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

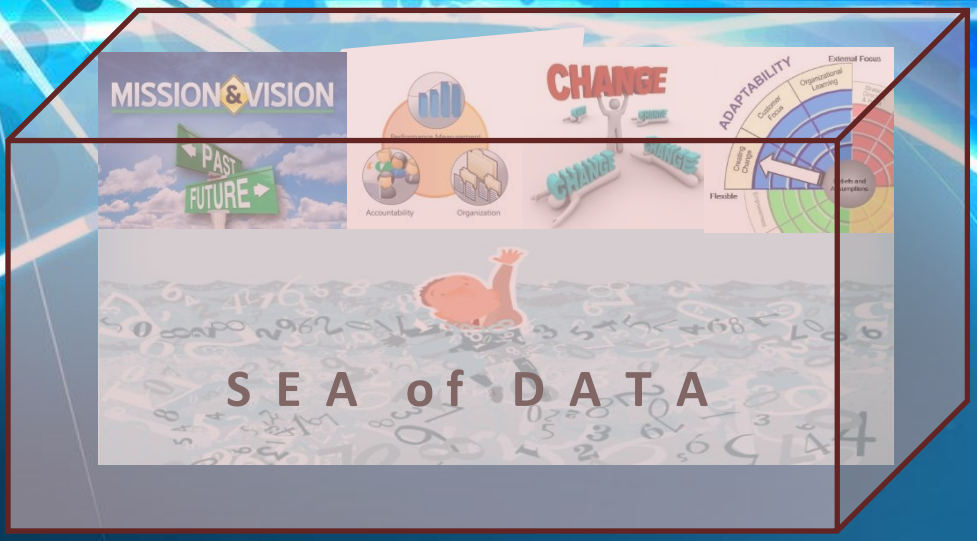
- Are you achieving the best or optimum performance (LOS) across the network at the current level of funding?
- Are you performing the right mix of activities, projects, strategies to achieve the best long term performance for the network?
- Can you readily determine the level of investment needed across 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

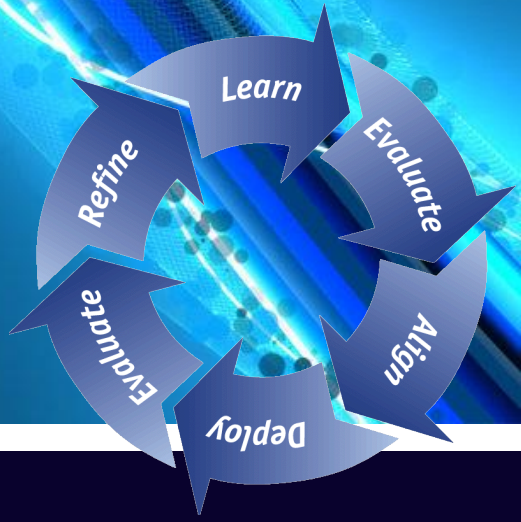
SYSTEMS APPROACH

MANAGED CHAOS

INTEGRATED TRANSPORTATION ASSET MANAGEMENT SYSTEM (ITAMS)



