



Federal Highway Administration and TSP2
National Bridge Management, Inspection
& Preservation Conference

*Determining Preservation Needs Using
Inspection & Bridge Management System Data*

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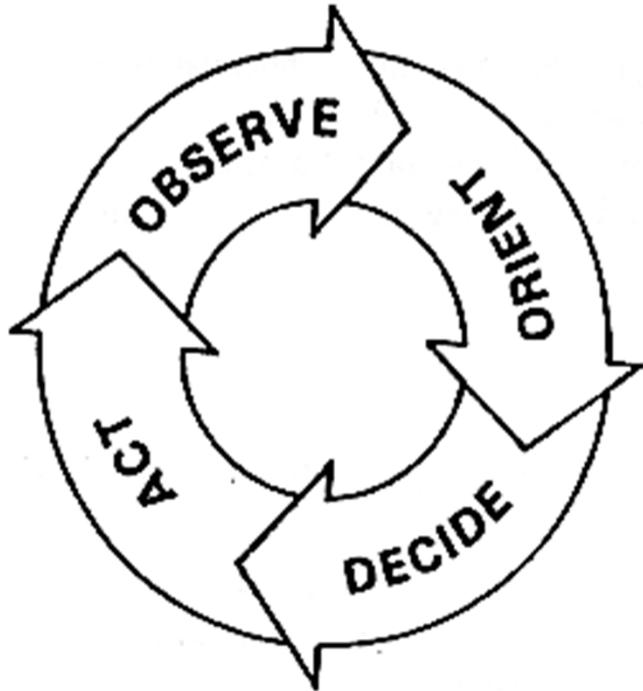


Agenda

- **OODA Loop**
- **Development of Data**
- **Data Repository**

OODA Loop (observe-orient-decide-act)

Looping Effect of Decision Making



The Components of Agency OODA Loop

- **Observe**
 - Inspections
- **Orient**
 - Data Analysis
- **Decide**
 - Program Development
- **Act**
 - Letting and Completing Projects



Observer - Inspections

Quality of the Data

- Visual Inspection
- Non Destructive Testing
- Destructive Testing

Quantity of the Data

- One Inspection
- Many Inspections
- Similar Bridges In the Inventory

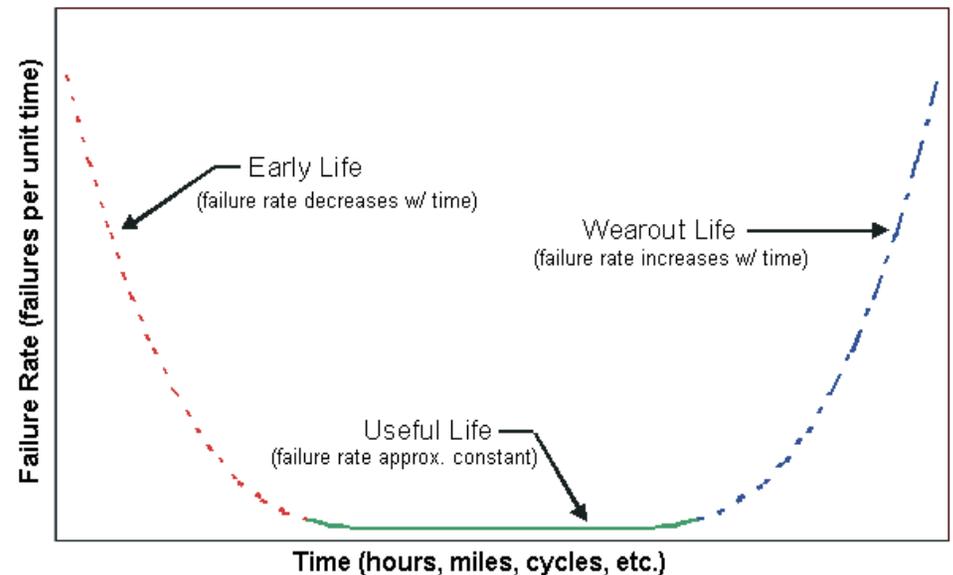
Granularity of Data

- NBIS Component Level
- AASHTO Element Level (NBE)
- AASHTO Element Level (BME)
- Agency Defined Data
 - Elements
 - Other Items



