



Transportation Asset Management Systems and Pavement Preservation

Southeast Pavement Preservation Partnership
San Antonio, Texas
May 29, 2013

Today's Discussion Topics

- Asset Management Systems Overview
- MAP-21 Influence
- Getting Better Results through Integration
- Pavement Preservation within an AMS Framework
- Improving Analysis through Research
- Taking AMS to the Next Level with Trade-off Analysis

Evolution of Asset Management Systems

- 1970's-80's
 - Mainframe systems
 - Primarily developed for financial purposes, e.g. cost accounting
 - Genesis of Pavement and Bridge Management Systems
 - Creation of Road Inventory Systems for Planning & Reporting
- 1990's
 - Federal legislation requires Pavement and Bridge Systems
 - Typically stand-alone systems
 - Transition to PC's, Windows and Client-Server Systems
- 2000's
 - Promotion of “Asset Management”
 - Expansion of systems within disciplines
 - Web-based platforms
 - GIS/LRS Advancements
 - Enterprise systems

Common SHA Asset Management Systems

- Pavement
- Bridge
- Maintenance
- Safety
- Traffic-Signs, Signals, ITS etc
- Road Inventory
- Fleet & Equipment
- Facilities
- Asset Inventory databases & spreadsheets

Common AMS Data Dependencies

- Financial
- Project Planning and Scheduling
- Construction
- Inventory
- Legacy
- DMV

Asset Management Systems Today

- Perception that Pavement and Bridge Management are mature
- Lots of Data, quality remains an issue
- Increasing Asset Inventories, Asset types
- Assessment Methodologies continue to advance
- Advancement of Analytics
- Disparate systems are still commonplace
- Enterprise approach gaining favor among agencies
- Multiple platforms and databases challenging to support
- MAP 21 is driving the need for integrated systems

MAP-21 Influence

- Required Asset & Performance Management Plans
- Required Agency Performance Measures and Targets
- Agencies must improve or preserve asset conditions and performance
- National Performance Goals, e.g. “State of Good Repair”
- National Highway Performance Program
- New minimum pavement condition requirements for Interstate system
- Recognition of ‘Preservation’
- Long Range Plans must reflect agency Performance Plans
- STIP must align with agency Performance Goals
- Trade-Off analytical tools desirable

MAP-21 AMS Implications for SHA's

- Are you achieving the best or optimum performance (LOS) across the network at the current level of funding?
- Are you performing the right mix of activities, projects, strategies to achieve the best long term performance for the network?
- Can you readily determine the level of investment needed across all assets to achieve agency performance targets? Can you conduct trade-off analysis?
- Do you have the capability to perform short and long term scenario analysis ?
- Can you readily meet MAP 21 reporting requirements?

Getting Better Results through Integration

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INTEGRATED TRANSPORTATION ASSET MANAGEMENT SYSTEM (ITAMS)

MISSION & VISION

CHANGE

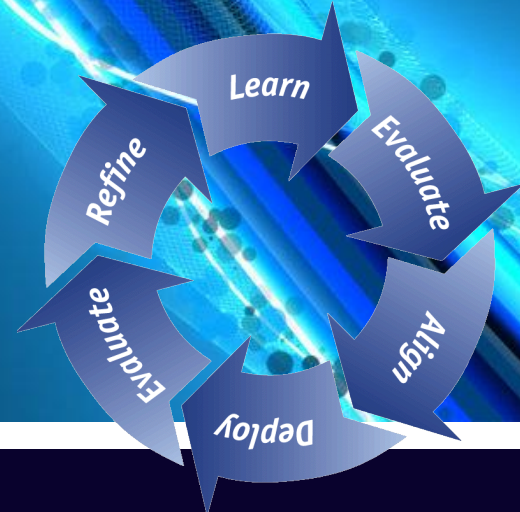
ADAPTABILITY

Accountability Organization

PAST FUTURE

SEA of DATA

Transform Data into Information



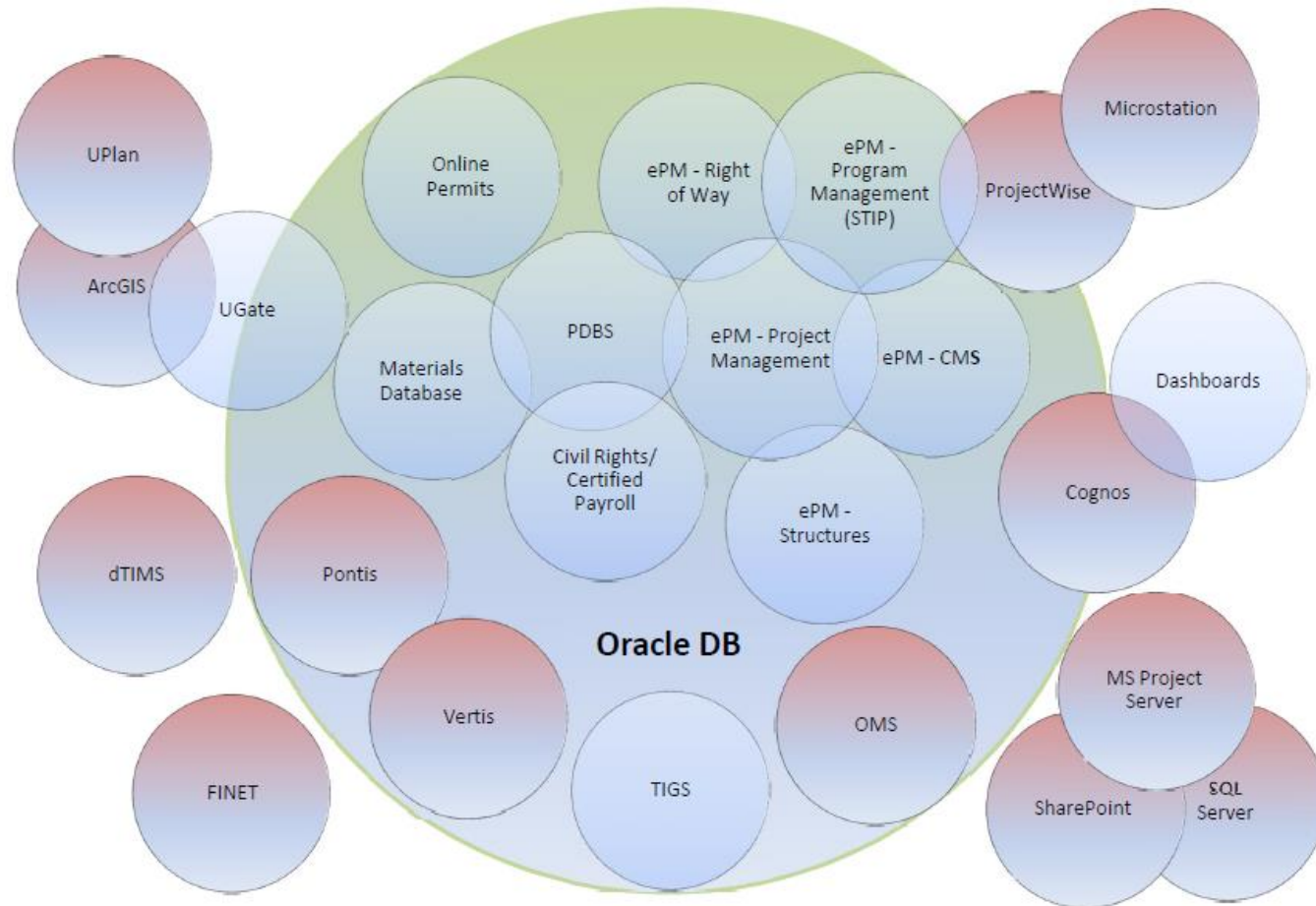
Integrated AMS: Vision

- Unified Transportation Plans and Analysis
 - Cross Asset Analysis and Portfolio Management
 - Remove Silos across people, data and strategies
 - Defined dashboards, metrics and outcomes



