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84TH ANNUAL MEETING & EXHIBITION

Optimizing Enterprise Road Asset Infrastructure with Data Analytics

Bill Rapp

AgileAssets

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IBTTA TOLLING. MOVING SMARTER.

Your Toll Infrastructure is Deteriorating While You Sit Here Listening to Me

- Relentless wear and tear
- Very significant bottom-line capital and expense costs
- Infrastructure deterioration can be modeled and predicted
- Moving toward preventive maintenance and away from worst-first

Toll Infrastructure Investment Growth

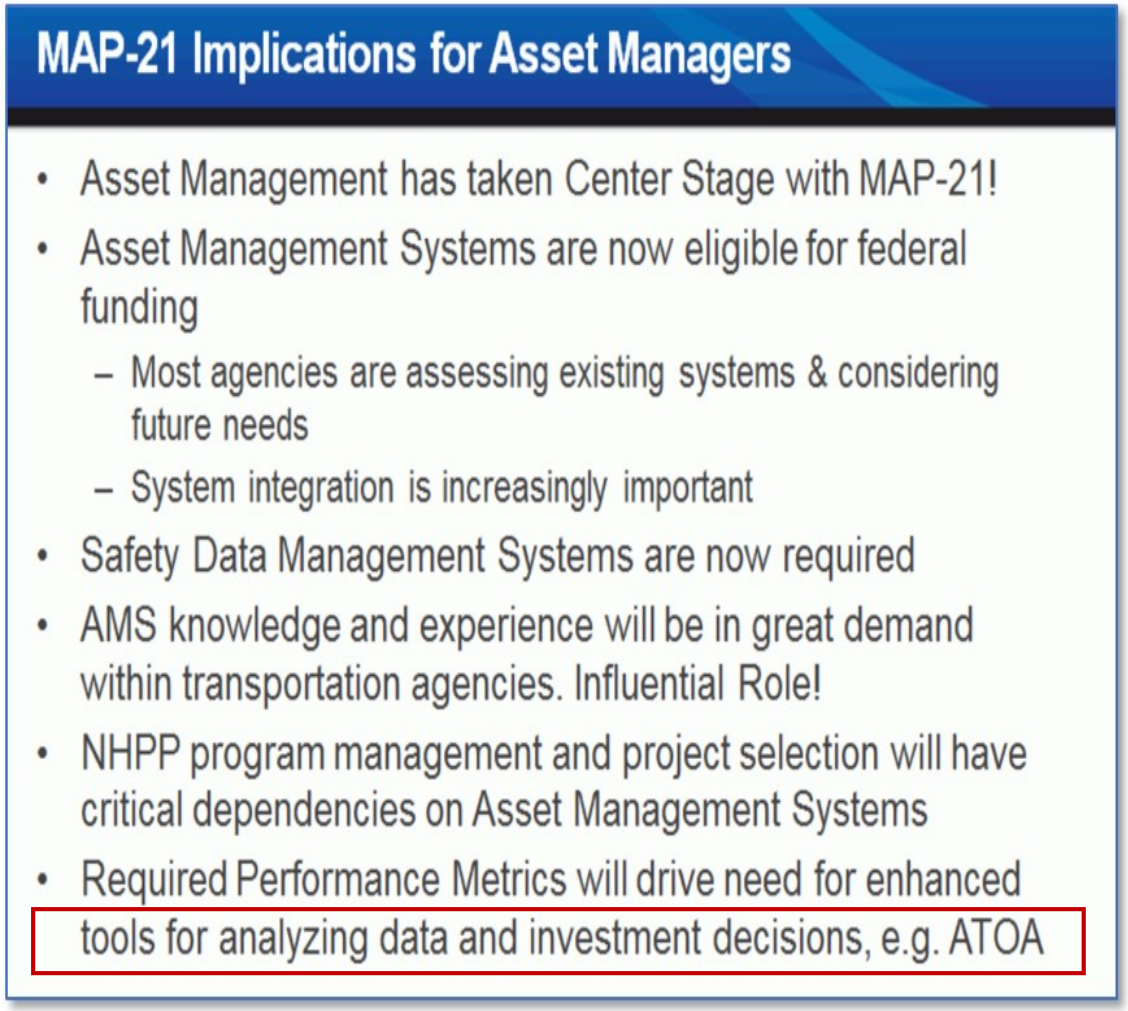
- More than $14 billion in capital investment was made over three years by the top 40 U.S. toll facilities
- The number of trips taken by drivers on tolls roads increased 14% over the last four years – from 5 billion trips in 2011 to 5.7 billion in 2015
- 9% increase in overall toll road mileage within the U.S., from 5,431 miles in 2011 to over 5,932 miles as of 2013

A lot of money goes into Tolling Infrastructure

Source: IBTTA & FHWA

Asset Management Regulations in Tolling

- U.S. legislation: ***Moving Ahead for Progress 21st Century*** (MAP-21) ***& Fixing America's Surface Transportation*** **Act** (FAST) allow selective tolling of Interstates
- Performance reporting
- Impact on toll infrastructure
- International public infrastructure condition requirements



What is Transportation Asset Management (TAM)?

- Strategic and systematic life-cycle process
- Focus on business and engineering practices
- Better decision making and budget management

