Preservation Triggers for PMS

Necessary Functionality That is Critical To Successfully Integrate Preservation

Presented by:

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Agenda

- How to Integrate Pavement Preservation into PMS
  - Why Integrate PP into PMS Software
  - Software Functionality
  - Pavement Condition
  - Treatments
  - Decision-Making Framework
  - Optimized Multi-Constraint Scenario Analysis
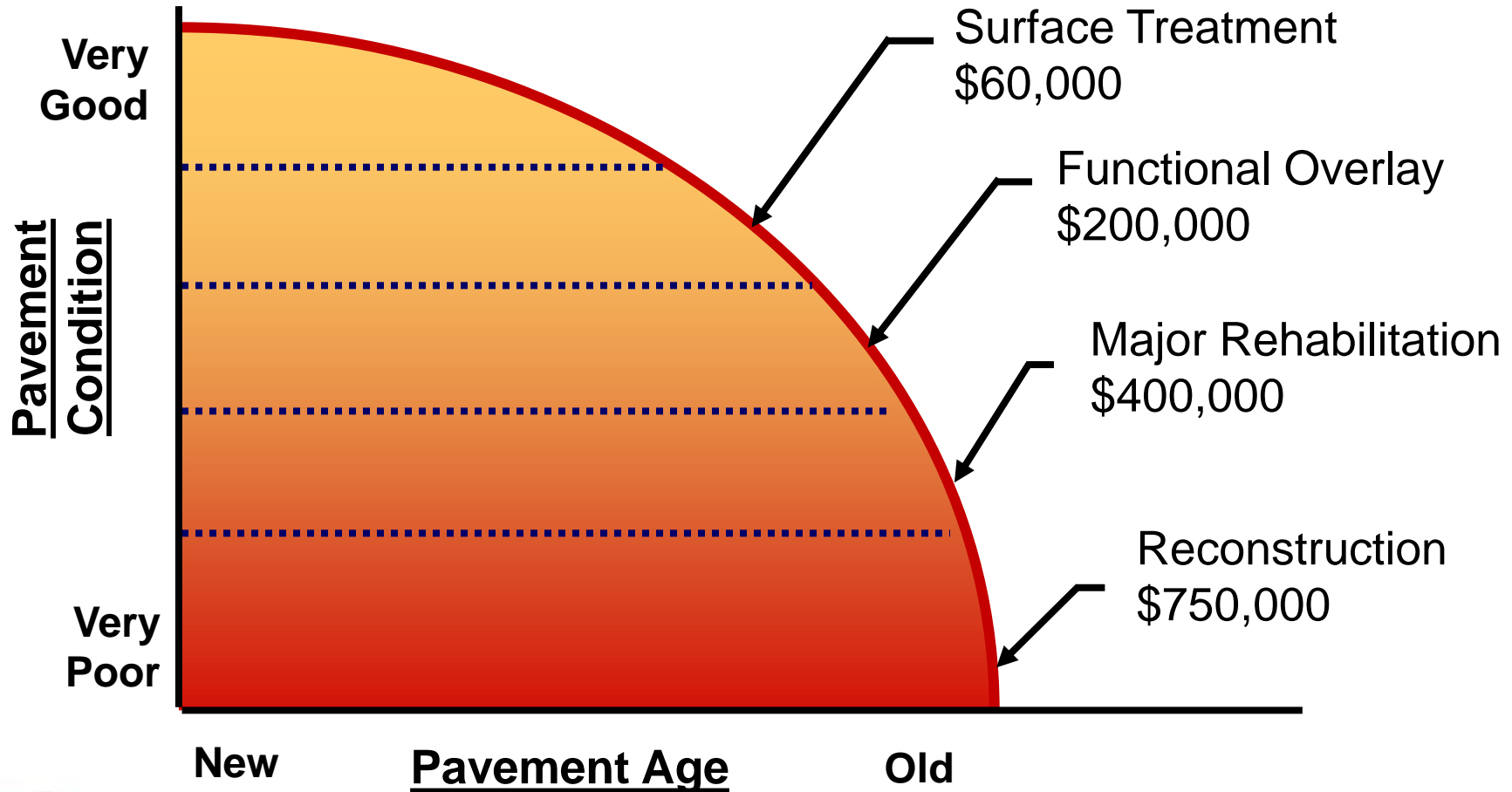 - Integration of PP/PMS into Broader AMS

Why Integrate PP into PMS Software

- Highly Complex Environment
  - Size and Complexity of the Network
  - Many Decision Variables
  - Many Performance Variables
  - Many Constraints

- PMS Software provides:
  - Decision-making Framework
  - Multi-Constraint Optimized Scenario Analysis
  - Reporting Tools

It Does Matter!
Cost of Delaying Maintenance

Pavement Condition (vertical axis: Very Good → Very Poor)

Pavement Age (horizontal axis: New → Old)

Surface Treatment $60,000

Functional Overlay $200,000

Major Rehabilitation $400,000

Reconstruction $750,000

Software Functionality

Well-Informed Decision Makers Require Data/Information

Inventory Data

Condition Data/Indices

Analysis Framework (Trees, Models, etc.)

Optimized Scenario Analyses (What-if's): Budgets and Performance Measures

Integrated Asset Management (CATOA)

Maintenance Management (Day-to-Day)

Condition Data

"The Critical Link"

The Triggers

Condition Data

- How Much is "Just Right"?

- Recommend Severity and Extent
  - Used for More Accurate Current Repair Needs (indices) and Costs
  - Use Distress Types that are "Preservation" Appropriate

- Bottom Line:

  - Sufficient to select the **Most Appropriate** Repair Strategy

    - **Quality, Repeatable** Data Collection Process

Pavement Conditions

Good Candidate?

Too Late

Appropriate Distresses for Preservation

- Consider what is the purpose of Preservation?

- Ride (IRI) ????

- What Distresses should be evaluated?
  - Primary Distresses
    - Transverse Cracking
    - Oxidation/Raveling
    - Block Cracking (???)
  - Secondary Distresses (?)
    - Bleeding, Skid, Longitudinal Cracking

How to Handle Crack Sealing

- **How to Rate Cracks**

  – Sealed or Not Sealed???

  – Type of Cracking (Environmental vs. Structural)

- **Need to Account for "Benefit"**

  – Do You Have Knowledge

    - Improvement in Condition
    - Length of Time

Condition Indexes

The <u>Link</u> between
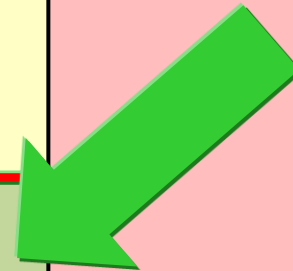
Conditions and Treatments

Indices

- Individual
  - Specific type of distress
    - Fatigue Cracking, **Transverse Cracking**, Rutting, Potholes, **Surface Defects**, etc.

- Combined
  - Focused boarder type of failure
    - Structural, **<u>Environmental</u>**, Functional, etc.

- Composite
  - Reflects the General Health
    - A poor "treatment trigger"

Typical Indices
Individual, Combined & Composite

Individual Index	Combined Index	Composite Index
Alligator Cracking	**Structural Index**	
Edge Cracking		
Patches/Potholes		
Transverse Cracking	**Environmental Index**	**Composite Index** (PCI, PSI, OCI, etc.)
Block Cracking		
Oxidation/Raveling		
Bleeding	**Functional Index**	
Skid		
Rutting		
Ride		
Condition/Treatment	**Treatments**	**"Health"/Benefit**

Treatments

"The Toolbox"

Utilize the Entire Tool Box

There is a most Cost-effective Treatment
for every combination of Distresses

Preservation Treatments

- Fog Seals

- Sand Seals

- Chip Seals

- Slurry Seals

- Micro-Surfacing

- Cape Seals

- Ultra-Thin Bonded Overlays

- Thin HMA Overlays/Inlays

- CIR/HIR

Question

- Should Individual Treatments be selected in a Network-Level Scenario Analysis???

