



Driving Indiana's Economic Growth

## Asset Management Overview

Samy Noureldin, Ph.D., PE  
INDOT Research & Development



## Asset Value in Asset Management

---

- An Asset of \$ 200,000 (House for Example)
- An Asset Value of \$ 20 Billion (Modest Estimation of INDOT Highways)
  - **New Construction – Added Value**
  - **Maintenance, Preservation & Rehab**
  - **Planning, Research & Development**



## Asset Value in Asset Management

- New Construction – Added Value
- 5% Maintenance, Preservation & Rehab
- 0.1% Planning, Research & Development
 

<b>(0.075%)</b>	<b>(0.025%)</b>
-----------------	-----------------
- An Asset of \$ 200,000 (House Example)
 

<b>(\$ 150/yr)</b>	<b>(\$ 50/yr)</b>
--------------------	-------------------

3



## INDOT Main Business Goal

### Public Service/Customer Service

- Customer Pays:
  - Federal Gas Tax at the Pump
  - State Gas Tax at the Pump
- Customer Expects:
  - High and/or Improving Level of Service
  - (longer-lasting pavements with fewer delays)

### Restaurant Example

Paying the same for many years and expecting high and/or improving LOS

4



## Asset Management - Definition

---

How to make limited budget dollars stretch and provide a network system that offers a high level of service?

5



## Asset Management - Definition

---

- **What is it?**
  - A systematic process of maintaining, upgrading, and operating physical assets, such as highways and bridges, in a cost-effective way
- **Combines**
  - Engineering, Research & Development  
Business Management, Economics,  
and the Latest Computer-Aided  
Technology

6



## Asset Management Loop

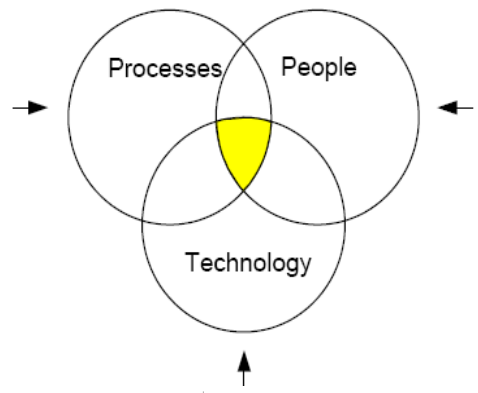


7



## Asset Management

### Overlap for Success



8



## Asset Management - Goal

---

Use short- and long-term decision making in the planning, budgeting, and operating functions so the assets stays at the highest condition level

9



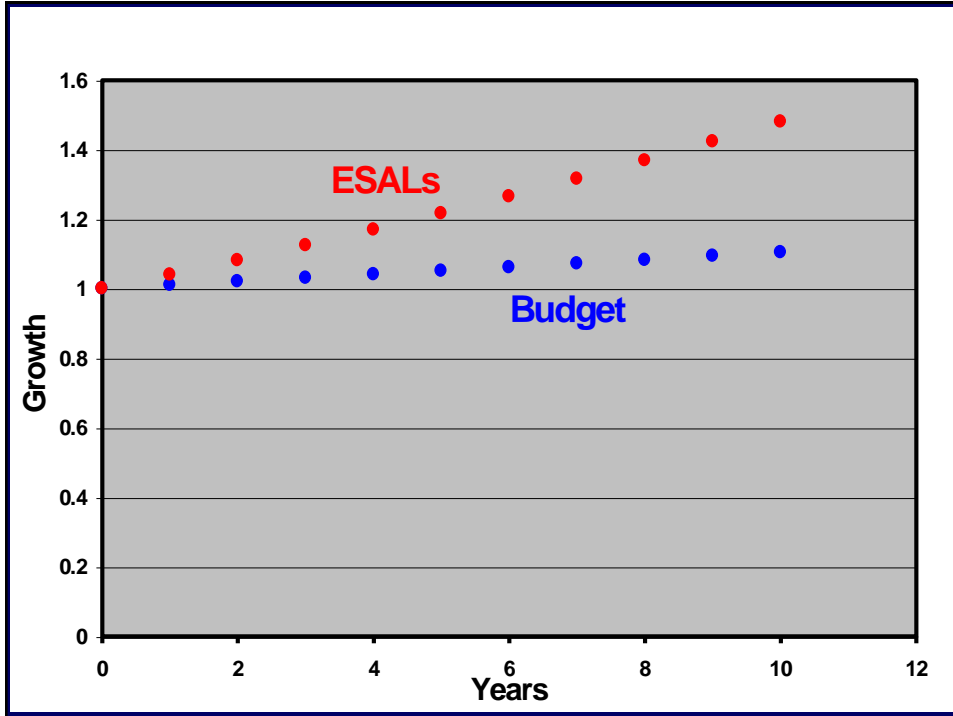
## Why is it needed with Highways?

