

# Pavement Remaining Service Interval: A Construction Event Driven Concept

Northeast Pavement Preservation Partnership  
Burlington, VT  
April 9, 2014

1. Background
2. RSI Concept
3. RSI Steps
4. RSI Implementation
5. What's in it for Me?
6. Discussion and Audience Thoughts

# Background

- Remaining Service Life (RSL) is a very familiar term to pavement engineers
- In one form or another, in use at a number SHAs
- Need for RSL estimation arises from:
  - Planning and programming activities
  - Remaining value at end of LCC analysis period
  - Compliance with concession and warranty agreements
  - **Communicating** pavement condition

- Wide variation in definition
  - Time until a pavement reaches a threshold condition
  - Extent of useful life left in a pavement
  - Time to next rehabilitation/reconstruction treatment
  - The life remaining in a pavement before a major rehabilitation or reconstruction is the most cost effective fix to apply
- Results in “RSL” values that are very different from and inconsistent with each other yet all often assumed to mean the same

# Challenges with the Use of RSL

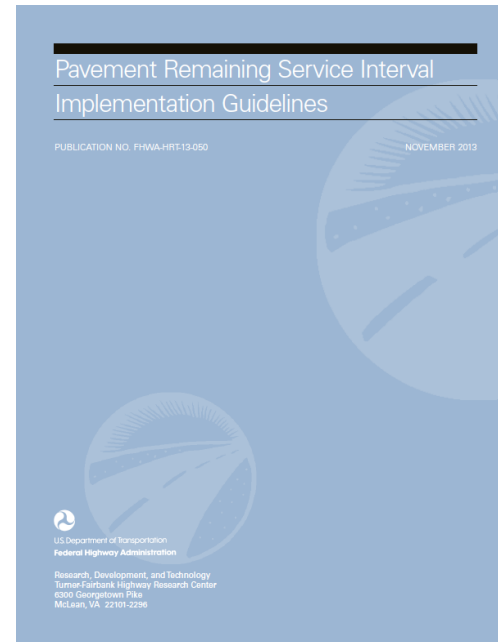
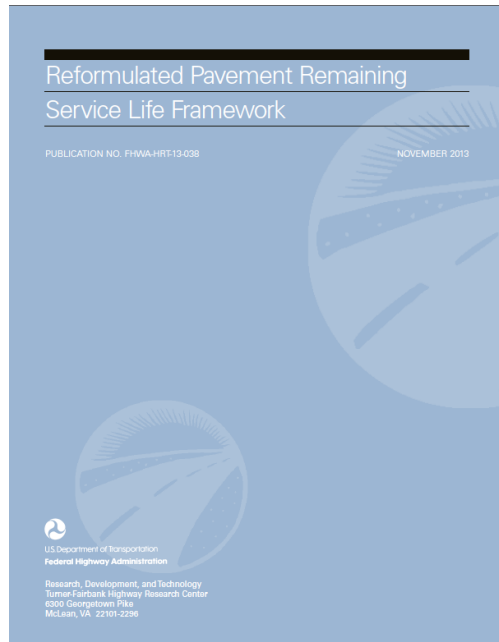


- Definition of end point “life” is not often not part of it the message and left to the recipients interpretation of “life”
- Use of word "life" in this context is improper since pavements do not “die;” **they are repairable systems**
- A term that is perceived to be well understood but in reality very much misinterpreted
- Can be the basis for a worst-first mentality

# FHWA Project 1: Project Reports



- Reformulated Pavement Remaining Service Life Framework  
<http://www.fhwa.dot.gov/publications/research/infrastructure/pavements/13038/13038.pdf>
- Pavement Remaining Service Interval Implementation Guidelines  
<http://www.fhwa.dot.gov/publications/research/infrastructure/pavements/13050/13050.pdf>



# FHWA Study 2: Application & Validation of RSI Framework to Pavements



## Objectives:

1. Conduct research and development services to develop detailed analysis methodologies for new Pavement RSI concept developed in recently completed FHWA research effort
2. Apply and validate developed methodologies using:
  - Two (2) DOT PMS data
  - HPMS 2010+ data sets for national level validation