- Typically not enough data/indices to select "specific" treatments

  – Utilize Repair Categories

    - "<u>General</u>" Groups of Treatments

Decision Variables

For Building Decision Trees

Decision Variables

No. o...

HMA
OGFC
...omposite

Questions:

Do You Have the Data?

What are the Decision Rules?

Does it Matter?

Environmental
Geographic
Available Resources

Traffic
Functional Class
Speed Limit

Condition vs. Repairs

Routi... ...g

Preservation Candidate

Some Prep Work Of Course

Decision Trees

Purpose:

Select the Most Cost-Effective Treatment

Small City
Decision Tree - Composite Index Using "PCI"

Composite Index:

- Selects a Treatment to address the "General" Condition

Flexible

PCI $\geq$ 80

Monitor

80 > PCI $\geq$ 60

Surf Coat (PM)

60 > PCI $\geq$ 40

Rehabilitate

PCI < 40

Recon.
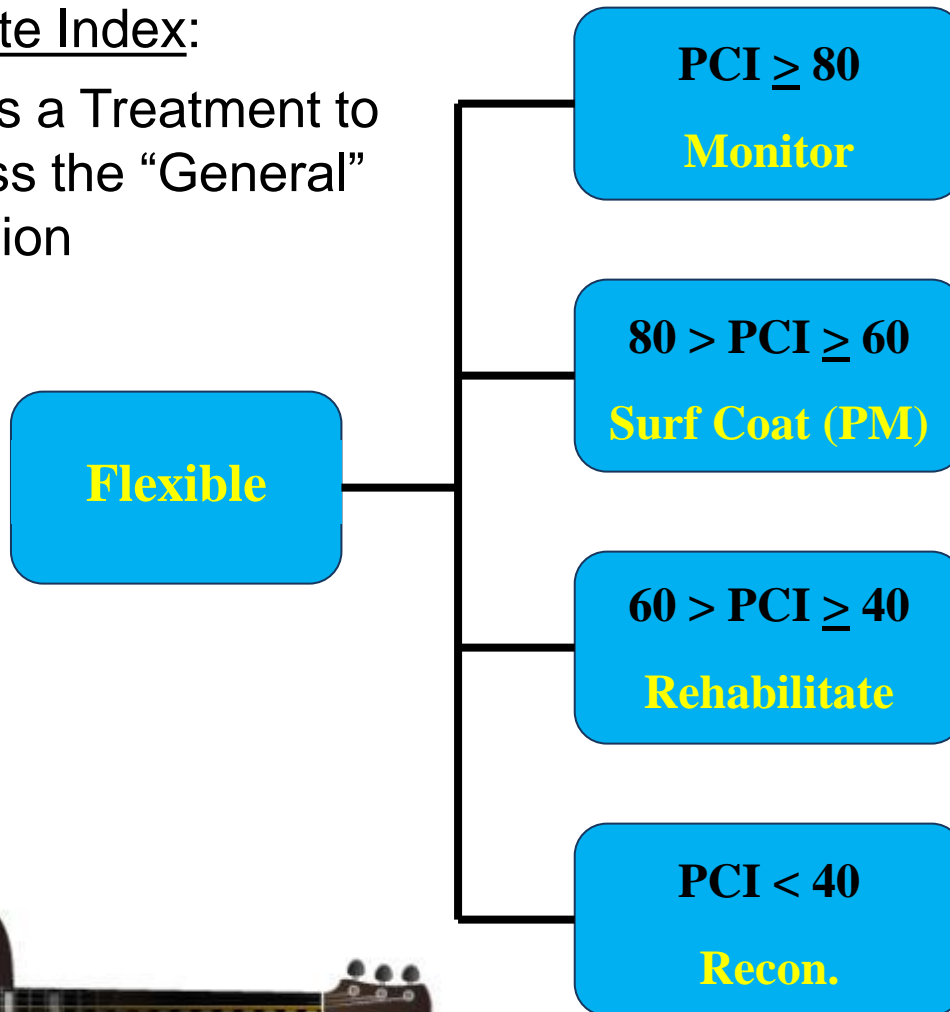
Question:

Is a "60 to an 80" a good PM Candidate?

???????

A County
Decision Tree – Environmental Index

- Transverse Cracking
- Block Cracking
- Oxidation/Raveling

```
WMA ── Functional Class 1 ──┬── EI < 30 CIR/Major Rehab
                            ├── EI 30 - 60 Minor Rehab
                            ├── EI 60 - 80 Preventive Maint
                            ├── EI 80 - 90 Crack Seal
                            └── EI 80 - 90 Monitor
```

EI < 30 CIR/Major Rehab

EI 30 - 60 Minor Rehab

EI 60 - 80 Preventive Maint

EI 80 - 90 Crack Seal

EI 80 - 90 Monitor

WMA

Functional Class 1
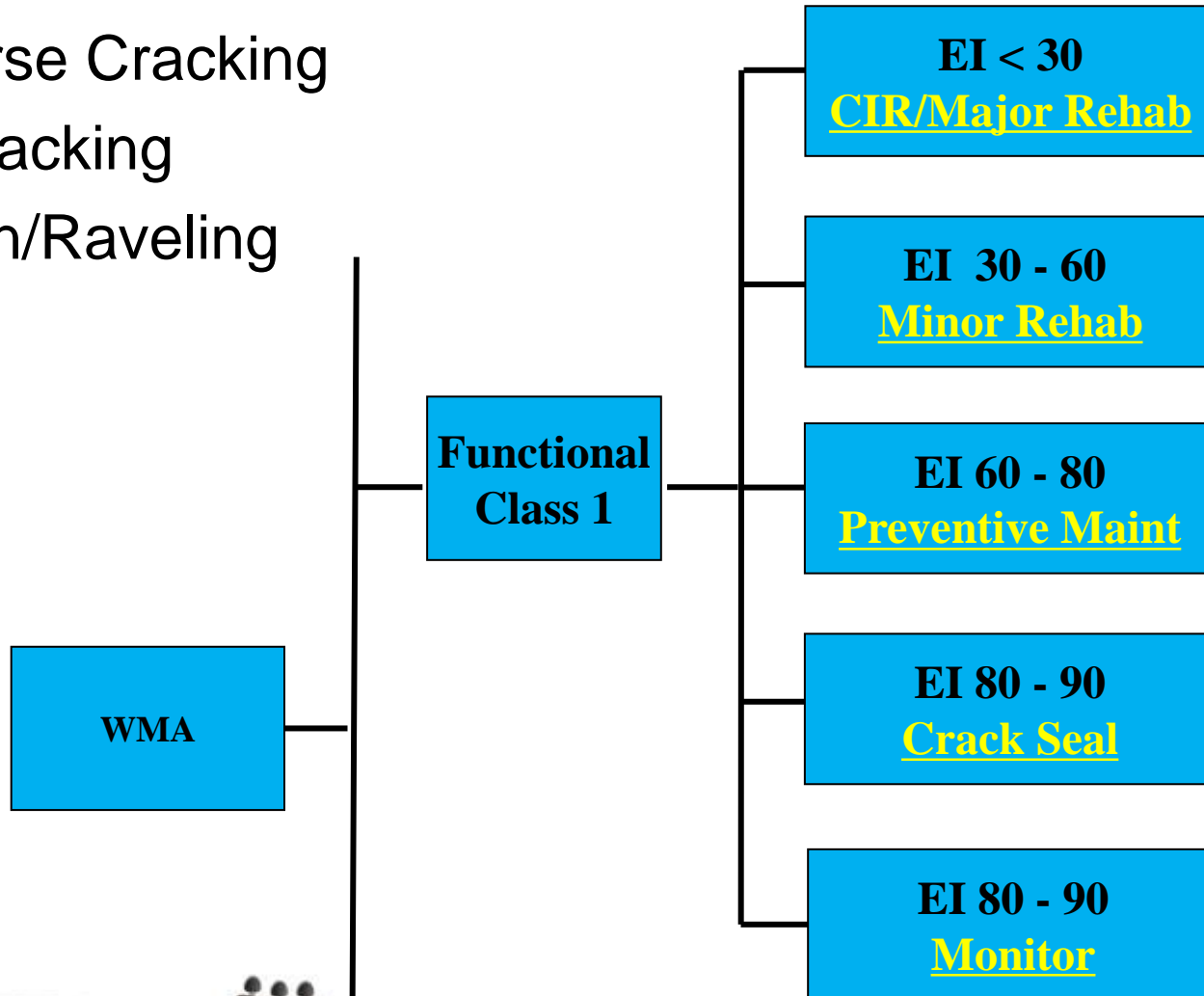
State DOT
Age Based Tree w/ Treatment Counters