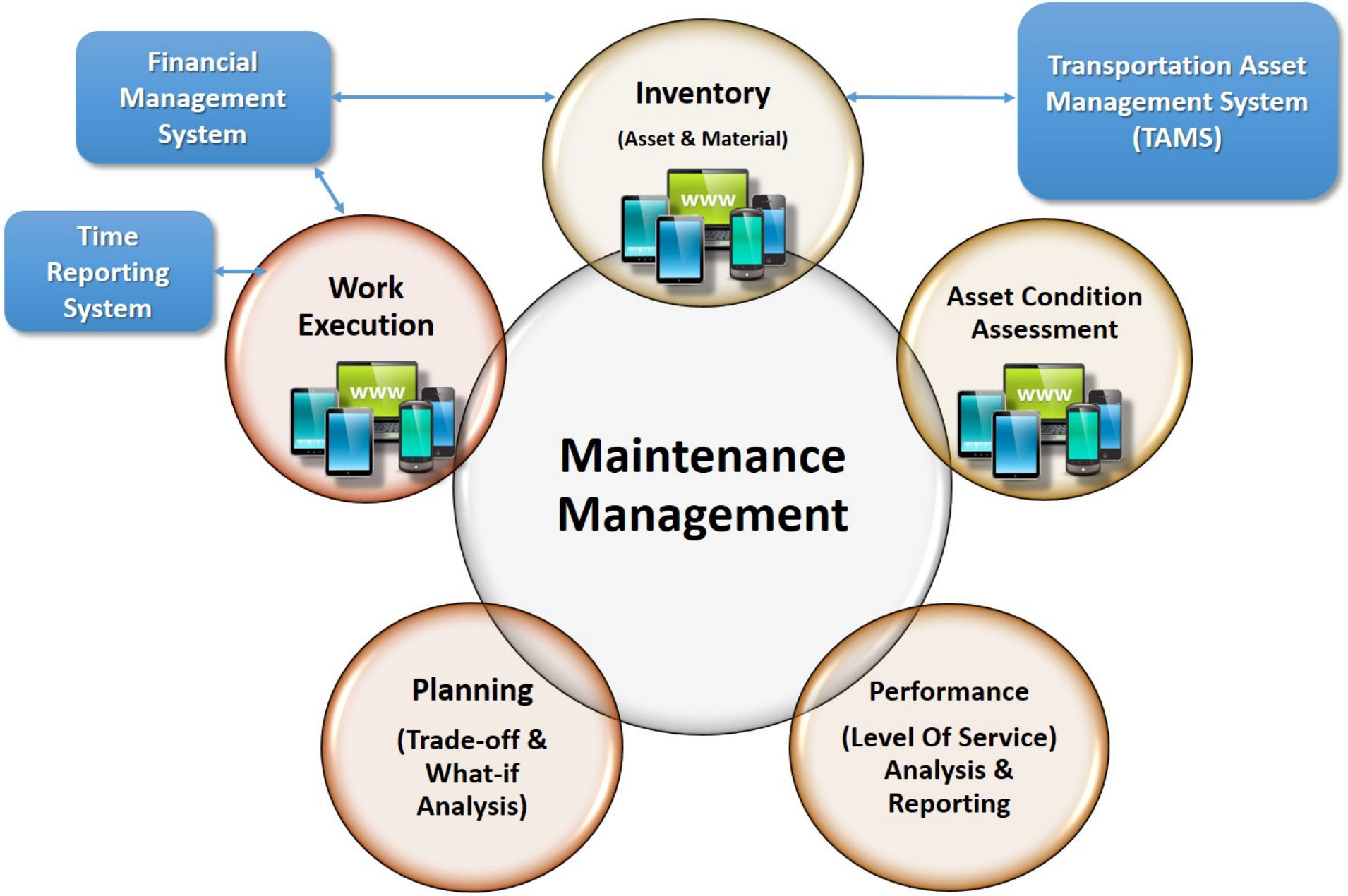
Source: AASHTO Sub Committee on Asset Management

TAM Addresses 5 Core Questions

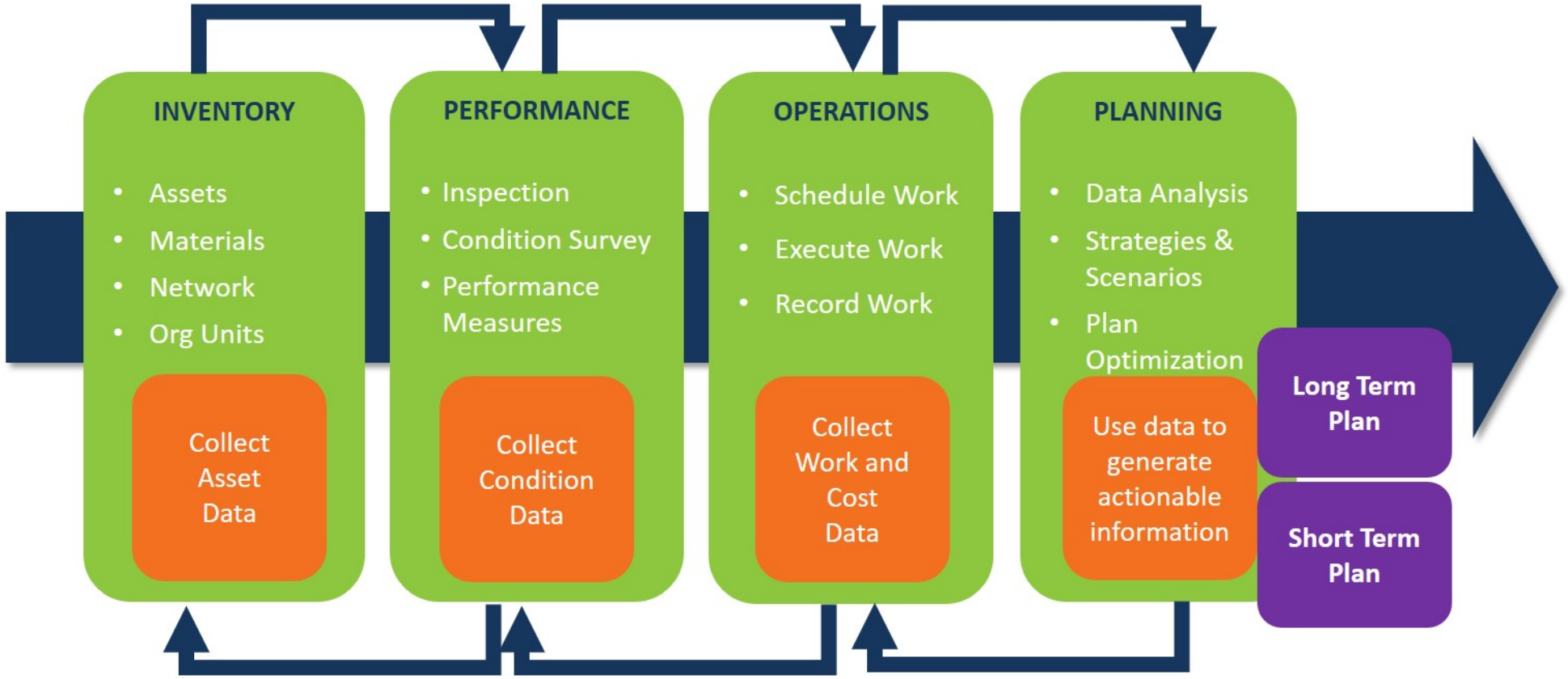
1. What is the current state of my assets?
2. What are my required levels of service and performance delivery?
3. Which assets are critical to sustained performance delivery?
4. What are my best investment strategies for operations, maintenance, replacements and improvement?
5. What is my best long-term funding strategy?