# RSI Concept

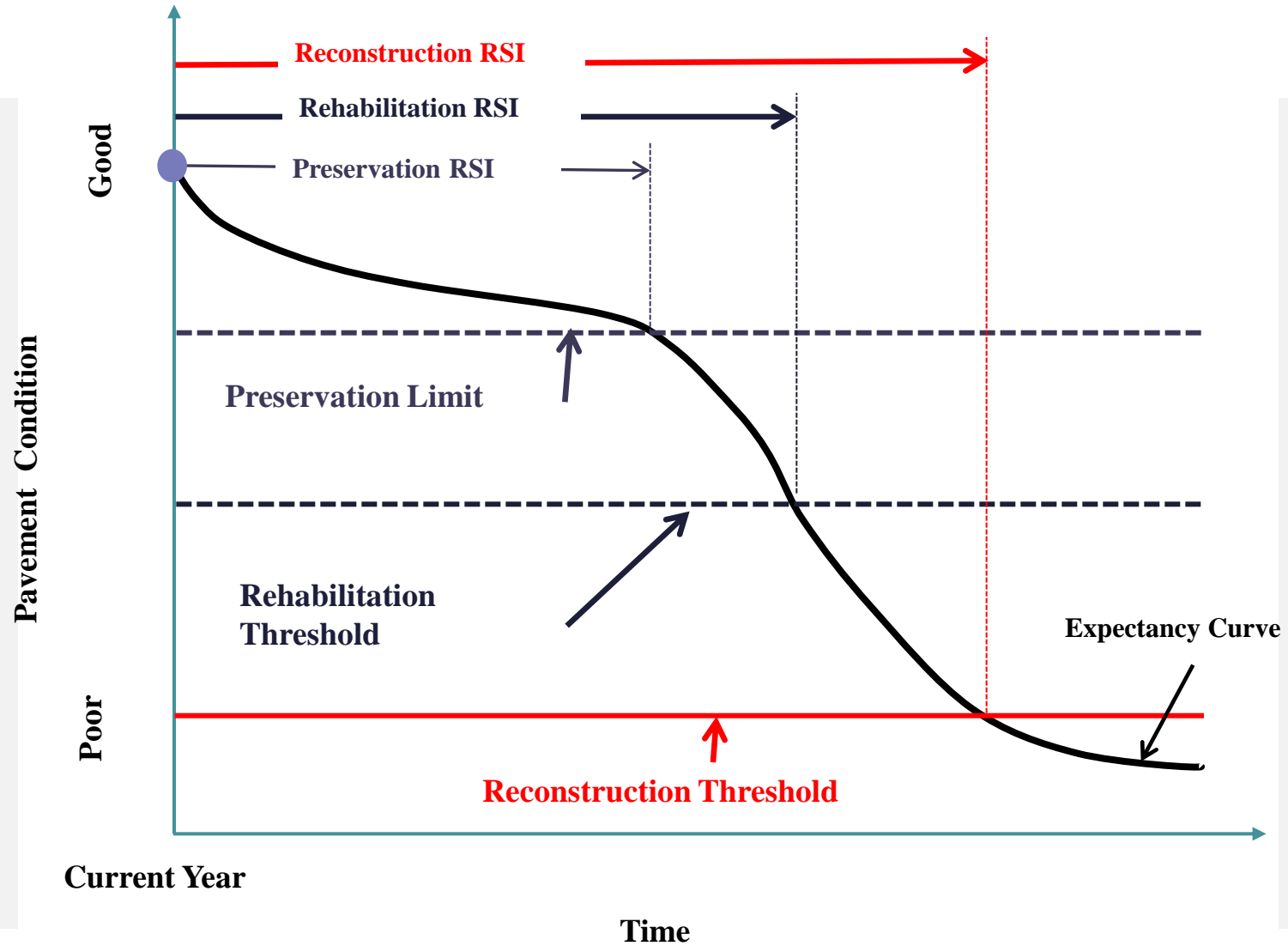
- RSI provides clear terminology and logical process to move us away from erroneous statements such as “pavement has only 5 years of life”
- Moves us toward consistent construction event-based terminology and understanding – types of construction events and timing of those events
- Premised on identifying “a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions” through lifecycle cost considerations to provide needed functions safely and reliably “over the lifecycle of the asset at minimum practicable cost.”

