U.S. Department of Transportation
Federal Highway Administration

The Role(s) of Pavement Management

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Presentation Outline

1. FHWA
   a. Current Efforts in Pavement Management
   b. PM Roadmap / Implementation
2. Roles of Pavement Management

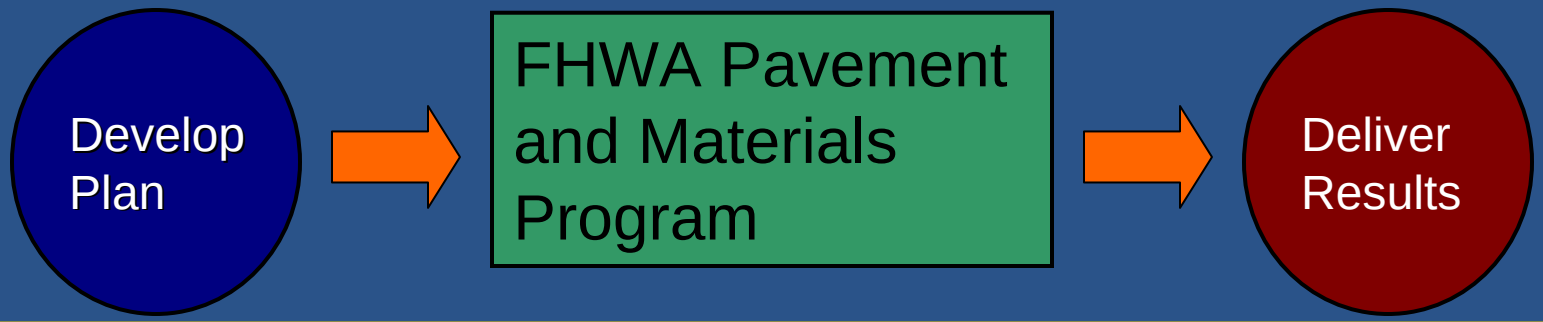
FHWA's Current Efforts in Pavement Management

1. Program Support
   - Technical Assistance & Training for State DOTs and others
   - LTPP – Long Term Pavement Performance
2. Participation in National Efforts
   - AASHTO, TRB, ASCE, and more
   - Measurement of Smoothness, Faulting, Cracking
3. Research and Development
   - PM Roadmap, RWD, Pavement Health Track

FHWA Pavement & Materials Program

Process to Deliver National Pavement Network That Is:

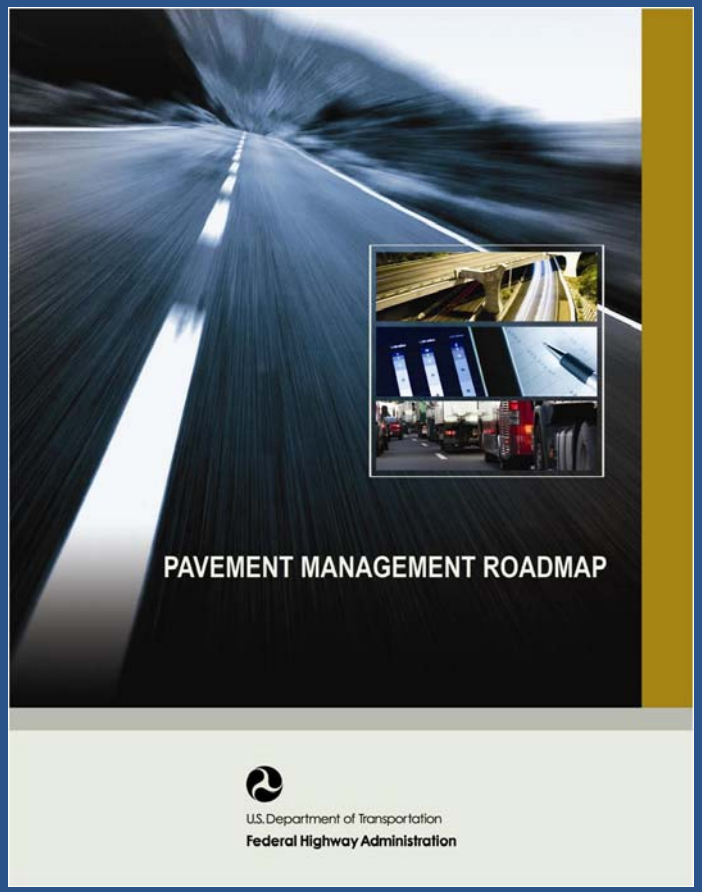
- Safe
- Cost Effective
- Long Lasting
- Effectively Maintained



Pavement Management Roadmap (2010)

Developed 23 Short-Term Research Needs Statements with projects valued at about $6.5 Million.

Developed 24 Long-Term Research Needs Statements with projects valued at about $8 Million.



Pavement Management Roadmap (2010) Project Team

SAIC

- Eric Perry (Task Manager)

Applied Pavement Technology, Inc.

- Katie Zimmerman (Principal Investigator)
- David Peshkin
- Linda Pierce

National Center for Pavement Preservation

- Doyt Bolling – Larry Galehouse
- Patty Hahn – John Hooks

Pavement Management Roadmap (2010)

Top 5 Short-Term Needs:

1)Communicating Pavement Management Information and Benefits
2)Development and Use of Effective Performance Measures
3)Improving Skills of Pavement Managers
4)Development of Automated Condition Data Processing Tools
5)Methods to Quantify the Benefits of Pavement Management

Theme Areas in the Roadmap

Use of existing tools and technology

Institutional and organization issues

The broad role of pavement management

New tools, methodologies, and technology

Roadmap Marketing Plan 2012


Accelerating Infrastructure Innovations

FOCUS

March 2011

INSIDE

3 Designing the next generation of wildlife crossings

4 Safer driving, Safer work zones: National Work Zone Awareness Week 2011

6 Highway technology calendar

7 Training in Action at the National Highway Institute

Pavement Management Roadmap:
A Roadmap to Preserving Our Pavement Investments

With greater demands being placed on today's roadway networks, coupled with reduced funding levels at transportation agencies across the country, what will the next 10 years mean for your agency's pavement investments? The Federal Highway Administration's (FHWA's) new *Pavement Management Roadmap* (Pub. No. FHWA-HIF-11-011) looks at the long-term vision for pavement management and the research, development, and technology transfer initiatives that are needed to help agencies realize that vision and preserve their valuable investments.

Over the past decade, the transportation community has witnessed an increased emphasis on the use of asset management principles to better allocate resources and make decisions based on system performance objectives. Asset management provides a coordinated approach to managing infrastructure assets over the course of their entire life cycle, thus improving performance, increasing safety, and providing greater value to the community. With an asset management approach, optimal decisions on what would be the most effective mix of preserving, maintaining, renewing, or replacing infrastructure components are based on accurate data, economic analysis, and sound engineering. Decisions are also supported by performance measures and performance-based goals.

"The availability of quality data has had a tremendous impact on an agency's ability to compare different investment options and to make sound business decisions that consider both engineering and economic factors," said Nastaran Saadatmand of FHWA's Office of Asset Management.

This new emphasis on asset management has meant a changing role for pavement management. While in the past, pavement management tools and techniques were primarily used to assess and report pavement conditions, prioritize capital improvements, and estimate funding needs, today's pavement management data can more broadly support an agency's asset management strategy by enabling the development of strategic performance objectives for the highway system.

To help agencies make this shift and more fully utilize their pavement management systems, the *Roadmap* identifies the steps need-

continued on page 2 >

www.fhwa.dot.gov/publications/focus/index.cfm

U.S. Department of Transportation
Federal Highway Administration

The audience can be divided into 3 primary groups:

1. Decision makers for funding and direction of research program
2. Practitioners who are directly involved in pavement management activities and would directly benefit from the products of Roadmap projects.
3. Researchers who would conduct Roadmap projects.

http://www.fhwa.dot.gov/pavement/management/roadmap/pdf/final_marketing_plan.pdf

Roadmap Marketing Plan 2012

The overarching message for the Roadmap marketing is that the Roadmap spells out a clear, logical, and practical path to more efficient and effective pavement management practices.

By implementing the Roadmap, the industry will:

- ✓Enhance the skills of pavement managers.
- ✓Improve the use of existing technology and tools.
- ✓Promote the concepts of pavement management among decision makers and the public.
- ✓Expand the data considered in a pavement management analysis.
- ✓Explore the use of new tools and technology to improve the current approaches to data collection and analysis.

Presentation Outline

1. FHWA
   a. Current Efforts in Pavement Management
   b. PM Roadmap / Implementation
2. Roles of Pavement Management

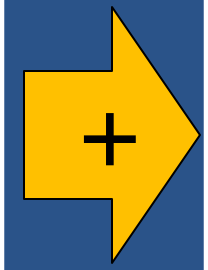
Functions vs. Roles of Pavement Management

Primary function:

Assessing and reporting pavement condition

Prioritizing capital improvements

Estimating funding needs

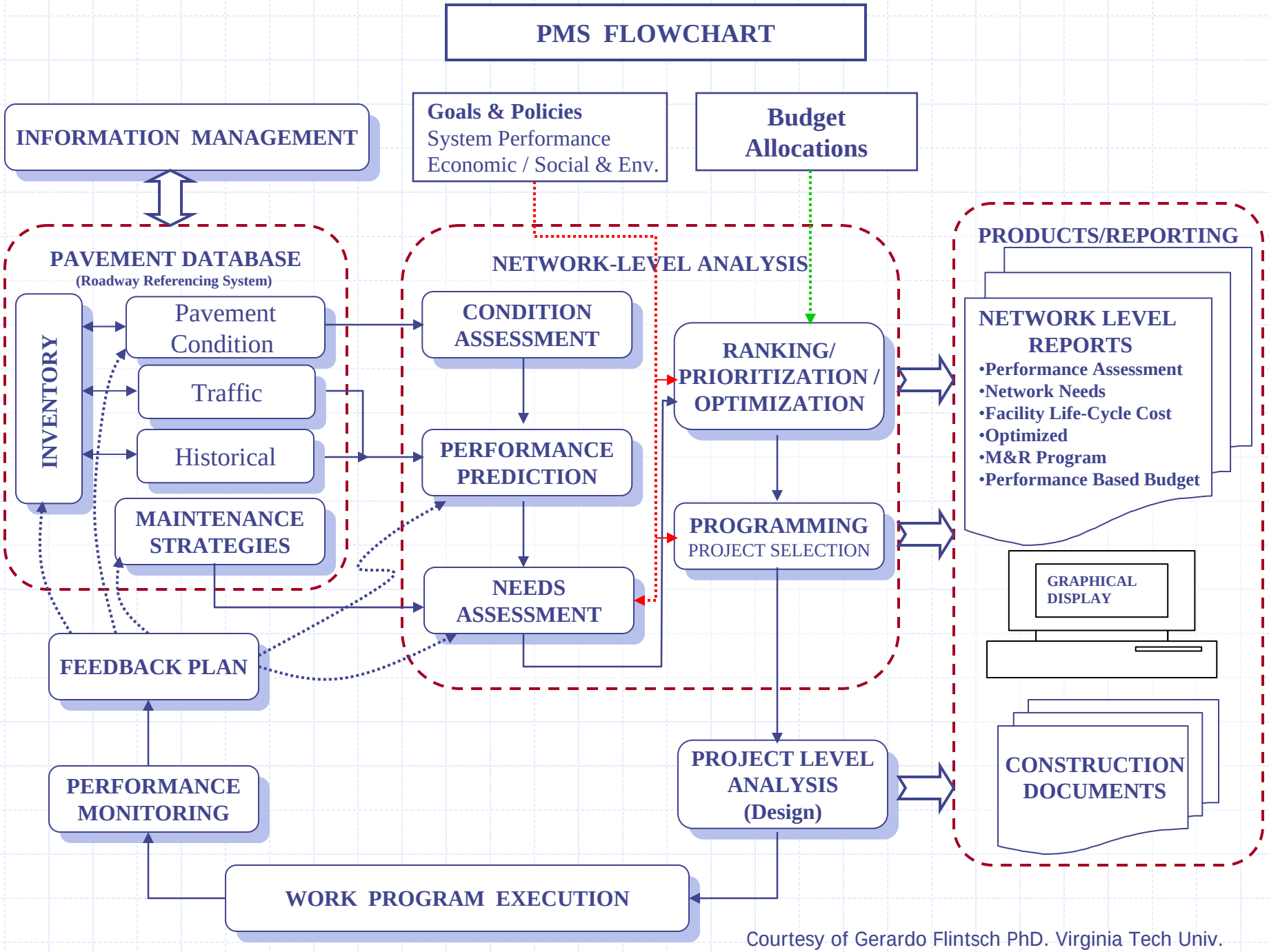


Broader role:

Support asset management

Analysis of preservation options

Calibrate mechanistic-based models



Courtesy of Gerardo Flintsch PhD. Virginia Tech Univ.