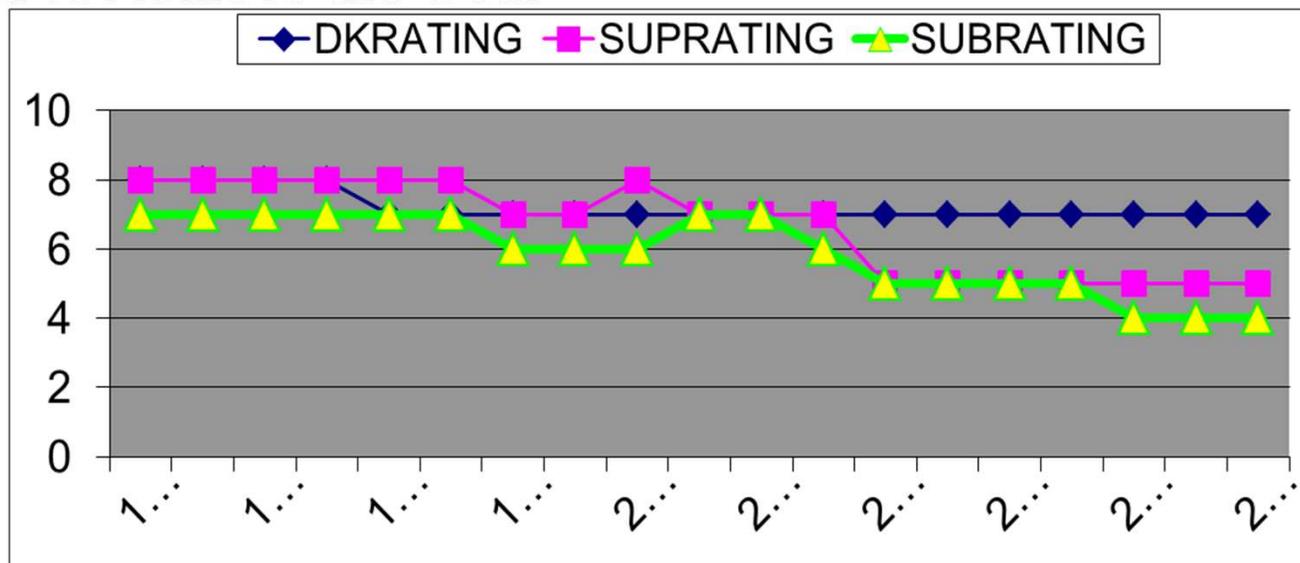
Orient – Data Analysis

- **Deterioration Models**
 - Markov Chain
 - Weibull Curves
- **Intervention Actions**
 - Cost of the Action
 - Preservation/Capital Action
- **Interaction Between Other Forces**
 - Truck Traffic
 - Material Properties
 - Construction Practice



Decide – Program Development

- Review Data from the Bridge Management Process
- Review the Metrics
 - Return on Investment (ROI)
 - Expenditures Need to Achieve the Goal





Act – Completing Required Projects

- **Track Completed Projects**
 - Update Bridge Condition
 - Update Intervention Costs
- **Review Inventory Metrics For Goal and Objectives**
 - Condition (Elements)
 - Safety (NBIS)

Bridge Condition	
Target 92% Non-Red (Non-SD)	
	1688
	3233
	15945
Green and Yellow Percent: 91.9%	



Developing the Data





Data Collection

- **Deterioration - From Field Observation**
 - NBI Inspections
 - Element Inspections
- **Cost Data**
 - Contract Data
- **Scheduled Contract Work**
 - State Transportation Improvement Plan (STIP)
- **Maintenance Work Records**