# Remaining Service Interval

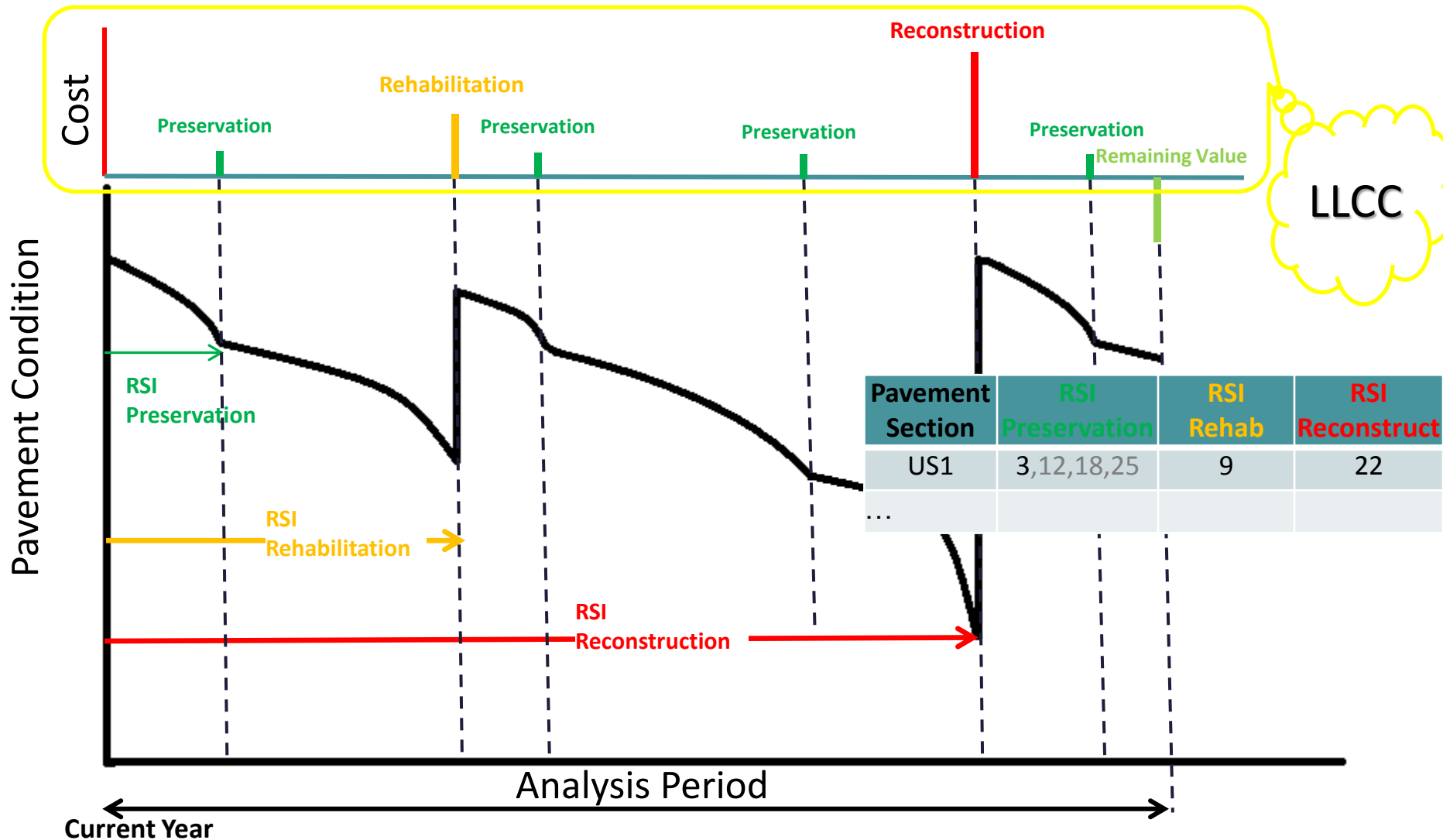
- Can and must consider both structural and functional condition of the pavement
- Concept requires further development and refinement of computational algorithms and refined presentation techniques in order to find acceptance in practice



# Illustration of Pavement RSI Concept



# Illustration of Pavement RSI Concept



# RSI Steps

# RSI Implementation Steps



1. Set construction triggers
2. Set threshold limits
3. Select or develop performance models
4. Identify collection of inputs
5. Establish construction strategy selection process
  - a) Engineering interpretation
  - b) Economic analysis
  - c) Optimization
6. Perform periodic assessments and updates

# 1. Setting Construction Triggers



- Construction triggers are measurable aspects or other aspects of a pavement's condition that can be used to indicate the need for application of a corrective treatment
- Selection of triggers is basis for development of field data collection programs to measure condition state of pavements
- Options include:
  - Level of service
  - Pavement surface distress
  - Structural considerations
  - Safety aspects
  - Agency time based rules
  - Traffic capacity