Performance Class (Models) Variables

Performance Class Variables

Truck Traffic
Functional (class)

Subgrade
Drainage
Pavement Structure
Material Issues

Environmental
Geographic

Questions:

Do You Have the Data?

How do the Variables affect Performance?

Does it Matter?

Decision and Performance Variables
A Summary

- Data sufficient to support level of analysis

- Must be available

- Should be:

  – Current

  – Maintained/Updated

  – QA/QC (garbage in, ……)

- Must be justified (simpler the better – "KISS")

User-defined "Other Improvements"

- Condition Reset Rules

- Update Models and Pavement Types

- Exclusion Years

- Priority Codes

- Reset Counters (Age, Treatments)

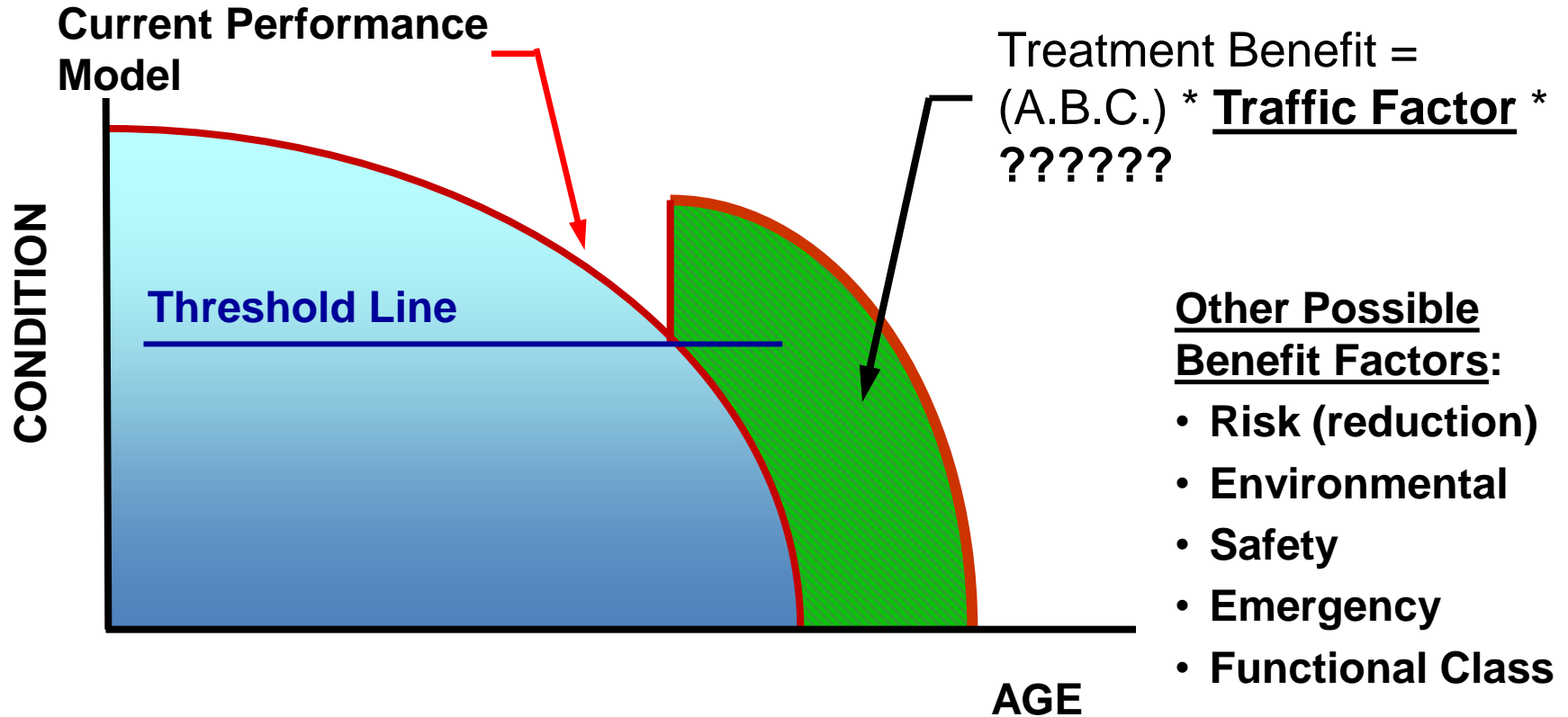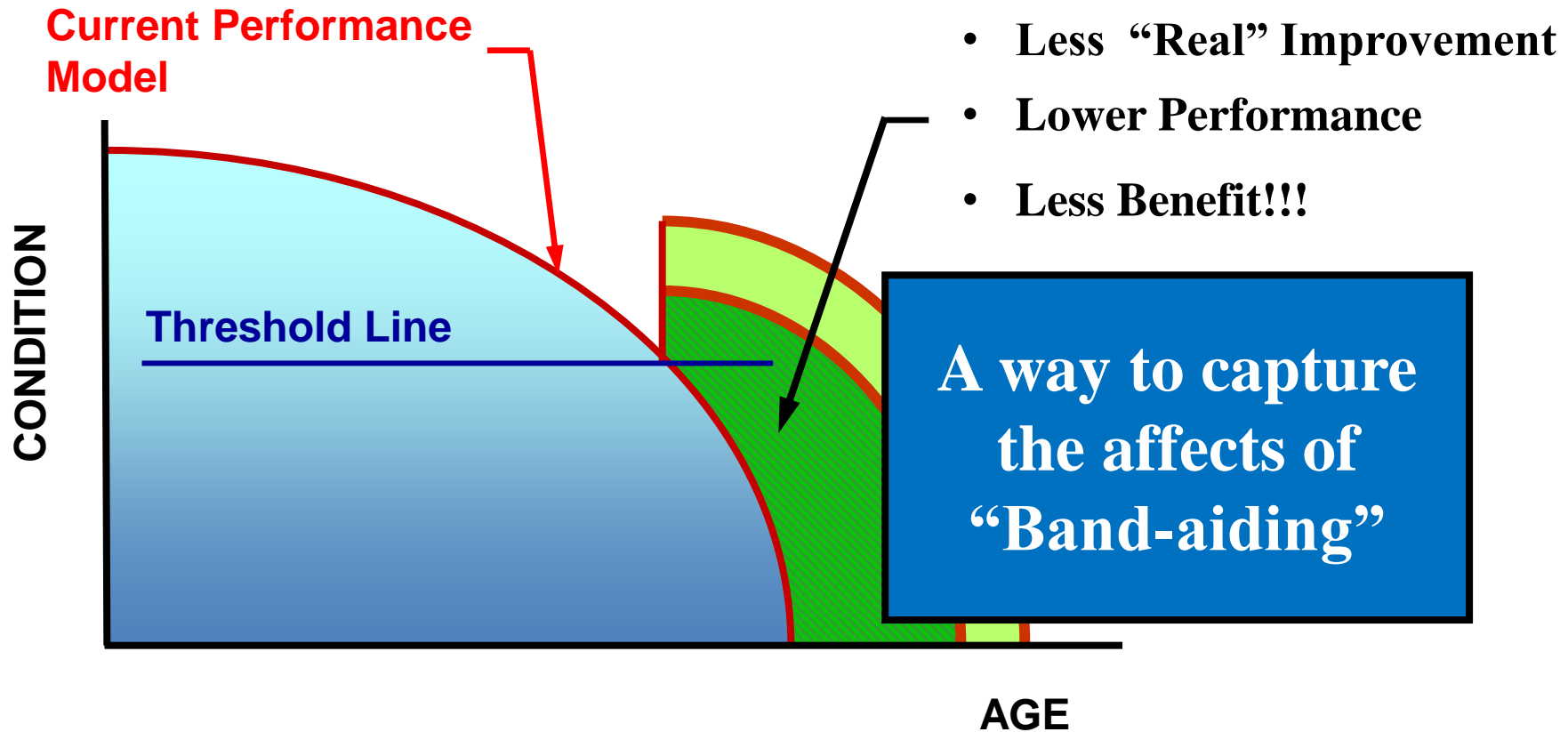"Other Improvements" can greatly affect the selection of Repairs