Performance Measure

- **Best Practice Is the Health Index**
 - **Range of Values More Reasonable Based on New Element Definitions**
 - **Elements for Preservation Can Be Separated from Capital Consideration**
 - **Painted Elements**
 - **Deck Overlay Elements (Asphalt, Polymer, Latex Overlays, ...)**
- **Calculated by Equation 4.2.1 of Pontis Technical Manual**

$$\text{Health Index} = \frac{\sum_n \text{Element Cost} * \text{Element Quantity} * \text{Percent Condition State}}{\sum_n \text{Element Cost} * \text{Total Element Quantity}} * 100$$



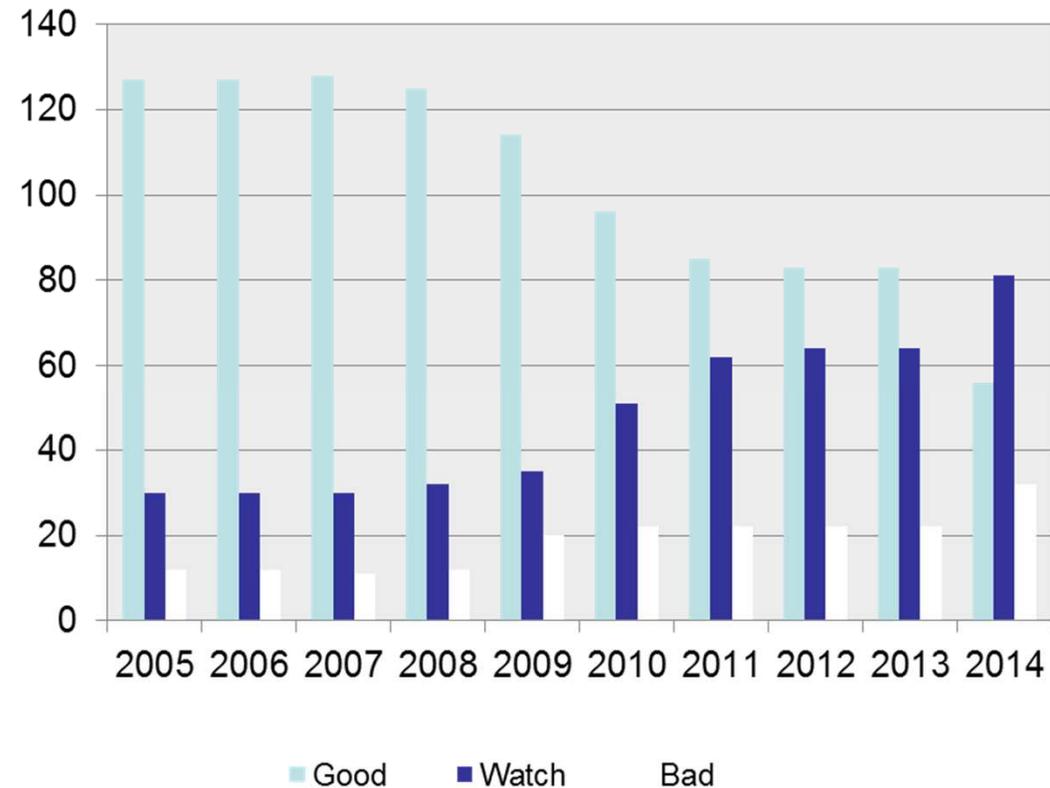
Reporting

- **Development of “Indifference Curve”**
- **Report**
 - **By Bridge (by Year)**
 - Recommended Action
 - Benefit / Cost Ratio
 - Health Index
 - Categorize by Good, Watch, Bad
 - **By Route (Break on County and Year)**
 - Average Health Index
 - Network Indifference Curve
 - Network Benefit / Cost Ratio
 - Network Cost to Improve
 - Count by Good, Fair, Poor Groupings



Groupings

- **Good Condition**
 - Hi Greater Than 70
 - No Defects
- **Watch (Fair Condition)**
 - Hi Between 50 and 69
 - Bridges Have Defects That Need Monitoring
- **Bad (Poor Condition)**
 - Hi Less Than 50
 - Defects Needing Corrective Action