Transform Data into Information

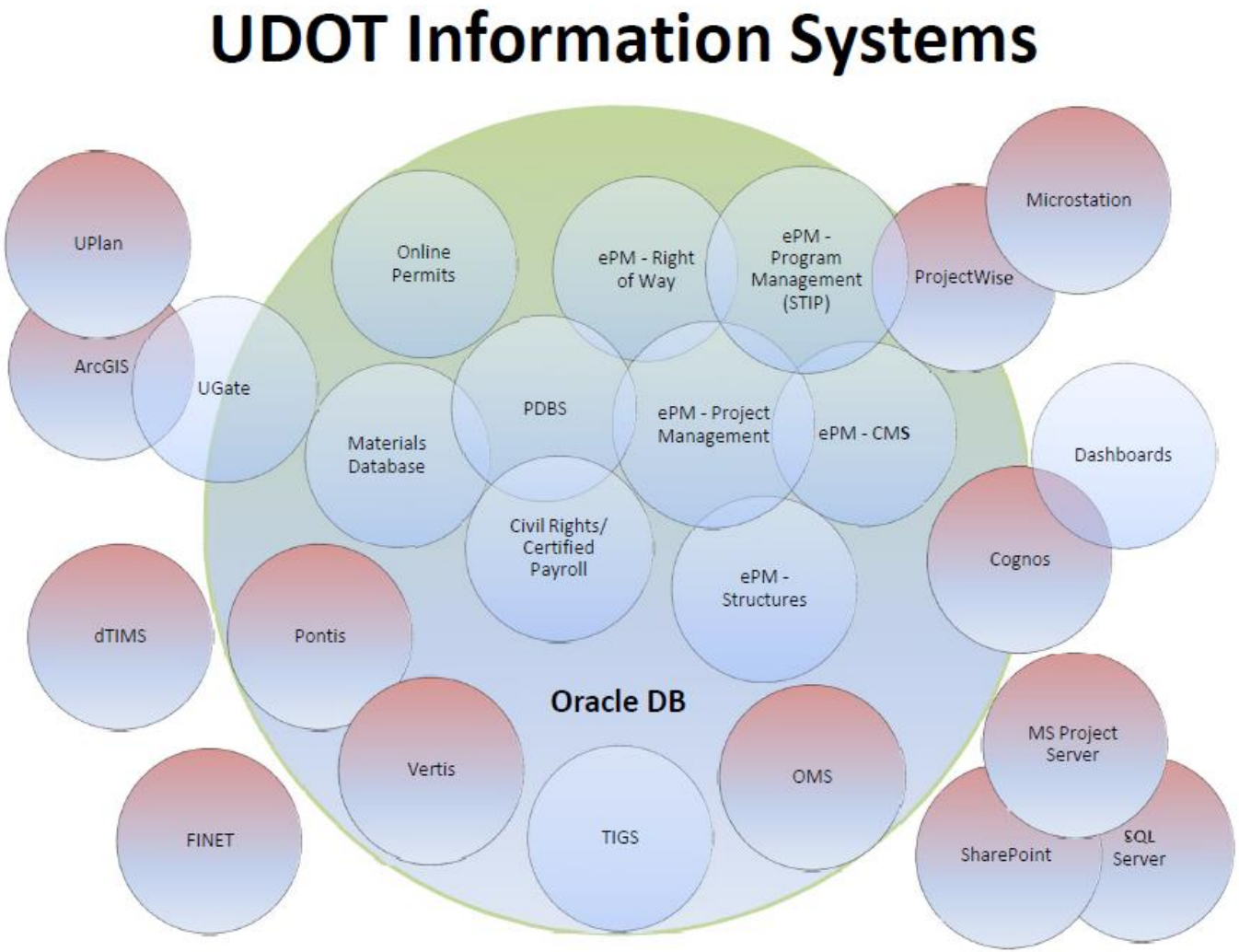


AGILEASSETS

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

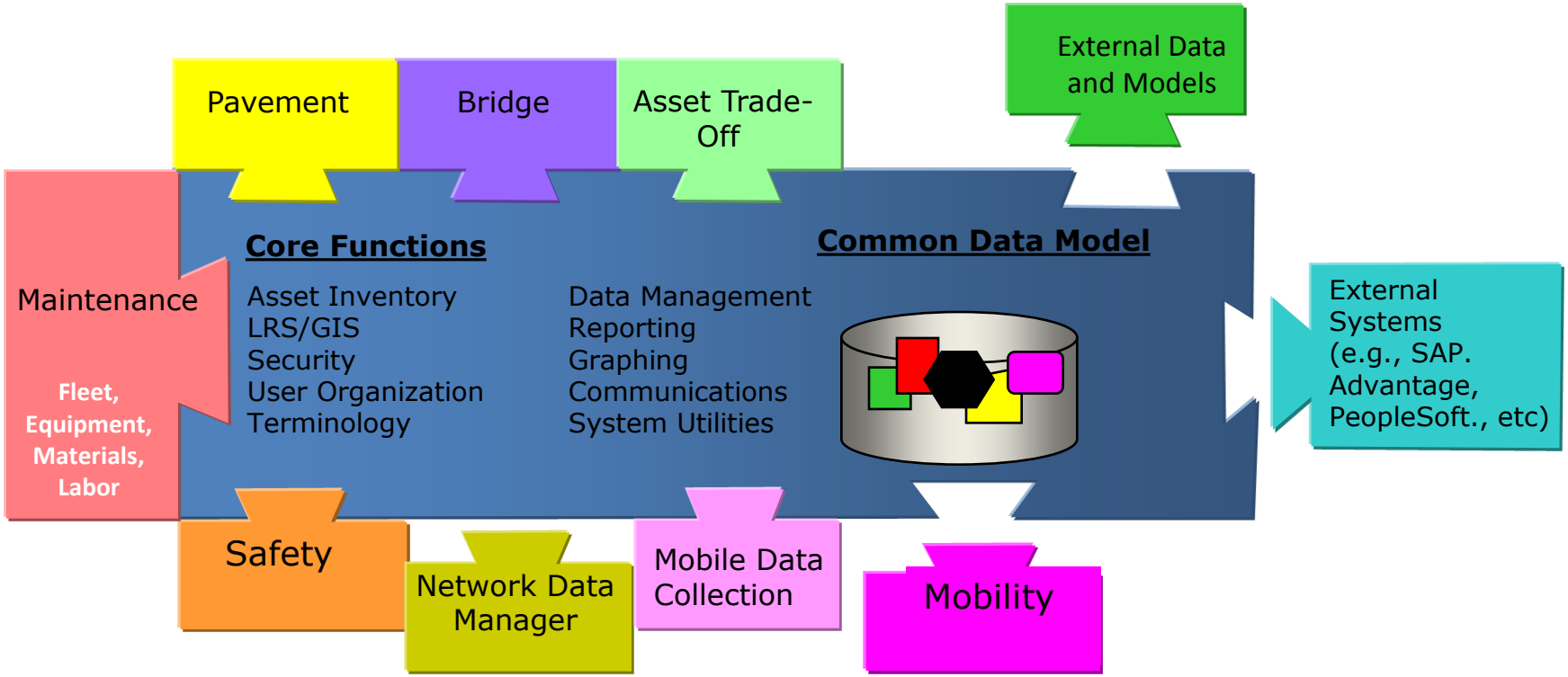


Integration across Multiple System Platforms

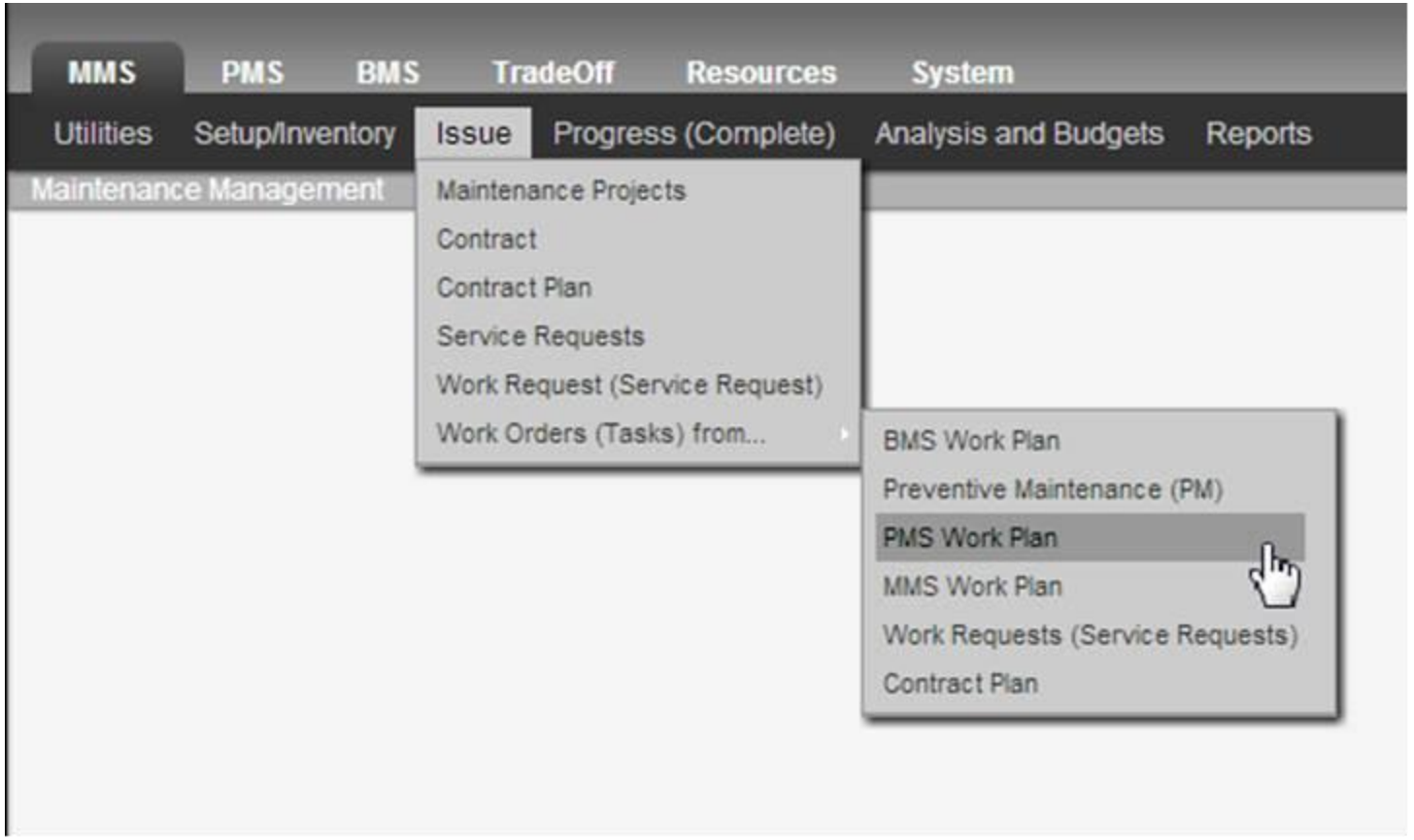
- Consistency of Location data
- Accurate capture of work accomplished
- Consistency of Business Rules/Processes
- Ability to share or view work plans, e.g. viewing PMS work plan in MMS for planning & scheduling
- Interface Requirements & ability to push or pull data
- IT resource requirements for multiple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