Benefit

"Benefit" Calculation

With Traffic as an *Additional Factor*

Current Performance Model

CONDITION

Threshold Line

AGE

Treatment Benefit = (A.B.C.) * **Traffic Factor** * **??????**

Other Possible Benefit Factors:
- **Risk (reduction)**
- **Environmental**
- **Safety**
- **Emergency**
- **Functional Class**

"Benefit" Calculation

Should Delay Create Less Benefit ???

Current Performance Model

Threshold Line

CONDITION

AGE

- Less "Real" Improvement
- Lower Performance
- Less Benefit!!!

A way to capture the affects of "Band-aiding"

"Band-Aiding"

- Capture "Lack of Improvement" and Benefit"

- Create a way of tracking "Band-Aids"
  - Better Models
  - Better Decisions
  - MEPDG

- If part of decision-making framework
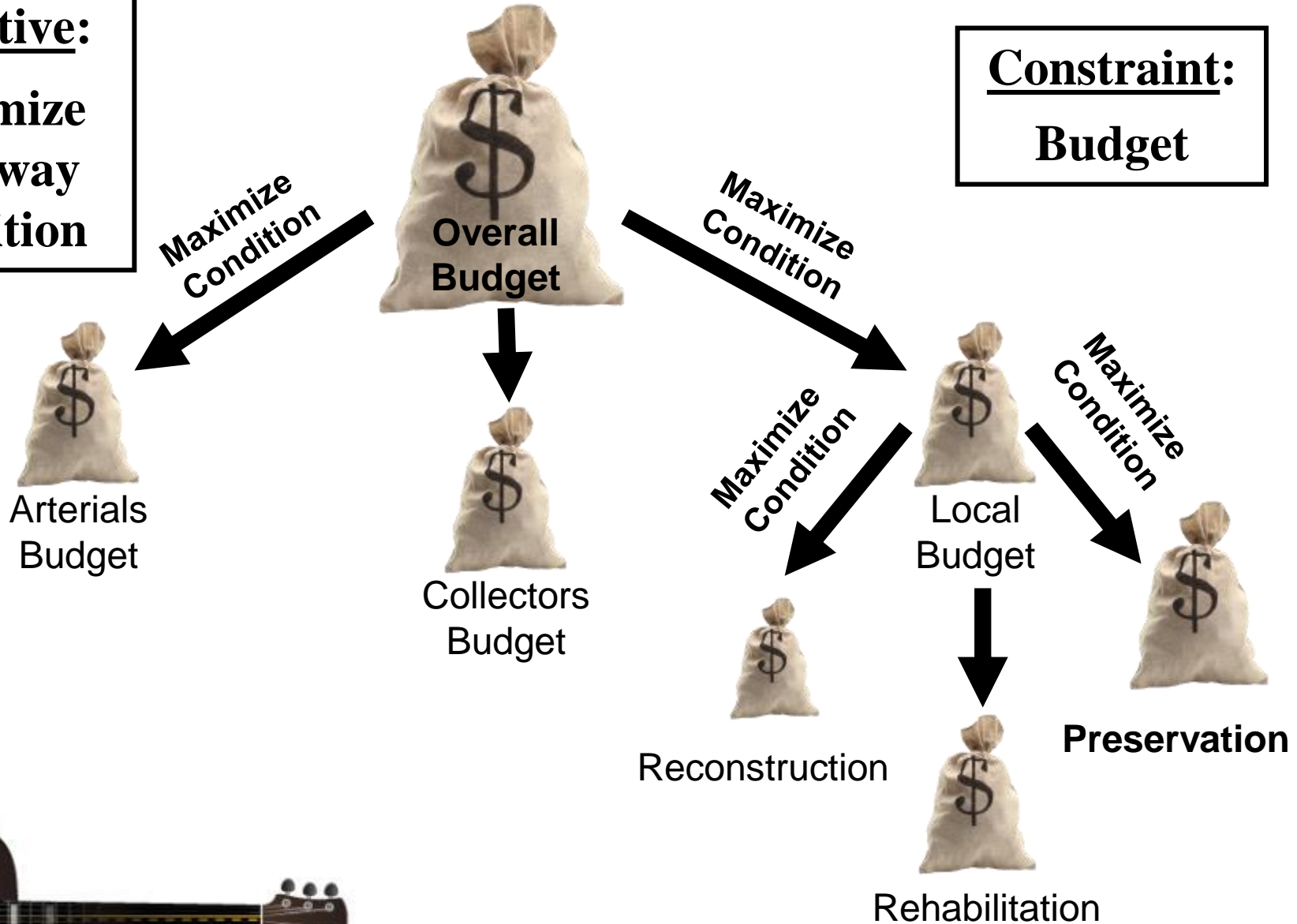 - Analysis can show the damage of Band-Aids

Optimized Multi-Constraint Scenario Analysis

Multi-Constraint Analysis

Objective:

Maximize Roadway Condition

Constraint:

Budget

Overall Budget

Maximize Condition

Arterials Budget

Collectors Budget

Maximize Condition

Local Budget

Maximize Condition

Reconstruction

Rehabilitation

Maximize Condition

Preservation

A Small City

100 Miles of Streets

2009 Budget $1 Million Per Year

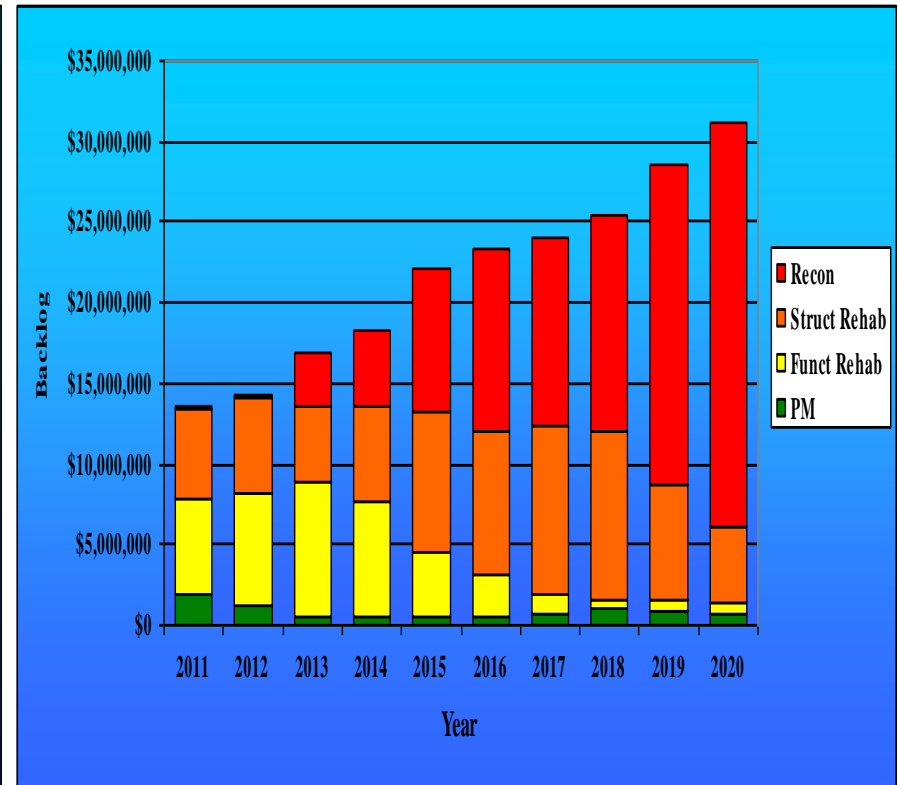**Many Subdivision Streets are 8-15 year age range and needing attention soon**
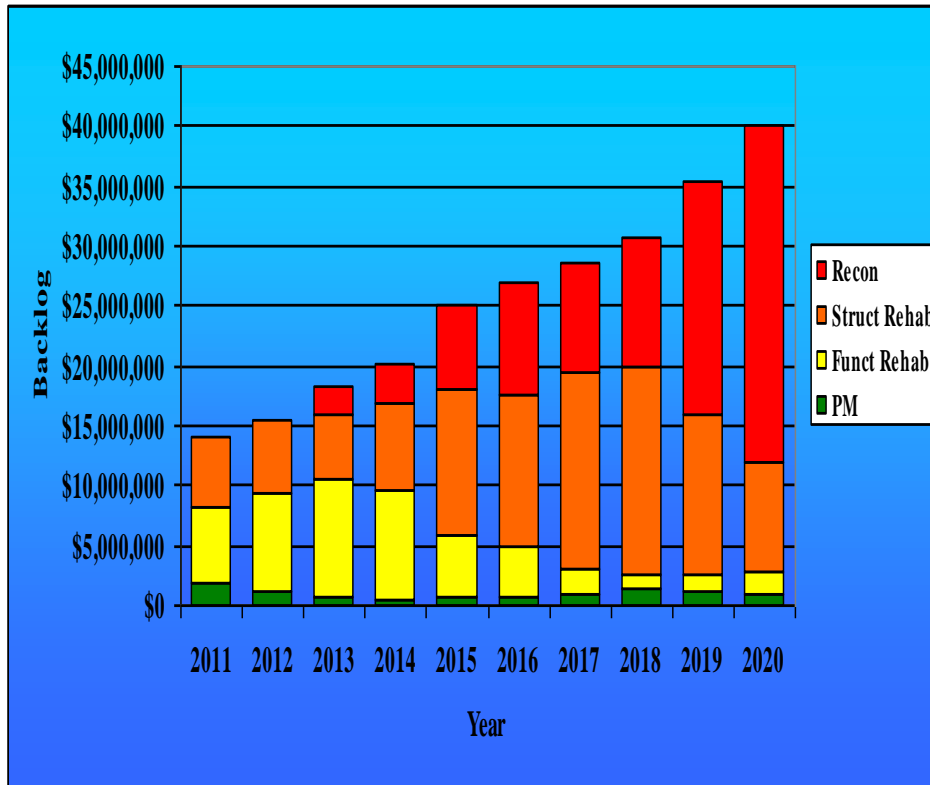
PCI Comparison
Optimized vs. Ranked Priority – Same Budget
10 Year Analysis
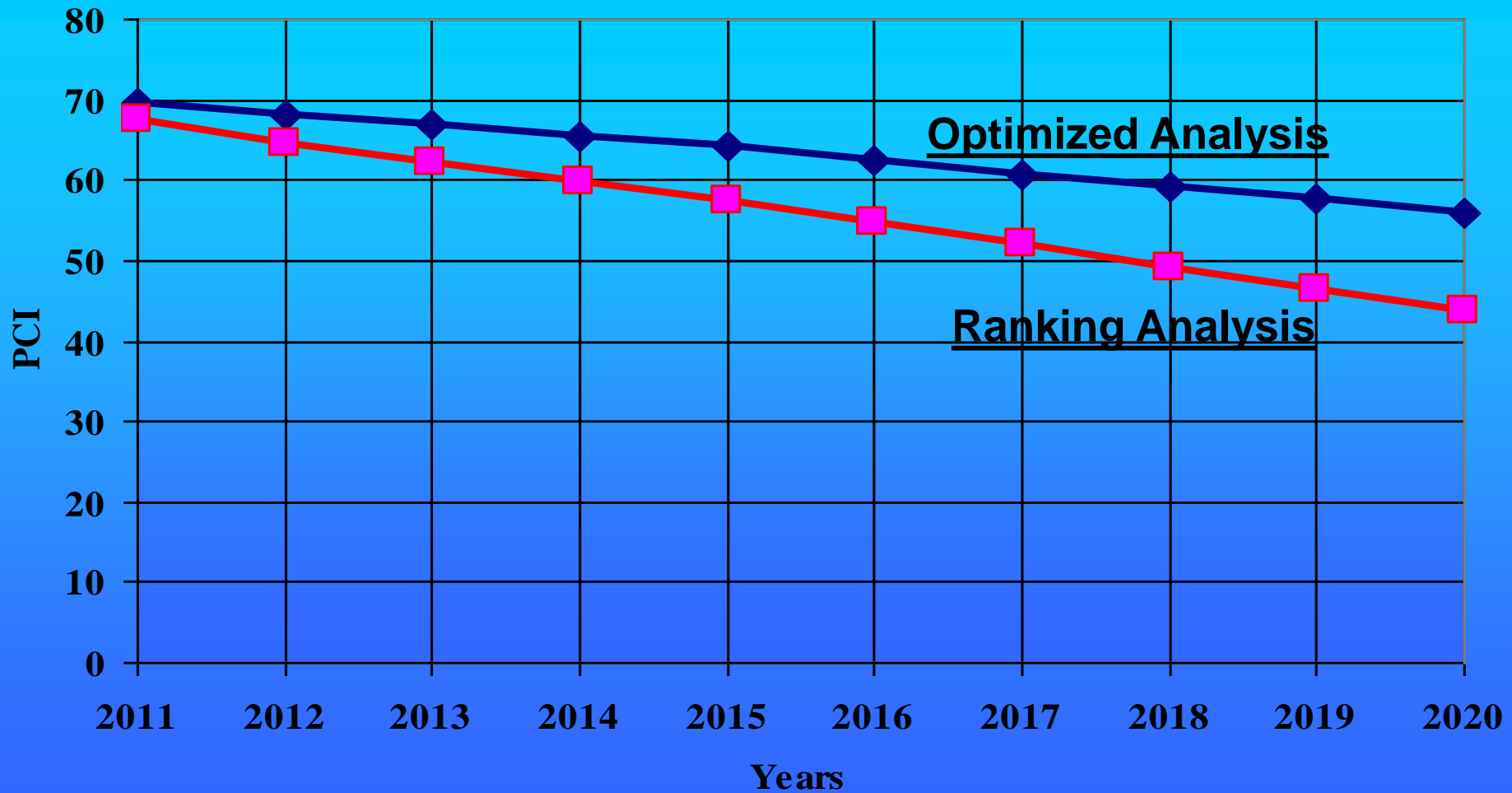
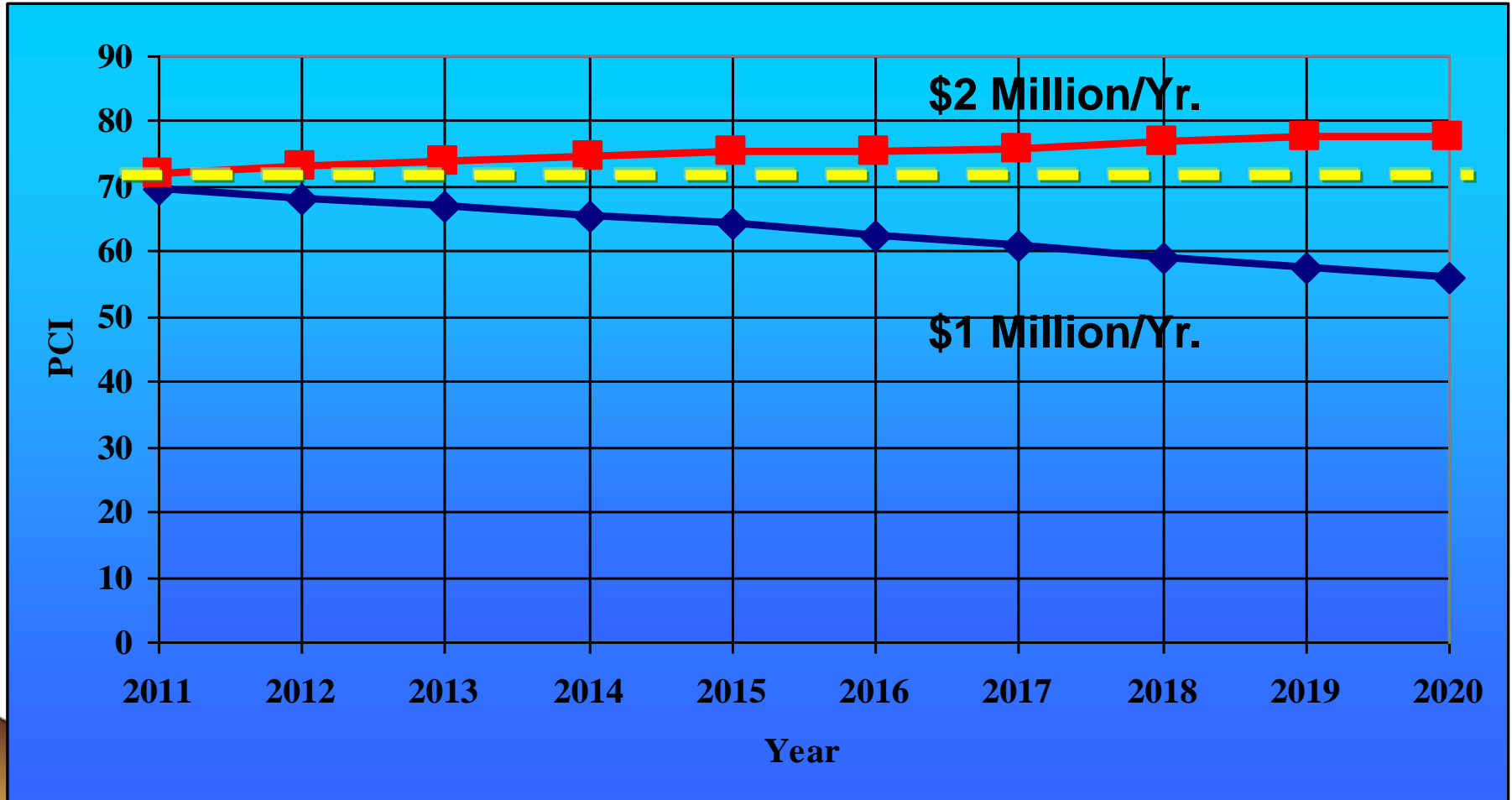# Backlog Analysis – Dollars by Repair Type
10 Year Analysis