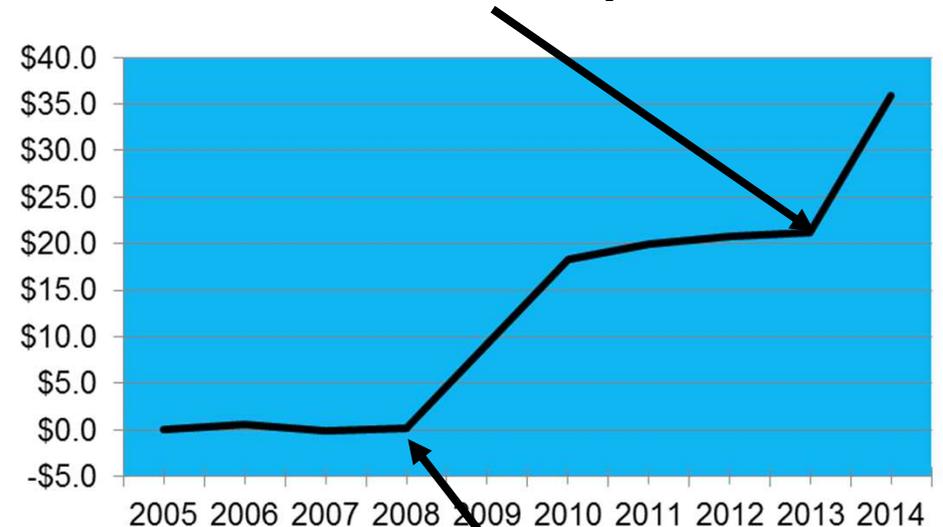


Indifference Curve

- **Need Cost or Bridge Count by Year**
- **Plot Cost (Bridge) and Year**
- **Take Action Before Going Near Vertical**

Needing Work Before Input Into a Capital Program

Maximum PM Cost < Capital Cost



**First Time to Consider Work
(Lest Cost)**



Field Review and Set Scope

- **Rank Corridors From Worst to Best**
- **Review Recommended Action From Bridge Management System With Field Observations**

Kick Some Rocks

- **Develop Scopes for Each Bridge**
- **Detailed Estimate for Each Bridge in the Corridor**



Check for Corridor Improvement

- **Input Projects, Scopes and Cost Into the Bridge Management System**
- **Run the Scenario With Proposed Budgets**
- **Compare Network Level Results**
 - **Fulfill Performance Goals?**
 - **Budgets Adequate for Scope?**
 - **Peaks and Valleys of Needs Smooth Out?**