Changes in Pavement Management

- Emphasis on performance monitoring
- Use in planning and programming
- Advancements in data collection and analysis
- Asset management

Goals & Policies
System Performance
Economic / Social & Env.

Safety???

Roles of Pavement Management

1. Money
2. Performance
   a. Long-Life Pavements
   b. Effectiveness/Efficiency (Mix of Fixes!)
3. Safety (Friction)
4. Environment
   a. Recycle / Reuse
   b. Mix of Fixes
   c. Noise
   d. Emissions
5. Asset Management
   a. Planning
   b. Trade-off analysis

Money!

It's always about the money.

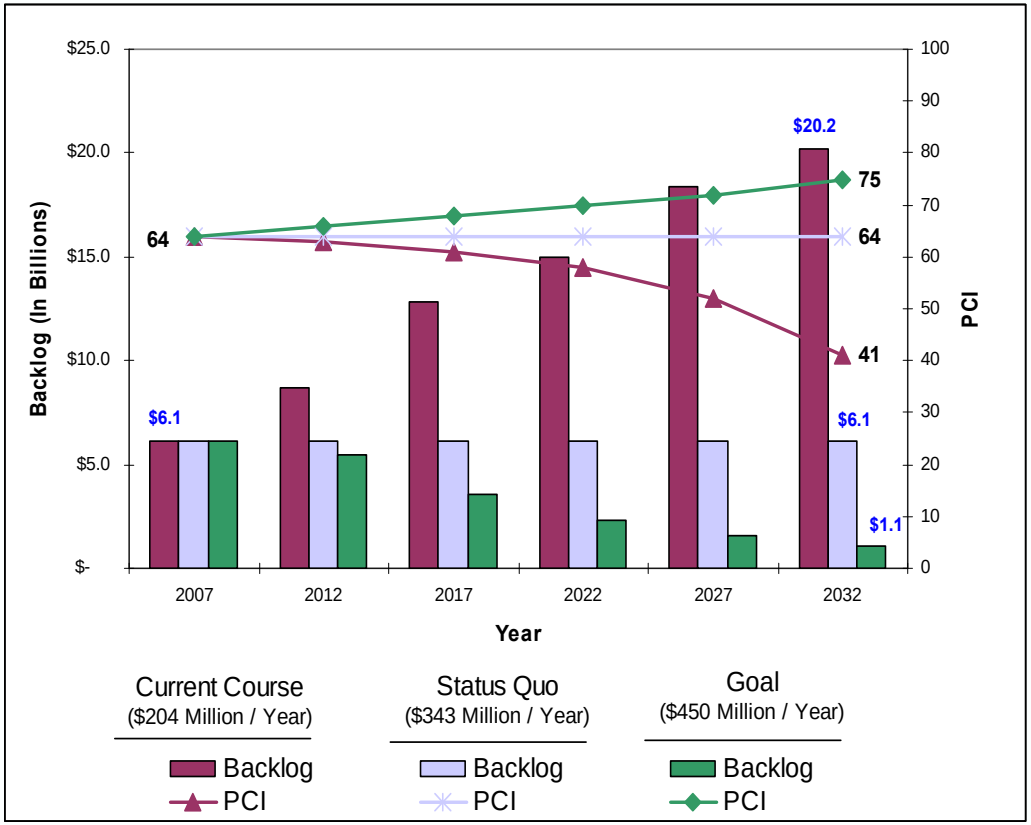
We have 4 Million centerline miles of roads and 600,000 bridges to take care of…

please collect the data and do the analysis, then let the decision makers know what it costs, and present the information so that they have a clear understanding!

Be DATA DRIVEN!

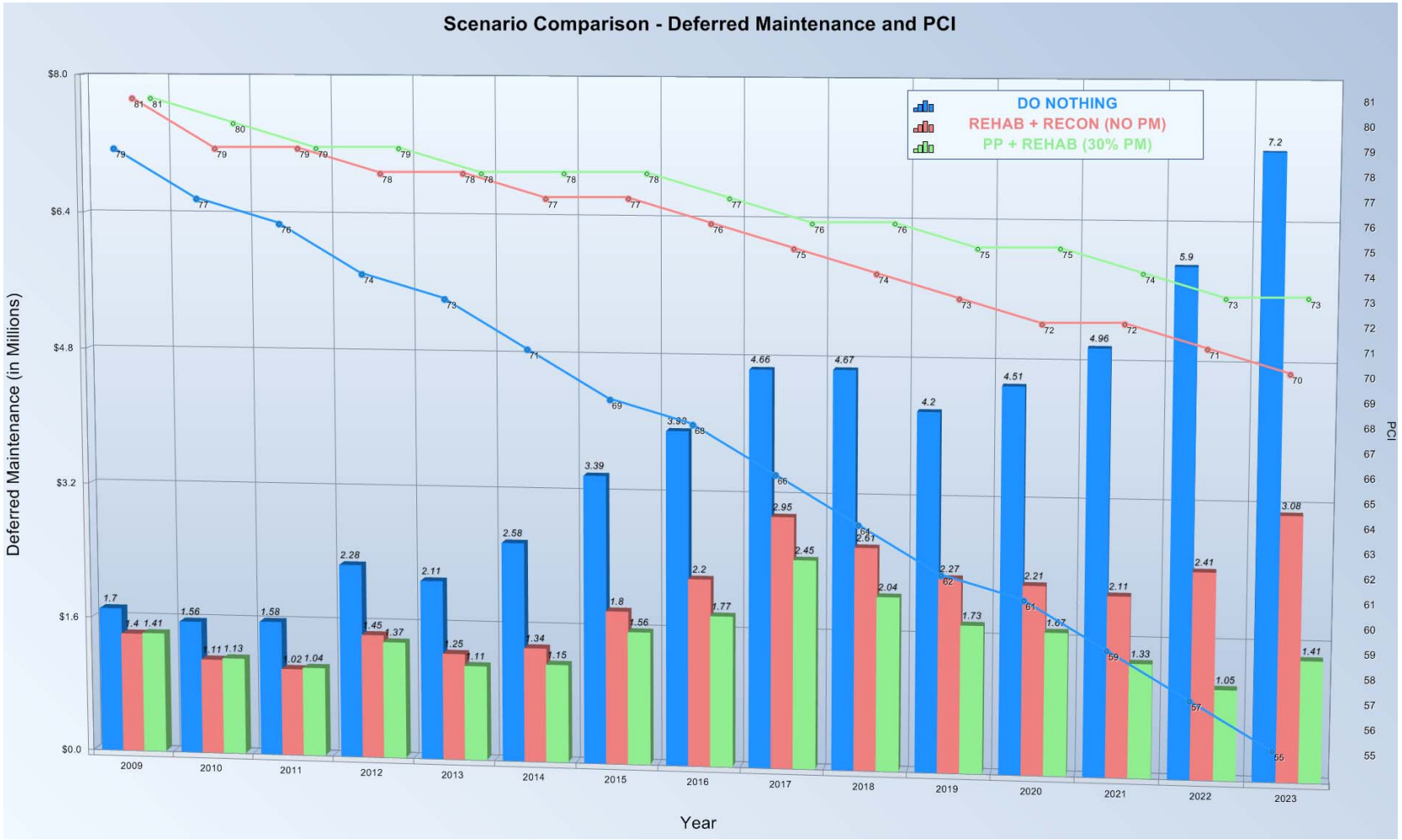
The Costs of Deferring Maintenance

- **Bay Area PCI Goal = 75**
- **Current investment in maintenance insufficient:**
  - 23 point reduction in PCI
  - 230% increase in repair backlog by 2032
- **Benefit to Cost ratio of maintenance investment is 5:1**



Theresa Romell & Sui Tan
ICPP Conference, Newport Beach
April, 2010

Importance of Preventive Maintenance



Theresa Romell & Sui Tan
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April, 2010

Cost of Delaying Maintenance

Teeth Cleaning: $75

Root Canal: $1,000

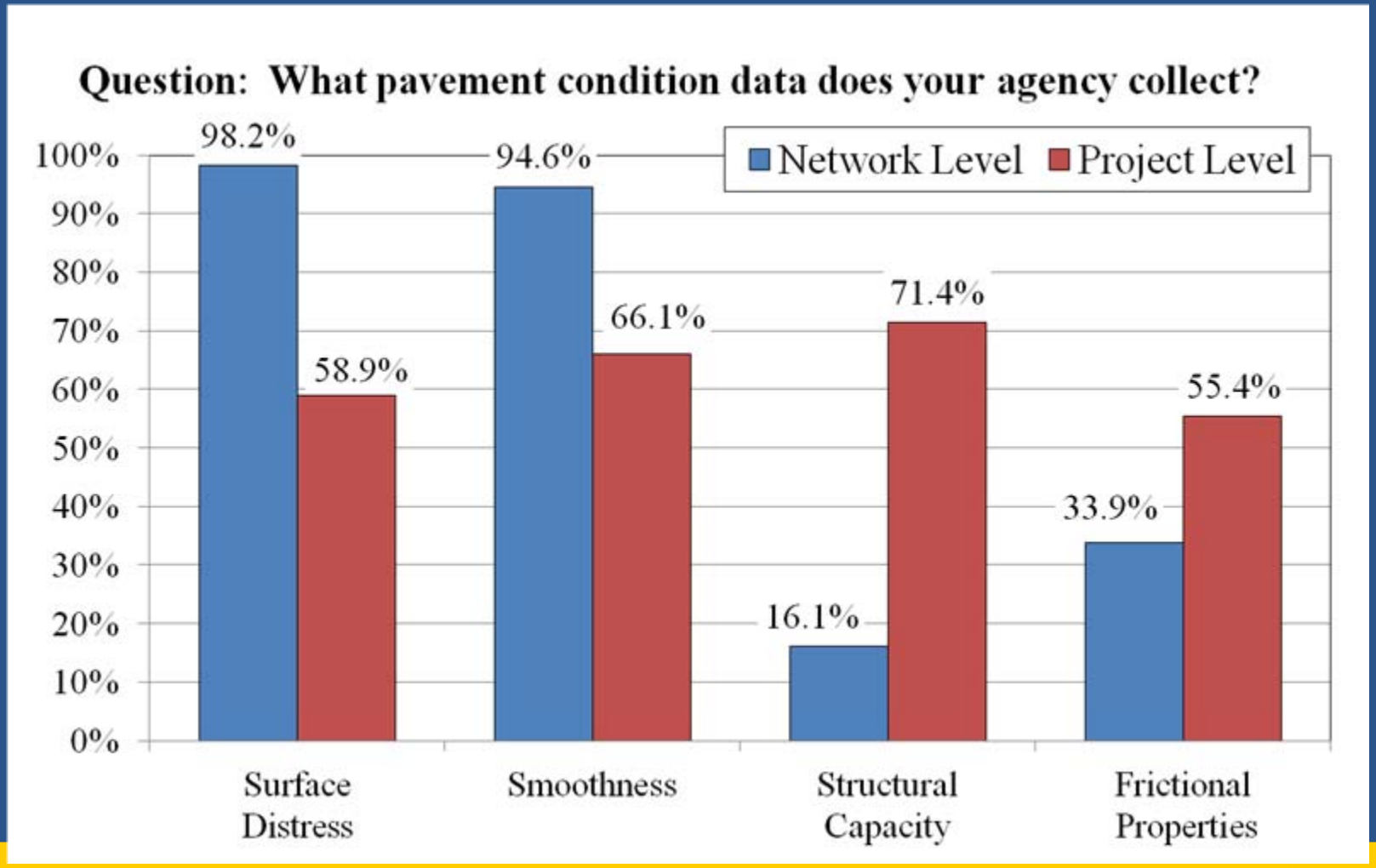
Performance

Long-Life Pavements
Effectiveness / Efficiency
(Mix of Fixes!)

