ 0.70	4
Crackseal	16	\$ 0.70	4
Microsurface	16	\$ 5.00	0
Crackseal	20	\$ 0.70	4
Mill & Inlay	24	\$ 12.00	4
24 Year Total		\$ 25.50	
Total Area Asphalt Collectors	298,342	SY	
24 Year Maintenance Cost	\$ 25.50	\$1.06	per sy/yr
24 Year Maintenance Budget	\$ 7,607,712.50		
Per Year Maintenance Budget	\$ 316,988.02		

Recommendation

Asphalt Locals (34 Year Maintenance Cycle)			
Maintenance Activity	Maintenance Year	Cost per SY	Years Between Activities
New Asphalt or Mill & Inlay	0	\$ -	
Crackseal	5	\$ 0.70	5
Crackseal	10	\$ 0.70	5
Microsurface	10	\$ 5.00	0
Crackseal	14	\$ 0.70	4
Crackseal	18	\$ 0.70	4
Microsurface	18	\$ 5.00	0
Crackseal	22	\$ 0.70	4
Crackseal	26	\$ 0.70	4
Microsurface	26	\$ 5.00	0
Crackseal	30	\$ 0.70	4
Mill & Inlay	34	\$ 12.00	4
34 Year Total		\$ 31.90	
Total Area Asphalt Locals	1,539,016	SY	
34 Year Maintenance Cost	\$ 31.90	\$0.94	per sy/yr
34 Year Maintenance Budget	\$ 49,094,617.5		
Per Year Maintenance Budget	\$ 1,443,959.34		

Recommendation

Asphalt Yearly Maintenance Budget Summary

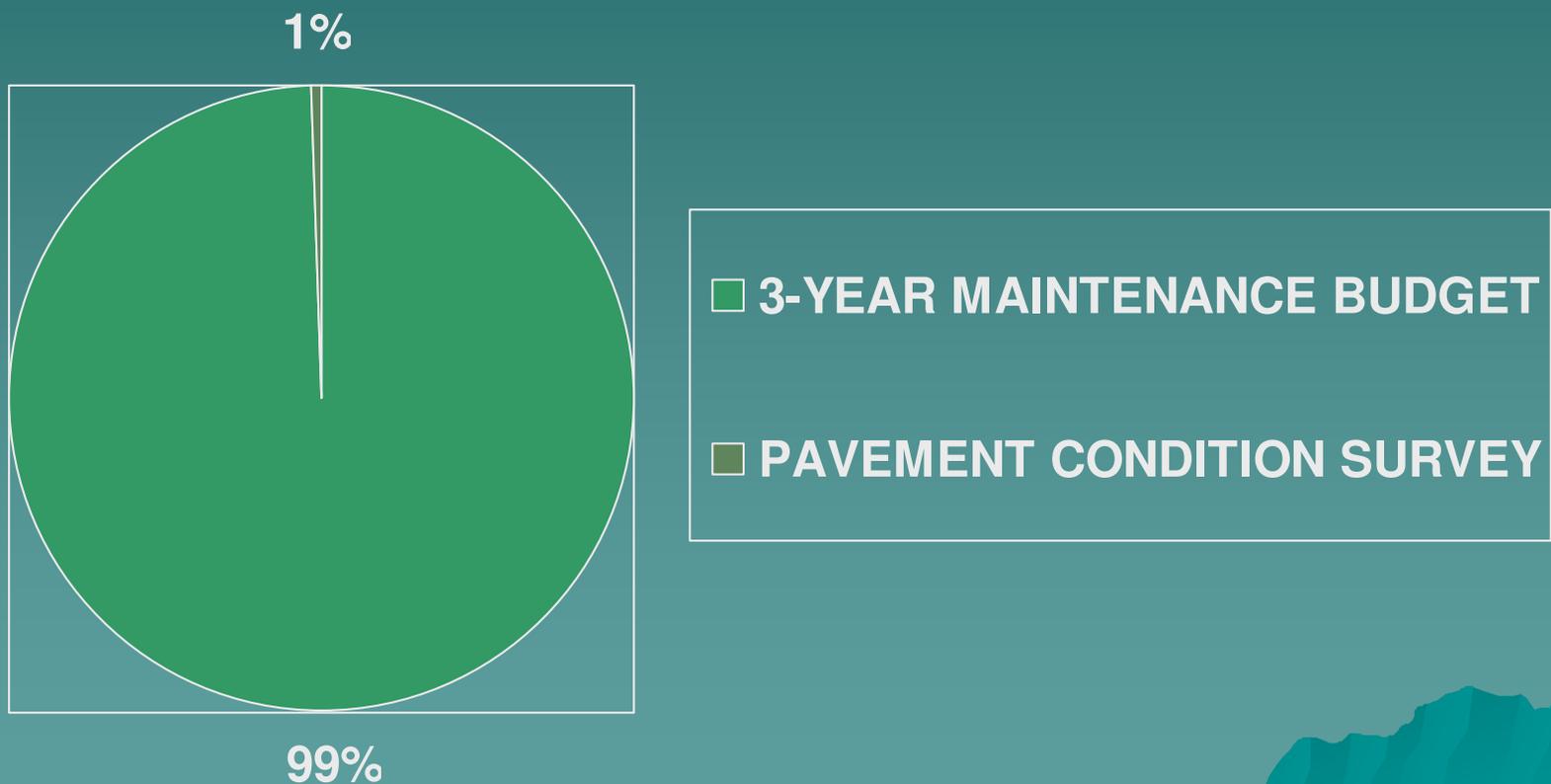
Arterials (12 Year Cycle)	\$1,101,988.83
Collectors (24 Year Cycle)	\$ 316,988.02
Locals (34 Year Cycle)	\$1,443,959.34
Total	\$2,862,936.18

Recommendation

- ◆ Maintain City streets at Funding Level II (20% or \$400,000 increase in spending)
- ◆ Keep the asphalt streets in the Good and Fair condition categories
 - Budget \$2.02 M per year for CIP asphalt maintenance projects
 - Budget \$250,000 per year to rehabilitate concrete streets
 - Continue the PW field operations gas tax budget at \$325,000
 - Add \$1,000,000 for reconstruction or major maintenance on poor streets (all classifications) for a total of \$3,595,000
- ◆ Allow KDOT federal Fund exchange dollars (\$400,000) to be used to help fund this amount

Recommendation

- ◆ Pavement condition survey impact on a 3-year sub-CIP budget



Questions