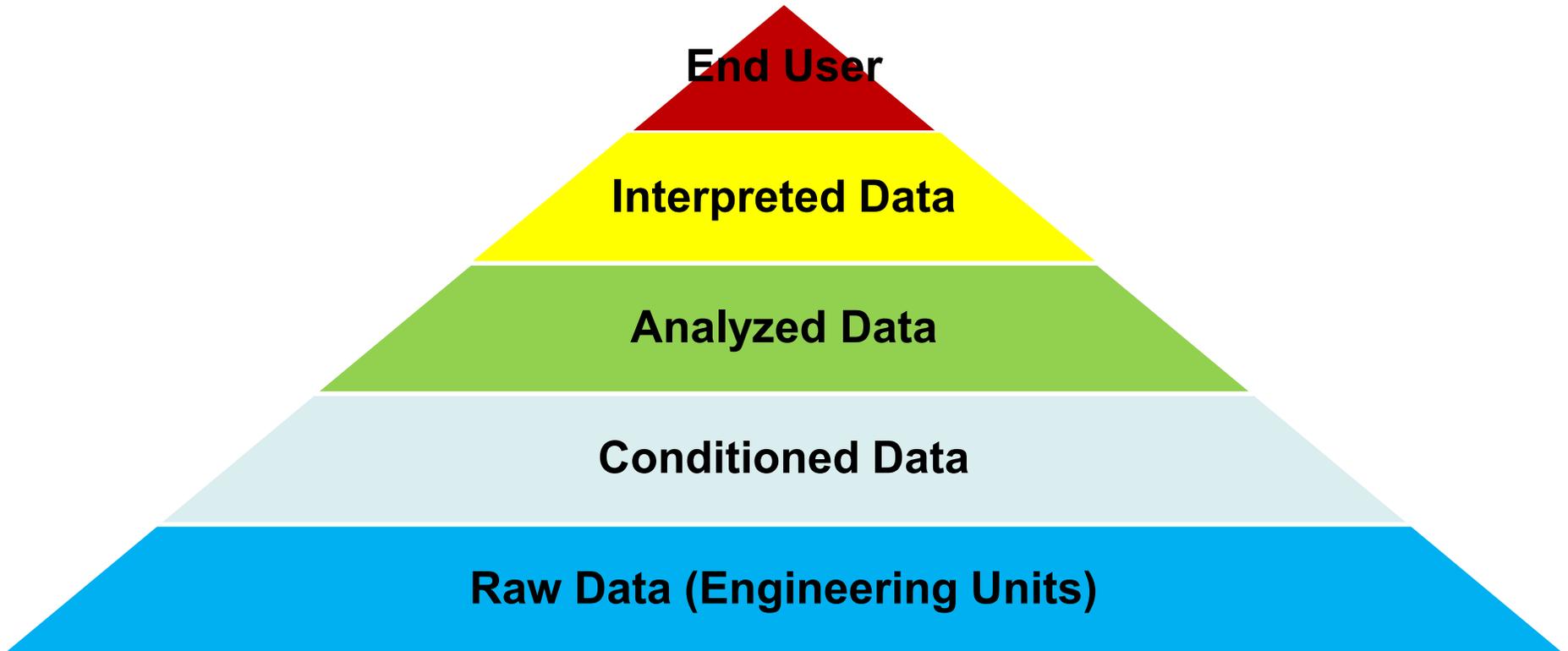


Long Term Actions

- **Compare Proposed and Actual Performance Measures**
- **Compare Performance Goals With Objectives for the Corridor or Area**
- **Update Models With Additional Data**
- **Update Cost Models As Bid Tabulations Change**



Data Repository



Long Term Bridge Performance Program

Data Collection

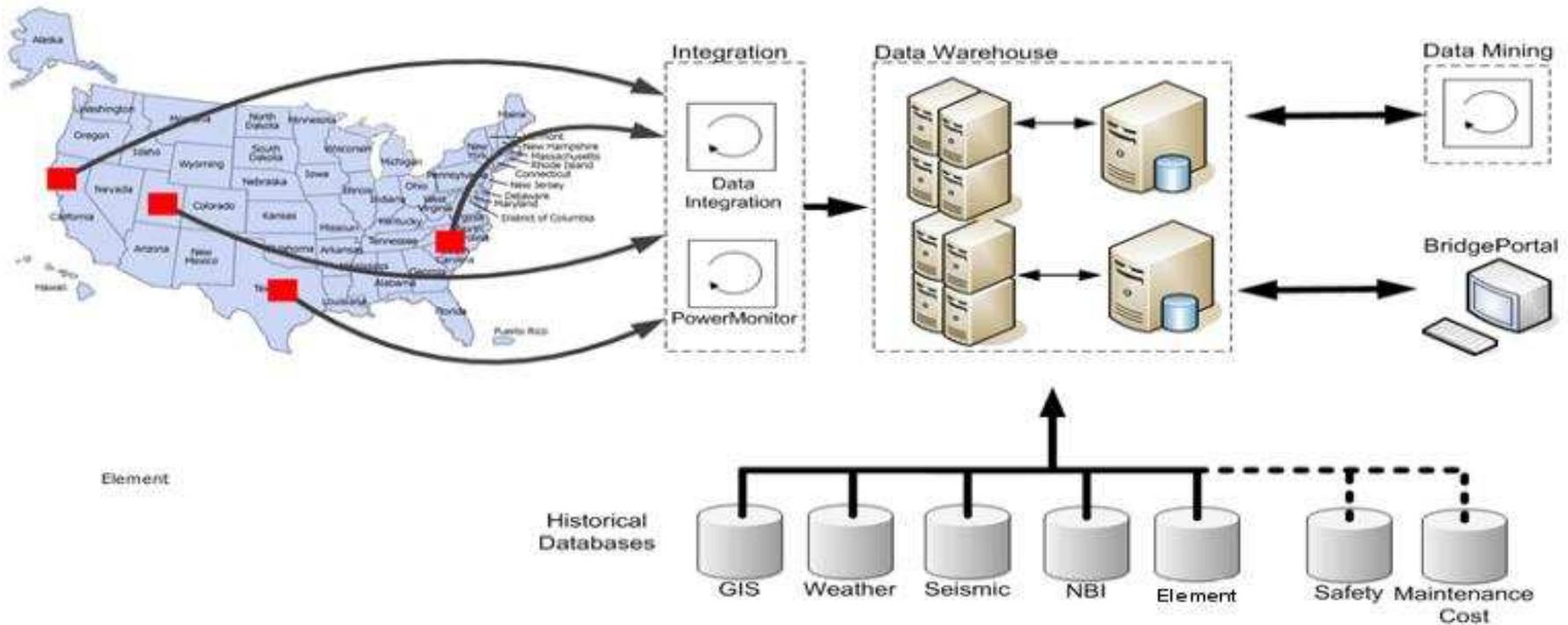
Inspection Reports
 Temperature
 Strain Gauge
 Traffic
 Wind
 NDE/NDT