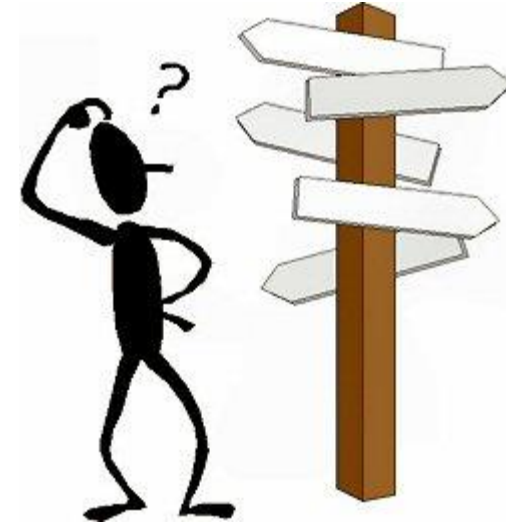
Big Picture Integration Example

UDOT Information Systems



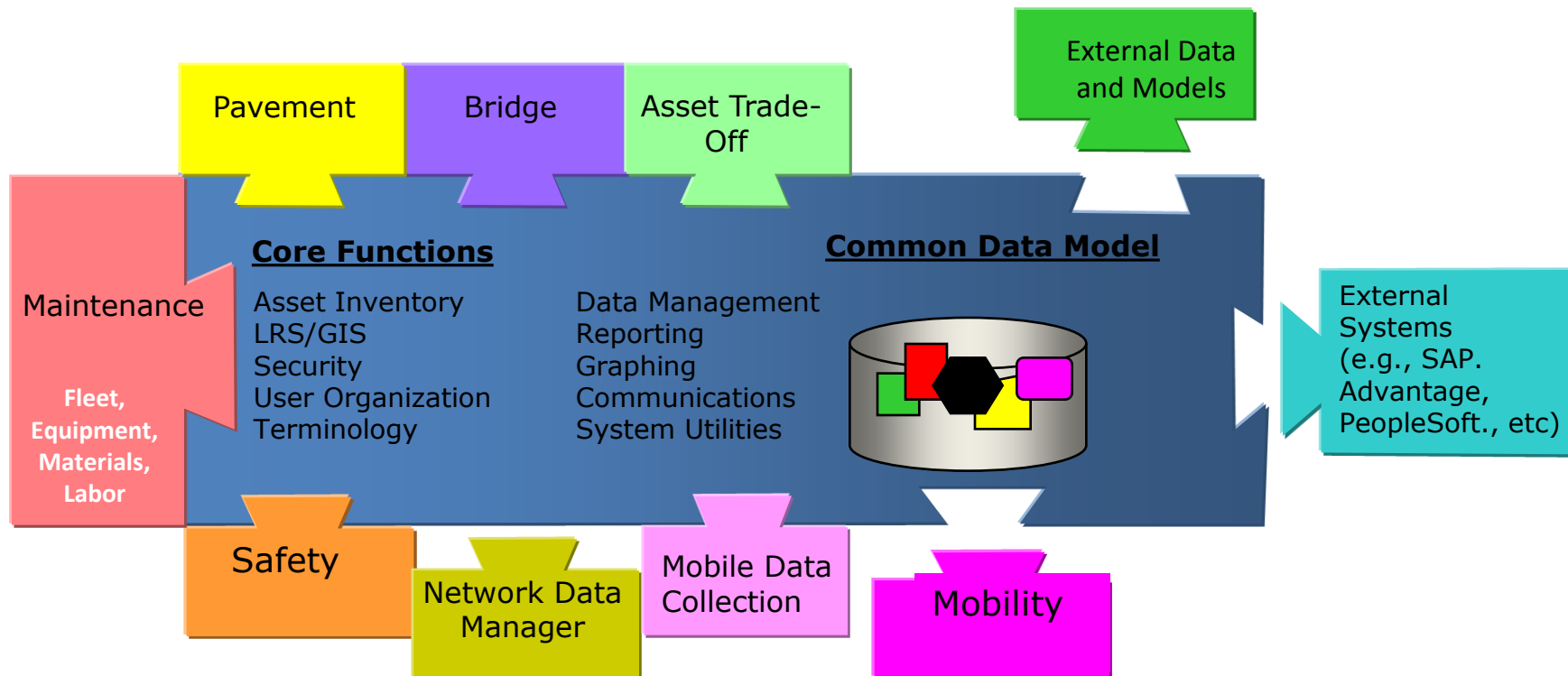
Integration across Multiple System Platforms

- Consistency of Location data
- Accurate capture of work accomplished
- Consistency of Business Rules/Processes
- Ability to share or view work plans, e.g. viewing PMS work plan in MMS for planning & scheduling
- Interface Requirements & ability to push or pull data
- IT resource requirements for multiple platforms
- Frequency and Impact of Upgrades
- Keeping pace with industry advancements