Integrated Asset Management System Example

Modular Framework



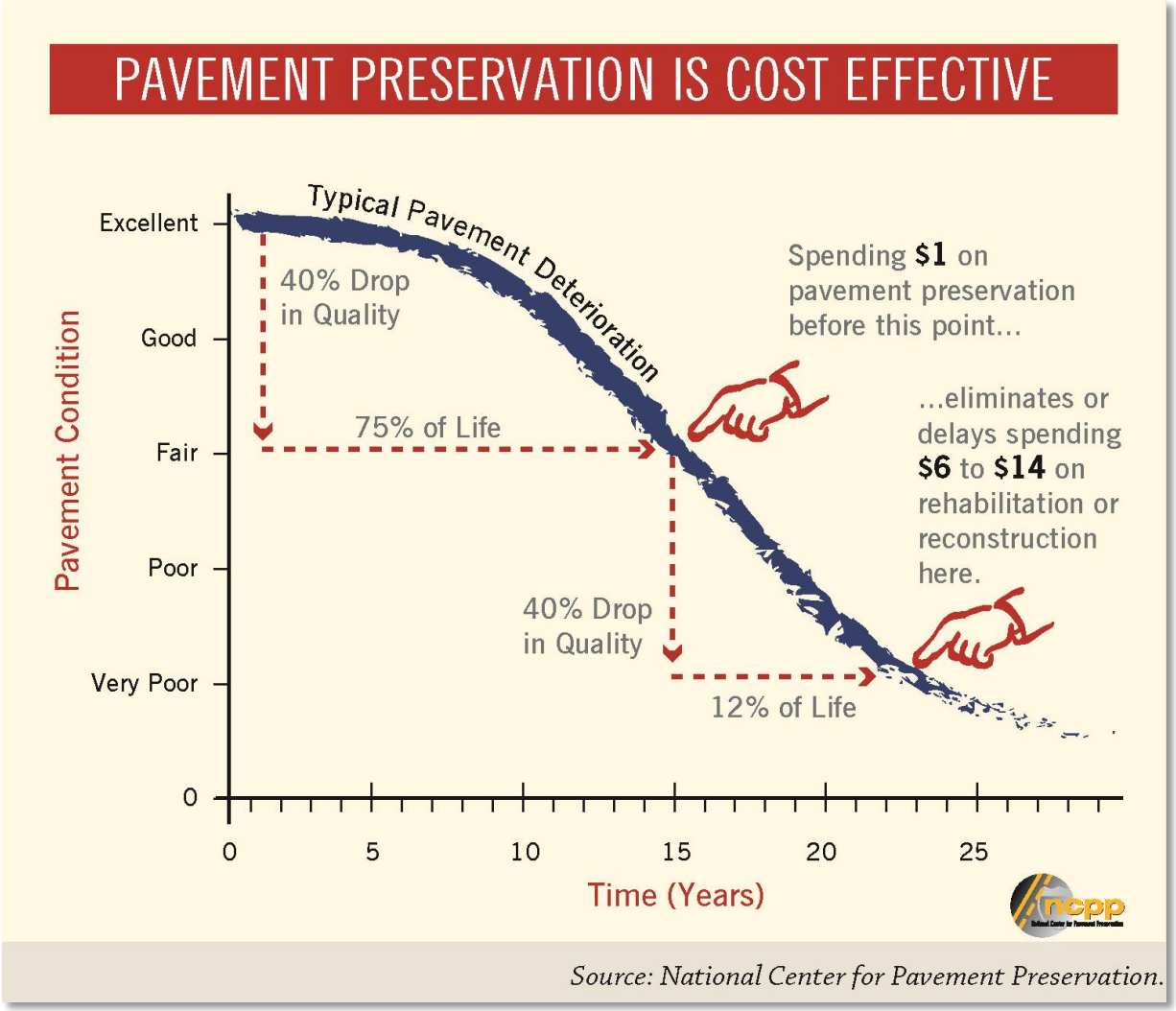
Example of Integration between Modules



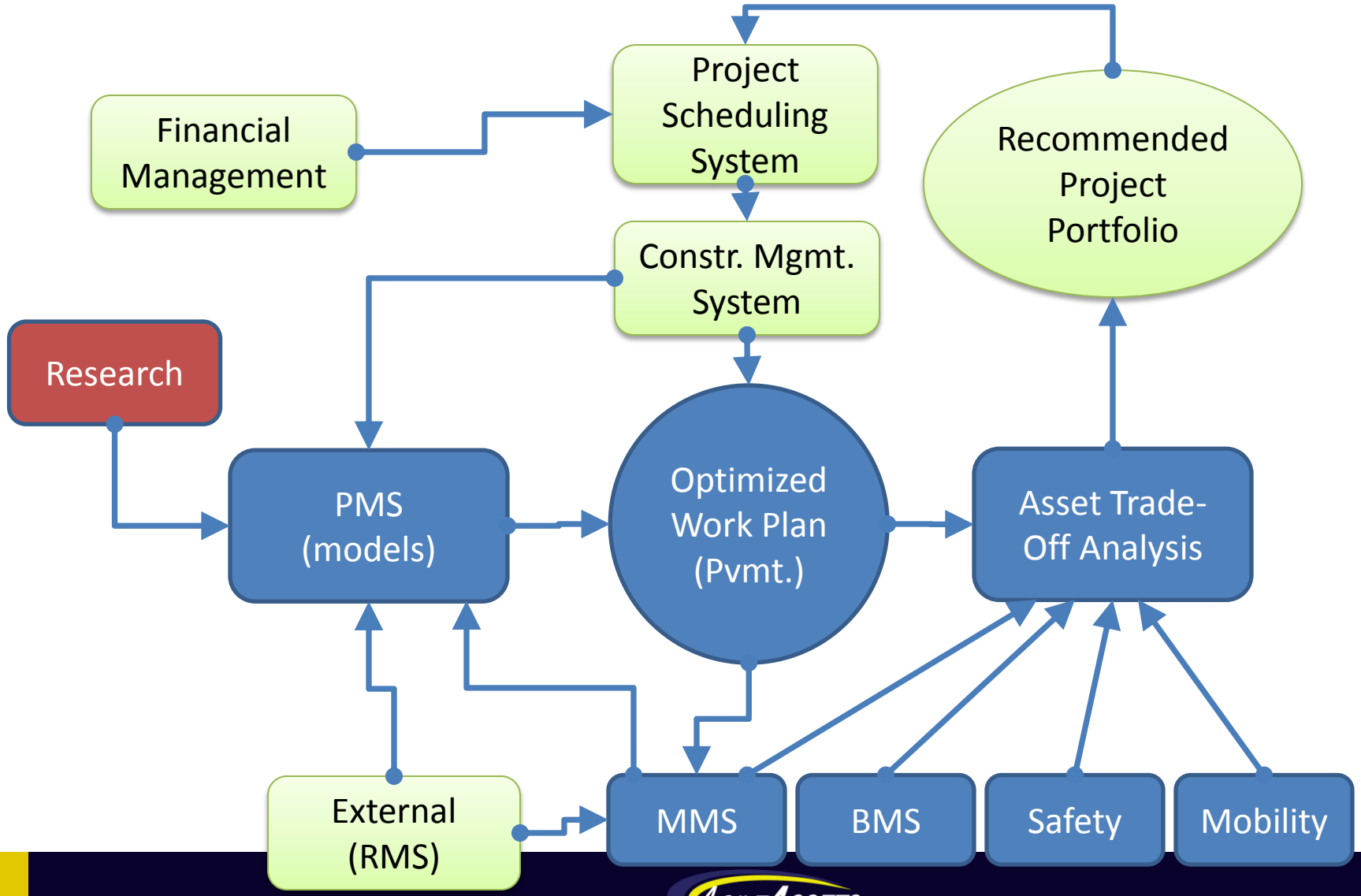
Integrated AMS Suite

- 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



Integrated PMS Framework

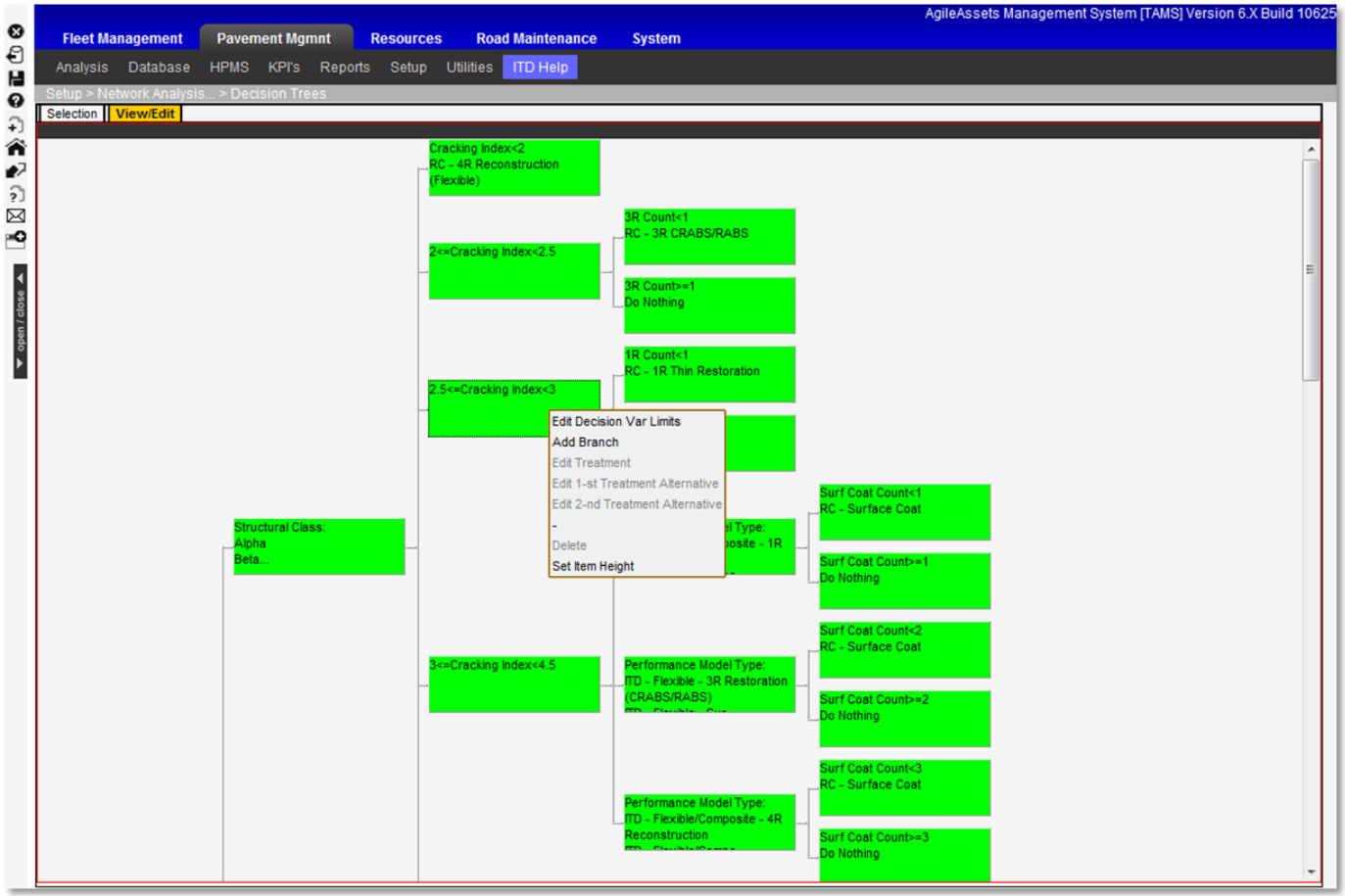


Key Pavement Preservation Issues

