Pavement Remaining Service Interval: A Construction Event Driven Concept

Northeast Pavement Preservation Partnership
Burlington, VT
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Agenda

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, it is in use at a number of SHAs. The 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
Challenges with the Use of RSL

- 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

- Pavement Remaining Service Interval Implementation Guidelines
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.”
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

- **Preservation RSI**
- **Rehabilitation RSI**
- **Reconstruction RSI**

**Preservation Limit**

**Rehabilitation Threshold**

**Reconstruction Threshold**

**Expectancy Curve**

**Current Year**

**Time**
Illustration of Pavement RSI Concept

Cost

Preservation

Rehabilitation

Preservation

Preservation

Preservation

Remaining Value

Preservation

Reconstruction

Pavement Condition

RSI Preservation

RSI Rehabilitation

RSI Reconstruction

Analysis Period

Current Year

Pavement Section | RSI Preservation | RSI Rehab | RSI Reconstruct
--- | --- | --- | ---
US1 | 3, 12, 18, 25 | 9 | 22
...
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
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
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

Time or accumulated traffic

\( T_A = \) 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.
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
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
MD SHA Pilot

- Goal: implement in a State to determine benefits/drawbacks
- Proof of concept
- Implement using current PMS – with modifications
- Underway
FHWA PHT Tool and HPMS Data

- 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.
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?
Asset Sustainability Index: A Proposed Measure for Long-Term Performance

JULY 2012

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

Maintenance Sustainability Ratio
The Maintenance Sustainability Ratio is comprised of the total amount of capital budgeted for maintenance divided by the amount needed to sustain all maintenance condition targets.

Pavement Sustainability Ratio
The Pavement Sustainability Ratio is comprised of the budget or budgets for all the needed capital expenses for pavements divided by the amount spent on pavements.

Bridge Sustainability Ratio
The Bridge Sustainability Ratio is comprised of the total amount of capital budgeted for bridge repair, preservation, rehabilitation and replacement divided by the amount needed.
You will be a Hero in Your Agency!
"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
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Discussion/
Audience Thoughts