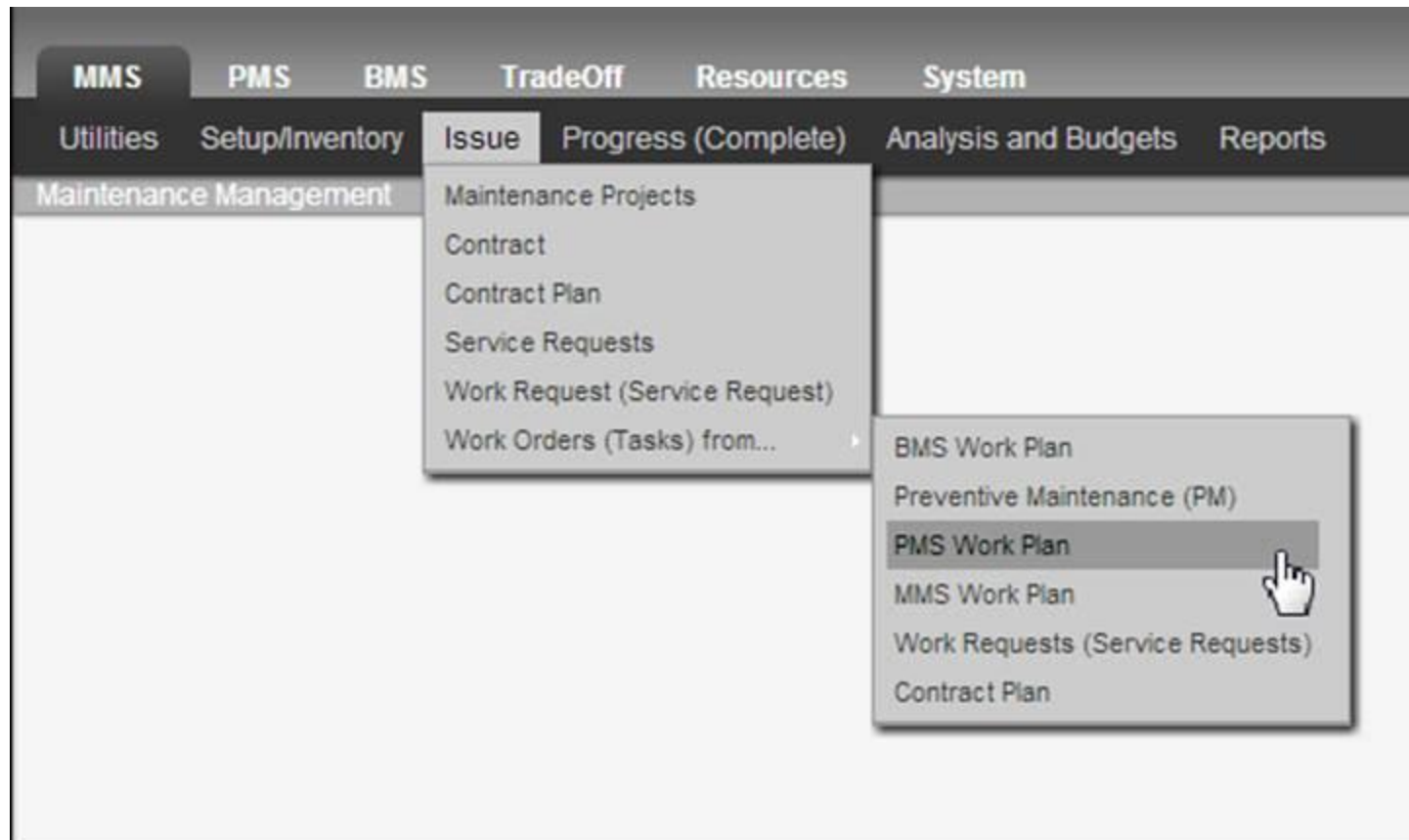


Integrated Asset Management System Example

Modular Framework



Example of Integration between Modules

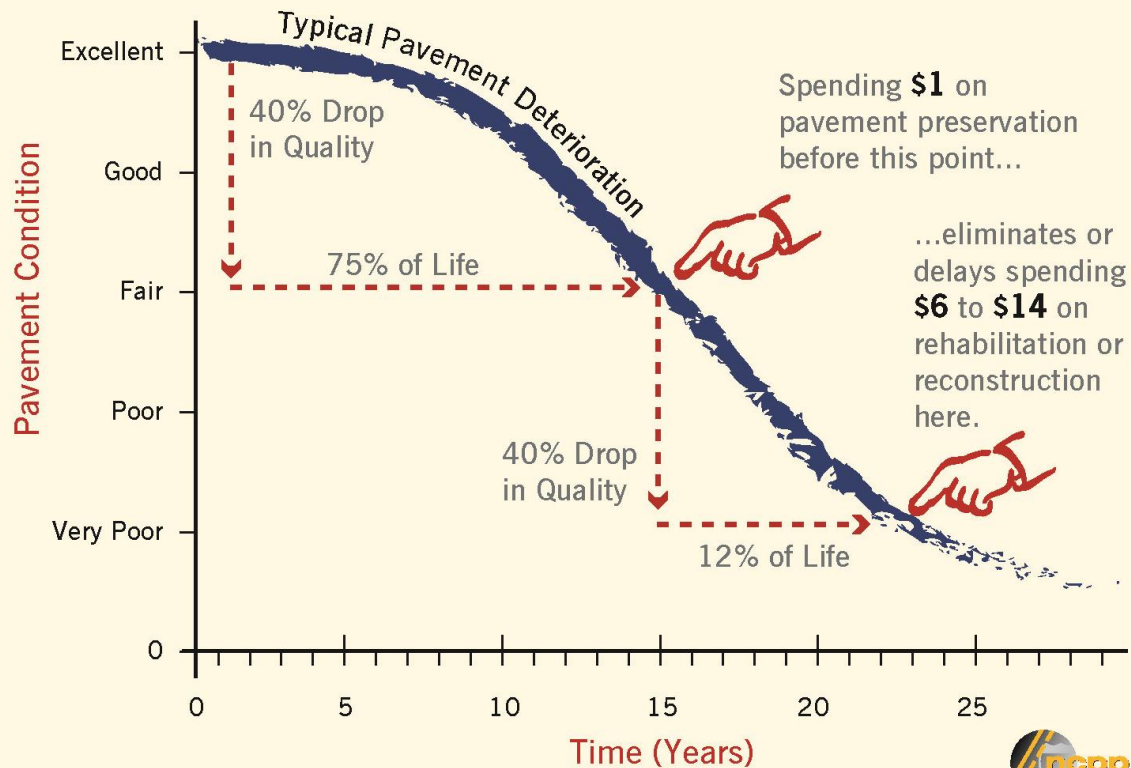


Integrated AMS Suite

- Data shared between system modules
- Shared data increases collaboration in achieving common organizational goals and metrics
- Similar look and feel across modules-User experience
- Data imported from external systems into “core”
- Supports more efficient decisions across organization
- Reduced level of IT support due to single platform vs. supporting multiple stand-alone applications
- Common Referencing System (LRS) & standardized handling of LRS updates
- Interfaces required for external systems

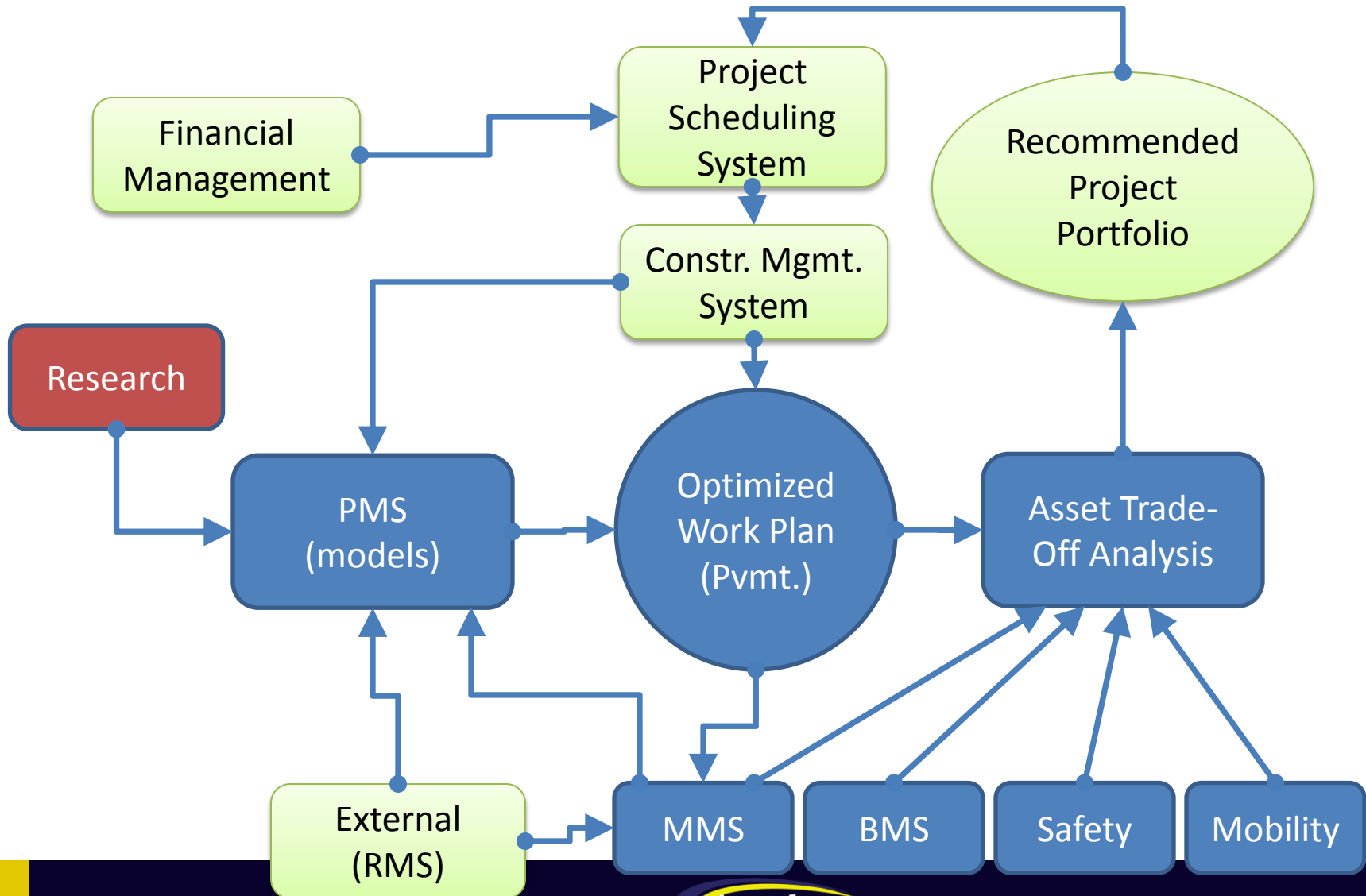
Pavement Preservation within an AMS Framework

PAVEMENT PRESERVATION IS COST EFFECTIVE



Source: National Center for Pavement Preservation.

