Federal Highway Administration

Long-Term Bridge Performance Program

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LTBP Program Objective

- Collect, document and maintain high quality, quantitative performance data
- Improved knowledge of bridge performance
- Improved asset management
Program Objectives

- Over the next five years, LTBP will inspect, document, evaluate, and periodically monitor a representative sample of bridges nationwide, taking advantage of advanced condition monitoring technologies in addition to detailed visual inspections.

- The high-quality data gathered in the process and the subsequent data analysis and data mining aim to significantly enhance our knowledge of bridge performance.
Program Objectives

- Among the study’s objectives are improved life-cycle cost and predictive models, better understanding of bridge deterioration and more effective maintenance and repair strategies.

- LTBP results should also support improved design methods and bridge preservation practices and help develop the next generation of bridges and bridge management systems.
Understanding and Evaluating Performance

Performance is a critical factor in optimal operation of highway systems.

Understanding performance is key to address bridge deficiencies and the design/construction of superior bridges of the future.
Understanding and Evaluating Performance

- How do we define bridge performance objectively?
- Are current measures (sufficiency and condition rating) sufficient to describe performance of critical nodes of a multi-domain system?
- Does “health index” account for interactions important to bridge and highway system performance?
- What are the critical design, fabrication and construction parameters, loading and behavior mechanisms, operational as well as maintenance practices that have significant impacts on bridge LC performance?
Understanding and Evaluating Performance

- How do we rationally estimate LCC given the complexity of multidomain infrastructure system?

- Challenge is to formulate performance in terms of rational, measurable indices that correlate with the performance of the entire system
Goals and Performance Categories

Structural Condition & Integrity
- Types, Materials and Specifications
- Clearance
- As built material and construction quality
- Traffic loads—trucks
- Environment—climate, air quality and marine atmosphere
- Snow and ice removal operations
- Type, timing and effectiveness of preventive maintenance
- Type, time and effectiveness of restorative maintenance and rehabilitation
- Hydraulic designs and scour mitigation programs
- Soil characteristics and settlement

Safety of User
- Structural geometry
- Vertical clearance
- Traffic volume and % trucks
- Posted Speeds

Cost to User and Agency
- User
- Accident cost
- Delay and detour costs to users
- Agency
- Initial costs
- Maintenance and rehabilitation costs

Hooks, 2008
Program Approach

1. Program Initiation and Pilot Planning
2. Pilot Program: Initial Field Work / Sampling
3. Data Collection and Data Management
4. Deterioration Models Performance Models
5. Life Cycle Cost Analysis
6. Improved Knowledge of Bridge Performance and Better Asset Management
Long-Term Bridge Performance Program

Developmental Phase - 5/08

Initiate Pilot Program - 9/08

Completion of Developmental Phase - 11/08

Col Long Term Data Collection 08

- Make available a user-friendly high-quality database on bridges

**Tasks & Objectives**

- Develop a national consensus that the program is critical for a more efficient nationwide bridge management system
- Review Pilot Program to determine lessons learned and area for improvement
- Develop future Phase Program that is:
  - Manageable
  - Comprehensive
  - Repeatable
  - Achievable
  - Measurable
  - Representative

* Implementation plan for Phase II*
### Development and Pilot Phase Tasks

<table>
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<th>Task Number</th>
<th>Task Description</th>
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<th>PB</th>
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- **X** Indicates team member with primary responsibility
- **✓** Indicates team member that will provide significant contributions to the task
Developmental Phase Tasks

• Task 1.1: Road Map
  – Understanding
    • Guide to the LTBP program
    • Basis of early communication and marketing plan
    • Identify the range of issues, needs, and desired state-of-practice at the end of the LTBP program.
  – Approach
    • Review lessons learned from similar projects
    • Work closely with advisory board and stakeholders
Developmental Phase Tasks

• **Task 1.2: Specific Data to be Collected**
  
  – Understanding
    • Identify key elements
    • Type of data
    • Determine what relevant data is available from other sources
  
  – Approach
    • Work with SHA
    • Bring together experienced bridge inspectors for symposium
Developmental Phase Tasks

• Task 1.3: Development of Data Infrastructure
  – Understanding
    • Open, scalable, extensible software and data infrastructure
    • Incorporate tools and algorithms for:
      – Life Cycle Cost Models
      – New Data analytical Methods
  – Easy to use
  – Approach
    • Experience from previous projects will be leveraged
    • Connection with NBI, NOAA, GIS, etc
Developmental Phase Tasks

• Task 1.4: Protocols for Data Sampling and Collection
  – Understanding
    • Develop protocols for:
      – Inspection
      – Instrumentation
      – Data Quality Assurance
    • Determine quantity and frequency of data collection
  – Approach
    • Protocols need to be coordinated with the rest of the LTBP team
Developmental Phase Tasks

• Task 1.5: Bridge Sampling
  – Understanding
    • Develop methodology and rational for sampling bridges
    • Recommend type, number, and location
    • Final sample shall support the objectives of LTBP program
  – Approach
    • Multiobjective constrained optimization problem
    • Combined top-down heuristic and bottom-up statistical approach
    • Work closely with stakeholders
Developmental Phase Tasks

• Task 1.6: Synthesis of Bridge Monitoring & Autopsy Methods
  – Understanding
    • Synthesize past work for both short-term and long-term monitoring
      – Structural Health Monitoring (SHM)
      – NDE/NDE techniques
    • Include benefits realized from the application of SHM and Autopsy
  – Approach
    • Work closely with Turner Fairbanks NDE/NDT Laboratory
    • Review published literature
Long-Term Bridge Performance Program

Developmental Phase Tasks

- Task 1.7: Protocols for Bridge Monitoring & Bridge Autopsy
  - Understanding
    - Develop protocols and standards for monitoring and autopsy
    - Document protocols for implementation
    - Accommodate a variety of sensors, instrumentation, and NDE/NDT methods
  - Approach
    - Based on findings of Task 1.6
    - Take advantage of existing documents
Review of Developmental Phase Tasks

• Task 1.8: Communication and Marketing Plan
  – Understanding
    • Develop aggressive communication and marketing plan including:
      – LTBP Website
      – PowerPoint Presentations
      – Briefings
      – Program Newsletter
      – Workshops
      – Conferences
  – Approach
    • Work closely with FHWA and Stakeholders
    • Aggressive outreach