Source: Multi-sector Asset Management, Publication No. FHWA-HIF-09-022

Maintenance Management Life Cycle

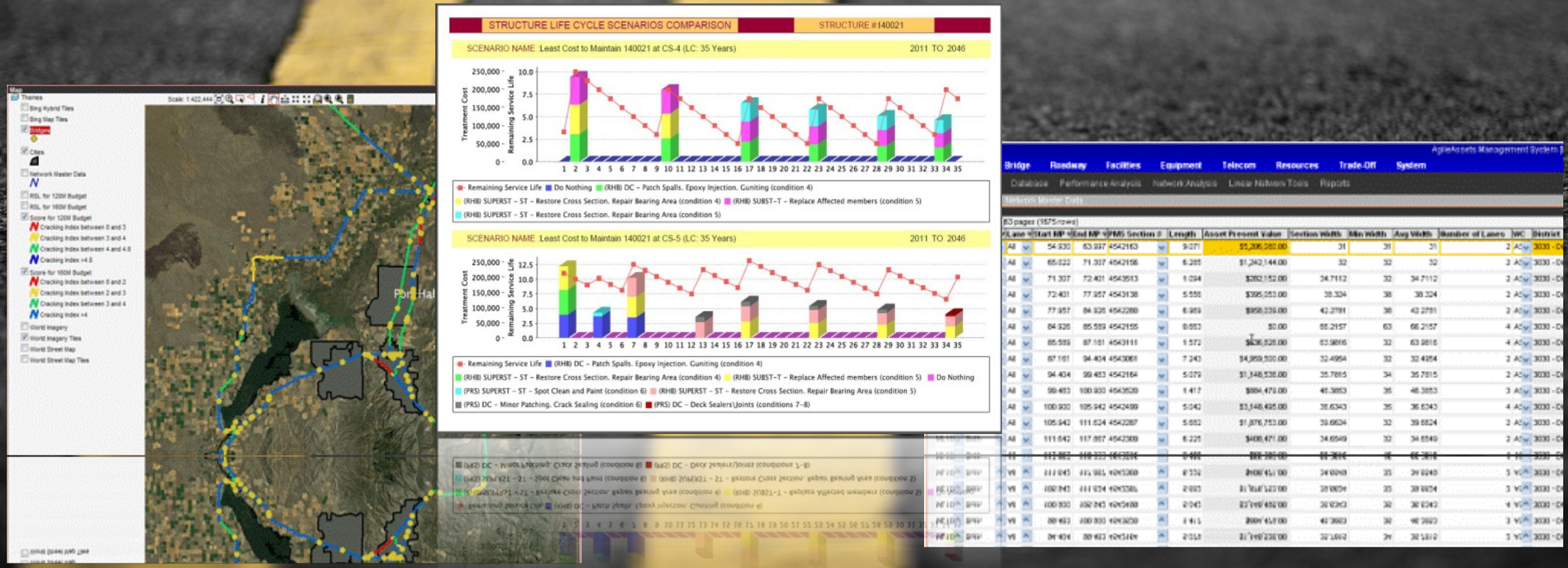


Iterative Asset Management Process



Toll Systems are Linear Assets

Increase Tolling Profits Through Technology



Transportation Asset Management Analytics

Analysis Methodology

Ranking Methods

- Worst First
- Custom Prioritization
- Incremental Benefit

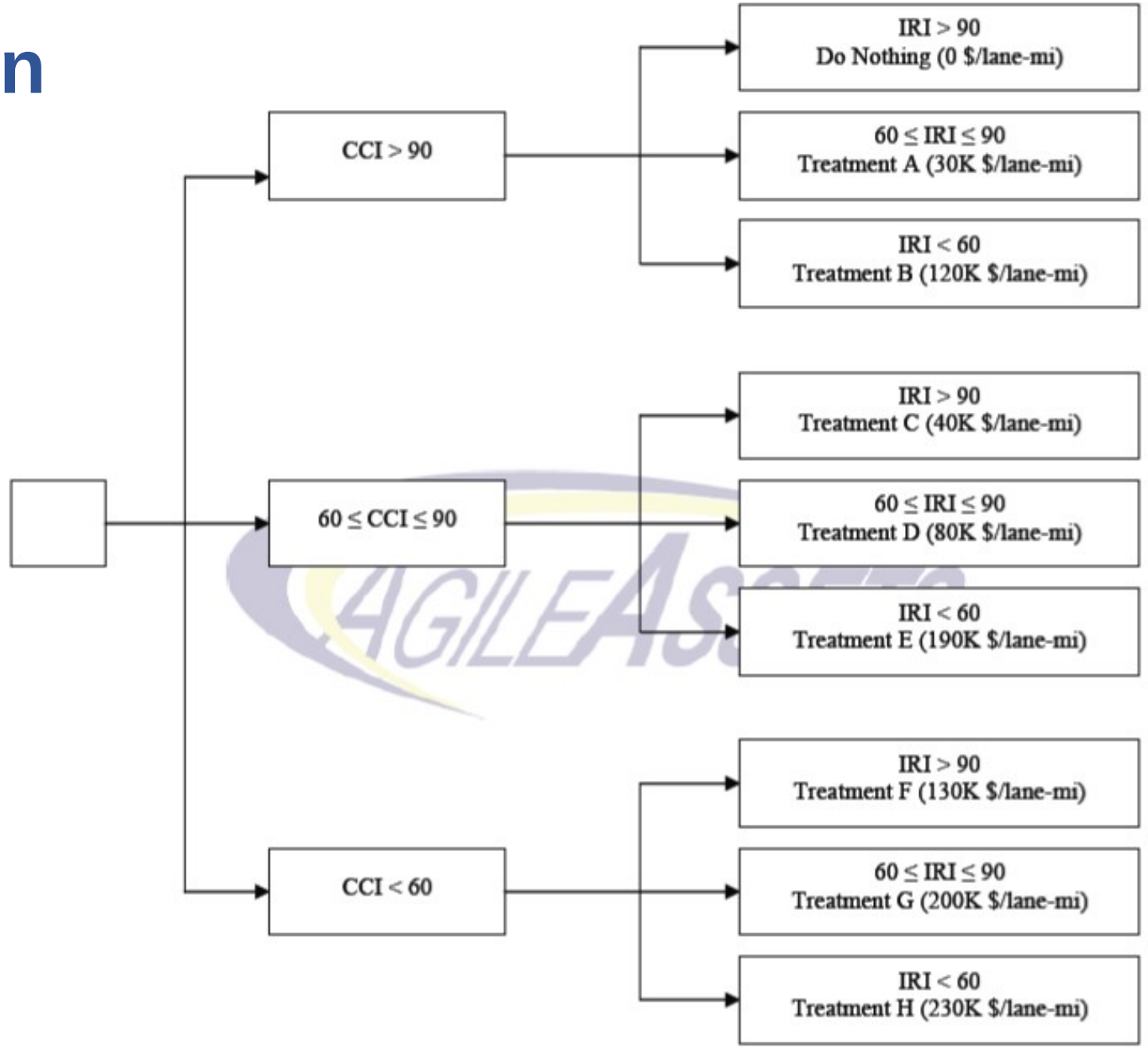
Optimization Methods

- Analyze Multiple Constraints
- Single and Combined Objectives