Integrated PMS Framework

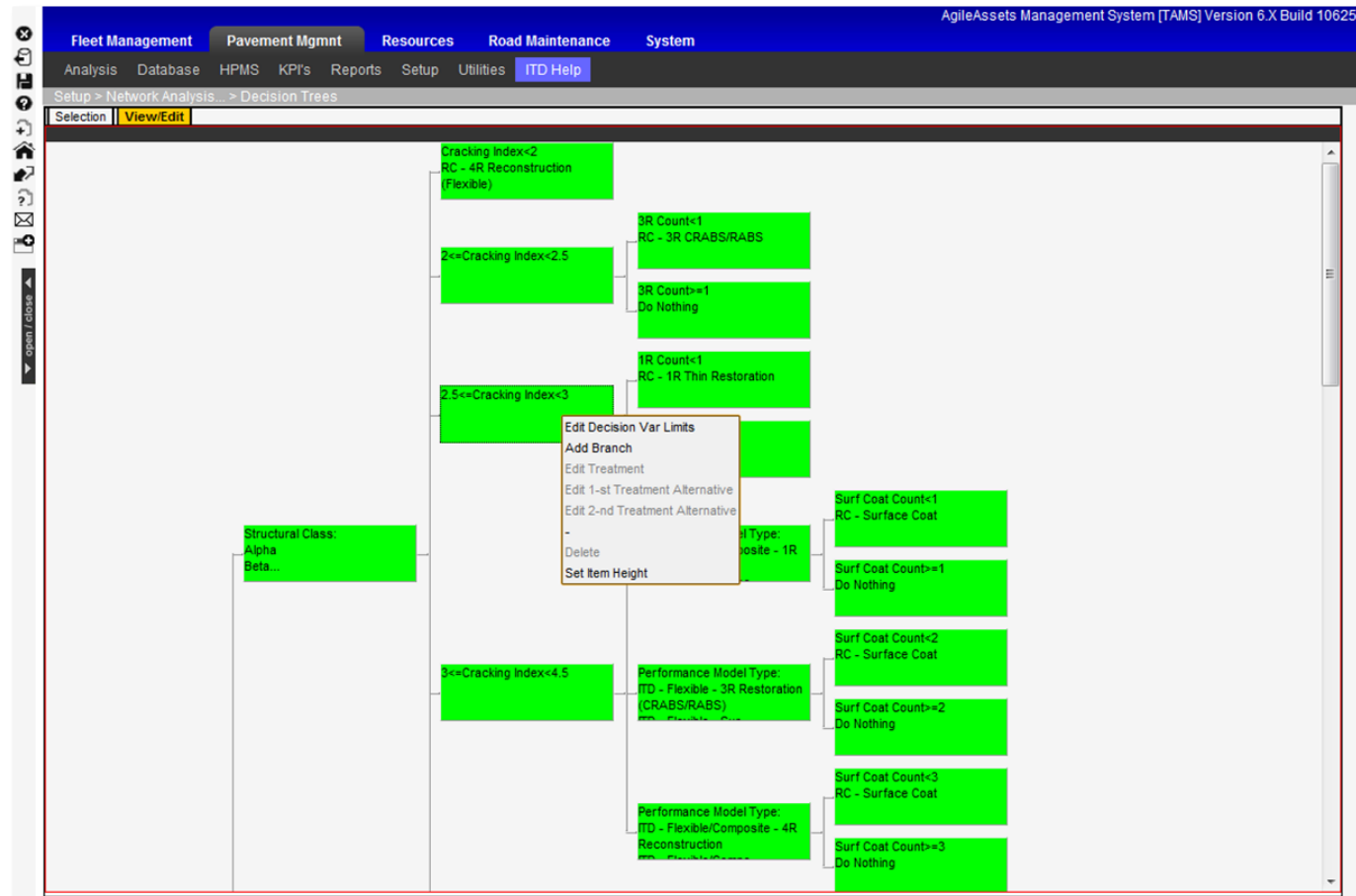


Key Pavement Preservation Issues

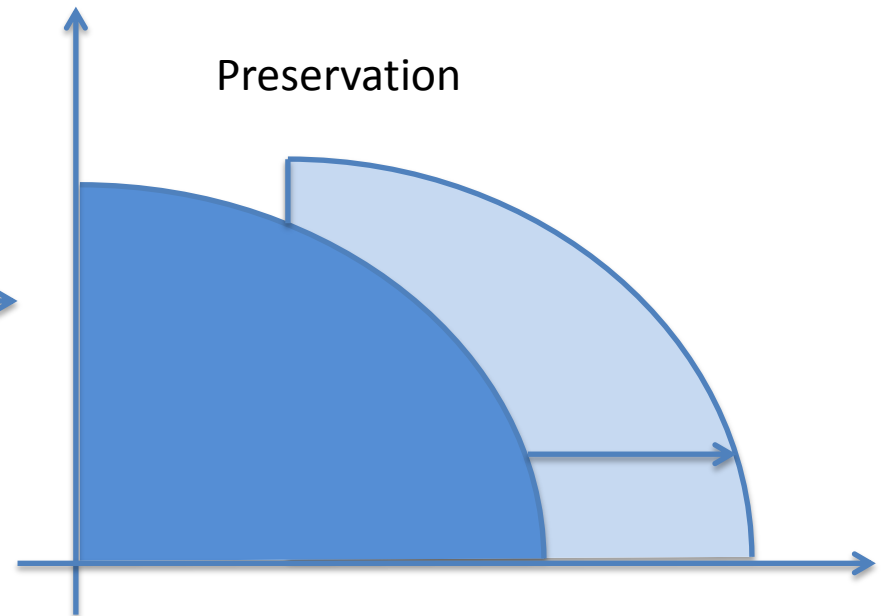
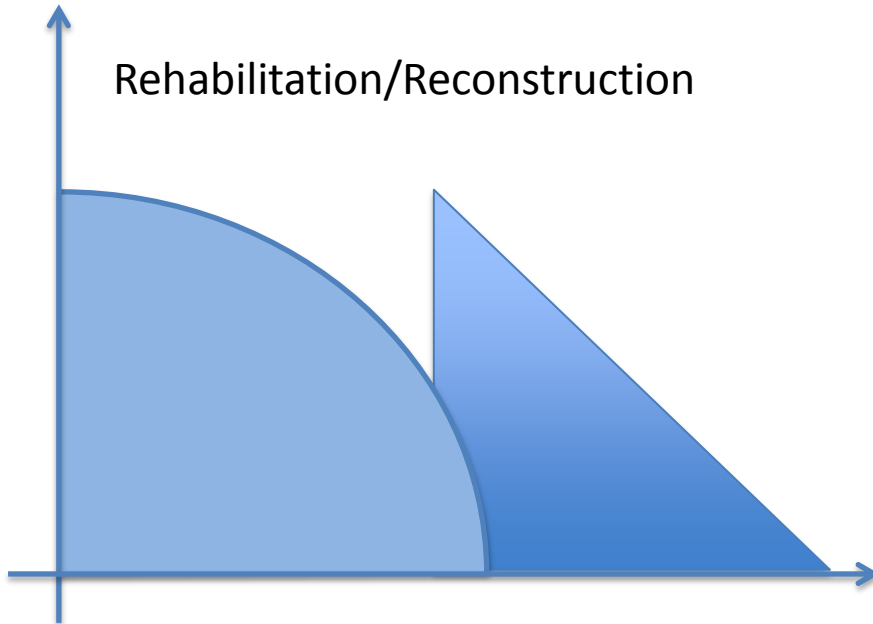
- Project /Treatment Selection Criteria
 - Decision Trees and Models
- Capturing details of completed Preservation work
 - Maintenance & Contracted work
 - Interfaces
 - Q/A-Q/C of data
 - Business Rules
 - Construction History
- Consideration of Planned Projects
 - “Hardwiring” programmed projects into analysis
- Validating the effectiveness
 - Performance monitoring
 - Determining life extension
- Timing of Treatments
 - Research