Priority Ranking Analysis - $40 Million Backlog

Optimized Analysis - $31 Million Backlog

PCI Comparison – Optimized Current vs. Proposed Budgets 10 Year Analysis
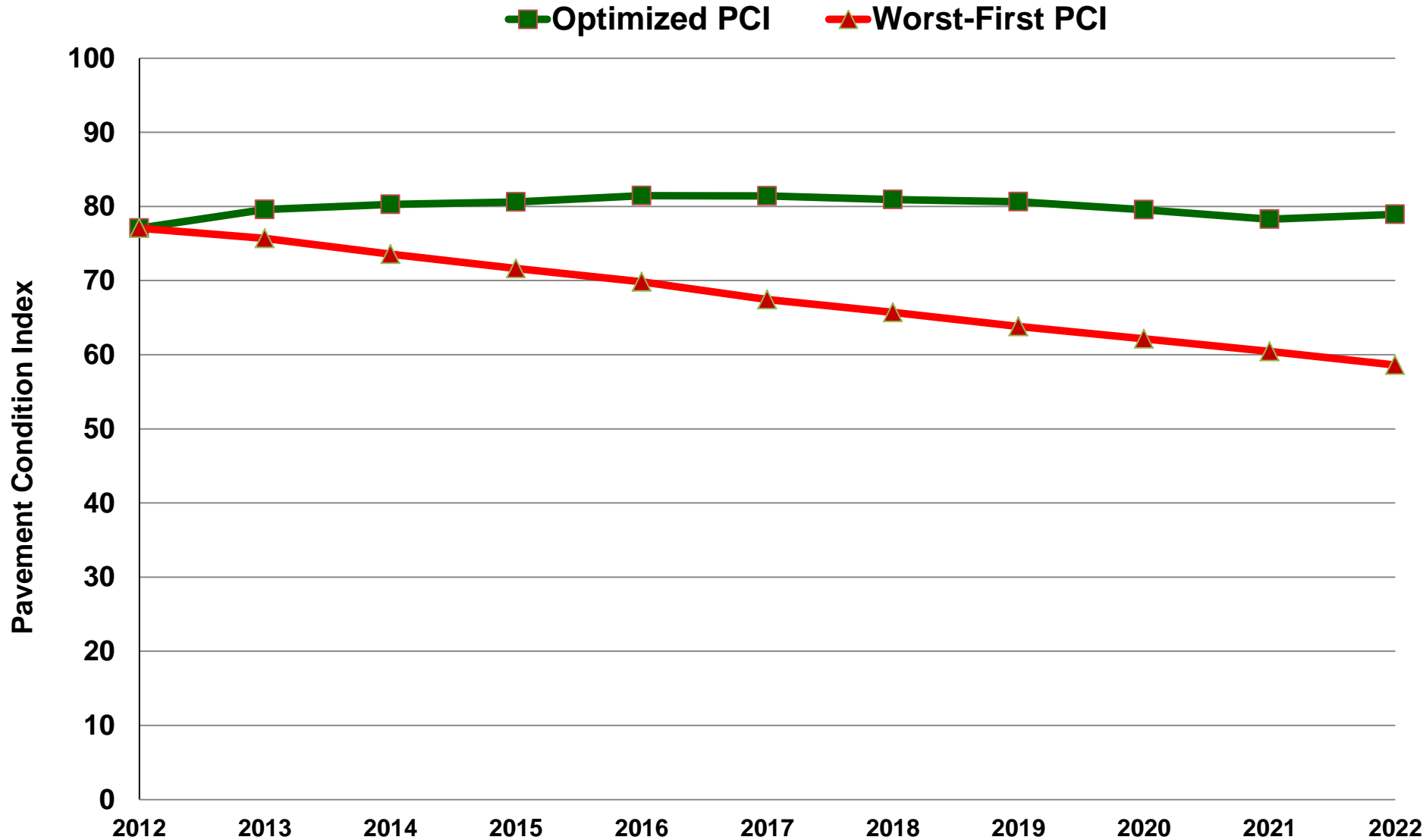
A Moderate-Sized County