---

During the last 30 years;

- roads mileage has marginally increased
- Average Daily Traffic has increased by 86%
- Average Daily Load has increased by 550%

10



## Why is it needed with Highways?

- Show taxpayer and motoring public you are doing your function properly and investing wisely their tax dollars
- Good public agency business practice
- Proactively respond to the GASB

**GASB - "Government Accounting Standards Board"**

**GASB Statement No. 34 issued June 10, 1999**



## GASB Statement No. 34 – Impact

- Report condition information about public infrastructure assets
- Report on the overall state of the agency's financial health, not just individual "funds"
- Provide comprehensive information reflecting the cost of delivering services to the public
- Provide alternative methods for reporting the condition of infrastructure assets

13



Rendering of Truck-Only Toll Lanes on I-70

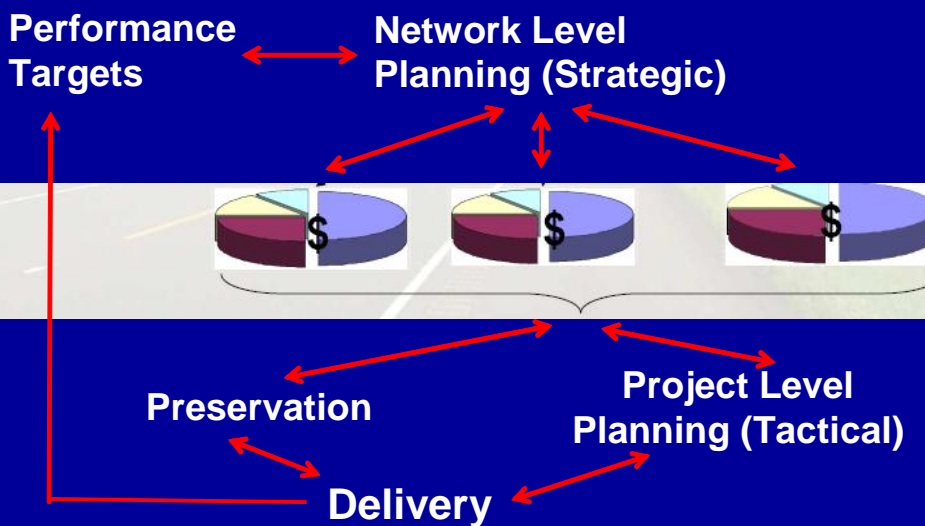


## GASB Rationale for Infrastructure Reporting

- Determine whether current-year revenues were sufficient to cover the cost of current-year services
- Assess the government agency's financial position and condition
- Assess the service potential of assets and physical resources

15

## Asset Management







## Asset Management- Items Needed

---

- Asset Inventory Data Base
- Condition assessment processes
- Asset valuation processes
- Performance prediction measures and trend indicators
- Cost estimates of options and resulting impacts
- Engineering/economic optimization tools

17



## Asset Management

---

### Classical Approach – Short Term

- Reactive Strategies
- Funds are Allocated without Direct Engineering Assessment
- Limited Review on Investment History
- Worst is First in Fixing
- Limited Investment on Good / Fair

18



## Asset Management

---

### New Rational Approach (Short & Long)

- Develop Long-Term Network Goals
- Develop Comprehensive Preservation and Maintenance Plans
- Proactively Manage Deterioration
- Commitment to Allocate Necessary Resources

19



## Asset Management

---

### New Approach (Short & Long)

- Look for network solutions not just individual project solutions
- Allow longer term planning to serve both local taxpayer and requirements
- Longer term network solutions require not only more durable assets but a "Mix of Fixes"