Project and Treatment Selection

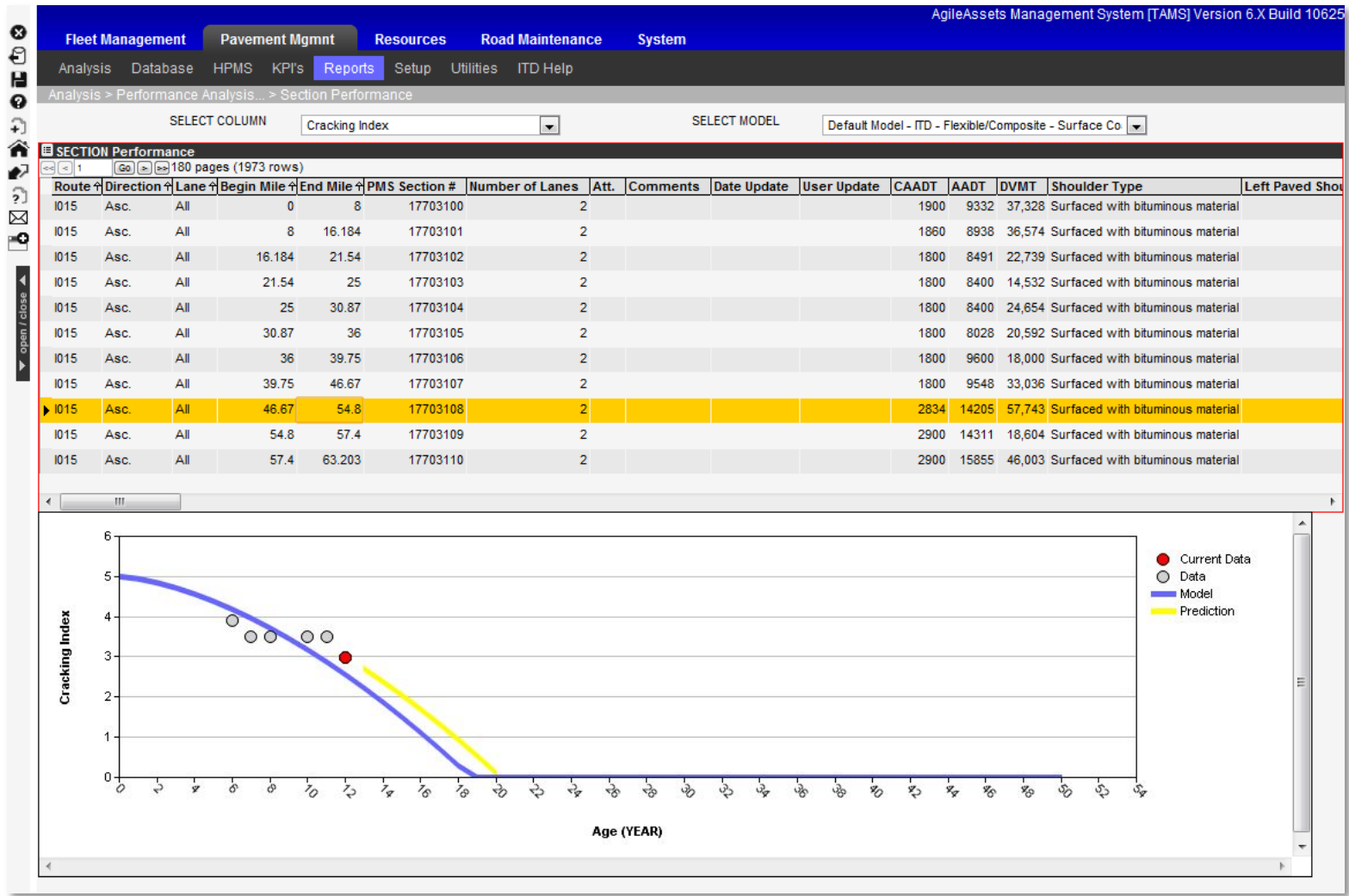
- Development of Decision Trees that include preservation



Models should Incorporate Preservation Influence

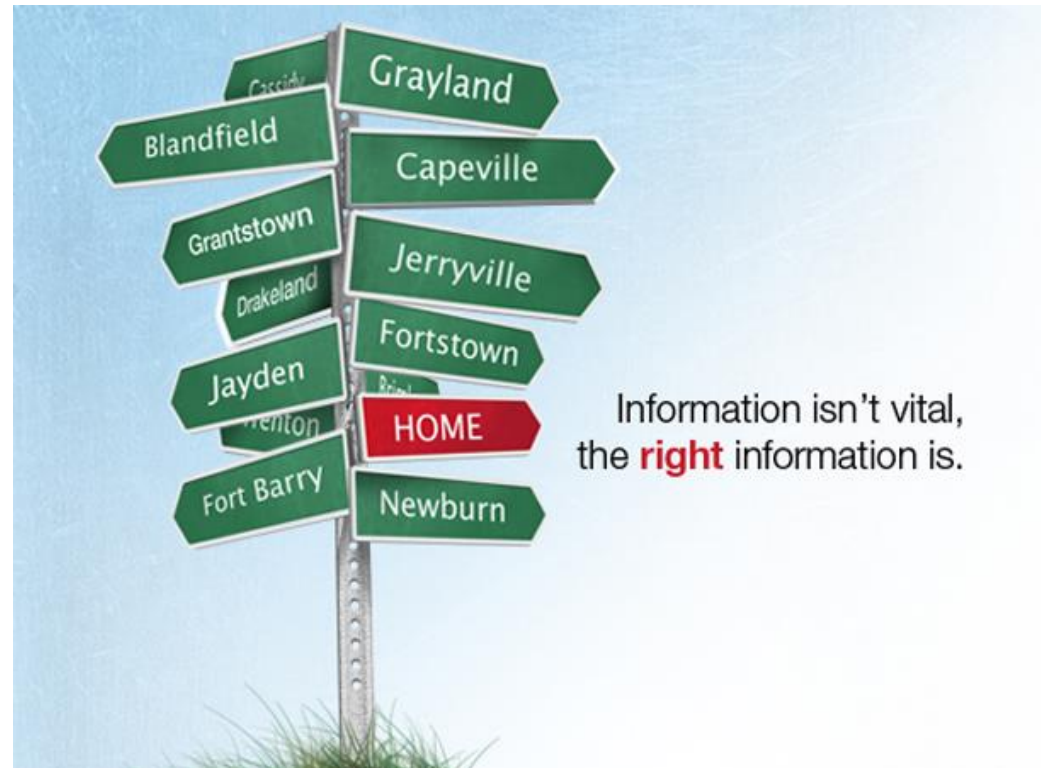


Section Modeling



Getting the Right Data

- Inventory
- Location
- Condition
- Traffic
- Construction History



Construction History Data is Critical

AgileAssets Management System (TAMS) Version 6.X Build 10625

Fleet Management | **Pavement Mgmt** | Resources | Road Maintenance | System

Analysis | Database | HPMS | KPI's | Reports | Setup | Utilities | ITD Help

Database > Construction > Pavement Structure (Profile / Cross Section)

Location: Route: 015, Direction: Asc., Lane: 1 (Outer/Right-most lane), Begin Mile: 0, End Mile: 20

Partitions	Layers						
Begin Mile	End Mile	Contract name	Year Completion	Layer	Material Code	Thickness (in)	Work Type
0.0	10.0	IH015(M(006))	2011	1	Asphalt	3	Rehabilitation
10.0	16.0	8602(1MD-15-1(129)0)	2004				Preventive Mai
16.0	16.184	8602(1MD-15-1(129)0)	2004	1	Asphalt	4.7	Rehabilitation

Work Data Table

Longitudinal Layer Data

Cross Sectional view

Common Challenges with Construction Data

- Interfaces with PMS typically required
- Data Q/A required, often manually by PMS staff-difficult to automate due to differing business rules and needs
- Construction Management System project location may not align with PMS LRS
- Delay in getting project information from the field
- Pay items in Construction Management System are typically measured in units such as SY or Tons and may not provide layer thickness for Construction history
- ERP Maintenance Management Systems don't generally provide required location data for pavement maintenance and preservation activities
- Preservation work performed by Maintenance not captured at all



Construction History – Data Entry Forms

AgileAssets Management System [TAMS] Version 6.X Build 10625

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Database > Construction > Construction History

Constr. History Sections

1 | Go | 2 pages (2 rows)

Contract name	IH015(M(006))	* Key Number	00132
* Year Completion	2011	Sub_Base Type	Key Number
Project Number	IH015-001	* Su	The key number of a project 8/2011
Treatment	RC - 1R Thin Restoration	HPMS Work Code	
User Update	ERIC	Work Description	
Date Update	5/30/2011	HPMS Pavement Type	
IRI Needs CP Adjustment		Approved	<input checked="" type="checkbox"/>
Aggregate Size		Approver	ERIC
Base Type		Approved Date	5/30/2011
Binder Grade		Reviewed	<input checked="" type="checkbox"/>
Gyrations Level		Reviewer	ERIC
Interlayer		Review Date	5/26/2011
Work Code	RC1R1	Att.	