Focus the Federal-aid program on the following national goals:

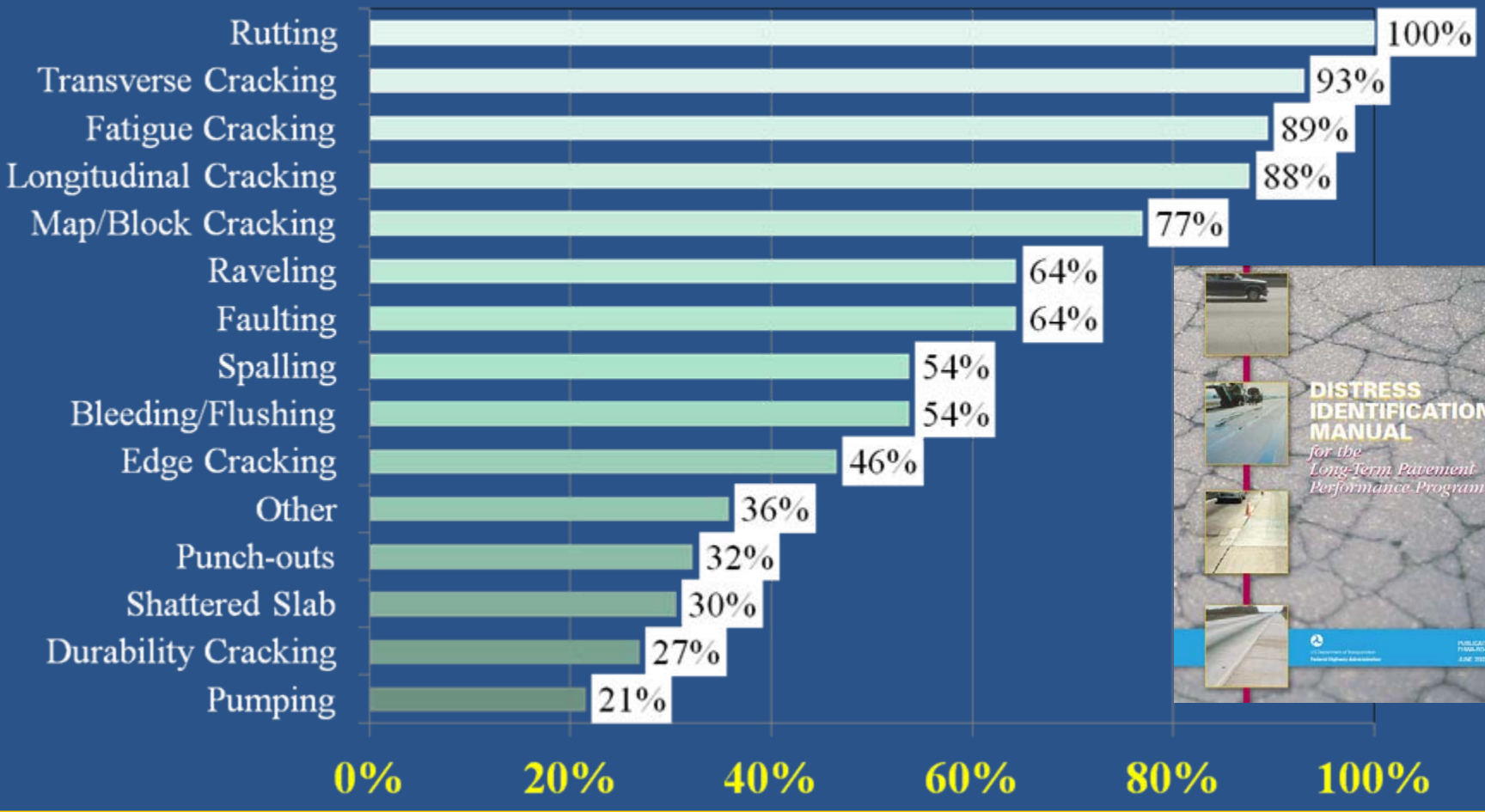
1) *SAFETY*
2) ***INFRASTRUCTURE CONDITION***
3) *CONGESTION REDUCTION*
4) *SYSTEM RELIABILITY*
5) *FREIGHT MOVEMENT / ECONOMIC VITALITY*
6) *ENVIRONMENTAL SUSTAINABILITY*
7) *REDUCED PROJECT DELIVERY DELAYS*

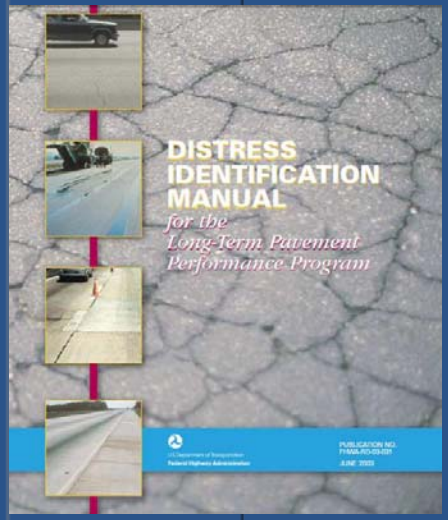
Pavement Condition Data Collected



Distress Data Collected

Question: What pavement distress data does your agency collect?





SAFETY

"It's the latest innovation in office safety.
When your computer crashes, an air bag is activated
so you won't bang your head in frustration."

SAFETY

Poor Friction

Rutting

SAFETY

Rumble Strips and Rumble Stripes?

Crash Costs?

-Fatalities?
-Injuries?
-Property Damages?

U.S. Department of Transportation
Federal Highway Administration

SAFETY

Medians / Median Barriers In Asset Management

Each and every person working in transportation has the power to save lives.

This means YOU.

FHWA's "3 E's"

ENGINEERING

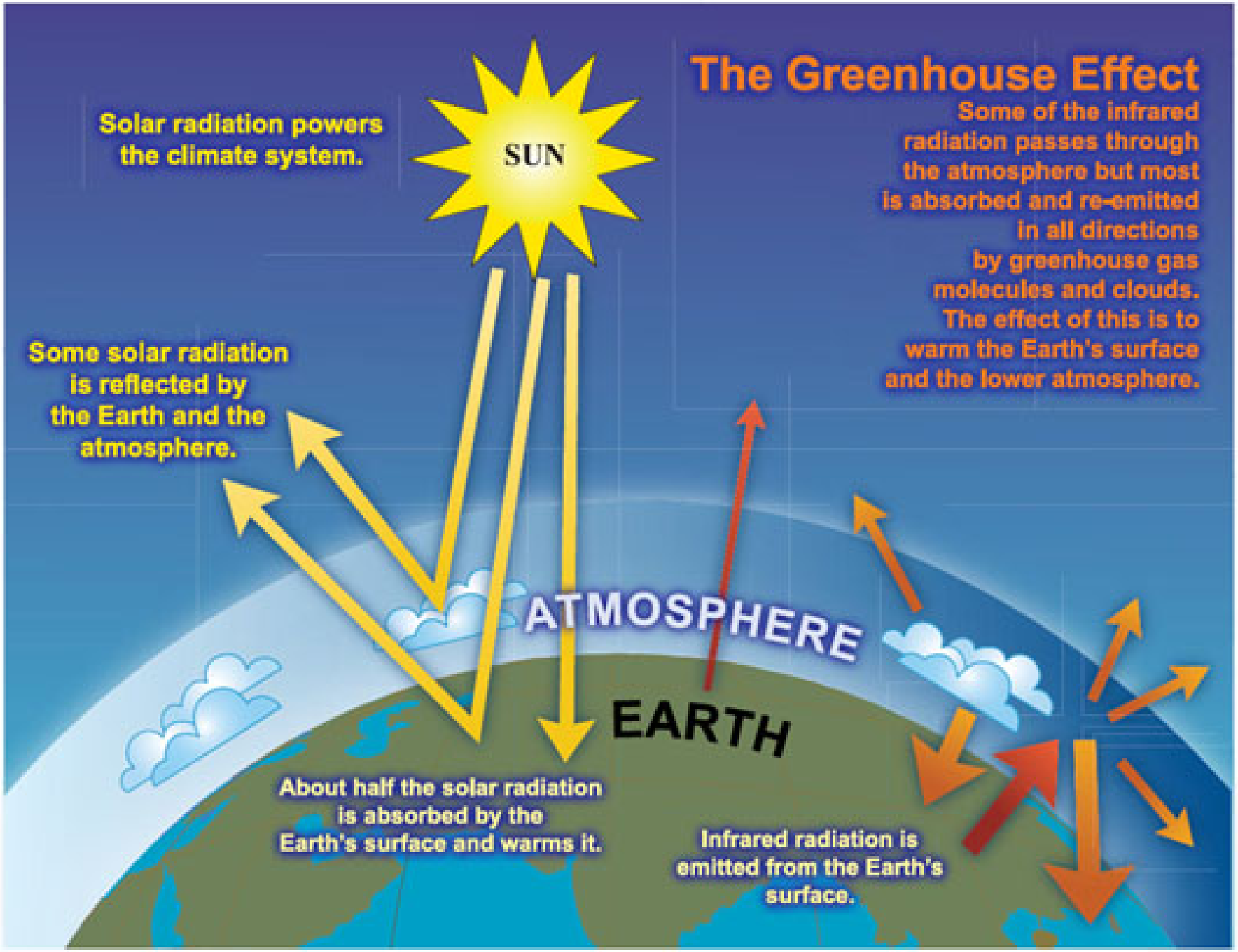
- Use Good Engineering Design to Assure Long-Life Pavements and Assets.

ECONOMICS

- Use Life-Cycle Cost Analysis for Project Selection.