20



## Key Asset Management System Components

---

- Pavement Management
- Maintenance & Preservation Management
- Bridge Management
- Safety Management
- Congestion Management
- Traffic Management
- Environmental Management

21



## Key Asset Management Analysis Component

---

### Life Cycle Cost Analysis (LCCA)

#### How it is done:

- Present Worth Analysis (PW)
- Equivalent Uniform Annual Cost Analysis (EUAC)

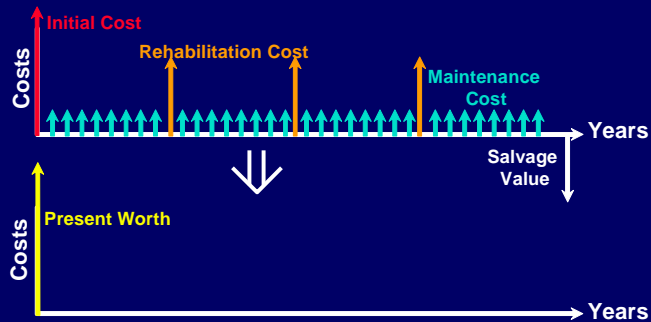
22



## Life Cycle Cost Analysis

### Present Worth Analysis:

Discounts all future costs (benefits) to the present



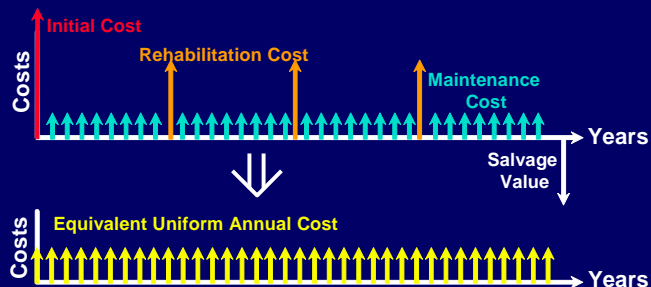
23



## Life Cycle Cost Analysis

### Equivalent Uniform Annual Cost:

Combines all present and future costs (benefits) into equal annual payments



24



## Life Cycle Cost Analysis

### Basic Factors:

- Economic Factors
  - Discount rate
  - Analysis Period
- Engineering Factors
  - Comparable sections
  - Rehabilitation selection
  - Agency Costs
  - User costs

25



## Life Cycle Cost Analysis

### Analysis Period:

- Normally equal for each alternative  
Highways: 20-50 years
- Include at least one rehabilitation
  - Needed to capture the true economic benefit of each alternative

26



## Life Cycle Cost Analysis

### Agency Costs:

- Initial costs of pavement
- Maintenance and preservation costs
- Anticipated future rehabilitation costs
  - Engineering
  - Construction
  - Traffic Control
- Salvage (recycling value)

27



## Life Cycle Cost Analysis

- Design equivalent pavement sections
- Establish strategies for analysis period
  - Estimate agency costs
  - Establish road user costs
  - Evaluate expenditure streams
- Analyze results
- Reevaluate strategies

28



## Pavement Management Example

---

### Strategy:

- ❖ Invest wisely to maximize the return (**raise the level of service of the roadway system**) through a program that balances long-term and short-term pavement strategies
- ❖ Recognize the difference between **project level** and **network level**

29



## Pavement Management Example

---

### Strategy:

- ❖ Pavement preservation, rehabilitation and reconstruction activities must be chosen so that **the flow of dollars into the pavement system are maintained at the lowest, constant level possible, yet maintain the pavement in an acceptable condition**

30



## Pavement Management Example

### Strategy:

- Always Consider **Network Impacts**
- Make the **Good-Fair-Poor** Distribution Drive the **Mix of Fixes**
- Use Iterative Process for Varied Mix of Fixes & Funding Levels

31



## Pavement Management Example

- **Key issues:**
  - Use Remaining Life Analysis
  - Use Mix of Fixes
    - **Dollars & the time frame till the next rehabilitation**
  - Network Impacts
  - LCCA