Pavement Type

Work History Information

Constr. History Sections Location

1 | Go | 1 pages (1 rows)

Route	Direction	Lane	Begin Mile	End Mile	Comments	Att.	User Update	Date Up
I015	Asc.	1 (O	0	20			ERIC	5/26/2011

Locations Information

Material Layer Information

1 | Go | 1 pages (1 rows)

* Layer	* Material Code	* Thickness (in)	Date Update	User Update	Att.	Commen
1	Asphalt	3	5/30/2011	ERIC		

Layers Information

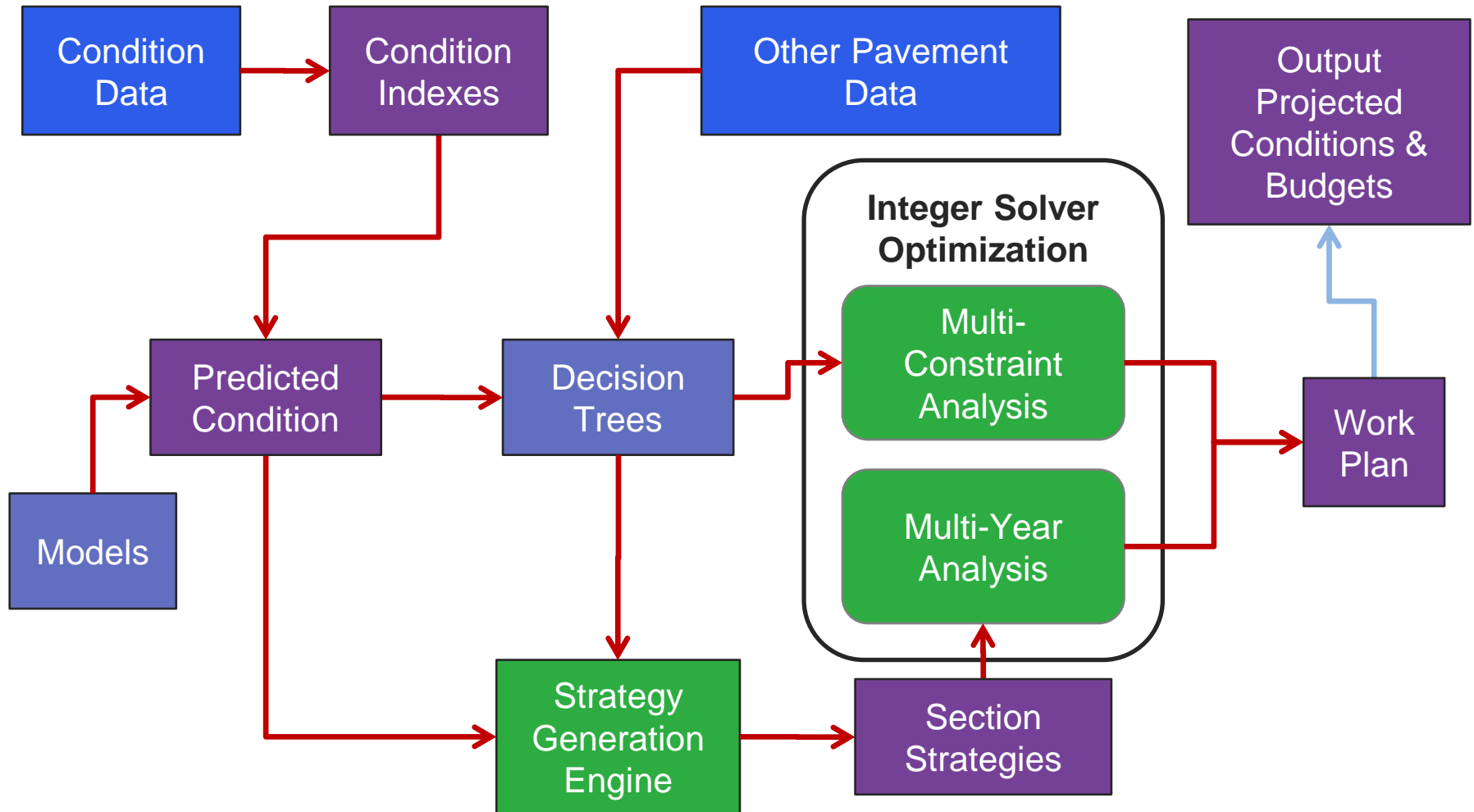
Consideration of Planned Projects

- Incorporation of planned or programmed R&R Capital projects
- Requires interface between PMS and Project Scheduling System
- Projects can be “hardwired” into scenario analysis
- Challenges encountered include:
 - Pavement treatments may be only part of a broader scope and lack sufficient detail
 - Correctly locating planned projects on LRS
 - Planned Pavement Preservation activities may not specifically identify a location or treatment. (Funding Placeholder)

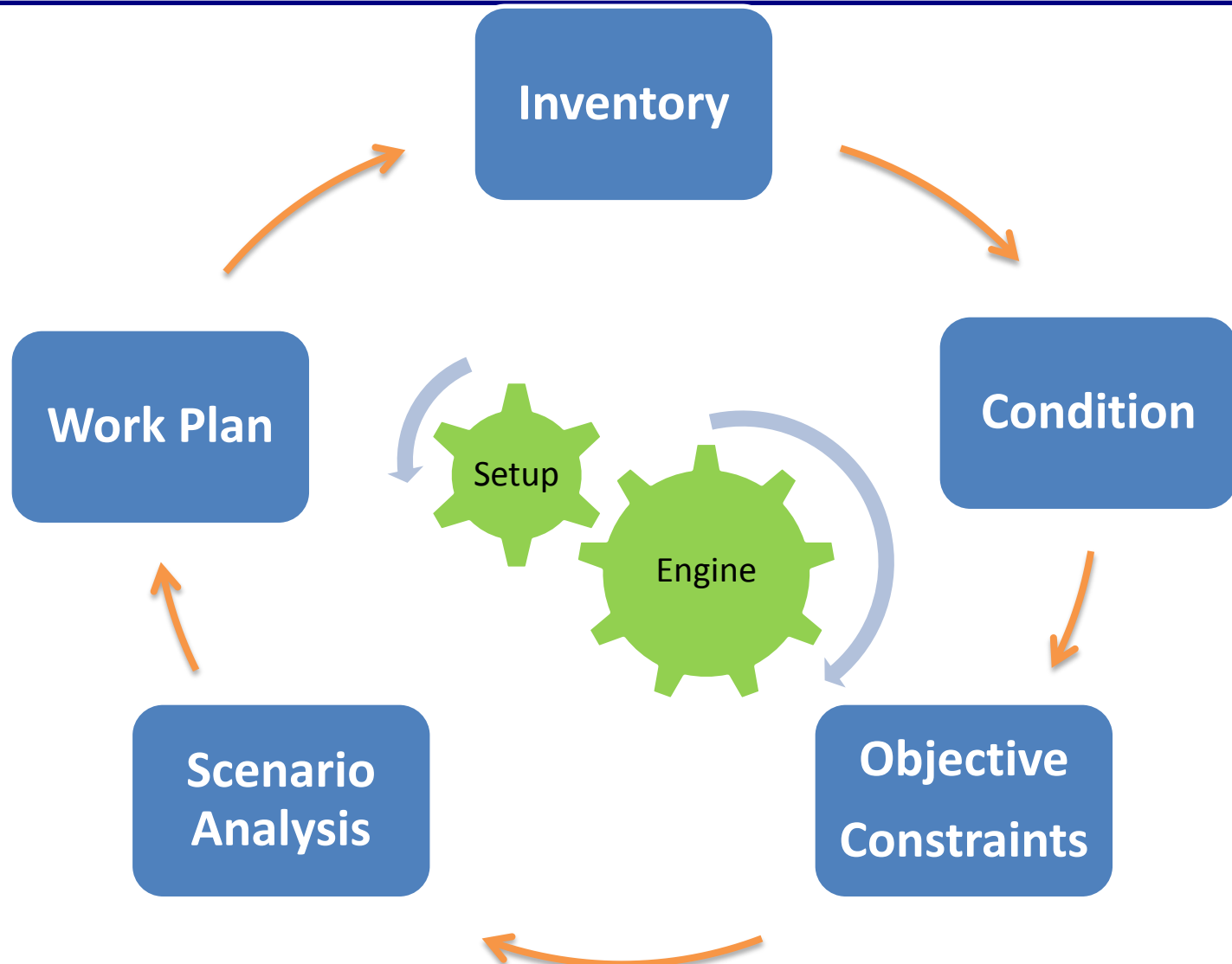
Determining Pavement Preservation Effectiveness