- Section Strategy Analysis

Multi-Constraint Optimization: Pavement Example

- Create an optimal work program using objectives and multiple constraints
- Analysis indicates a series of treatments
  - applied to individual assets over time
  - to minimize the treatment cost
  - or maximize the condition-based benefit subject to constraints

Treatment Selection Decision Tree (Pavement Example)

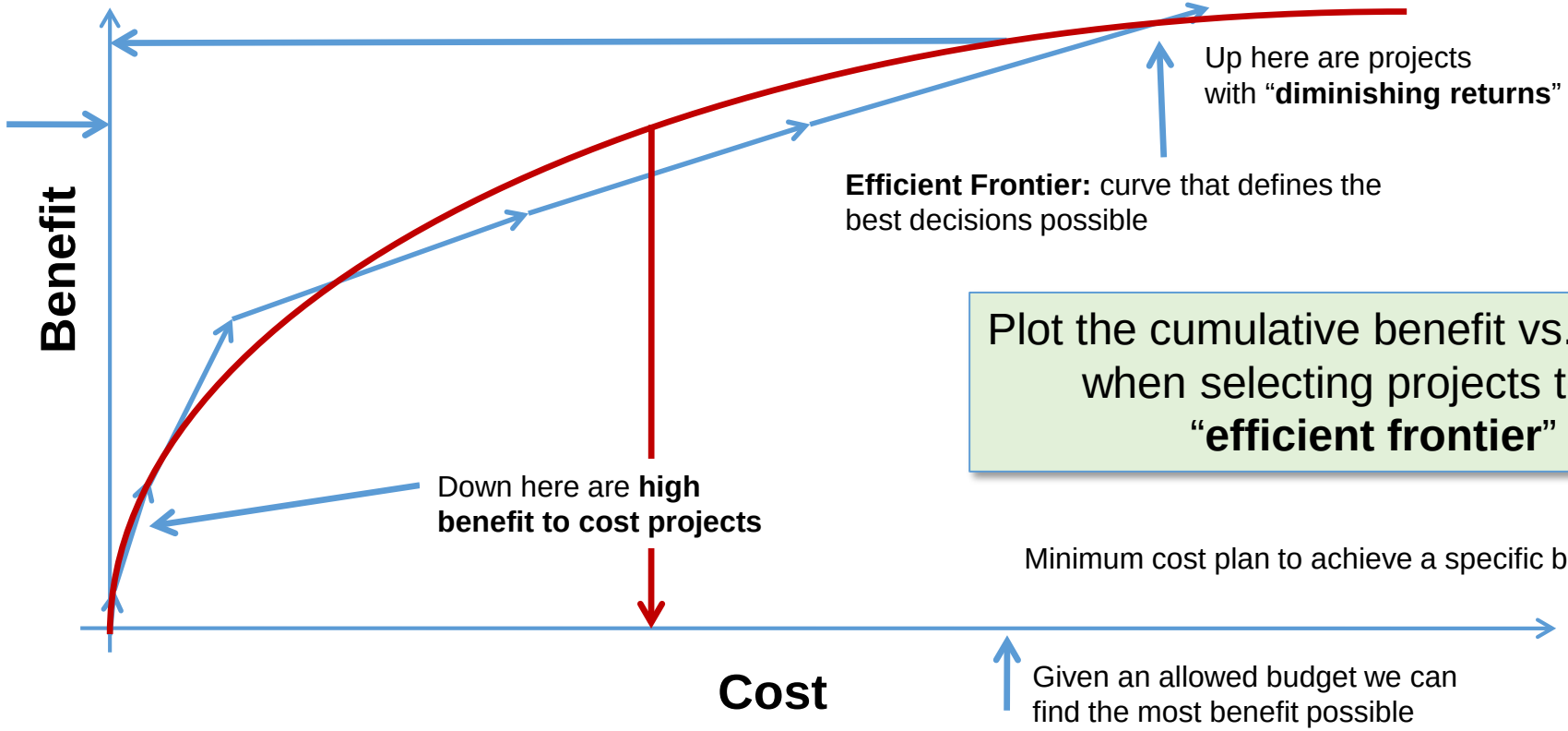


- Acronyms:
  - CCI: Critical Condition Index
  - IRI: International Roughness Indicator Index