32





## Pavement Network Goal

- Preserve the pavement network to insure safety, mobility and serviceability, while optimizing all available resources
  - Pavements of Critical Concern: address 100%
  - Freeway: 95% Good or Fair by 200X
  - Non-Freeway NHS: 85% Good or Fair by 200X
  - Non- NHS: 85% Good or Fair by 200X

33



## Pavement Treatments “Mix of fixes”

- Differentiate between Preservation, rehabilitation & Reconstruction
- Routine Maintenance & Preventive Maintenance
- Restoration (like CPR with PCCP)
- Resurfacing (overlays)
- Reconstruction
- Which is used depends on Good-Fair-Poor Distribution

34



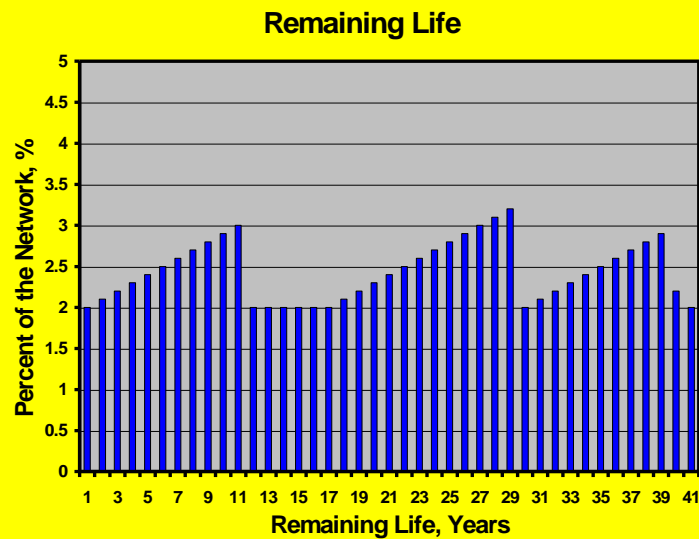
## Pavement Management Example

- Assess Current Business Practices
- Available Network Level Modeling Resources
- Modeling Information Needs
  - Deterioration Rates
  - Historic Costs Data
  - Network Impacts of Treatment Activities

35



## Remaining Life

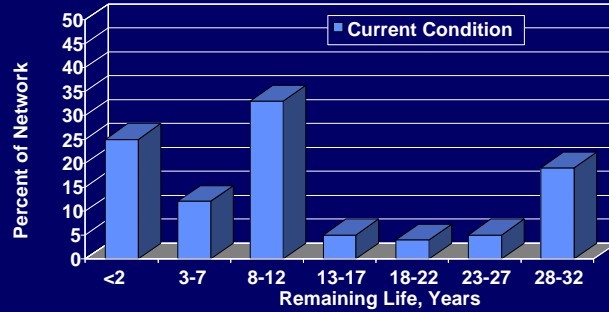


36



# Remaining Life

Time frame before each segment of roadway needs repair



37

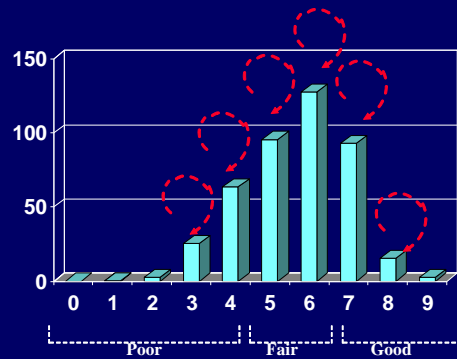


# Pavement Treatment

## Maintenance

Maintenance activities maintain serviceability

- High Benefit, Low User Impact
- Manages Deterioration Rates on "All" Structures
- Delays Category Drop on "All" Pavements



38

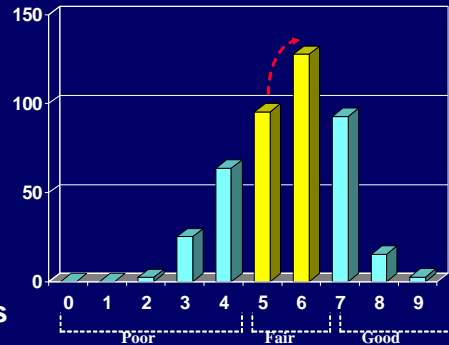


# Pavement Treatment

## Preservation

### Preservation restores pavement integrity

- Manages Deterioration Rates on "Fair" Pavement
- Delays "Fair" From Becoming "Poor"
- Cost Effective Fixes - Touches More Pavements