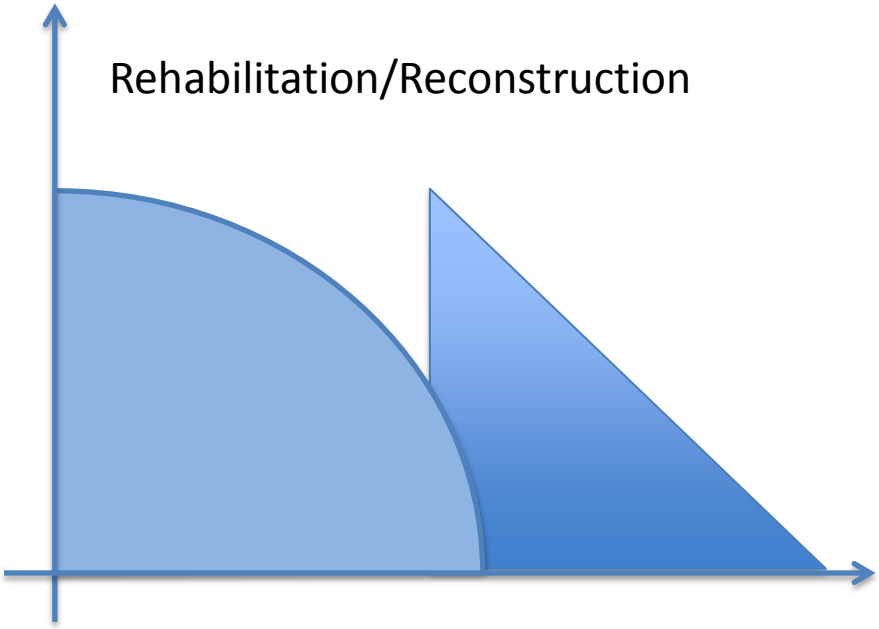
- Project /Treatment Selection Criteria
  - Decision Trees and Models
- Capturing details of completed Preservation work
  - Maintenance & Contracted work
  - Interfaces
  - Q/A-Q/C of data
  - Business Rules
  - Construction History
- Consideration of Planned Projects
  - “Hardwiring” programmed projects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