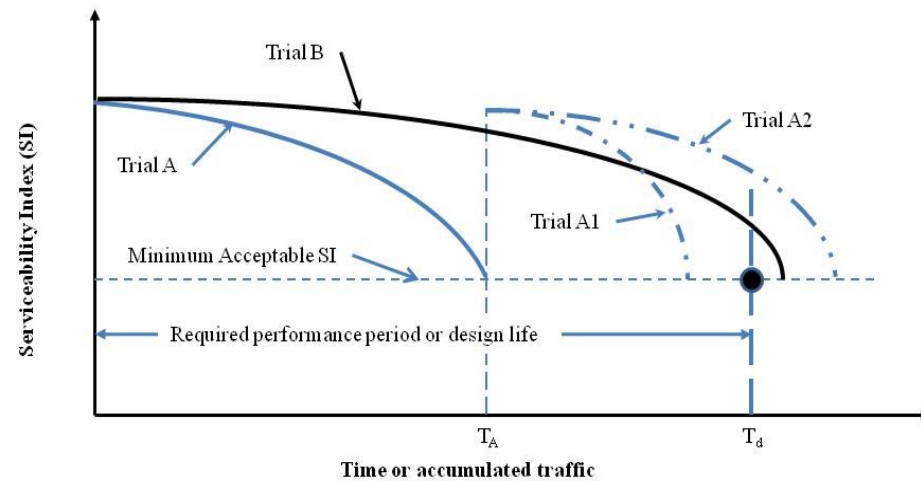
## 2. Setting Threshold Limits

- Threshold limits are used to indicate when a construction trigger reaches a condition and a corrective or preventive construction treatment is needed
- Types of threshold limits:
  - Related to road users
  - Based on agency economics
- Options include:
  - Subjective
  - Engineering
  - Empirical
  - Economic analysis
  - Combinations

# 3. Selecting/Developing Expectancy Performance Curves



- Expectancy performance curves are used as means to predict time when pavement condition reaches construction trigger threshold
- Options include:
  - Models based on design equations
  - Empirical models
  - Agency time-based rules



$T_A$  = life of design Trial A

$T_d$  = design life desired

## 4. Identifying Collection of Inputs

- Collection of data on condition state of pavements under an agency's jurisdiction should be based upon same construction triggers that form the basis for local decisions on corrective construction needs
- Data includes:
  - Pavement roughness
  - Pavement distress
  - Pavement structural response
  - Traffic loads
  - Climate
- Other considerations – missing data, measurement variability, and sampling intervals/frequency



# 5. Establishing Strategy Selection Process



- Selecting most appropriate corrective strategy has many facets and considerations that start with pavement condition subject to other constraints such as budget, etc.
- Objectives of strategy selection process:
  - At network level, objective is to characterize current and future condition state of pavements included in the system, which require consideration of appropriate corrective treatments
  - At project level, objective is to provide detailed decisions on what corrective construction treatments are needed for each project identified from network level needs analysis
- **Challenge of process is to move from “worst first” to “lowest LCC” allocation of agency resources**

## 6. Performing Periodic Assessments & Updates



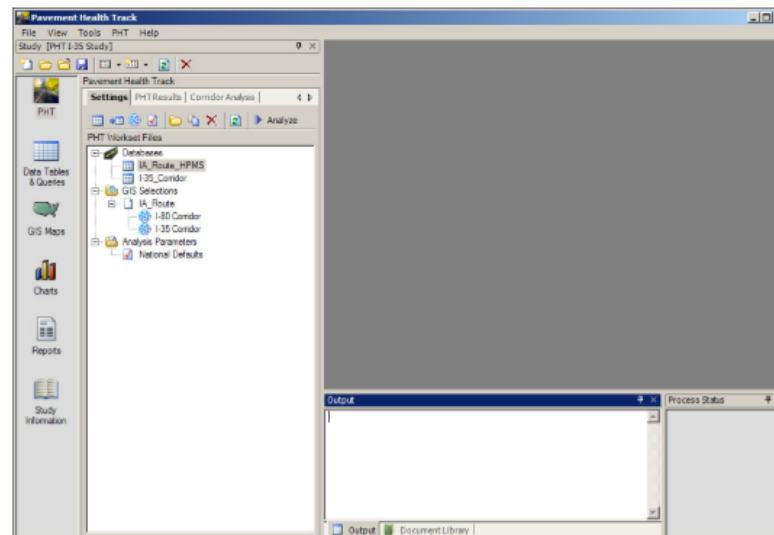
- Modern quality management system concepts are based upon continual cycle of assessments and updates
- All systems require formal assessments; updates are based upon assessment results
- Assessments performed at periodic intervals to identify improvement opportunities
- Updates are needed to adapt to technology changes (new materials, construction methods, models, etc.)