- A PMS can model preservation as one of the tools in the management toolbox
- As time progresses it is important to utilize the data collected in the PMS to refine the models
 - Use the PMS as a source for on-going research
 - Improve deterioration models
 - Better represent preservation improvements
- Investigate the effects of preservation policies and priorities by comparing scenario outputs

Example PMS Scenario Analysis Framework



Scenarios Analysis — Concept



Scenario Analysis Objectives

- Best Set of Projects
 - The projects meet a set of constraints
 - Maximizes or minimizes an objective (Maximize condition, minimize budget, etc.)
- The desired OUTPUT of the analysis is a WORKPLAN, that tells us:
 - Using which treatments to apply, (What)
 - To which sections (Where)
 - In which year (When)

Optimized Work Plans

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Fleet Management Pavement Mgmt Resources Road Maintenance System

Analysis Database HPMS KPI's Reports Setup Utilities ITD Help

Analysis > Network Analysis > Optimization Analysis

Setup | Results | Constr Results | Report

Work Plan Results

Go to page 37 of 37 pages (990 rows)

Plan Year	Budget Group	Treatment	Estimated Cost	Route	Direction	Lane	Begin Mile	End Mile	Length	MWP Project Status	Pri
1	Preservation - PM	RC - Surface Coat	\$211,200.00	I015	Asc.	All	36	39.75	3.75	Scenario Recommended	
1	Preservation - 1R	RC - 1R Thin Restoration	\$2,289,408.00	I015	Asc.	All	46.67	54.8	8.13	Scenario Recommended	
1	Preservation - 1R	RC - 1R Thin Restoration	\$1,658,624.00	I015	Asc.	All	76.01	81.9	5.89	Scenario Recommended	
1	Restoration	RC - 3R CRABS/RABS	\$1,719,168.00	I015	Asc.	All	81.9	85.6	3.7	Scenario Recommended	
1	Preservation - PM	RC - Surface Coat	\$191,037.00	I015	Asc.	All	92.48	95.872	3.392	Scenario Recommended	

Floating Map

Map

Themes

- Bing Map Tiles
- Routes
- Highlighted features
- World Street Map

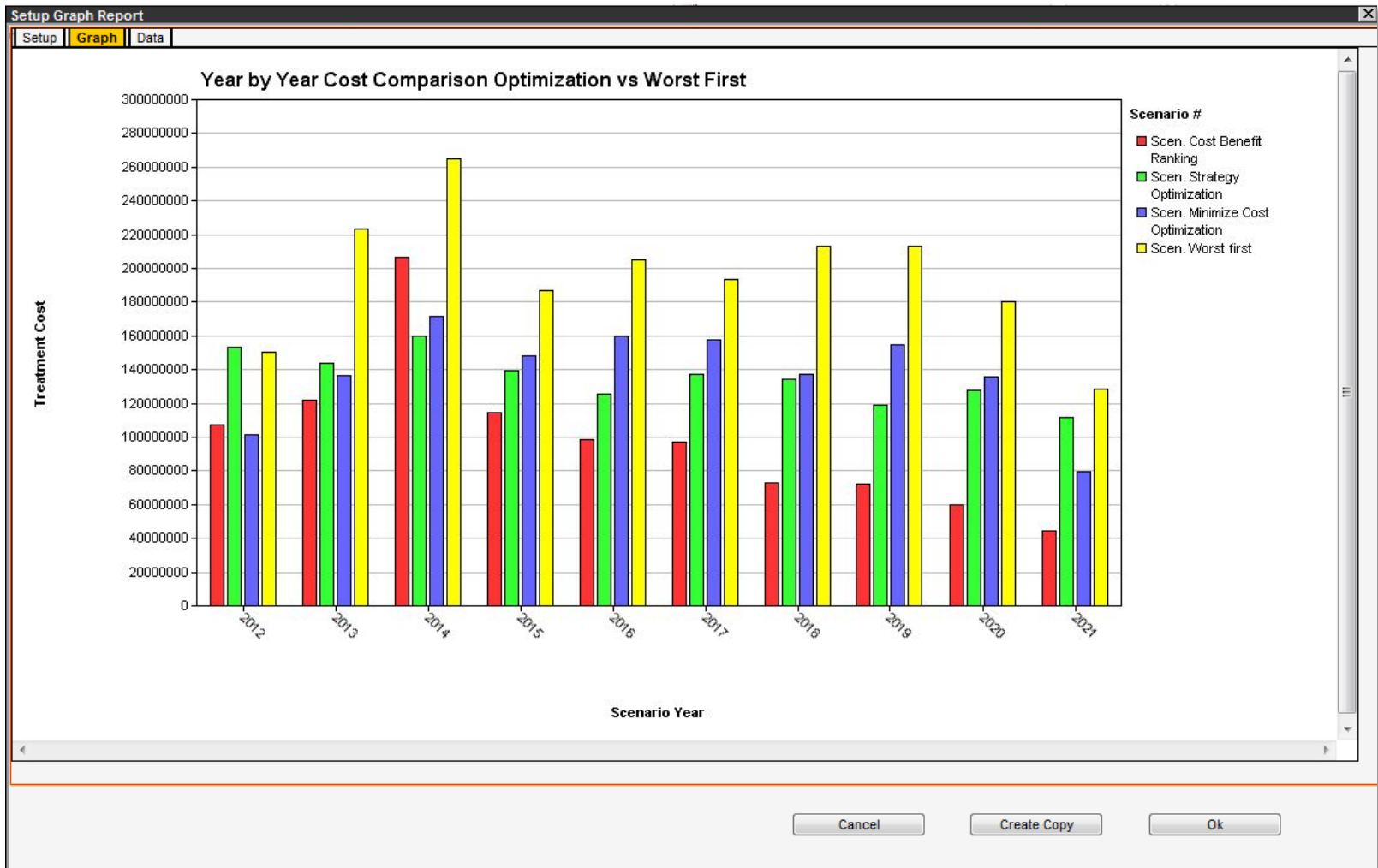
Scale: 1:1,690,586

The map shows a network of roads in Idaho. Route I015 is highlighted in red, showing a path from the northwest to the southeast through cities like Boise, Idaho Falls, and Pocatello. Other routes shown include I26, I20, I30, and I84.

Work Plan lists

- Year
- Treatment
- Cost
- Location

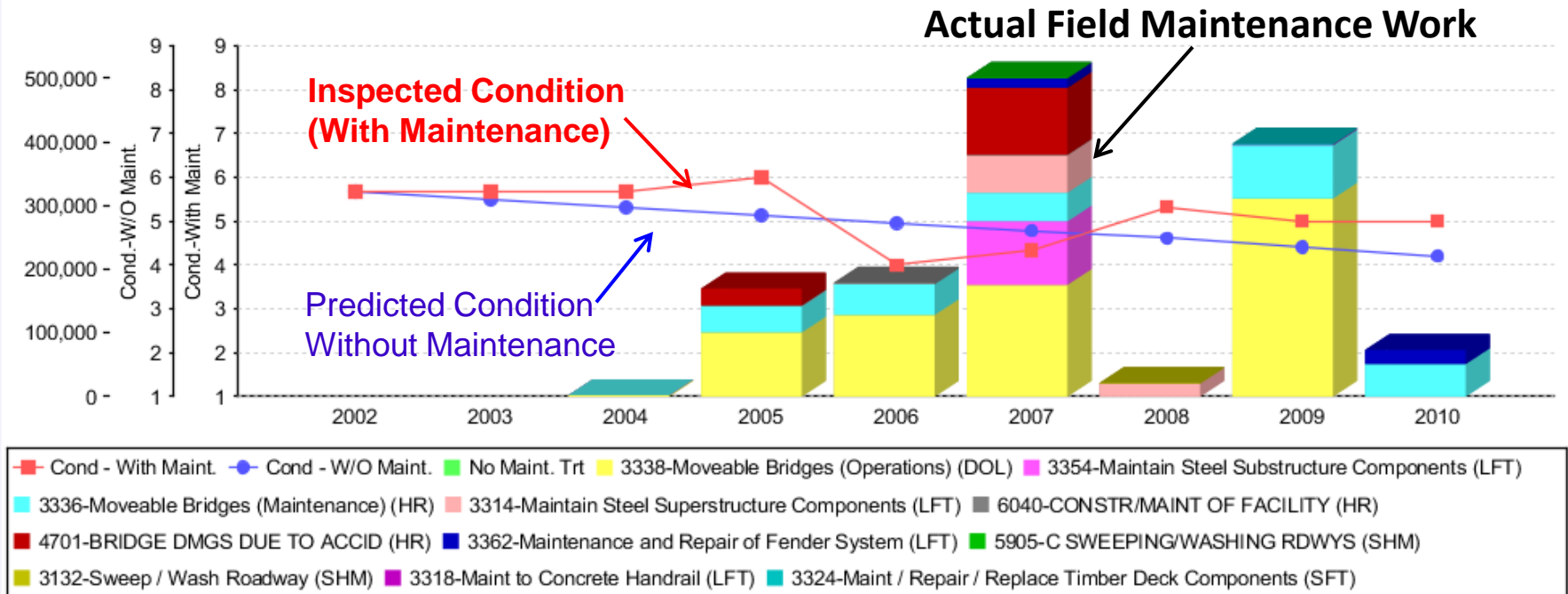
Comparing Scenarios: Compare Analysis Methods