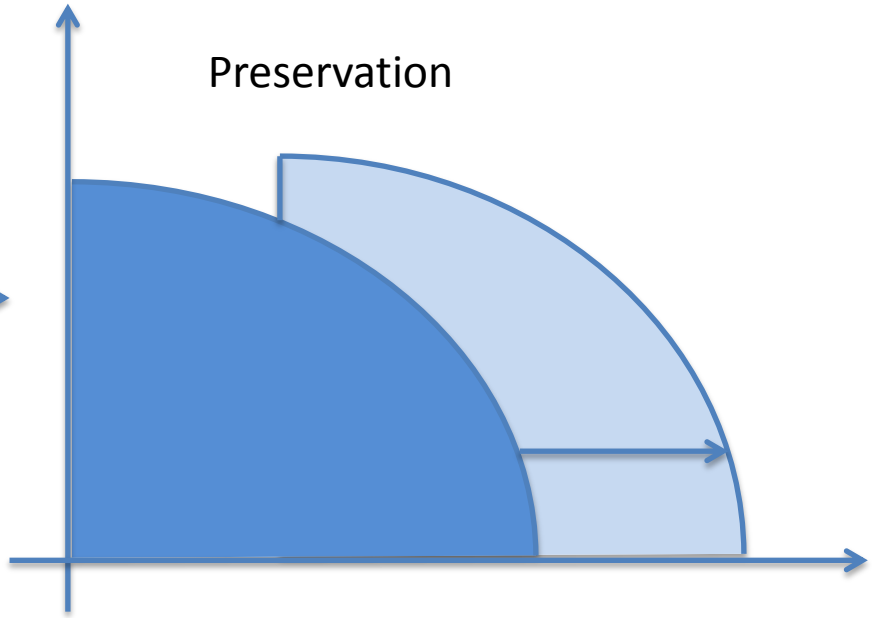
Project and Treatment Selection

- Development of Decision Trees that include preservation

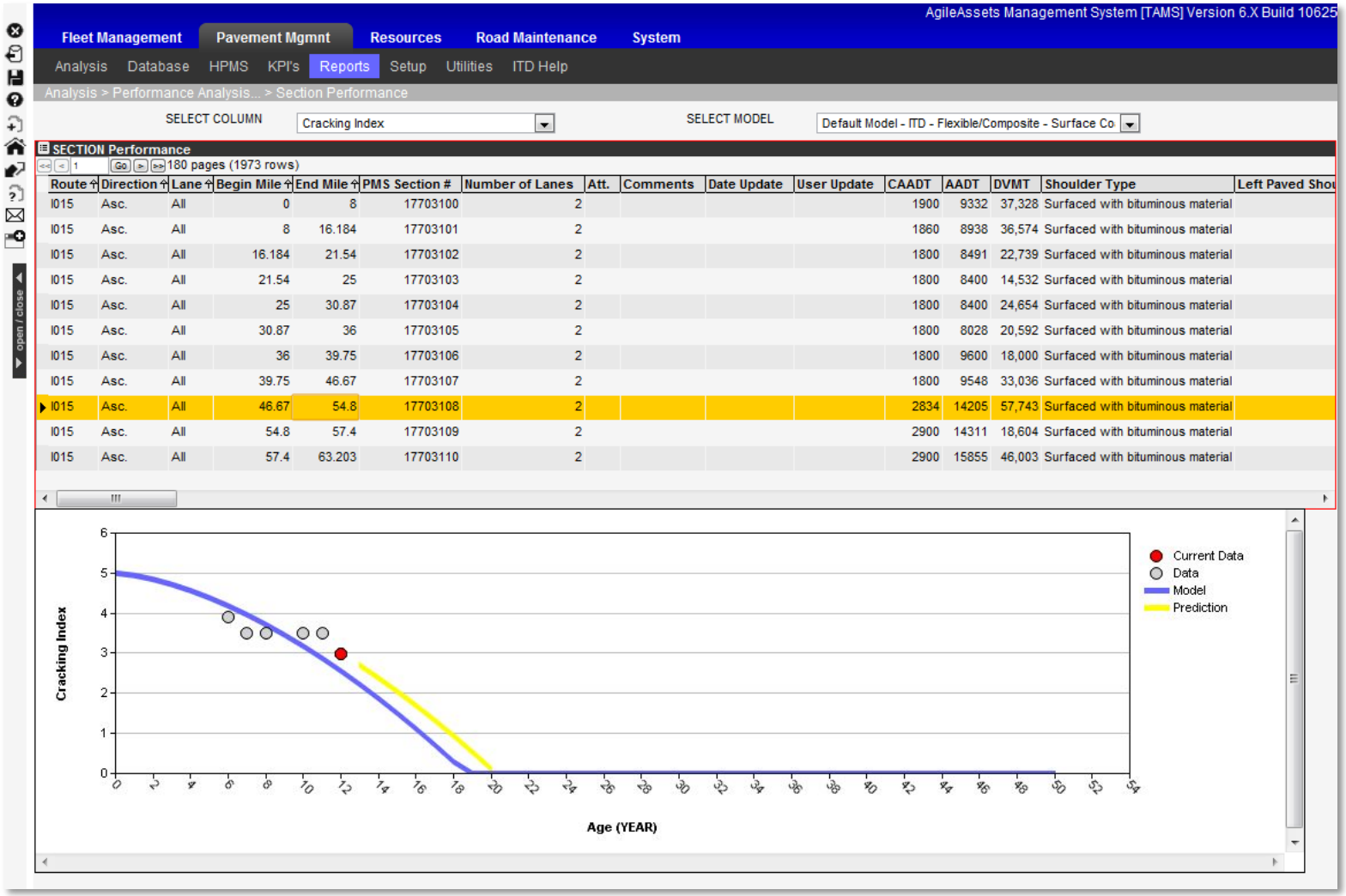


Models should Incorporate Preservation Influence





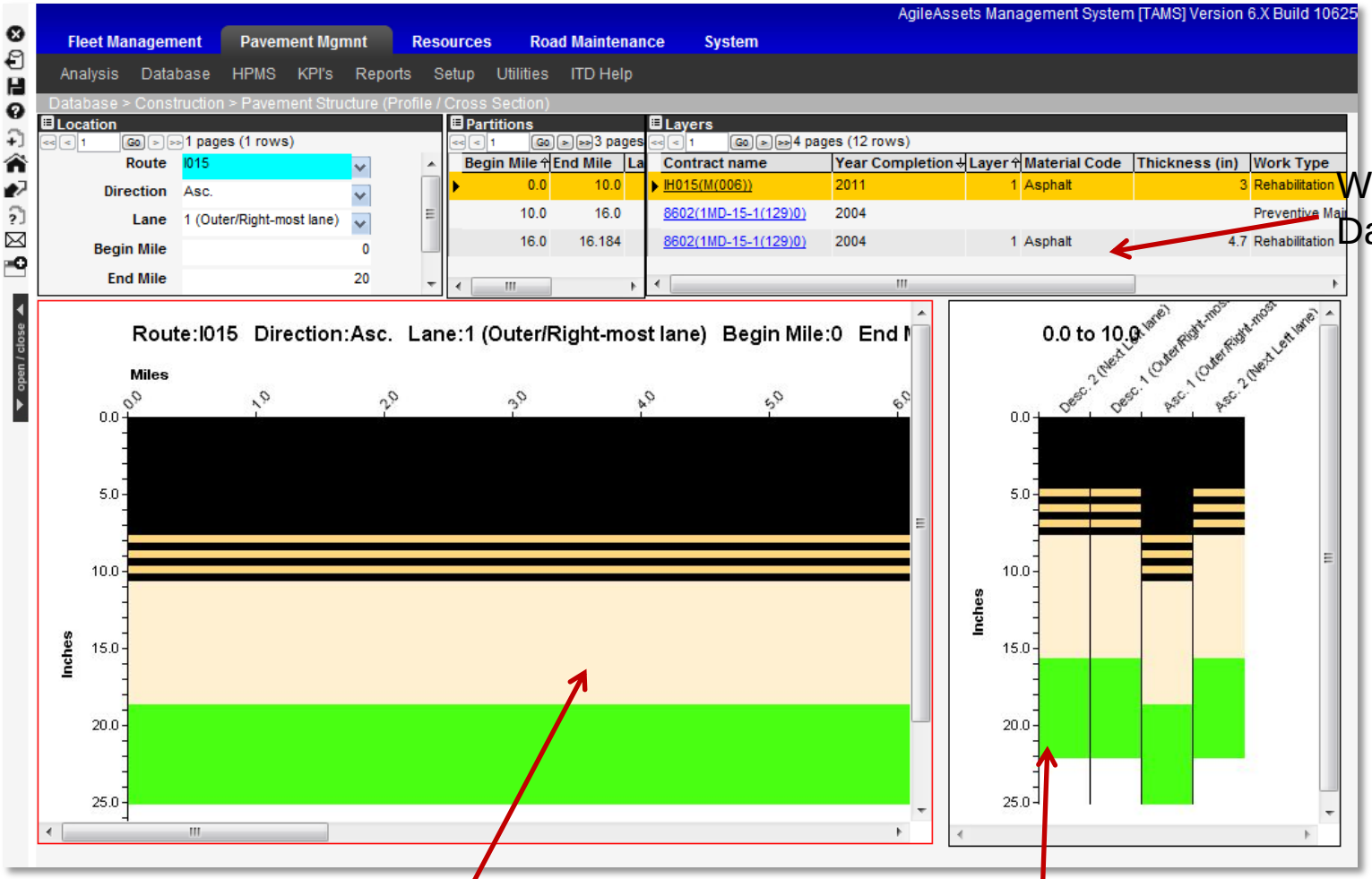
Section Modeling



Getting the Right Data

- Inventory
- Location
- Condition
- Traffic
- Construction History