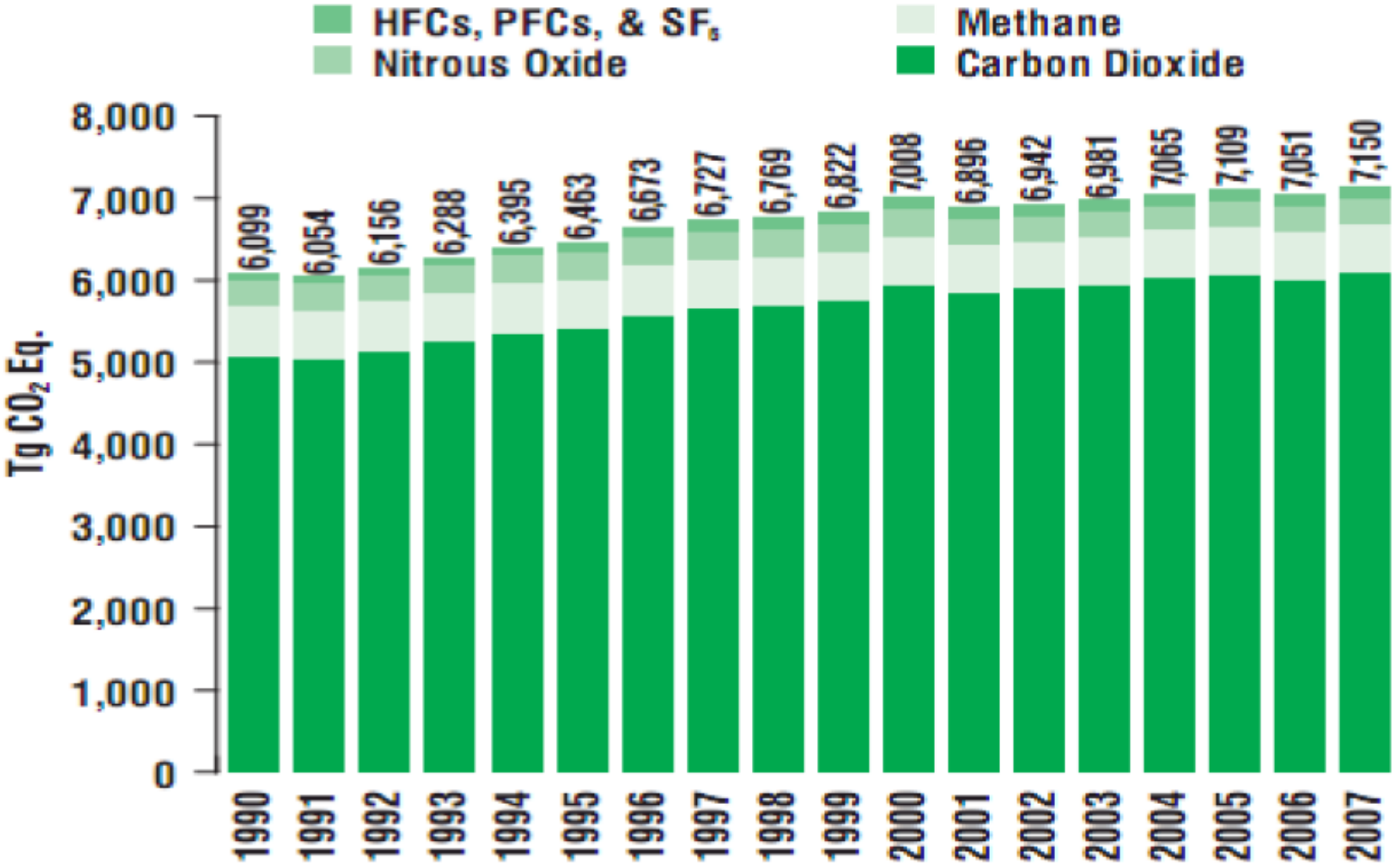
ENVIRONMENT

- Consider Recycling First
- Be Good Stewards of the Environment


The Greenhouse Effect
Some of the infrared radiation passes through the atmosphere but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth's surface and the lower atmosphere.
Solar radiation powers the climate system.
SUN
Some solar radiation is reflected by the Earth and the atmosphere.
ATMOSPHERE
EARTH
About half the solar radiation is absorbed by the Earth's surface and warms it.
Infrared radiation is emitted from the Earth's surface.

Gas	GWP
CO_2	1
CH_4*	21
N_2O	310
HFC-23	11,700
HFC-32	650
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF_4	6,500
C_2F_6	9,200
C_4F_{10}	7,000
C_6F_{14}	7,400
SF_6	23,900

Figure 2.1: Total U.S. Greenhouse Gas Emissions: 1990-2007



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007 (U.S. EPA, 2009b). Excludes land-use change and forestry and international bunker fuels.

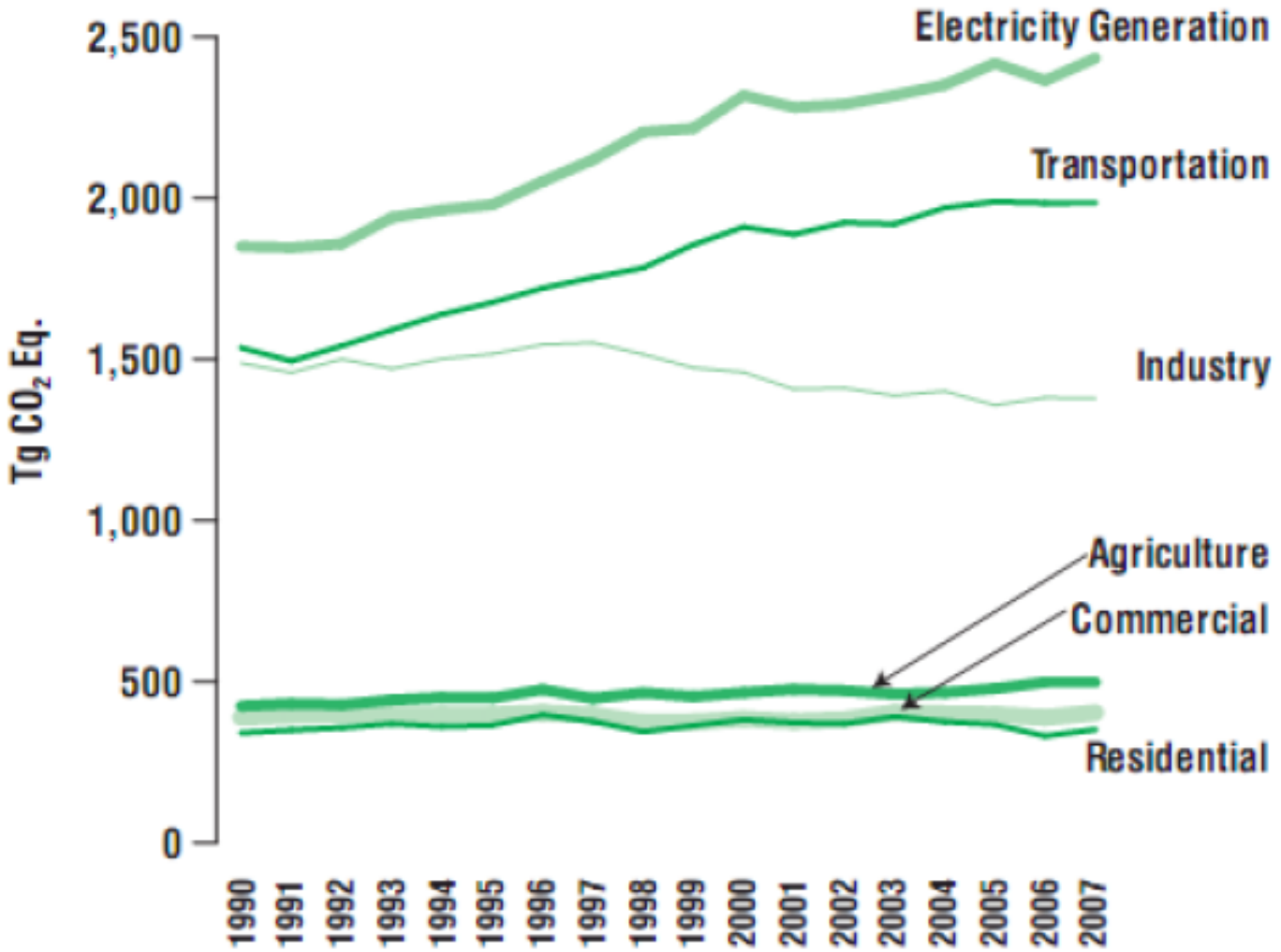
Quantifying CO_{2e} Emissions

In 2007, U.S. GHG emissions were 7,150 teragrams of CO2 equivalent (T_gCO_{2eq}).

The dominant gas emitted is CO2, mostly from fossil fuel combustion.

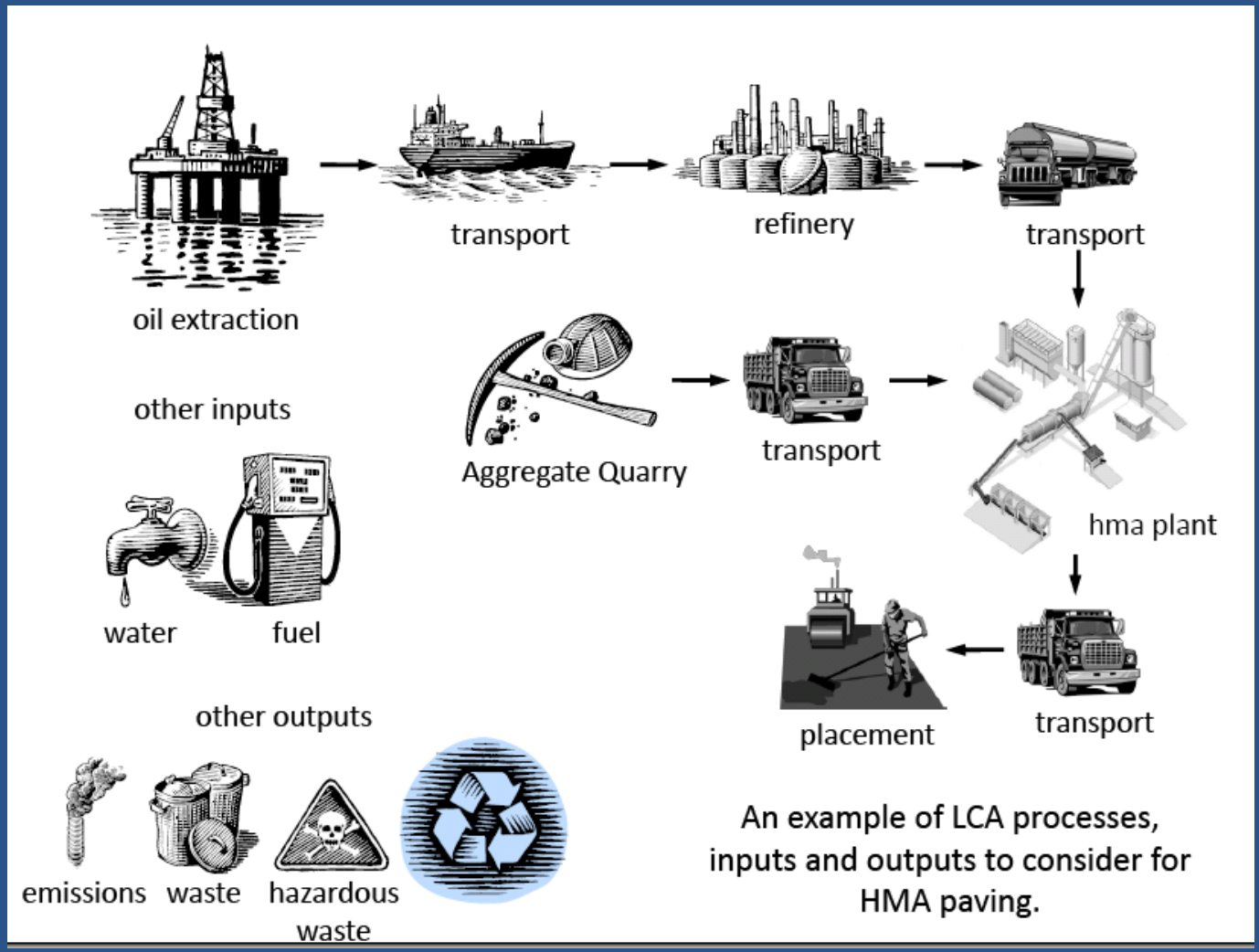
- Electricity generation (34%),
- Transportation (28%) and
- Industry (19%).