Validating the Impact-BMS Example

Performance Management: Evaluate impact of bridge maintenance/preservation activities on bridge element condition rating (Project/Bridge Level)

STRUCTURE NO: 700016

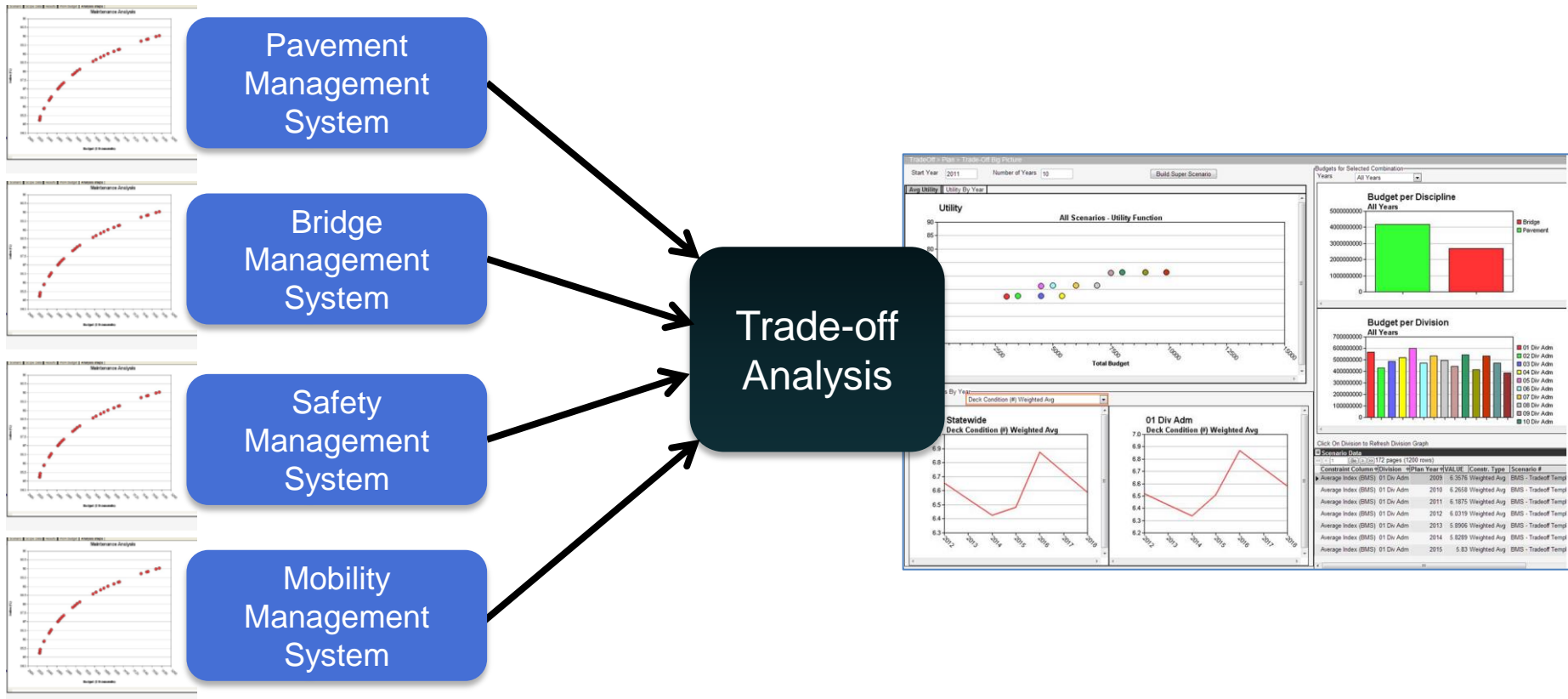


Improving Analysis through Research

- Meaningful Research results dependent on good data sets
- Accurately capturing details of completed Maintenance and Preservation work completed is critical for validating treatment effectiveness and timing
- Decision trees and models can be adjusted
- Continuous validation and updating process based on performance data

Enhancing AMS results through Trade-off Analysis

- Need to be able to analyze tradeoffs between competing objectives...
- Multi-criteria and efficient surfaces



Impact Analysis

Evaluate Impact on Bridge, Pavement and Overall System



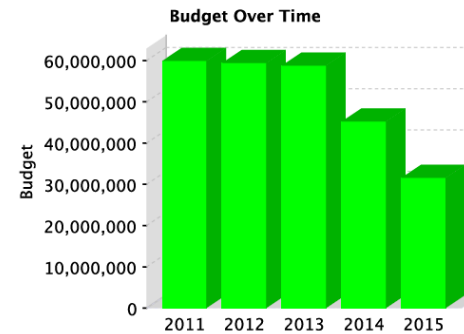
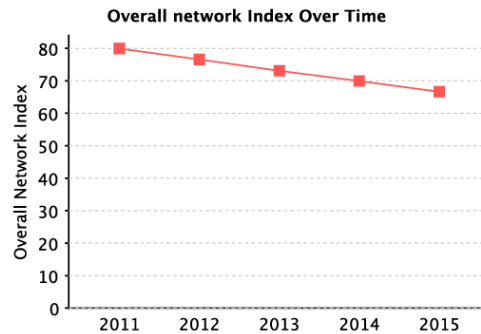
Tradeoff Analysis - Scenario: I-40 5-YRS BMS-30M PMS-30M

Date:04/16/2012

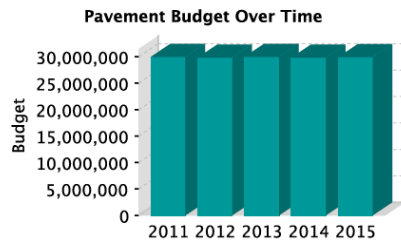
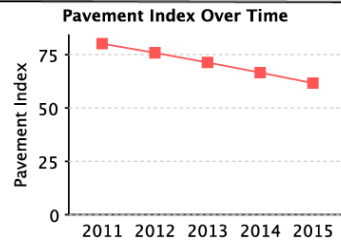
Time:10:34 PM

Start Year = 2010; Number of Years = 5

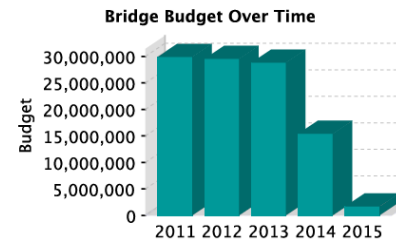
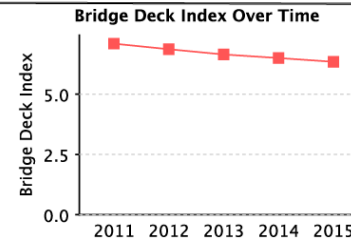
NETWORK



PAVEMENTS



BRIDGES



Closing Thoughts

- MAP-21 is a Game Changer!
- The Future is about Performance
- Robust Systems are Critical for Achieving Performance Goals
- “Preservation” is actually in Law!
- Leverage AMS Analytics & Research to validate Pavement Preservation Benefits



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