Construction History Data is Critical



Work Data Table

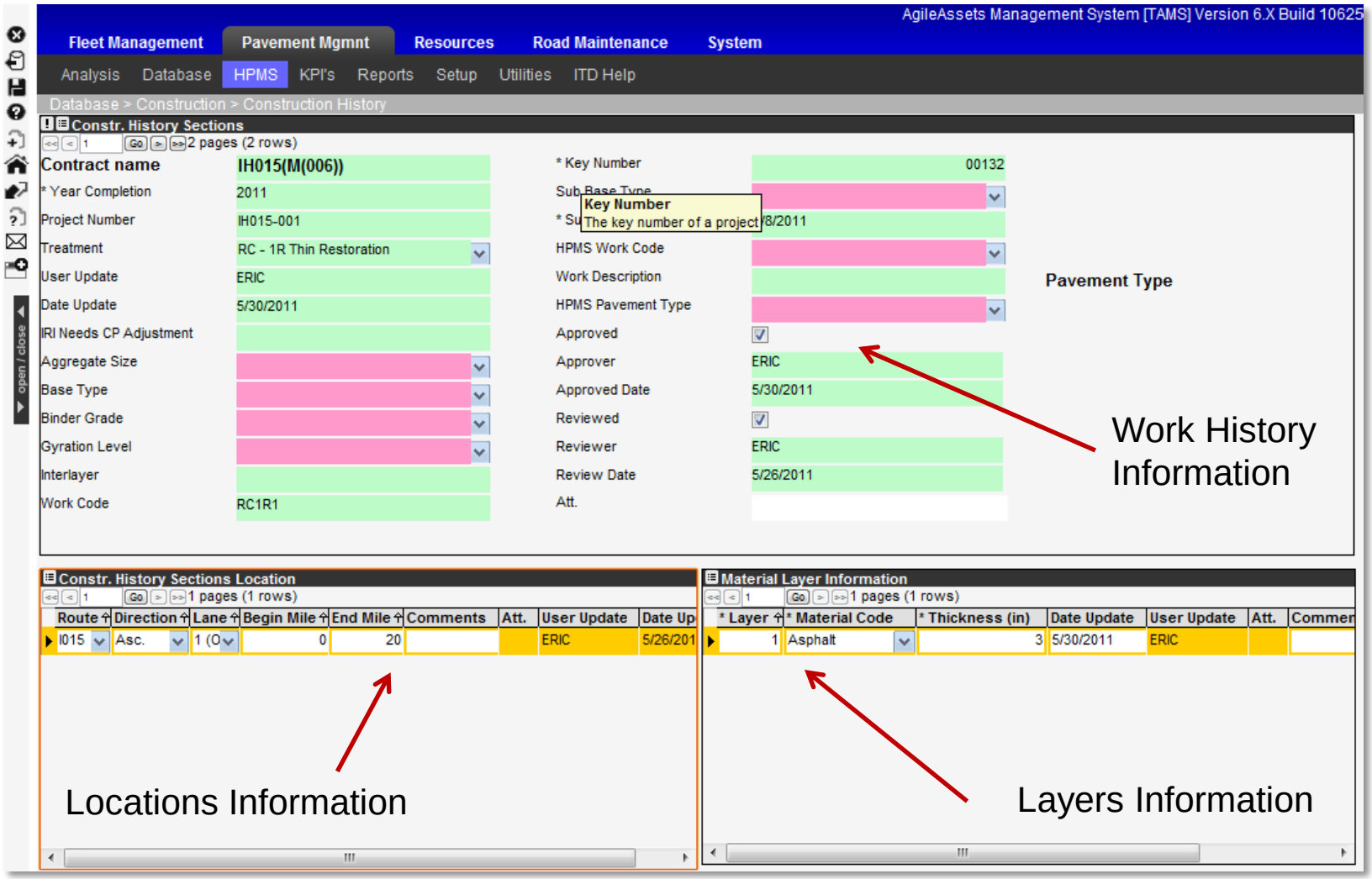
Longitudinal Layer Data

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



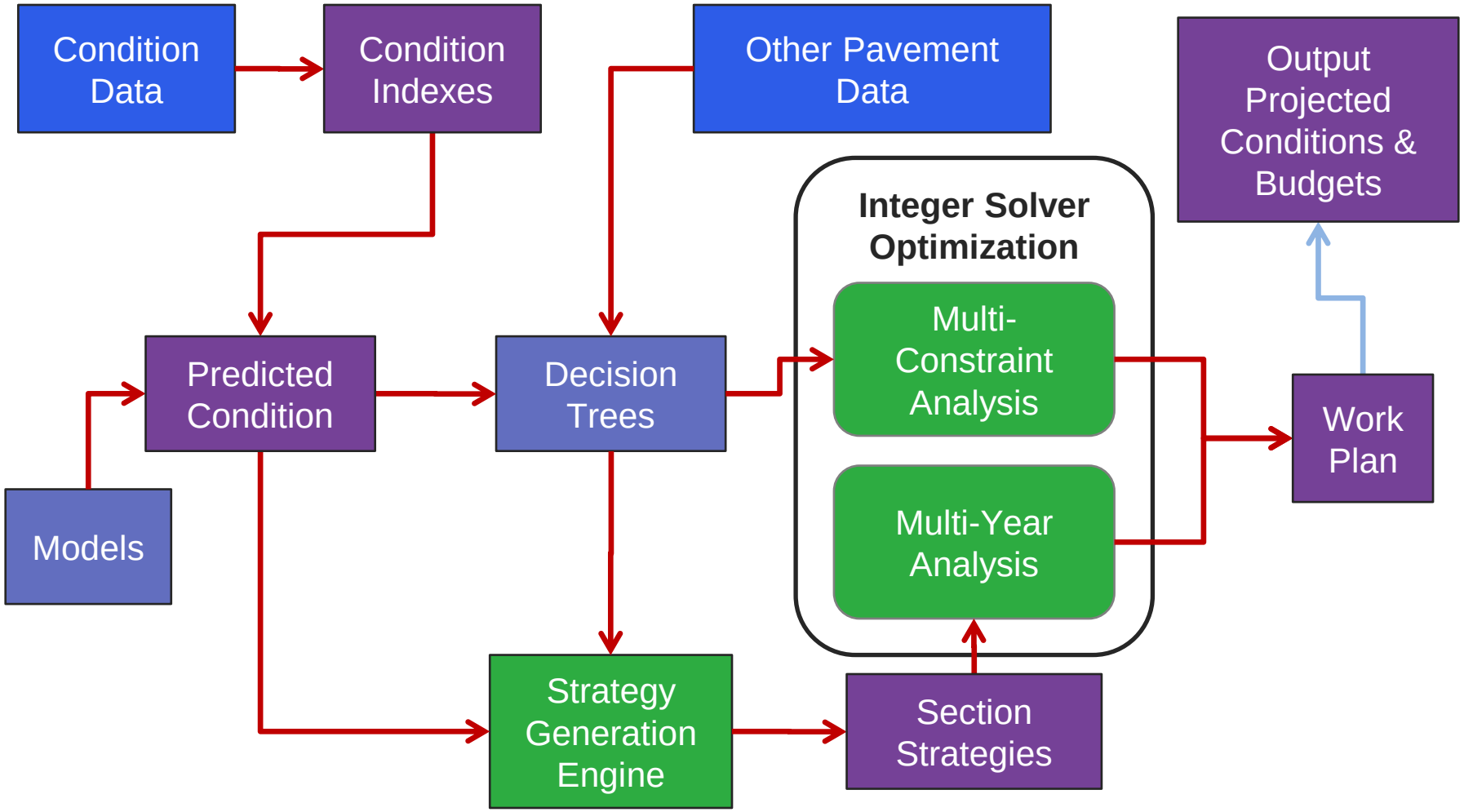
Consideration of Planned Projects

- 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)

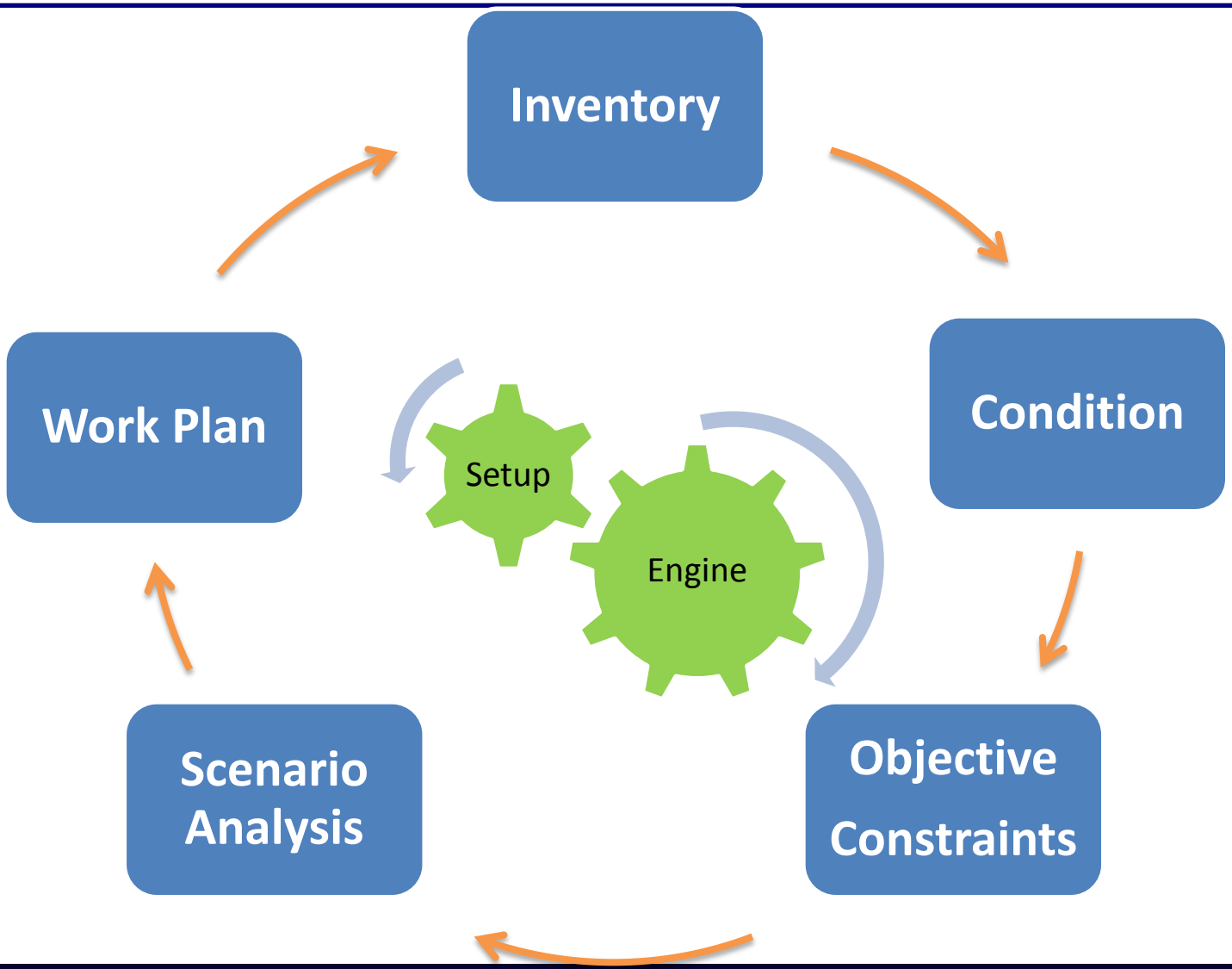
Determining Pavement Preservation Effectiveness