39

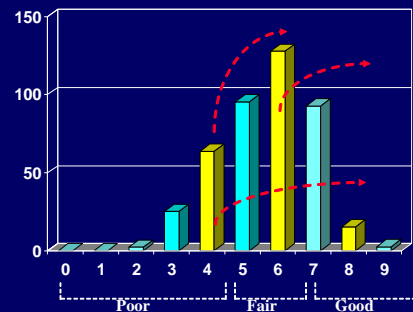


# Pavement Treatment

## Rehabilitation

### Rehabilitation improves pavement condition

- Improves Condition Ratings
  - "Poor" to "Good"
  - "Poor" to "Fair"
  - "Fair" to "Good"
- Prioritizes Critical Concern Structures



40

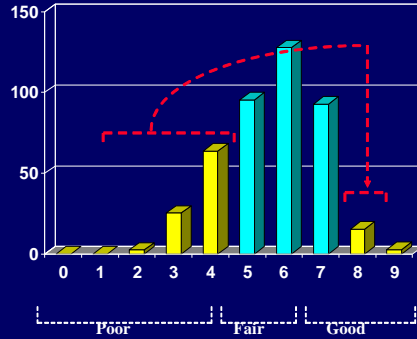


# Pavement Treatment

## Reconstruction

### Replaces pavements

- Address Other Pavement Needs
- Improves Condition Rating
  - “Poor” to “Good”
- Prioritizes Critical Pavements

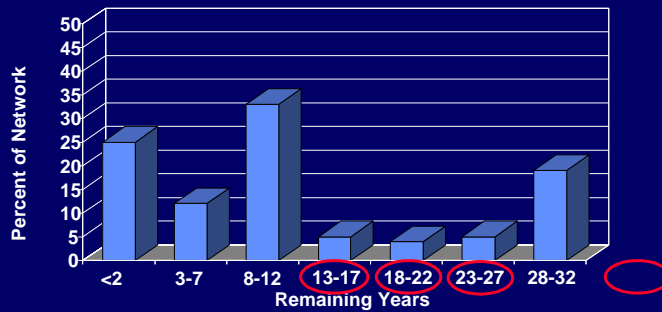


41



# Remaining Life

## Network Impact

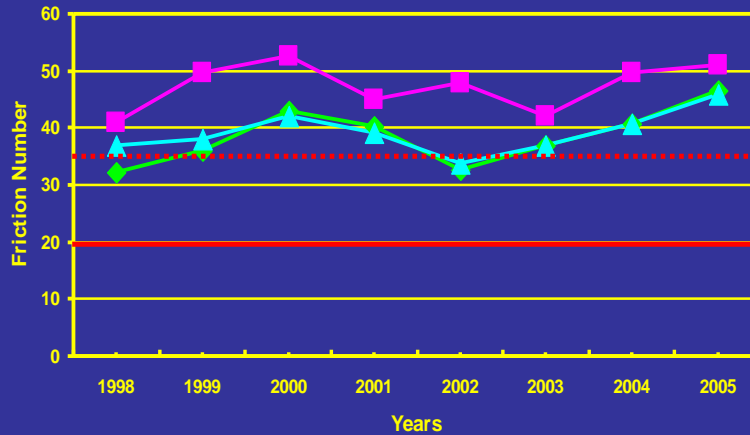


42



## Network Impact

Average Skid Resistance (Friction number)  
40 mph, Smooth Tire & Wet pavement



43



## Asset (Pavement) Management Benefits

- **Network**
  - Systematic Approach to Network
  - Proactively Manages Deterioration Rates
  - Commitment to Do the Right Work at the Right Time on the Entire System
  - Ability to Meet Established Network Goals

44



## Asset (Pavement) Management Benefits

---

- **Organization**
  - Increased Program Stability (Credibility)
  - Coordination with Other Programs
  - Organizational Commitment

45



## Asset (Pavement) Management Benefits

---

- **Customer**
  - Reduced Impact to Motoring Public
  - Increased Program Stability (Confidence in agency)
  - Efficient Investment of Tax Dollars

46