1,700 Miles of Roads

Again:

Many Subdivision Streets are 8-15 year age range and needing attention soon
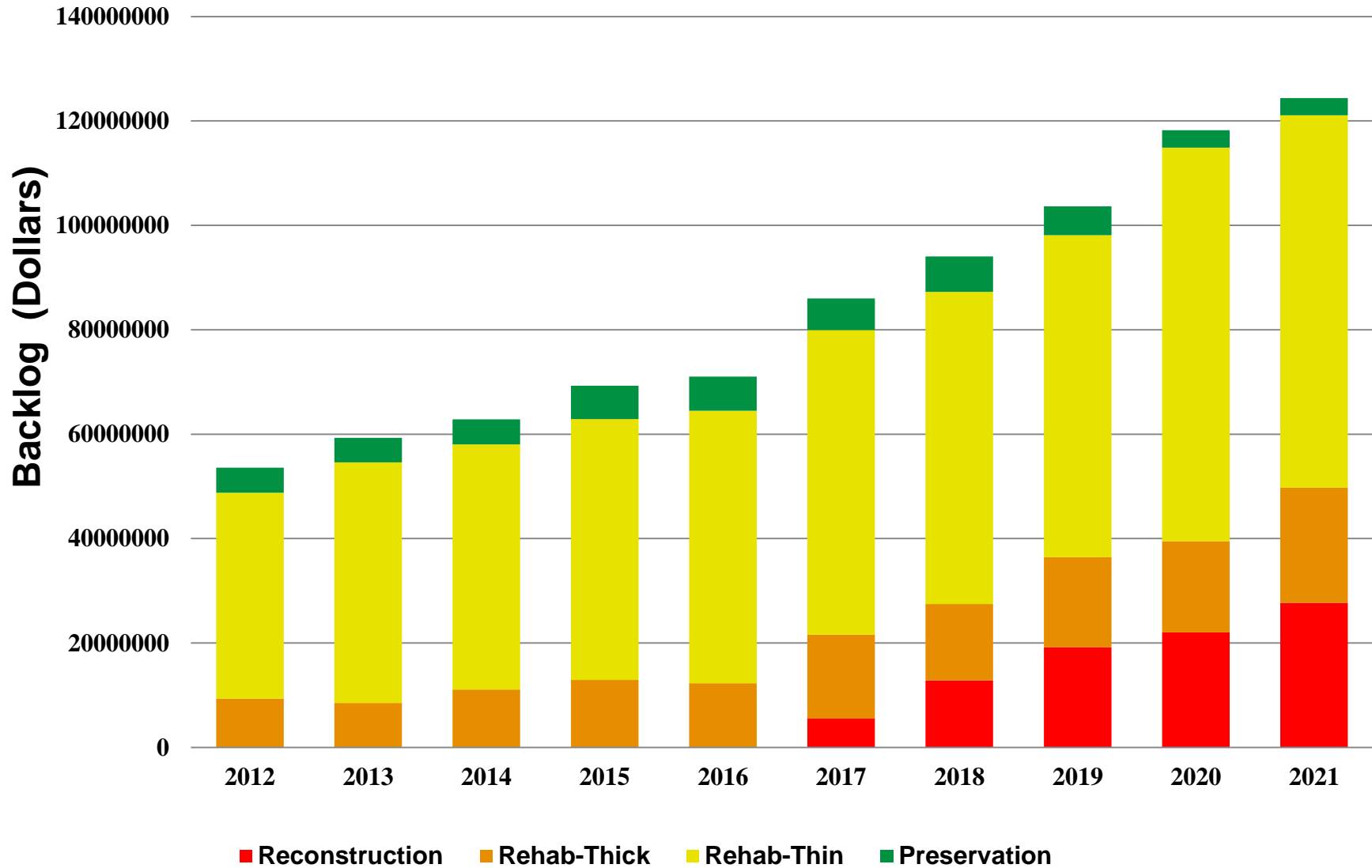
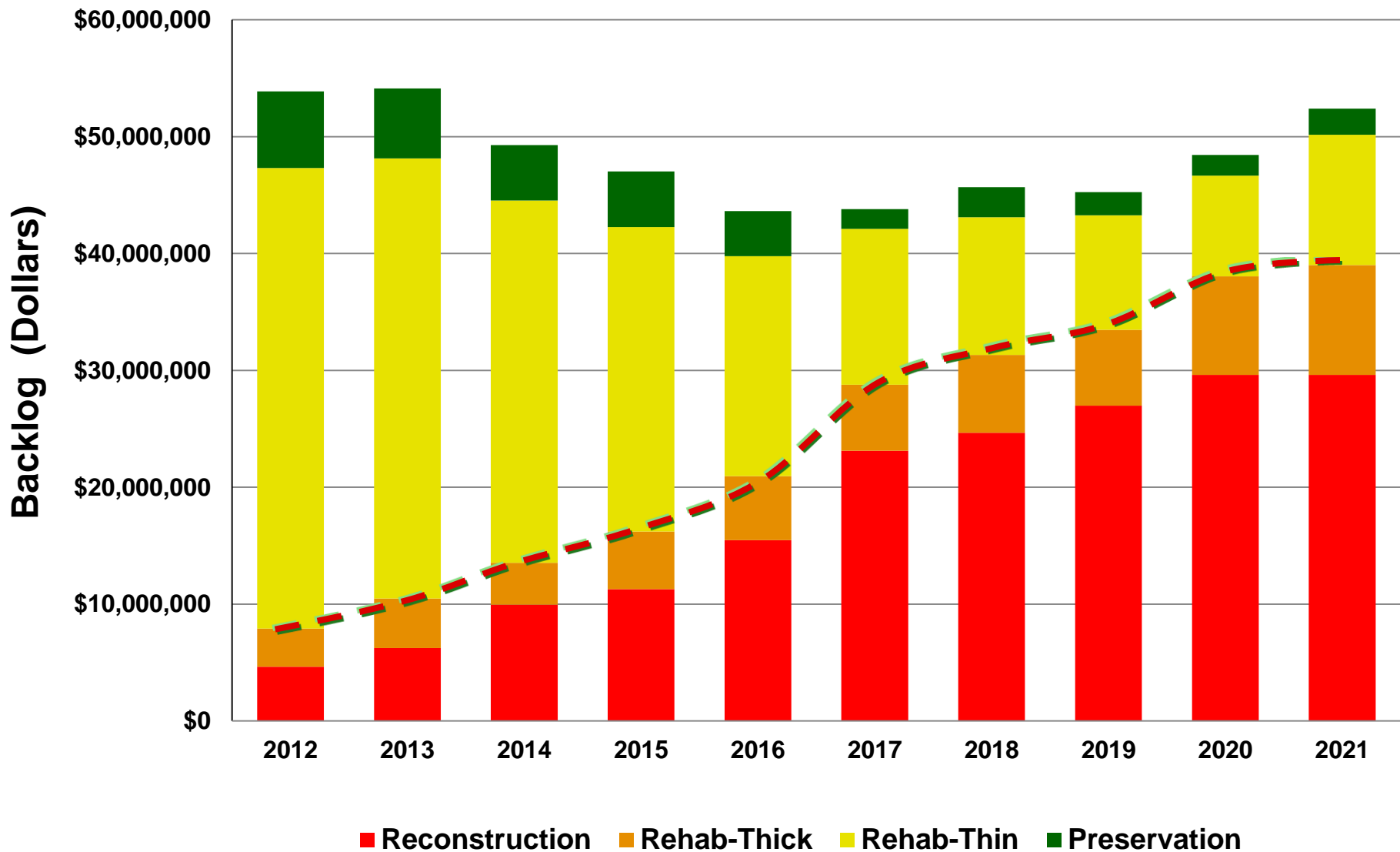PCI Comparison - Optimized vs. Worst-First