Data Management

Online Monitoring
 Data Mining
 Data Integration

Data Access

Data Access
 Visualization
 Query





What The Portal Is Not

- **Not a Bridge Management System**
- **On-line Service for Data Hosting**

Portal Is A Toolbox

- Bridge Management Data Not Available to Agency Practitioners
- Develop Model Parameters For
 - Deterioration
 - Cost
 - Life Cycle Cost



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Deterioration Models

Rollup Data Into Parameters For End Users (BMS)

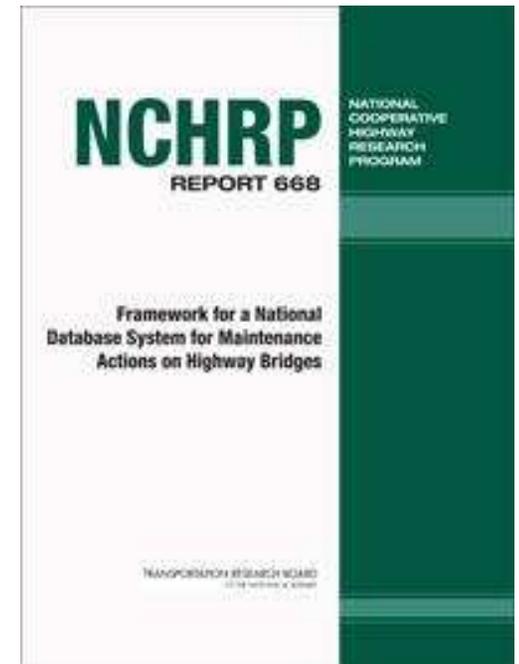
- **Deterioration Based on Elements**
- **Deterioration Based on Component**
 - Rollup From Elements
 - Deterioration Based on Component
 - **Develop Model Development**
 - Weibull Curve Shaping
 - Markov Chaining
- **No Consideration of Intervention Activity (Do Nothing)**





Life Cycle Cost Modeling Rollup Data Into Parameters For End Users (BMS) **Cost Models by Action Activity**

- **Maintenance**
- **Preservation**
- **Capital Program**





Needing Help from the Community of Practice

- **Upload of Inspection Data**
- **Upload of Intervention Actions**
- **Upload of Cost Data by Intervention Action Type**





Questions

<http://www.fhwa.dot.gov/research/tfhrc/programs/infrastructure/structures/ltbp/>



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