The *Efficient Frontier* for TAM

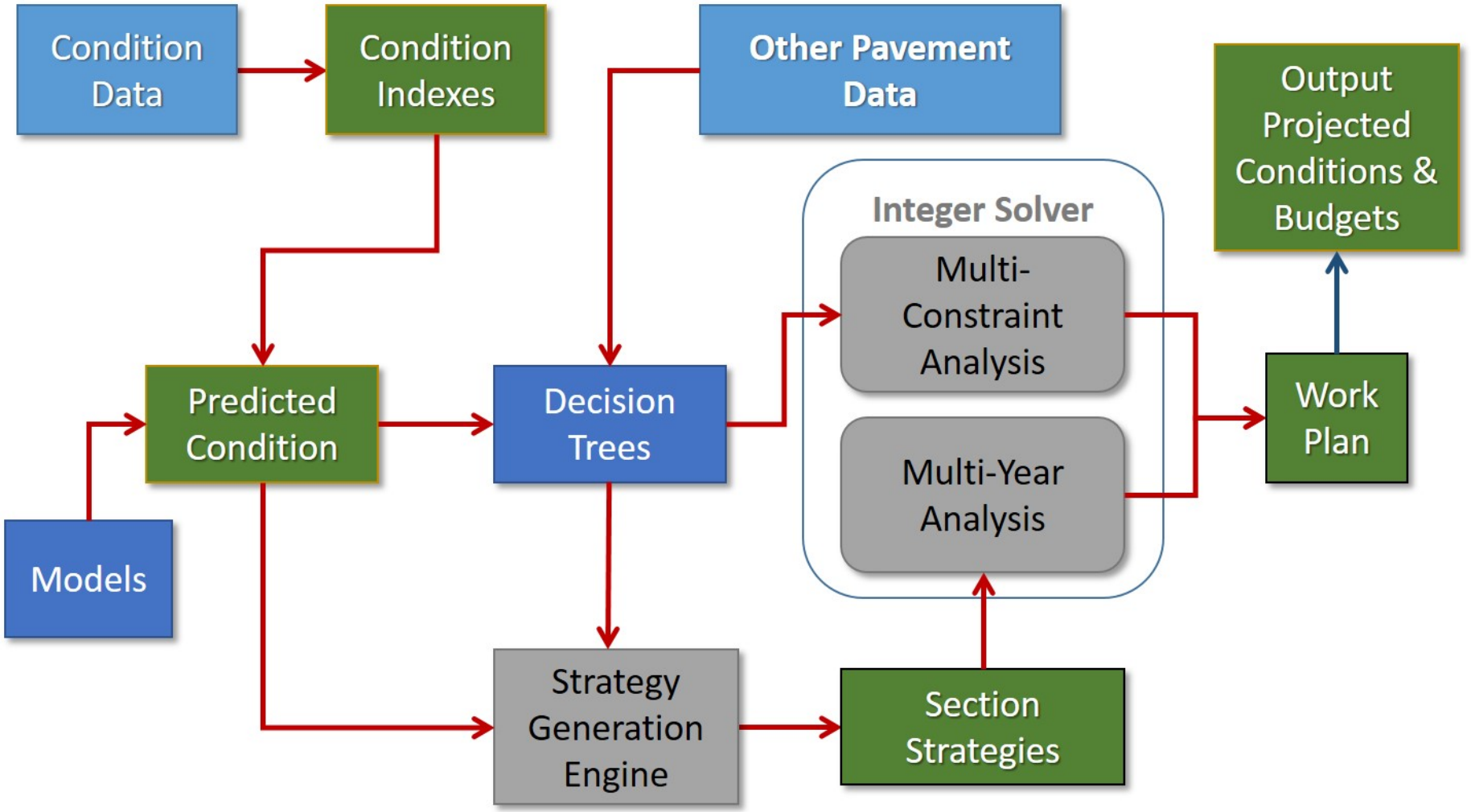
- Prioritize and optimize allocation of maintenance funds
- Models data to determine the maintenance *level of service* (LOS) that can be achieved
  - *within* a given budget or
  - the budget *required* to achieve a desired LOS

The Efficient Frontier



Plot the cumulative benefit vs. cumulative cost when selecting projects to derive the "**efficient frontier**" shape