Figure 2.2: U.S. GHG Emissions Allocated to Economic Sector

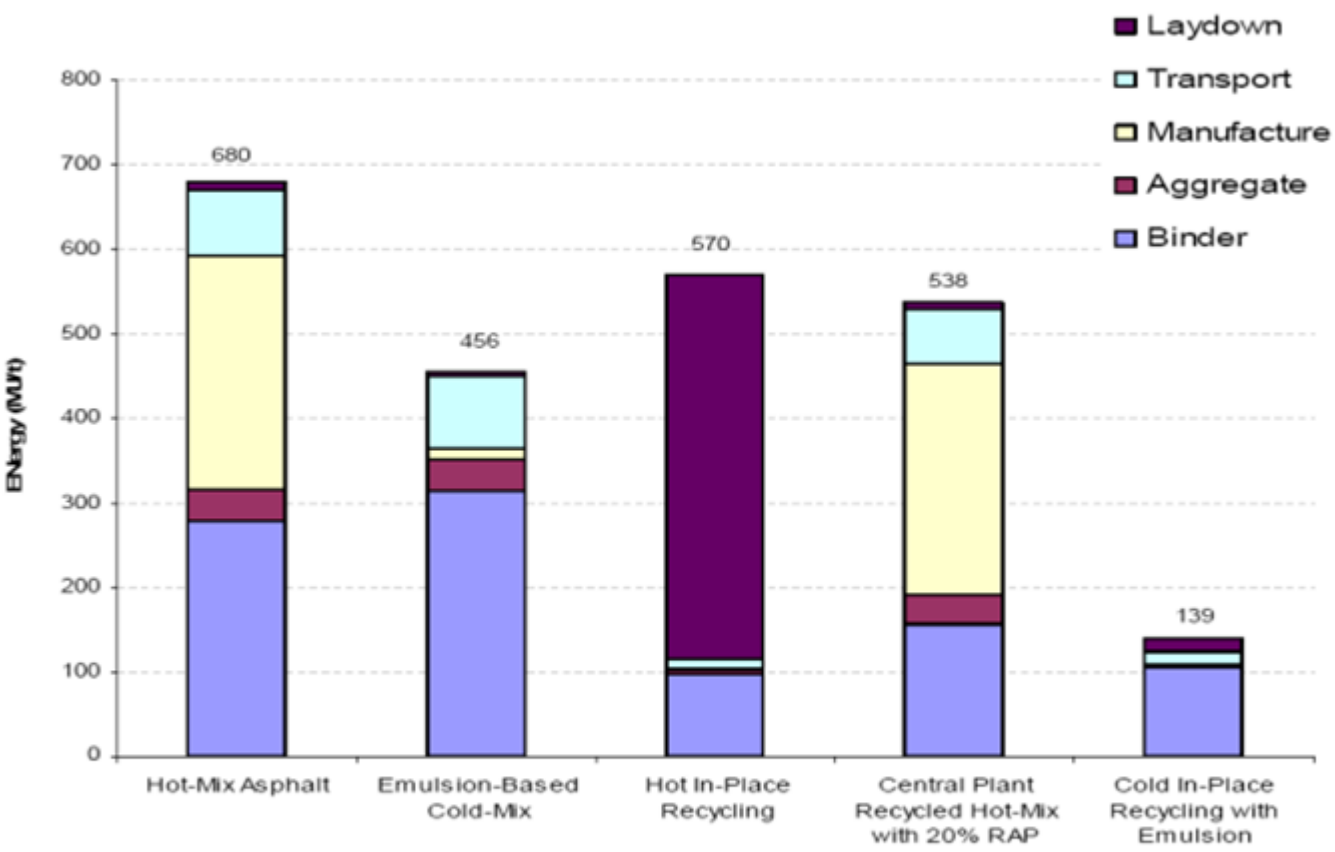


Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007 (U.S. EPA, 2009b). All GHGs. Excludes land use, land-use change and forestry, emissions from U.S. territories and international bunker fuels.

"Greenroads" – LCA in HMA



Pavement Mix of Fixes



Source: *The Environmental Road of the Future, Life Cycle Analysis* by Chappat, M. and Julian Bilal. Colas Group, 2003, p.34

Ontario

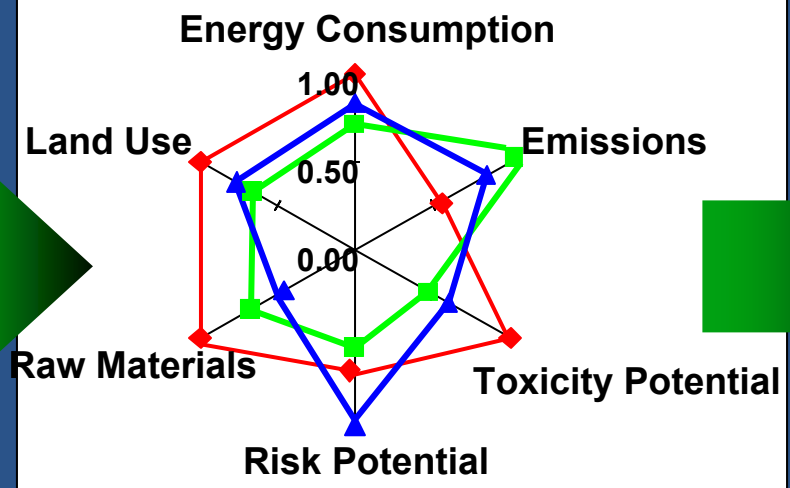
Ministry of Transportation
Ministère des Transports

Development of Environmental Impacts

Parameters considered

- Raw Materials
- Energy consumption
- Land Use
- Emissions
- Toxicity
- Risk potential

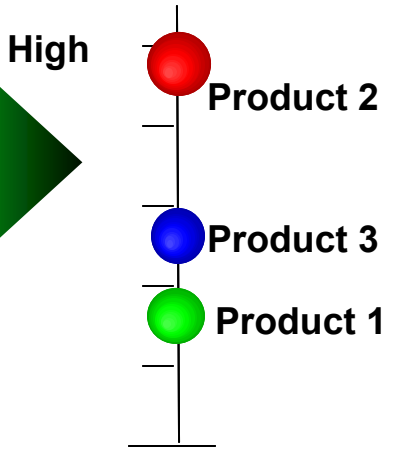
Ecological footprint



1.0 = greatest environmental burden

Ecological advantage

Relative environmental impact



Life-cycle data is gathered in six environmental categories and depicted on an ecological footprint. The data are then weighted and aggregated to obtain an overall environmental impact.

Courtesy of BASF

Evolution of IRI Smoothness Impacts on GHG

Consumption
Increase by 1.5%

Asset Management Levels

- Strategic
  - Funding Allocation
  - Communication
- **Network Level** – Long-Term
- Project Level – Short-Term
- Project Design

"A PMS doesn't design pavements, nor does it fix potholes"
Dr. Roger Smith

MPO's – Stronger Partners in Pavement Management and Asset Management at the Strategic Level.

and Network Level?

What is an MPO?

A Metropolitan Planning Organization (MPO) is a federally required transportation planning body comprised of elected and appointed officials representing local, state and federal governments or agencies having interest or responsibility in transportation planning and programming.

An MPO is responsible for the development of:

- **a Long Range Transportation Plan (LRTP),**
- **the Transportation Improvement Program (TIP), and**
- **a Unified Planning Work Program (UPWP) for its metropolitan planning area.**

The adoption of these documents is a prerequisite for the receipt of both federal transit and federal highway funding.

http://www.smtcmpo.org/mpo.asp

MPO's are a Federal Requirement

Each urbanized area in the United States with a population of 50,000 or more is required by the federal government to have a metropolitan planning organization (MPO).

The Federal Government wants to ensure that the transportation planning process and resulting transportation network are cohesive and functional for areas that have grown together. In other words, **transportation planning needs to be regional in scope because transportation systems cut across governmental boundaries.**

http://www.campo.in.gov/what_is_an_mpo.php

What Does An MPO Do?

The MPO discusses and votes on multi-modal transportation issues of region-wide significance, and decides which local transportation projects should be implemented.

http://www.smtcmpo.org/mpo.asp

Transportation Planning Capacity Building

Planning for a Better Tomorrow

Metropolitan Transportation Planning

Metropolitan transportation planning is the process of examining travel and transportation issues and needs in metropolitan areas. It includes a demographic analysis of the community in question, as well as an examination of travel patterns and trends. The planning process includes an analysis of alternatives to meet projected future demands, and for providing a safe and efficient transportation system that meets mobility while not creating adverse impacts to the environment. In metropolitan areas over 50,000 population, the responsibility for transportation planning lies with designated Metropolitan Planning Organizations (MPO).

The Transportation Planning Capacity Building (TPCB) Metropolitan Planning Resources page offers MPOs and transportation professionals legislative, regulatory, and general guidance; technical resources; and relevant links to address metropolitan transportation planning issues.

Please click on the links below to access the metropolitan transportation planning resources.

Related Topics

Legislation, Regulations, and Guidance: Find detailed information on state and Federal laws, regulations, and guidance pertaining to transportation planning and Federal requirements related to the formation of new MPOs.

Technical Resources

Find detailed information on state and Federal laws, regulations, and guidance pertaining to metropolitan transportation planning and Federal requirements related to the formation of new Metropolitan Planning Organizations.

1. Publications
2. Case Studies
3. Briefing Notebook for Transportation Decisionmakers

Related Sites

Use the resource index to view all websites related to metropolitan transportation planning.

Search for TPCB resources

For more information contact Susan.Grosser@dot.gov at FHWA (202-366-2825), or John Sprowls at FTA (202-366-5362).

http://www.planning.dot.gov/documents/BriefingBook/bbook.htm#14BB

	Who Develops?	Who Approves?	Time Horizon	Content	Update Requirements
UPWP	MPO	MPO	1 or 2 Years	Planning Studies and Tasks	Annually
MTP	MPO	MPO	20 Years	Future Goals, Strategies, and Projects	Every 5 Years 4 years for nonattainment and maintenance areas
TIP	MPO	MPO/ Governor	4 Years	Transportation Investments	Every 4 Years
LRSTP	State DOT	State DOT	20 Years	Future Goals, Strategies, and Projects	Not Specified
STIP	State DOT	US DOT	4 Years	Transportation Investments	Every 4 Years

14 MAJOR POLICY AND PLANNING ISSUES

Air Quality
Congestion Management Process (CMP)
Financial Planning and Programming
Freight Movement
Land Use and Transportation
Performance Measures
Planning and Environment Linkages
Public Involvement
Safety
Security
System Management and Operations (M&O)
Technology Applications for Planning: Models, GIS, and Visualization
Title VI/Environmental Justice (EJ)
Transportation Asset Management

What are some examples of system management and operations tools?

Intelligent Transportation Systems (ITS) are technological tools that can help to facilitate better system M&O. For example, roadway video surveillance allows better responses to changes in network conditions, such as clearing an accident faster to keep traffic moving. ITS technologies also can be used to collect real-time data, like travel speeds, which can be used to monitor system performance over time.

Other examples of system M&O tools include:

- Metropolitan traffic management centers;
- Traffic signal coordination;
- Freeway/arterial corridor management;
- Incident management programs;
- Preferential treatment for transit/ride-shares;
- Special event traffic management;
- Emergency management strategies;
- Pricing of transportation services;
- Customer information services;
- ITS applications for transit;
- Traveler information; and
- Commercial vehicle programs.