Worst-First Analysis
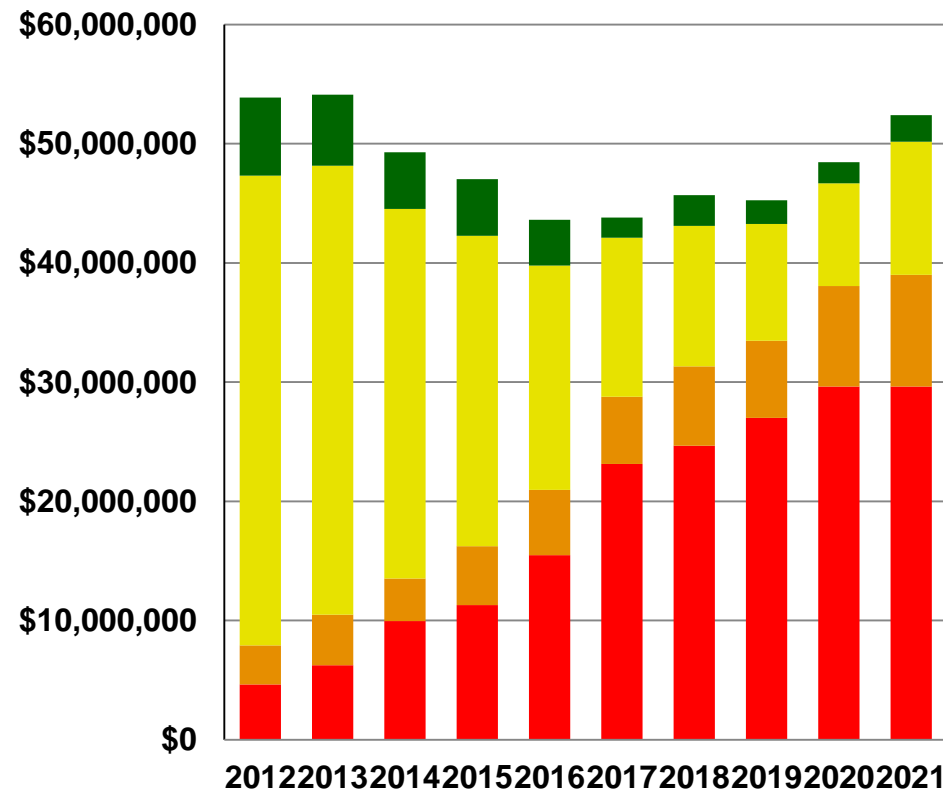## Backlog by Repair Cost & Category

Optimized Analysis
Backlog by Repair Cost & Category

Backlog (Dollars)

$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$0

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

■ Reconstruction ■ Rehab-Thick ■ Rehab-Thin ■ Preservation

Backlog Analysis – Dollars by Repair Type
10-Year Analysis
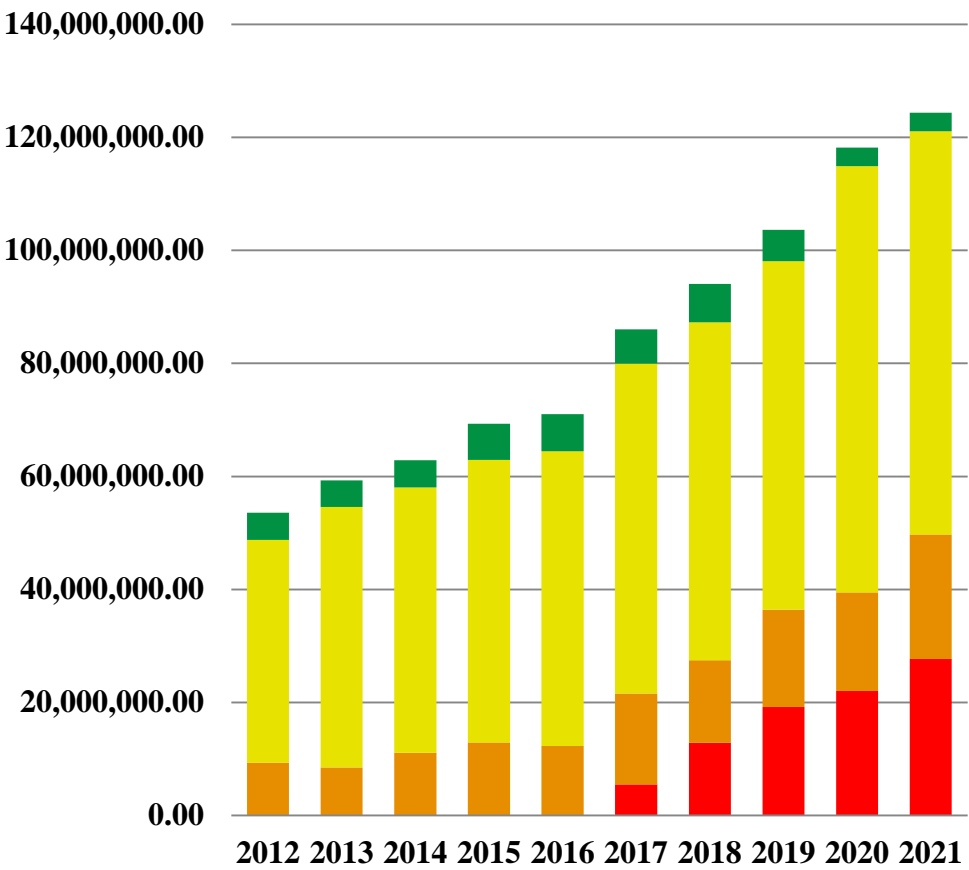
Priority Ranking Analysis - $124 Million Backlog   **Optimized Analysis - $53 Million Backlog**

"Integrated PP" into Pavement Management

- PMS Software is only part of the answer
  - It is a tool to manage the agencies policies and practices

- Doing Things the Right Way:

  - Proper Selection (3 R's)

  - Mix Designs/Pavement Designs

  - Quality Contract Documents

  - Thorough Inspection

    - Prep Work, Calibration, Yields, Materials

Integration of PP/PMS into Broader AMS

Integrating PMS and AMS
A Few Quick Examples

- If Culvert_Condition is "Bad" – Defer Treatments except Maintenance (Patching or Crack Sealing)

- Significant Crack Sealing (MMS) – Improve Index(es) (PMS)

- If "Surface Treatment – 2013" – Do Not Redo Pavement Markings unless it is a Safety Priority

Parting Wordings

Just do It!!!
Get Started Today

Or you may still be talking about Integrating Preservation 10 Years From Now

Something Is Better Than Nothing

No Excuses – The Taxpayers Deserve It

Questions????

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