# RSI Implementation

- Goal: implement in a State to determine benefits/drawbacks
- Proof of concept
- Implement using current PMS – with modifications
- Underway



- PHT tool developed by FHWA for HERS and NAPCOM that reports health of pavement networks
- Pavement models based on MEPDG, but simplified – distress and IRI models included
- Primary source of data is 2010+ version of HPMS data





# What's in it for Me?

ASSET MANAGEMENT - The term 'asset management' means a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on **both engineering and economic analysis** based upon quality information, to identify a **structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions** that will achieve and sustain a desired state of good repair **over the lifecycle of the assets at minimum practicable cost.**



PUBLIC LAW 112-141—JULY 6, 2012

126 STAT. 405

Public Law 112-141  
112th Congress

An Act

To authorize funds for Federal-aid highways, highway safety programs, and transit programs, and for other purposes.

July 6, 2012  
[H.R. 4348]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

**SECTION 1. SHORT TITLE; ORGANIZATION OF ACT INTO DIVISIONS; TABLE OF CONTENTS.**

(a) **SHORT TITLE.**—This Act may be cited as the “Moving Ahead for Progress in the 21st Century Act” or the “MAP-21”.

(b) **DIVISIONS.**—This Act is organized into 8 divisions as follows:

- (1) Division A—Federal-aid Highways and Highway Safety Construction Programs.
- (2) Division B—Public Transportation.
- (3) Division C—Transportation Safety and Surface Transportation Policy.
- (4) Division D—Finance.
- (5) Division E—Research and Education.
- (6) Division F—Miscellaneous.
- (7) Division G—Surface Transportation Extension.
- (8) Division H—Budgetary Effects.

(c) **TABLE OF CONTENTS.**—The table of contents for this Act is as follows:

- Sec. 1. Short title; organization of Act into divisions; table of contents.
- Sec. 2. Definitions.
- Sec. 3. Effective date.

**DIVISION A—FEDERAL-AID HIGHWAYS AND HIGHWAY SAFETY CONSTRUCTION PROGRAMS**

**TITLE I—FEDERAL-AID HIGHWAYS**

**Subtitle A—Authorizations and Programs**

- Sec. 1101. Authorization of appropriations.
- Sec. 1102. Obligation ceiling.
- Sec. 1103. Definitions.
- Sec. 1104. National Highway System.
- Sec. 1105. Apportionment.
- Sec. 1106. National highway performance program.
- Sec. 1107. Emergency relief.
- Sec. 1108. Surface transportation program.
- Sec. 1109. Workforce development.
- Sec. 1110. Highway use tax evasion projects.
- Sec. 1111. National bridge and tunnel inventory and inspection standards.
- Sec. 1112. Highway safety improvement program.
- Sec. 1113. Congestion mitigation and air quality improvement program.
- Sec. 1114. Territorial and Puerto Rico highway program.
- Sec. 1115. National freight policy.
- Sec. 1116. Prioritization of projects to improve freight movement.
- Sec. 1117. State freight advisory committees.

Moving Ahead for Progress in the 21st Century Act. State and local governments. 23 USC 101 note.

# Role of PMS in TAMP



- MAP-21 has a requirement for production of a risk-based Transportation Asset Management Plan - or TAMP - for pavement and bridges.
- PMS has a huge role to play.
- Current and future condition, funding levels, asset value, etc.
- Key questions:
  - How do you measure financial sustainability?
  - How do you value pavement assets?