These M&O strategies and tools focus on optimizing the performance of the transportation system. ***It is essential to mention that M&O does not include traditional maintenance activities, such as lawn cutting, pothole repair, or resurfacing.***

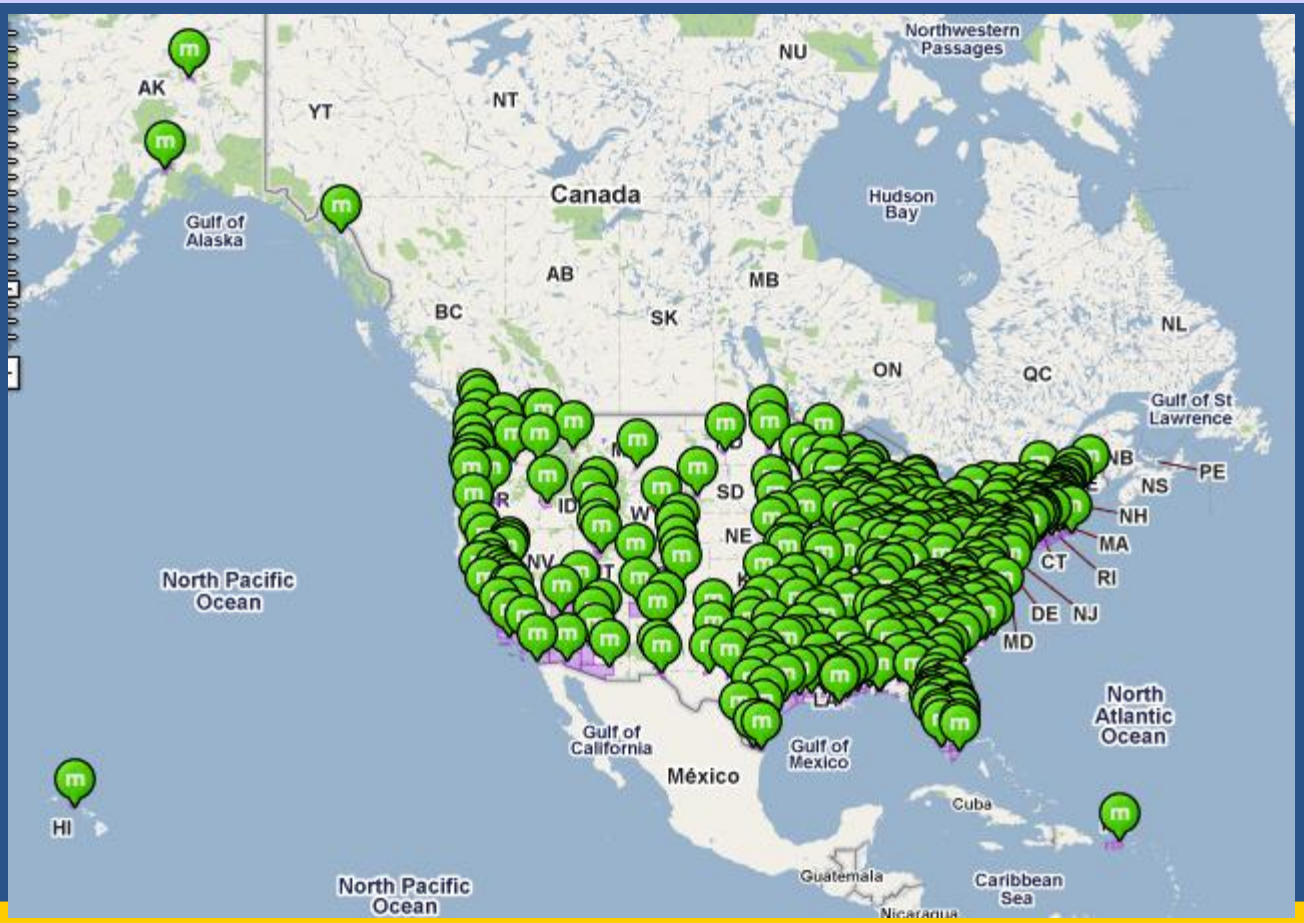
http://www.planning.dot.gov/documents/BriefingBook/bbook.htm#14BB

How Many MPO's Are There?

http://www.bts.gov/external_links/government/metropolitan_planning_organizations.html

382 TOTAL

http://www.cartosoft.com/lab/ampo/index.htm



Census Bureau Data – Metropolitan Areas

http://www.census.gov/popest/metro/CBSA-est2009-annual.html

366 Metropolitan Statistical Areas – 257.4 Million

- There are additional "Micropolitan Areas"

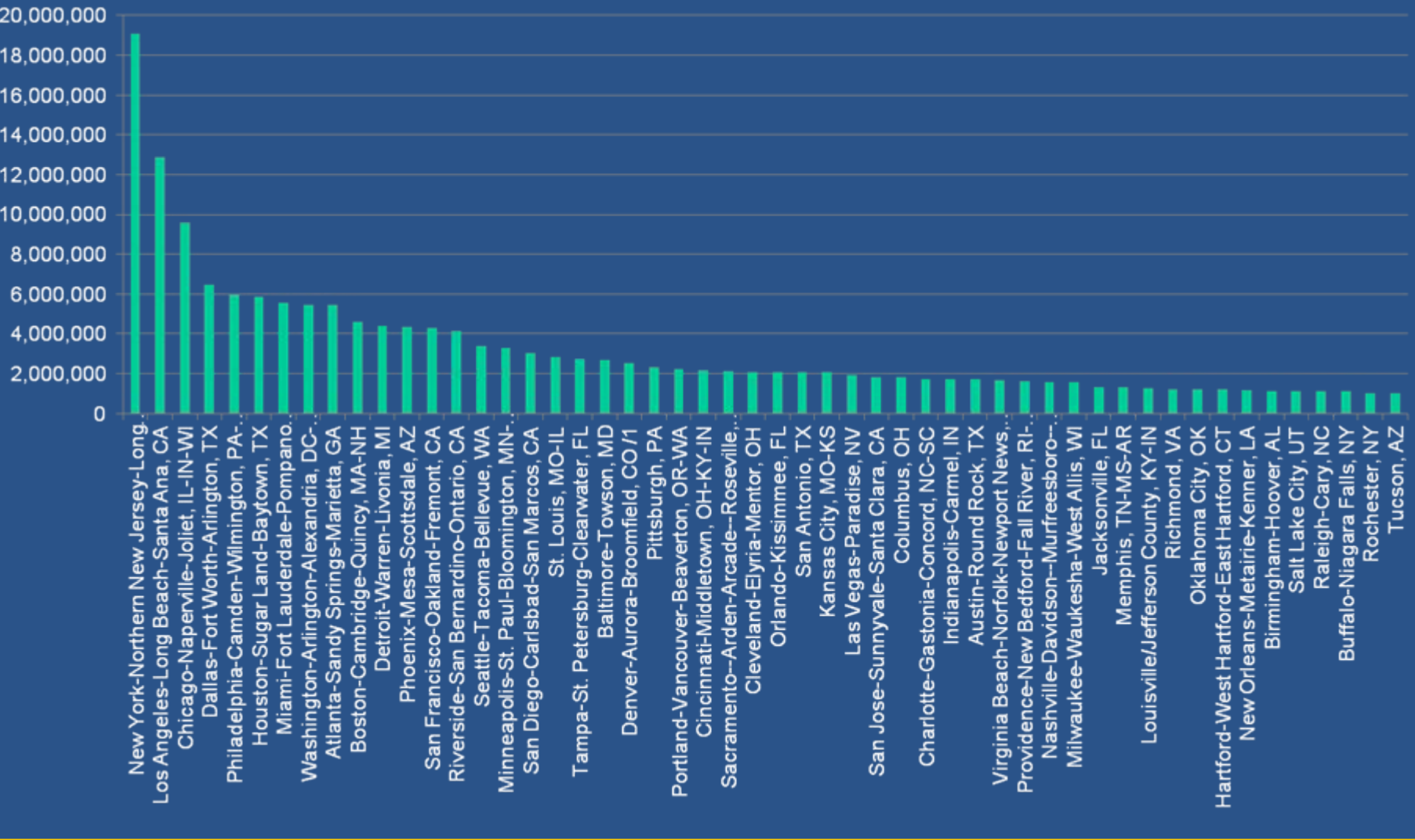
52 have more than 1 million people – 168.4 Million

2010 Total US Population = 309.8 Million

54% of Americans live in the 52 largest Metro Areas!

U.S. Department of Transportation
Federal Highway Administration

168.4 Million People in 52 largest metro areas



Roles in Pavement Management

1. Money
2. Performance
   a. Long-Life Pavements
   b. Effectiveness/Efficiency (Mix of Fixes!)
3. Safety (Friction)
4. Environment
   a. Recycle / Reuse
   b. Mix of Fixes
   c. Noise
   d. Emissions
5. Asset Management
   a. Planning
   b. Trade-off analysis

Presentation Outline

1. FHWA's Current Efforts in Pavement Management
2. Roles of Pavement Management

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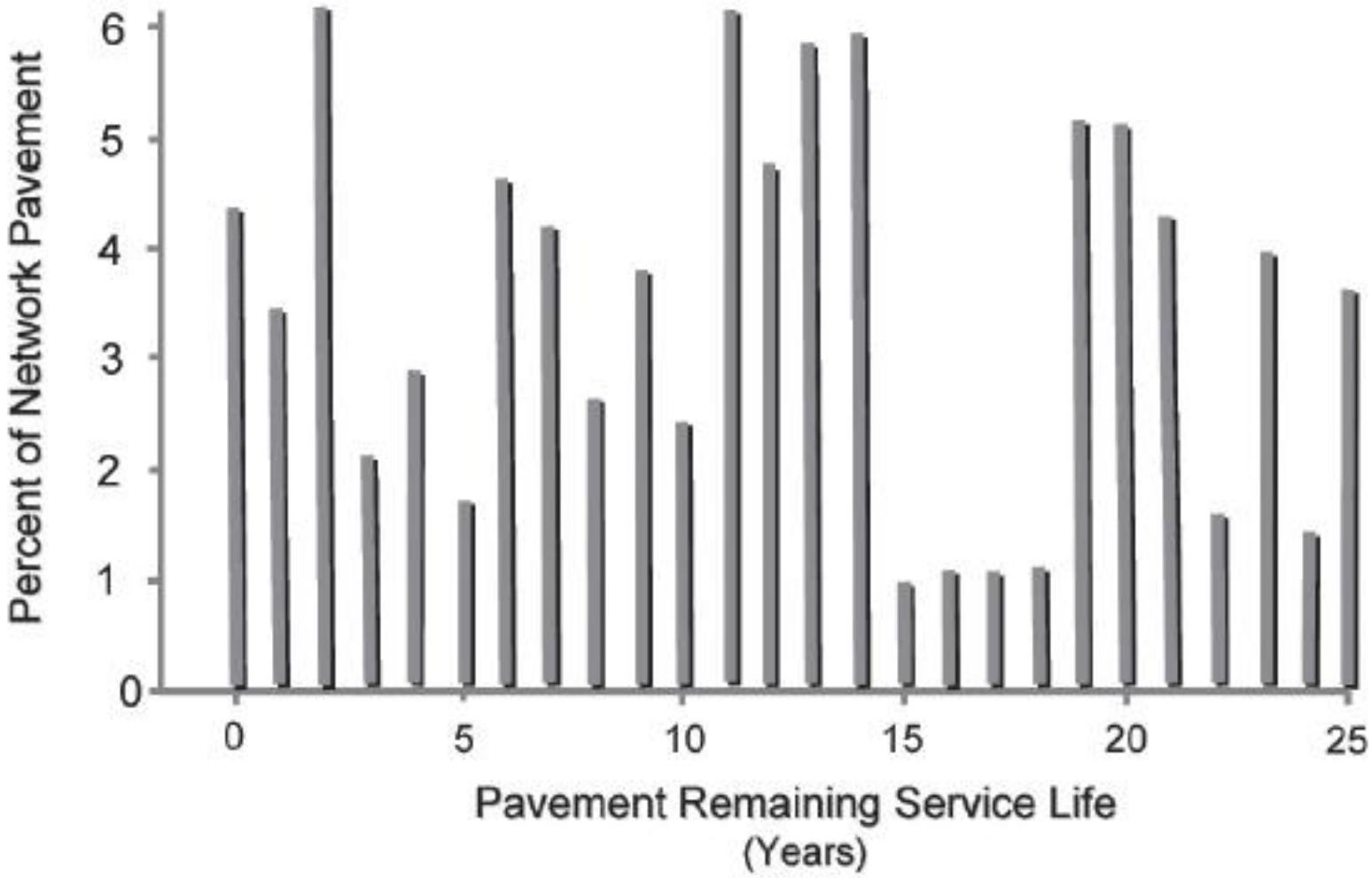
a) Quick Check Guide