Optimization Analysis – Logic

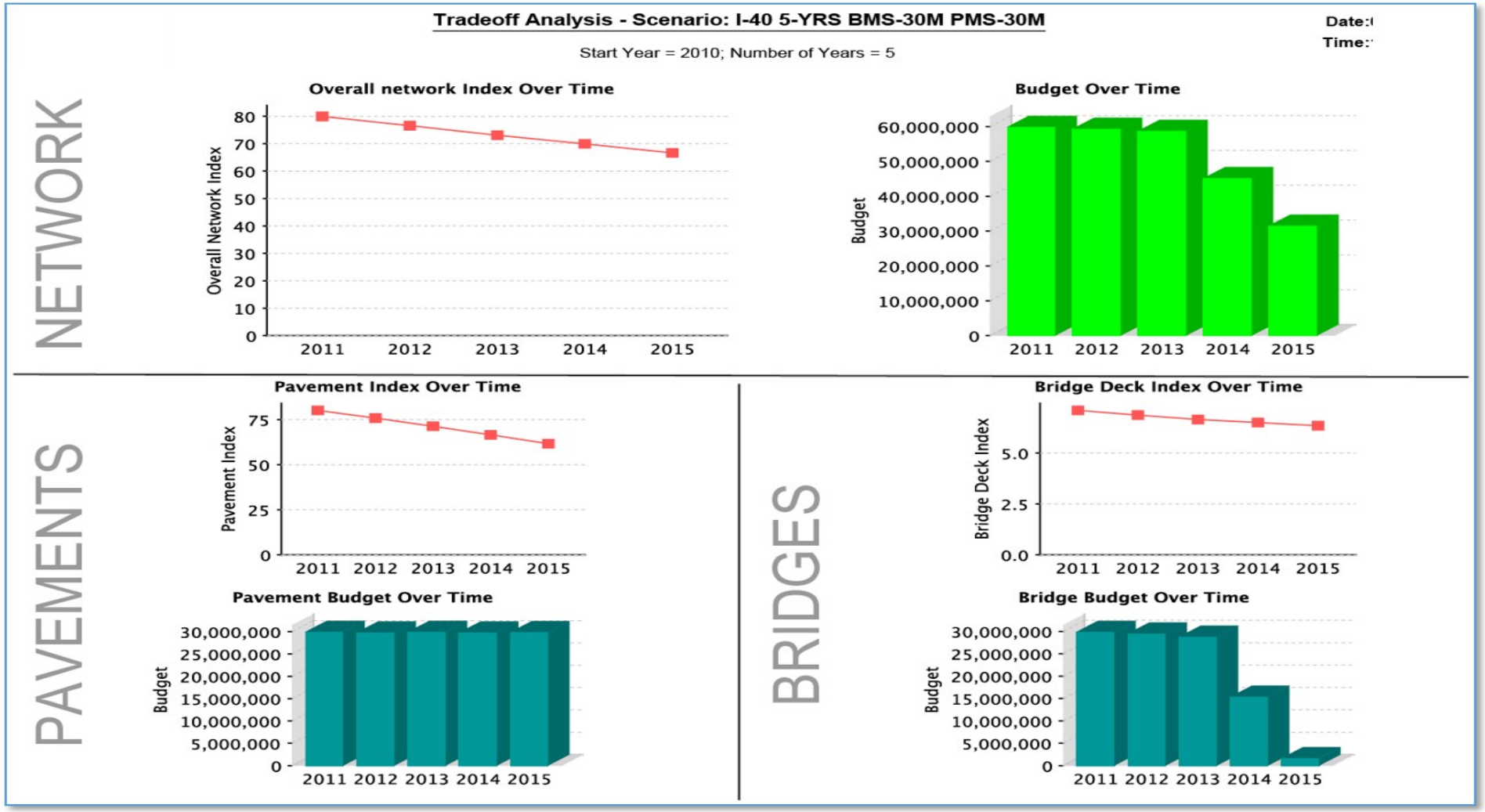


Multi-Constraint Analysis Result (Example)

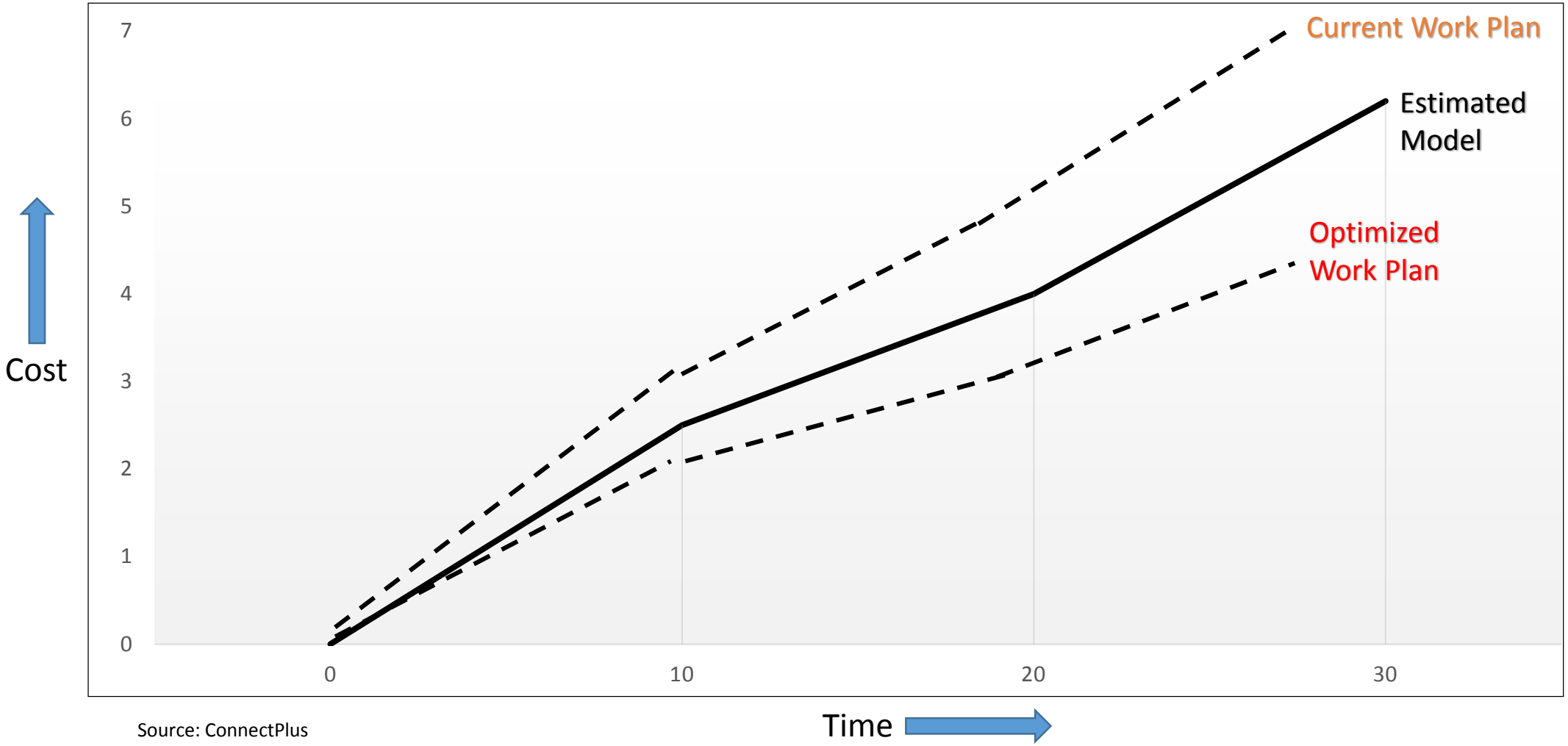
The **optimal solution** found by Multi-Constraint Analysis:

Year	Project on each section						Budget ($)	Spending ($)	Weighted average Performance index - PI
	1	2	3	4	5	6			
1		CM					50,000	23,750	49.3
2				CM			100,000	82,728	50.0
3					RM		100,000	93,645	50.8
4		PM					150,000	3,282	47.1
5							150,000	0	43.1
5-Year Average:									48.1

Trade-off Analysis: Comparing Multiple Bridge & Pavement Scenarios (Example)

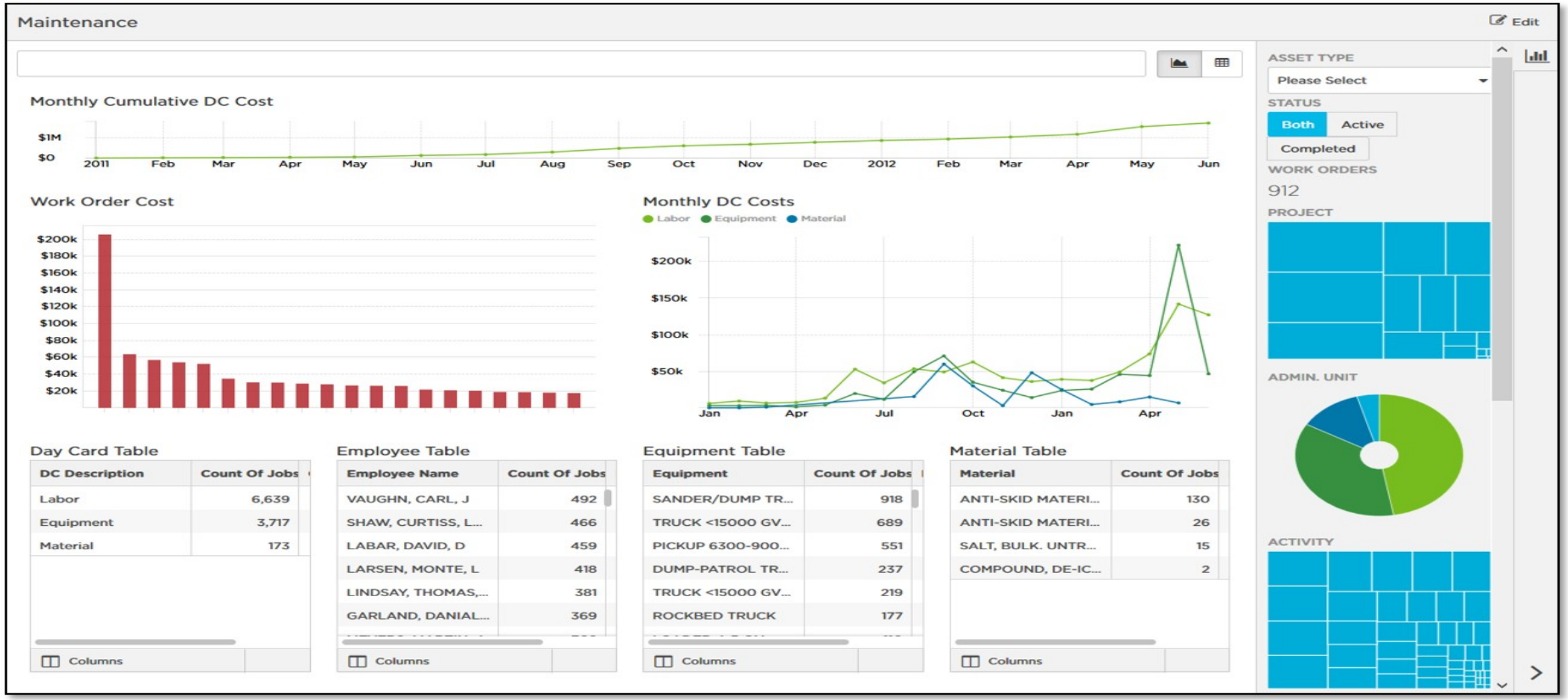


Visualize Optimization With Decision Support

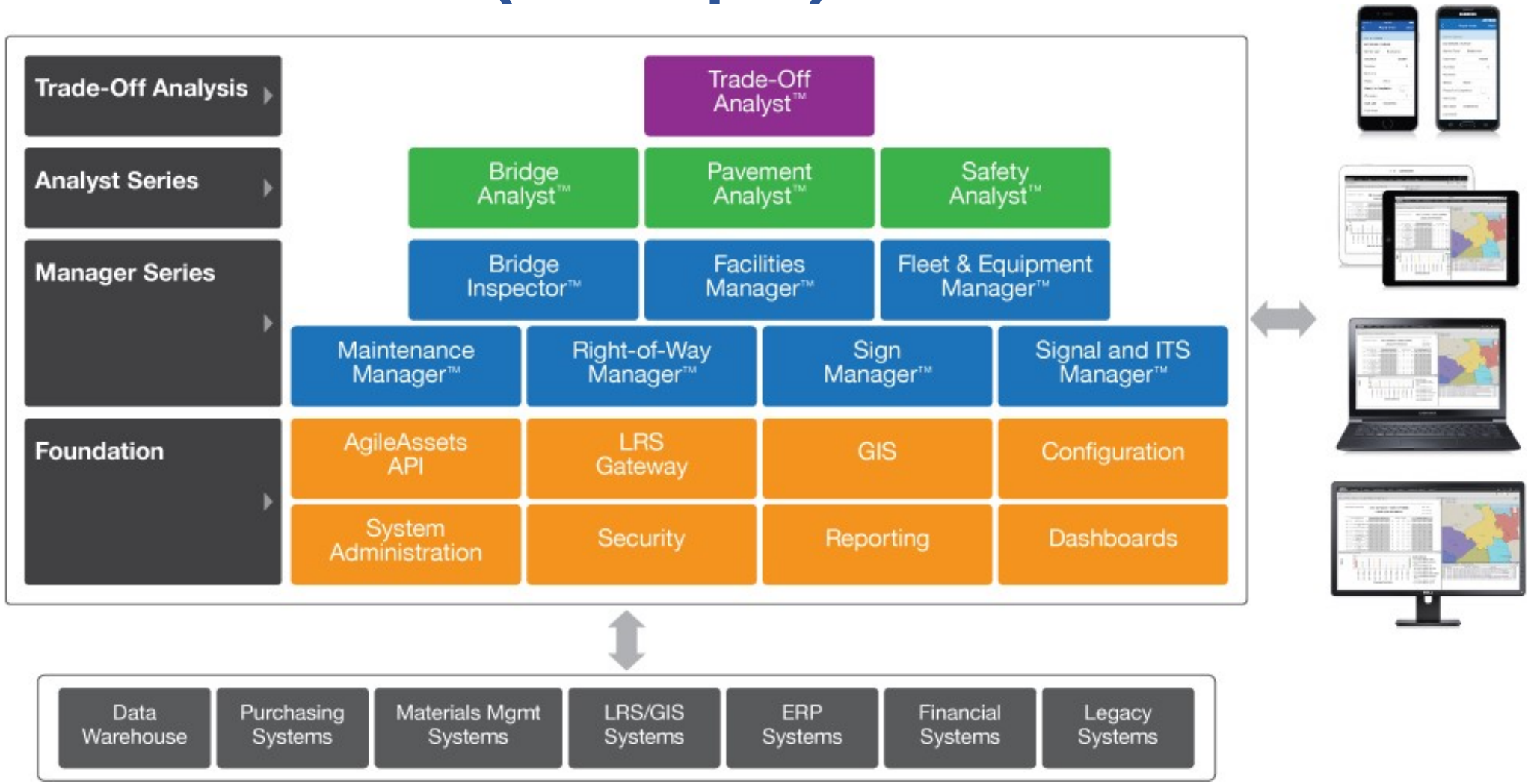


Source: ConnectPlus

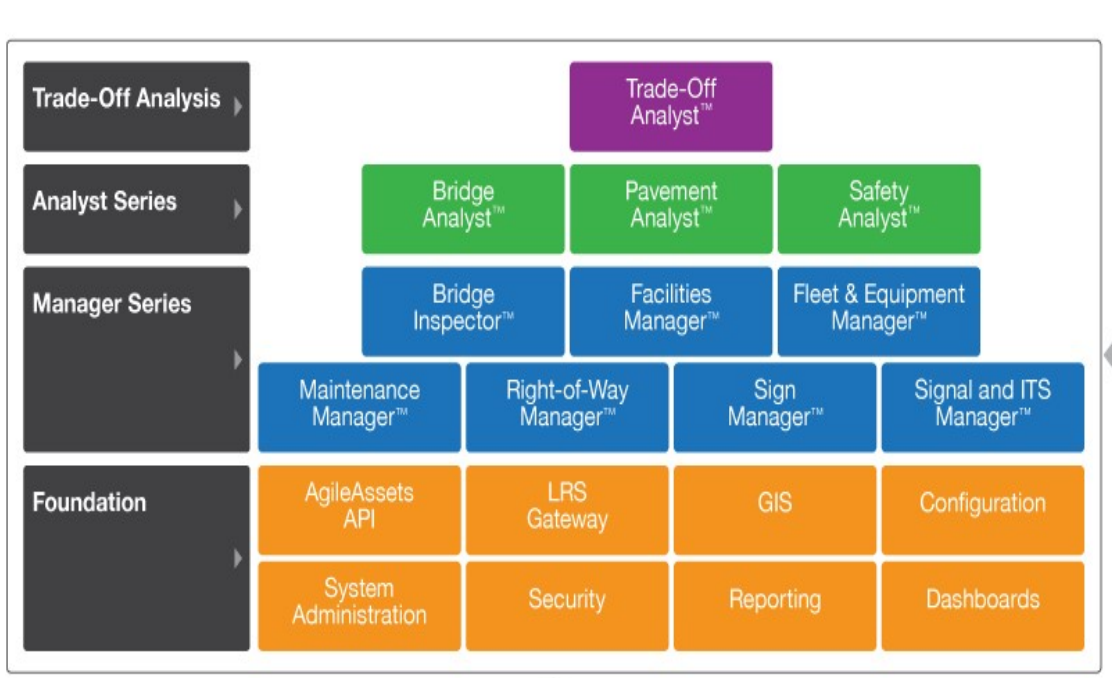
Asset Management Dashboards
Business Intelligence for Toll Infrastructure

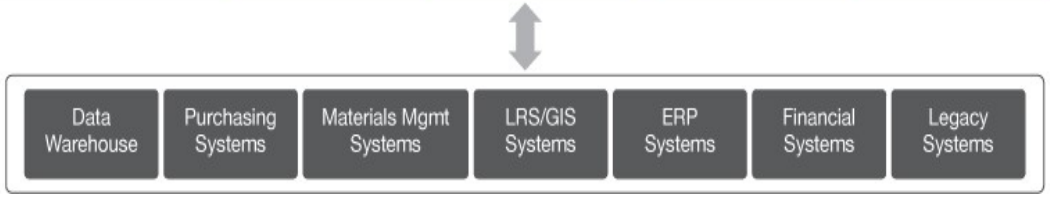


Integrated Transportation Asset Management (TAM) Application Suite (Example)



TAM Systems - Integration Not Isolation





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ERP/Financial System

1. Material Master In
2. Material Inventory In
3. Work Orders Out
4. Material Day Cards Out
5. Equipment Inventory In
6. Equipment Day Cards Out
7. Labor Inventory In
8. Labor Day Cards Out
9. WBS Elements In
10. Actual Work Order Cost In
11. Cost Center In
12. Employee Security In
13. WO Activity Out
14. Control Sections Out

Save the Assets, Save the World

- Balance your infrastructure maintenance investment across all assets
- Acquiring TAM analytical tools to optimize needs with cost investments
- Build TAM dashboards and KPIs to monitor infrastructure asset performance
- **Drive greater toll profitability and sustainability through technology**

Thanks for listening

Bill Rapp
Account Executive
AgileAssets, Inc.

Brapp@AgileAssets.com

https://www.agileassets.com/resources/

www.agileassets.com