- 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



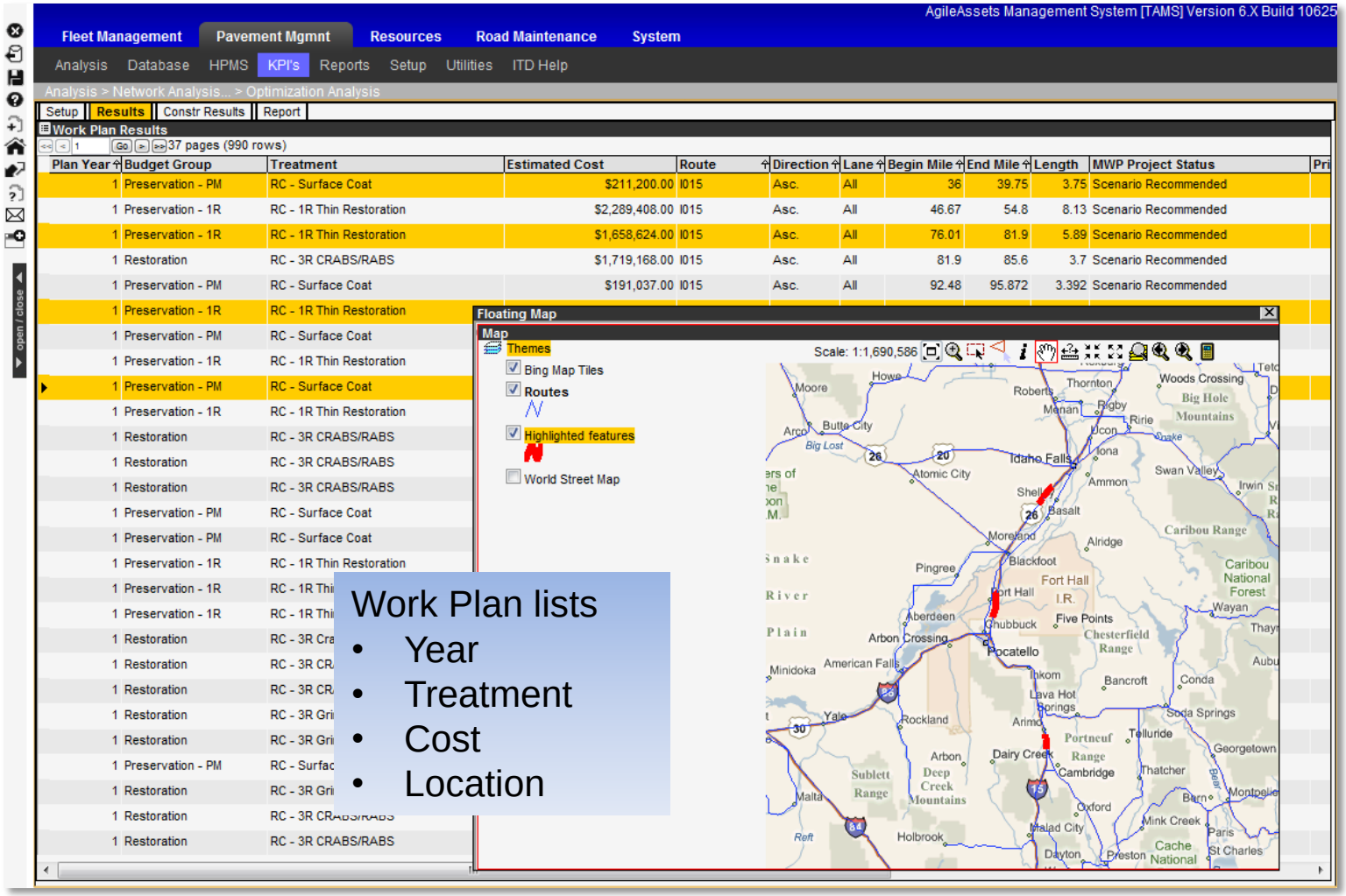
Scenarios Analysis — Concept



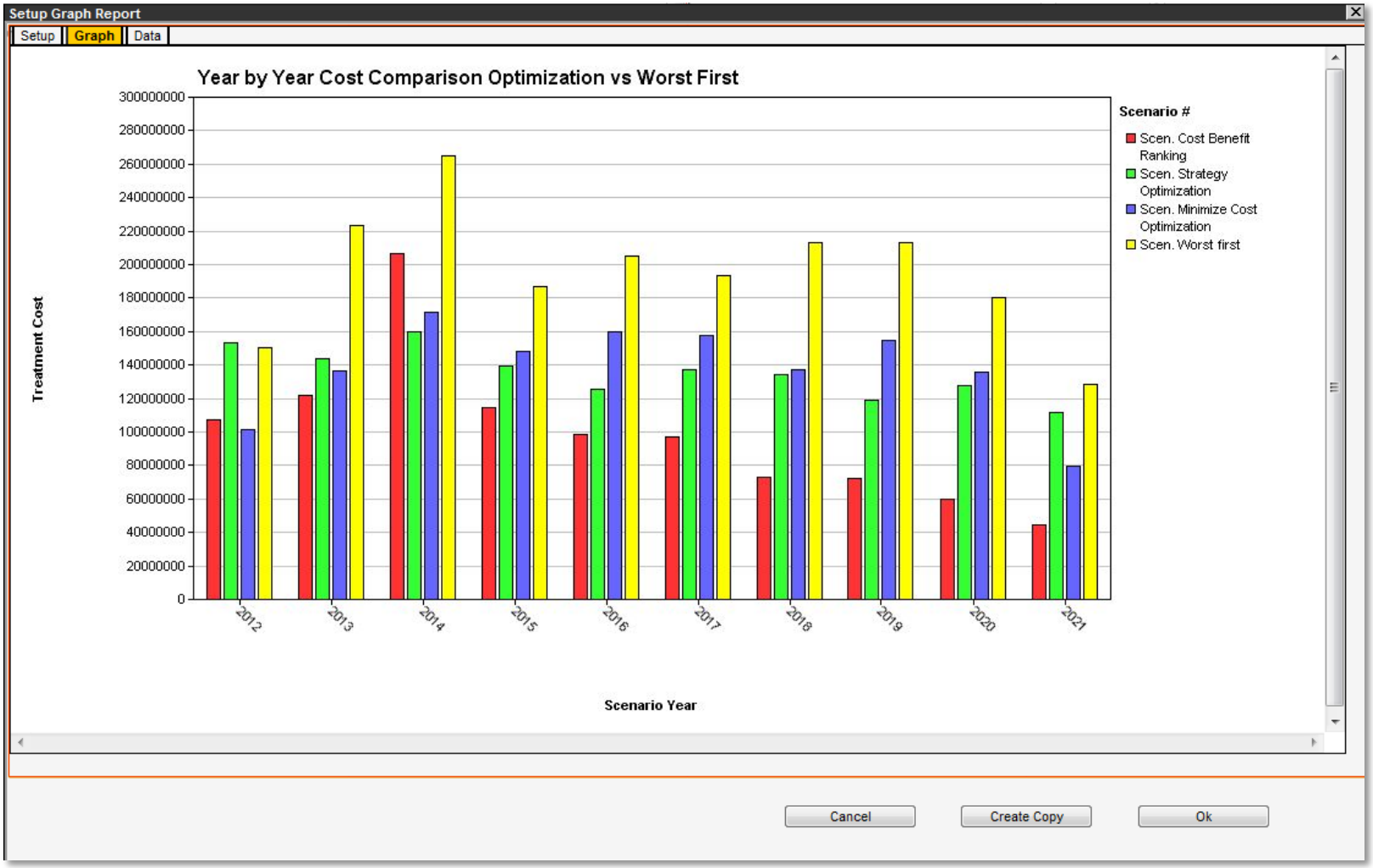
Scenario Analysis Objectives

- 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

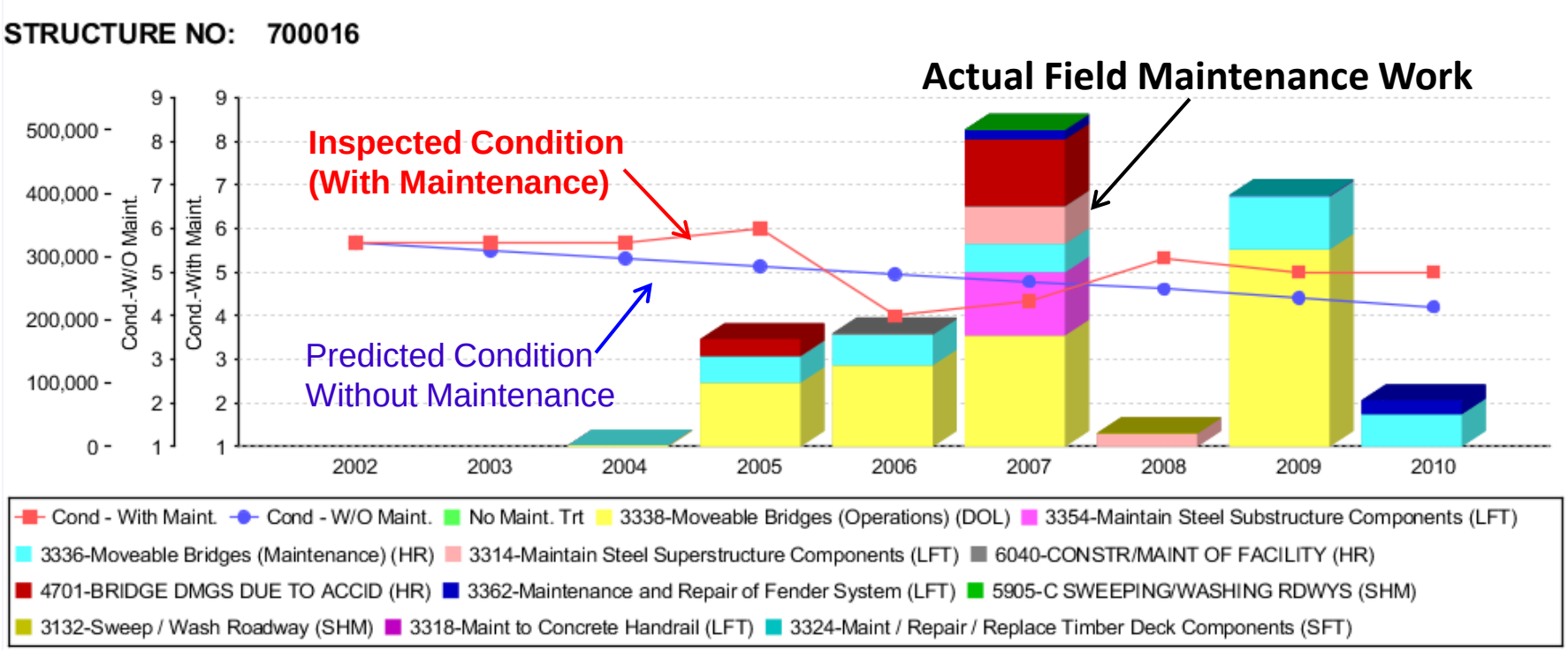


Comparing Scenarios: Compare Analysis Methods



Validating the Impact-BMS Example

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

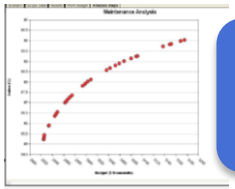


Improving Analysis through Research

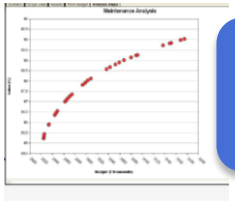
- Meaningful Research results dependent on good data sets
- Accurately capturing details of completed Maintenance and Preservation work completed is critical for validating treatment effectiveness and timing