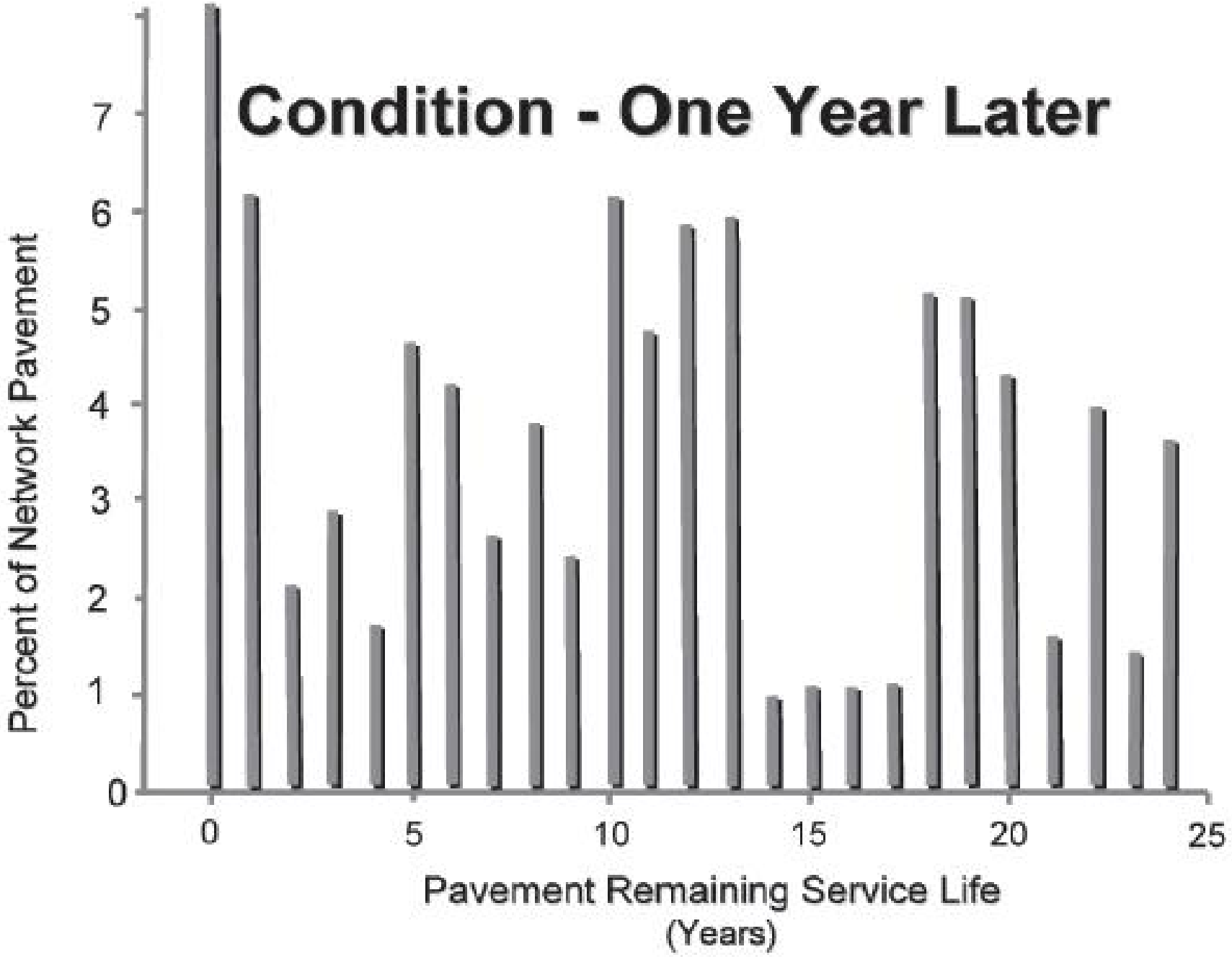
b) Shout-Out to Don Newell from 2006 NWPMA meeting.

A Quick Check of Your Highway Network Health

by Larry Galehouse, Director,
National Center for Pavement Preservation
and
Jim Sorenson, Team Leader,
FHWA Office of Asset Management

Current Condition




Condition - One Year Later
Percent of Network Pavement
0
1
2
3
4
5
6
7
0
5
10
15
20
25
Pavement Remaining Service Life
(Years)

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

Agency Highway Network =

_____ lane-miles

Each year the network will LOSE

_____ lane-mile years.

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

Agency Highway Network = 250 lane-miles

Each year the network will LOSE

250 lane-mile years.

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

RECONSTRUCTION PROJECTS

_____ Lane Miles x **20** Year Design Life = _____

REHABILITATION PROJECTS

_____ Lane Miles x **10** Year Design Life = _____

PRESERVATION PROJECTS

_____ Lane Miles x **5** Year Design Life = _____

Highway Agency Work ADDS _____ Lane-Mile Years

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

RECONSTRUCTION PROJECTS

2 Lane Miles x 20 Year Design Life = 40

REHABILITATION PROJECTS

5 Lane Miles x 10 Year Design Life = 50

PRESERVATION PROJECTS

20 Lane Miles x 5 Year Design Life = 100

Highway Agency Work ADDS

190 Lane-Mile Years

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

Each year the network will LOSE 250 lane-mile years.

Highway Agency Work ADDS 190 Lane-Mile Years

Each year the network is LOSING 60 lane-mile years.

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

RECONSTRUCTION PROJECTS

2 Lane Miles x 20 Year Design Life = 40

REHABILITATION PROJECTS

5 ~~6~~ Lane Miles x 10 Year Design Life = 60

PRESERVATION PROJECTS

20 ~~30~~ Lane Miles x 5 Year Design Life = 150

To "Stay Even" the Highway Agency Work MUST ADD 250 Lane-Mile Years

" A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH"

This simple tool does NOT replace a Pavement Management System, But it is great for decision makers to get a "feel" for your pavement management and pavement preservation programs!

Bench Marking Your PMS

PMS 102

Don Newell
Multnomah County, Oregon
(Home of the Tonya Harding trials)