---

## New York State DOT Work Plan for Developing a TAMP

*prepared for*  
Federal Highway Administration

*prepared by*  
AMEC Environment & Infrastructure, Inc.  
12000 Indian Creek Court, Suite F  
Beltsville, Maryland 20705

*and*  
Cambridge Systematics, Inc.  
115 South LaSalle Street, Suite 2200  
Chicago, IL 60603

*date*  
July 2013

---

# Asset Sustainability Index

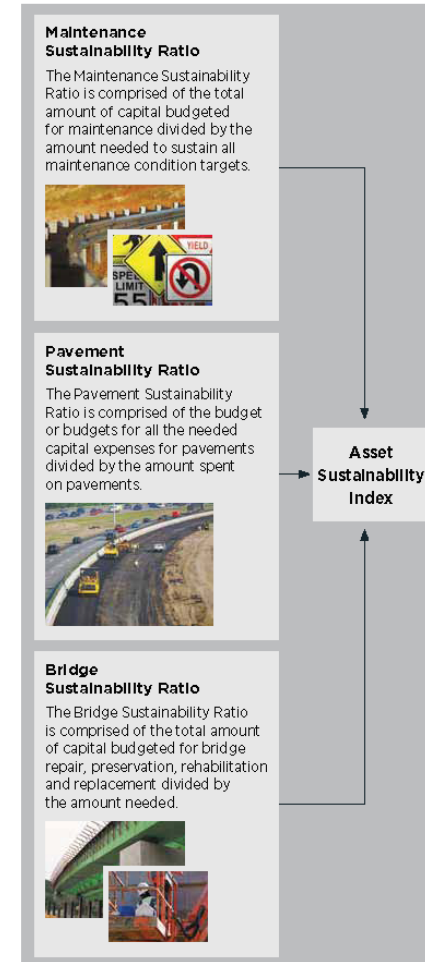
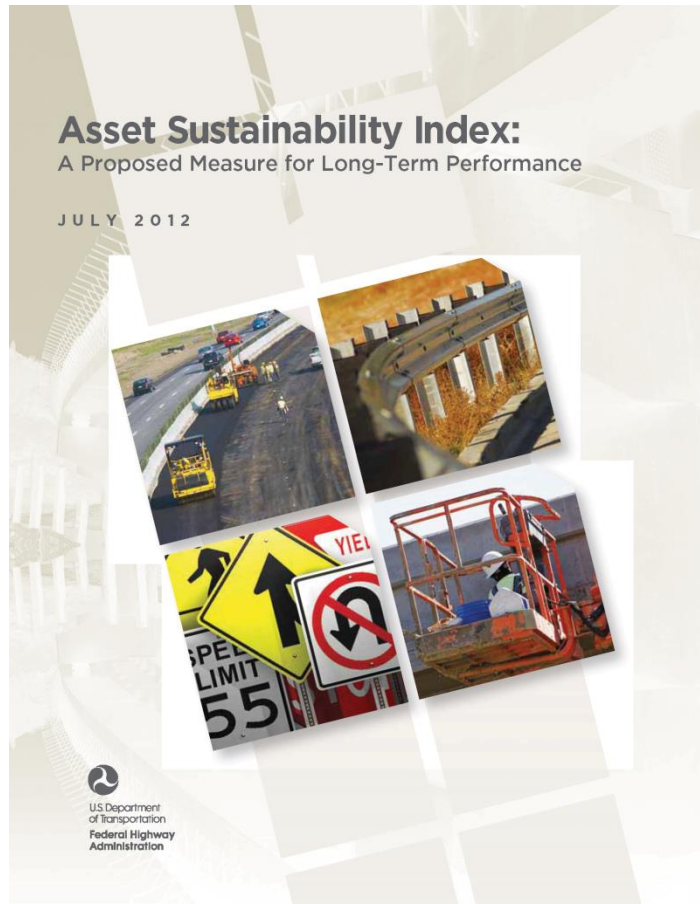


Figure 1. Ratios from Maintenance, Pavements and Bridges combine into the Asset Sustainability Index.

You will be a Hero in Your Agency!



# Takeaways



- "Remaining Service Life" is replaced by "Remaining Service Interval" or "RSI"
- Outcomes from RSI process can be used, presented and communicated in same fashion agencies have been doing for years using RSL
- Provides more meaningful terminology and better logic process that will move us away from erroneous statements such as "this pavement has only 5 remaining years of life"
- RSI methodology provides a readily available way to communicate impacts of alternate budget scenarios
- More meaningful term for MAP-21 intent
- Work underway – 1 year

# Acknowledgements



- Dr. Nadarajah Sivaneswaran, P.E. (Siva) – FHWA TFHRC, COR
- Dr. Gonzalo Rada, P.E. – AMEC, PI
- Dr. Beth Visintine – AMEC
- Geoff Hall, P.E., Nathan Moore, P.E. – MD SHA (Pilot Study)

# **Discussion/ Audience Thoughts**