- Decision trees and models can be adjusted
- Continuous validation and updating process based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

Enhancing AMS results through Trade-off Analysis

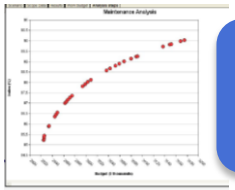
- Need to be able to analyze tradeoffs between competing objectives…
- Multi-criteria and efficient surfaces



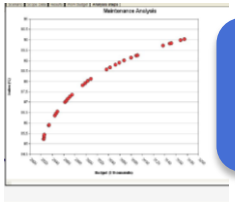
Pavement Management System



Bridge Management System

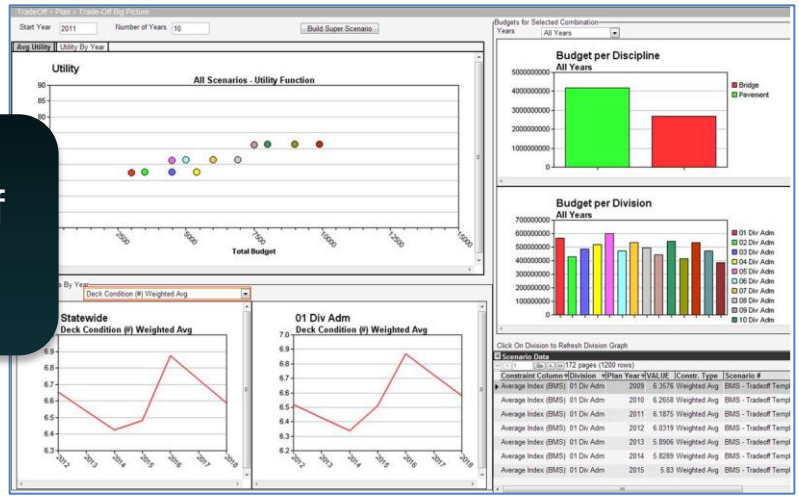


Safety Management System



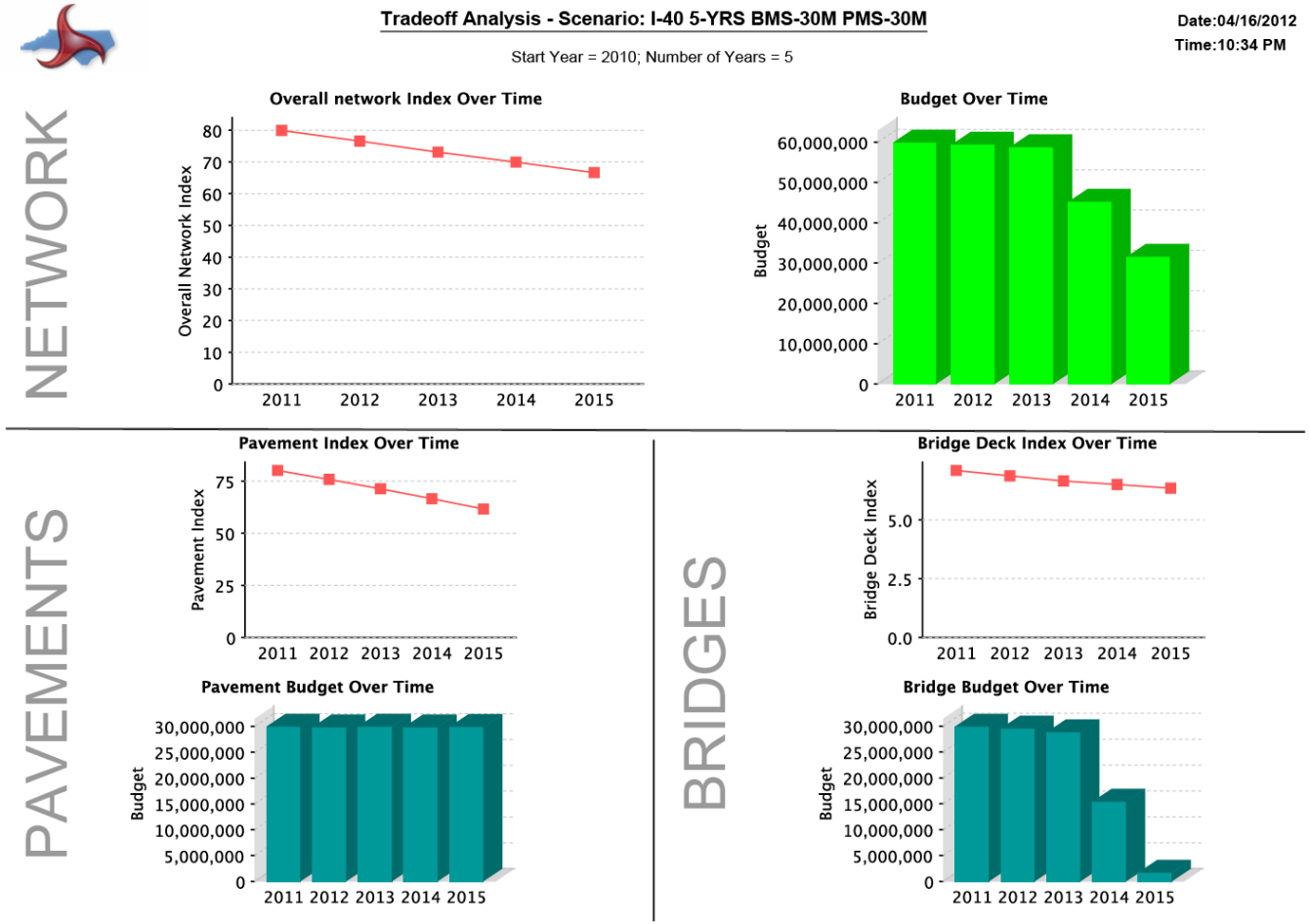
Mobility Management System

Trade-off Analysis



Impact Analysis

Evaluate Impact on Bridge, Pavement and Overall System



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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