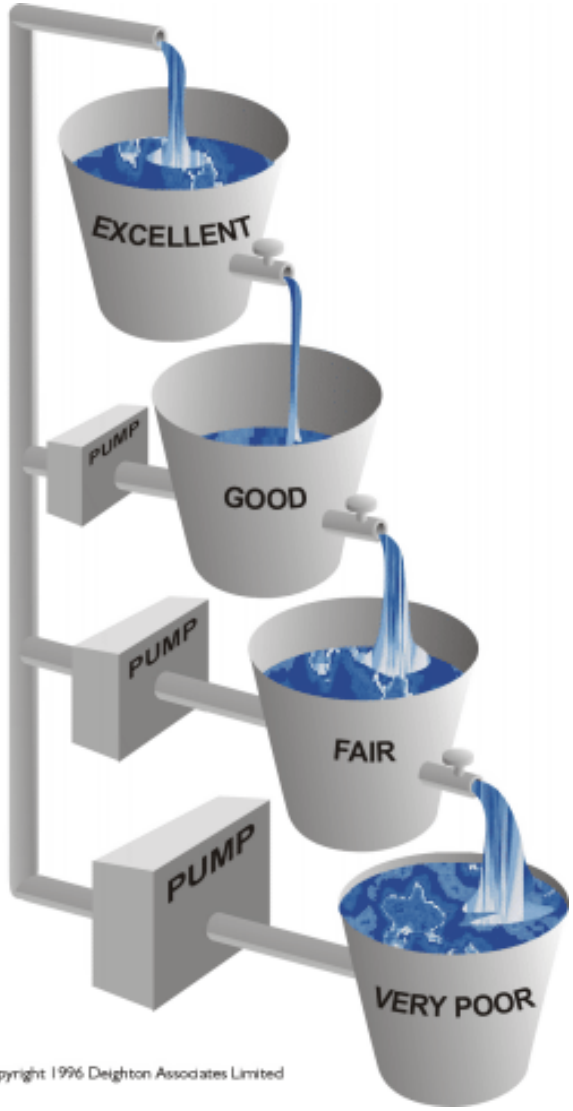
2006 NWPMA Meeting Presentation

An Analogy

Seal =
$.50 / sq yd

Overlay =
$5 / sq yd

Reconstruct =
$15 / sq yd



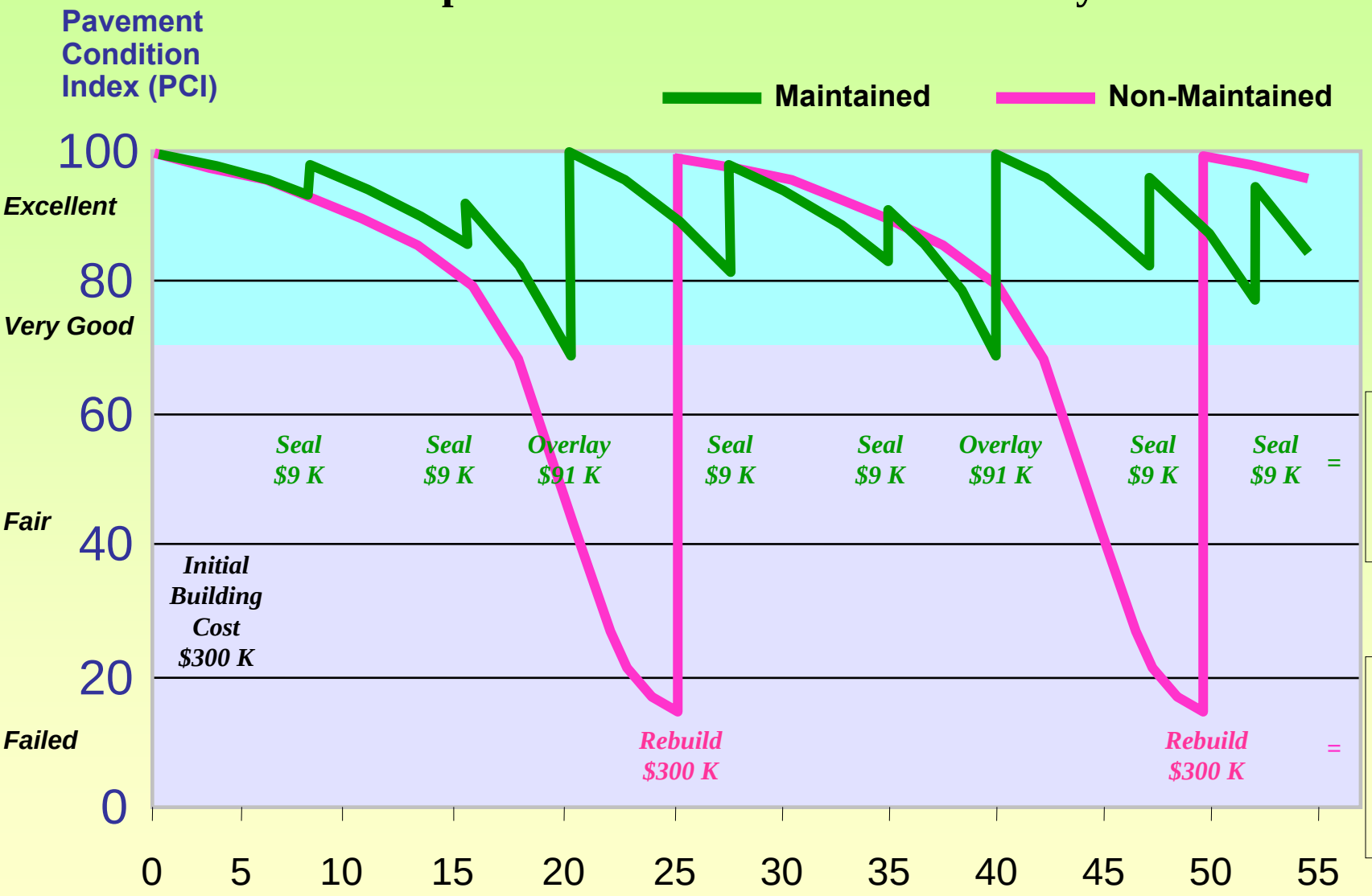
Process is continuous and inevitable

The rate of water flow increases as condition decreases

The effort to pump water increases with decreasing condition

Maintained vs Non-Maintained County Road

Cost per Mile for 2 Lane Road Over 55 years



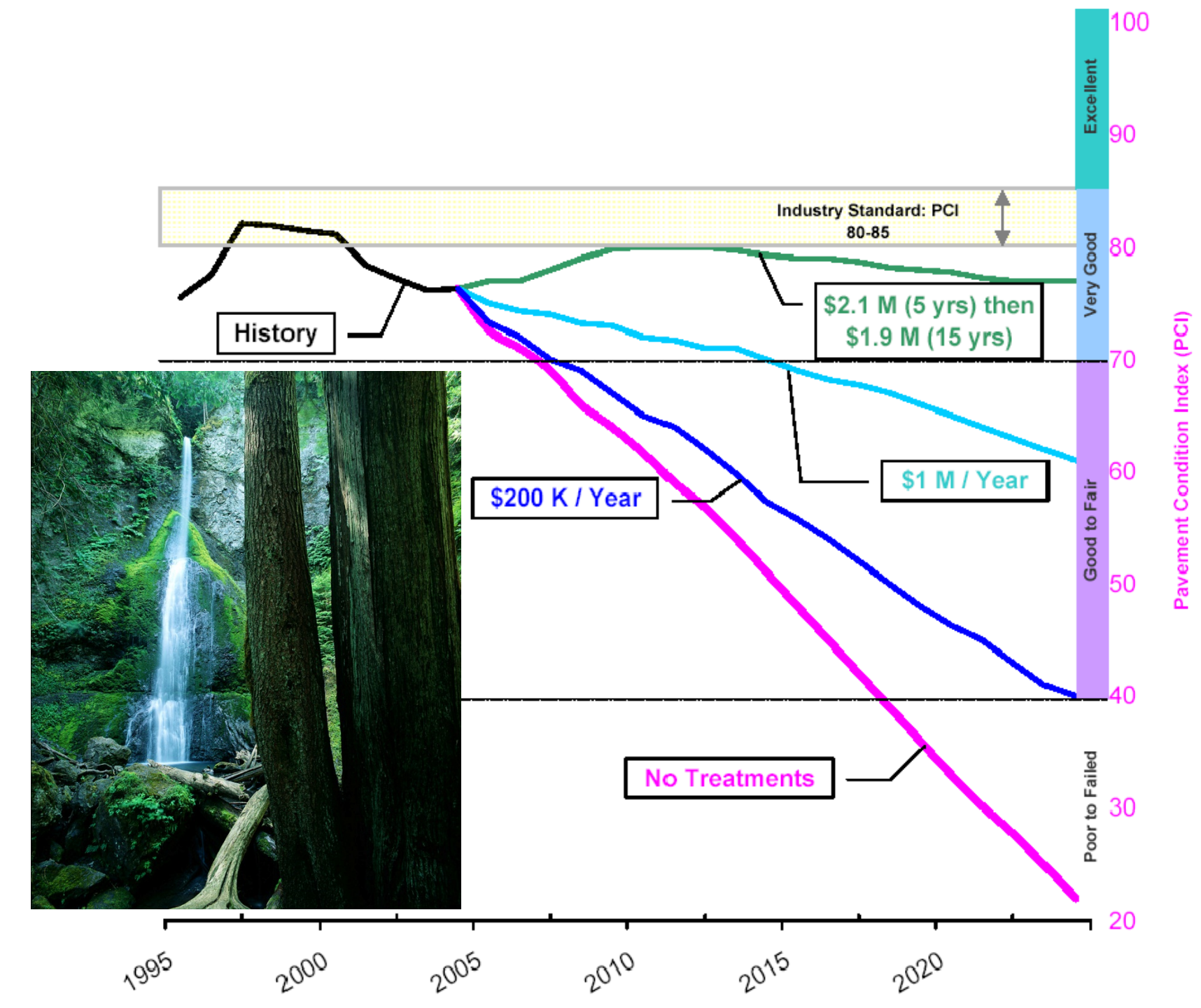
Maintained Total = $236 K Life Avg. PCI = 90

Non-Maintained Total = $600 K Life Avg. PCI = 76

The poorer the road, the greater the liability.

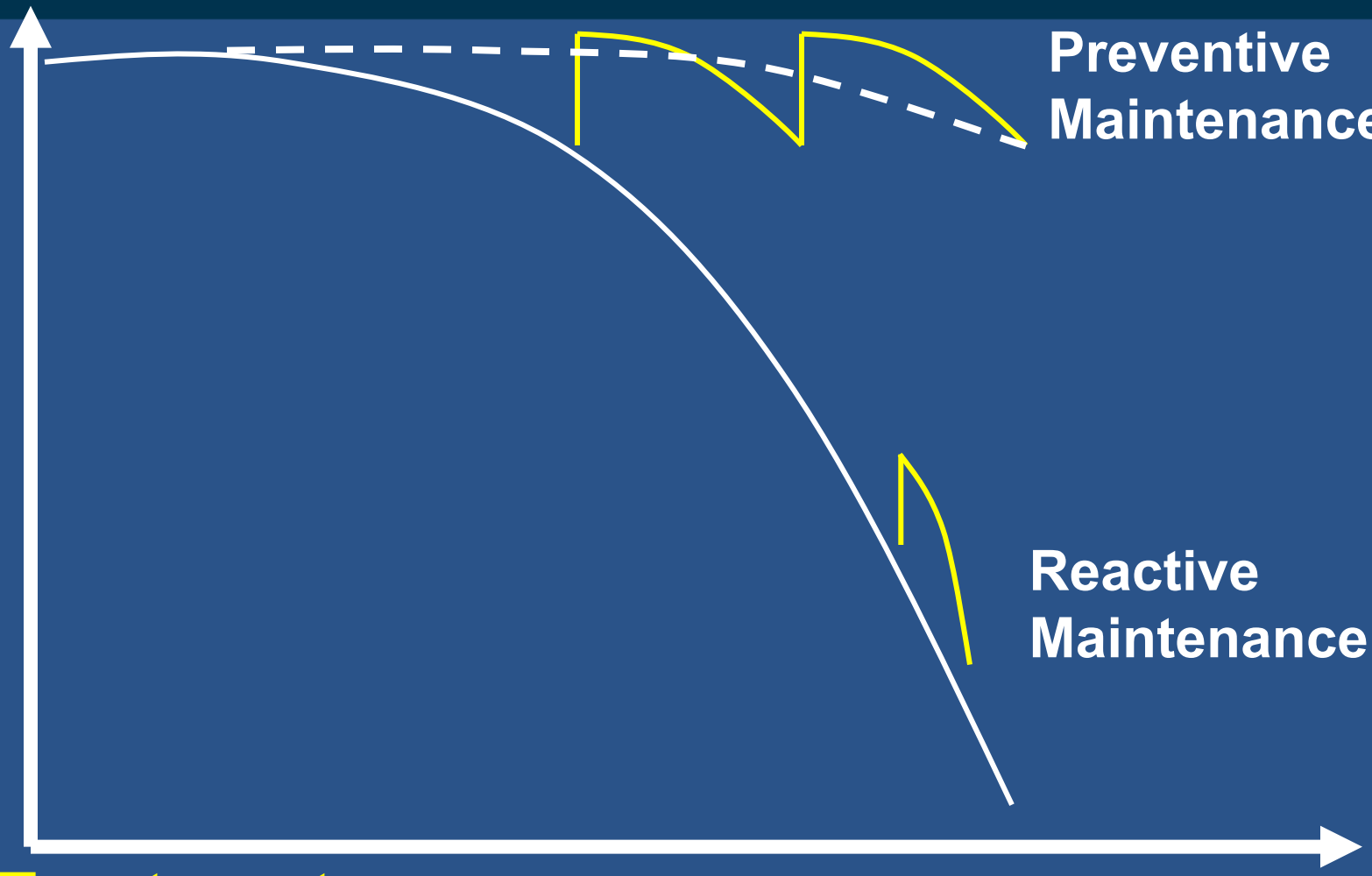
Multnomah County, Oregon
DCS -Transportation

http://www.co.multnomah.or.us/dbcs/LUT/road_maintenance/


Excellent
Very Good
Good to Fair
Poor to Failed
100
90
80
70
60
50
40
30
20
Pavement Condition Index (PCI)
Industry Standard: PCI
80-85
History
$2.1 M (5 yrs) then
$1.9 M (15 yrs)
$1 M / Year
$200 K / Year
No Treatments
1995
2000
2005
2010
2015
2020

Thank You for the Invite!

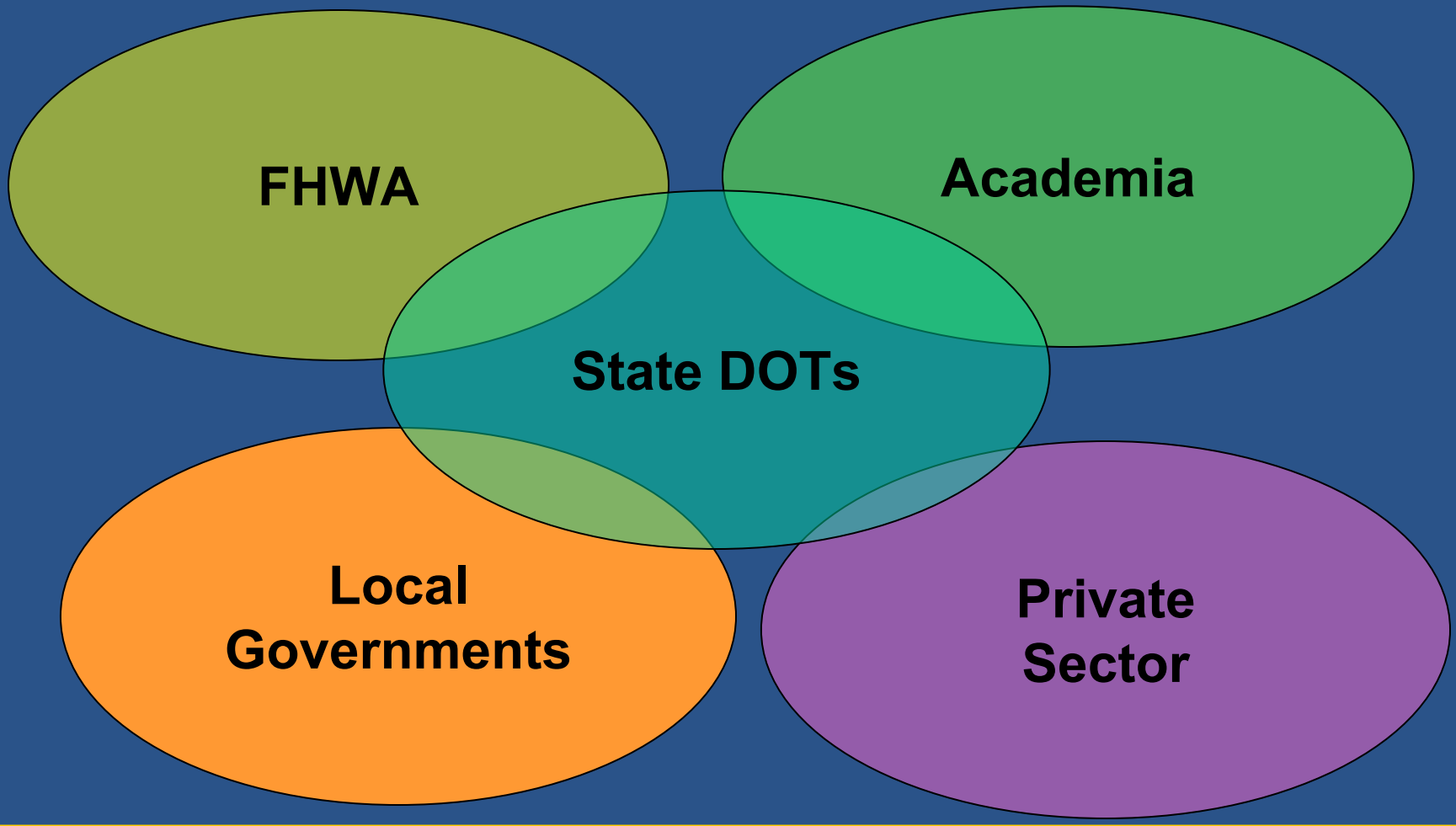
Northwest Pavement Management Association



***Right* Treatment…**
…*Right* Road… *Right* Time.

USE PMS

Partnerships Are Required



Questions?

THANK YOU!

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Steve.Mueller@dot.gov