Federal Highway Administration

Long-Term Bridge Performance Program

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FHWA Long-Term Bridge Performance Progra

- Designated in the "SAFETEA-LU" surface transportation authorization legislation as a **20-year research effort** to improve our knowledge of bridge performance

- **Funding** is currently only authorized **through FY-2009**

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Challenges!

FHWA's Perspective

1) **Aging bridge population – performance poorly understood**

2) **Currently available data will not support desired performance assessments**

3) **LTBP Program is essential to understanding, improving bridge performance**

LTBP program should,

    a. **Focus on most common bridges**

    b. **Serve FHWA and stakeholder needs**

    c. **Not burden bridge owners with new requirements**

    d. **Encourage international cooperation**

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State DOTs' Perspective

1) **Available road and bridge funds have leveled off or decreasing**

2) **Key material prices escalating beyond inflation rate**

3) **Traffic Volume and load demands growing rapidly**

4) **Demand and expectations from users of the system will continue to grow**

5) **Eliminating deficient bridges**

LTBP program should,

    a. **Help States meet challenges**

    b. **Set data protocols**

    c. **Focus on practical, useful data**

    d. **Take advantage of sensing technology**

Research Community's Perspective

Availability and quality of data will affect the degree of uncertainty in assessing bridge performance, developing deterioration models and performing LCC analysis

Uncertainty in data is
- Aleatory– that is the inherent randomness or variability in the data
- Epistemic– that is the lack of sufficient knowledge or the inability to predict or estimate the desired data correctly

Bridge Performance ?

- **Define**
- **Measure**
- **National consensus**
  - **Number of bridges needing work**
  - **Structural deficiencies, posting or sufficiency rating (uncertainties)**
  - **Deficiencies and load carrying capacity**
  - **Customer satisfaction**

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Challenges in Measuring Bridge Performance

- **It is not well defined and understood or documented**
- **Relies too heavily on expert opinion and not on objective data**
- **Based on significant assumption or generalization based on a very simplistic understanding of bridge behavior**
- **Uncertainties**
  - **Subjectivity of current condition ratings**
  - **Lack of proper documentation (i.e., records of actions and costs)**
  - **Incomplete data (i.e., cost, maintenance)**
  - **Many hidden deterioration and damage escape visual inspection**
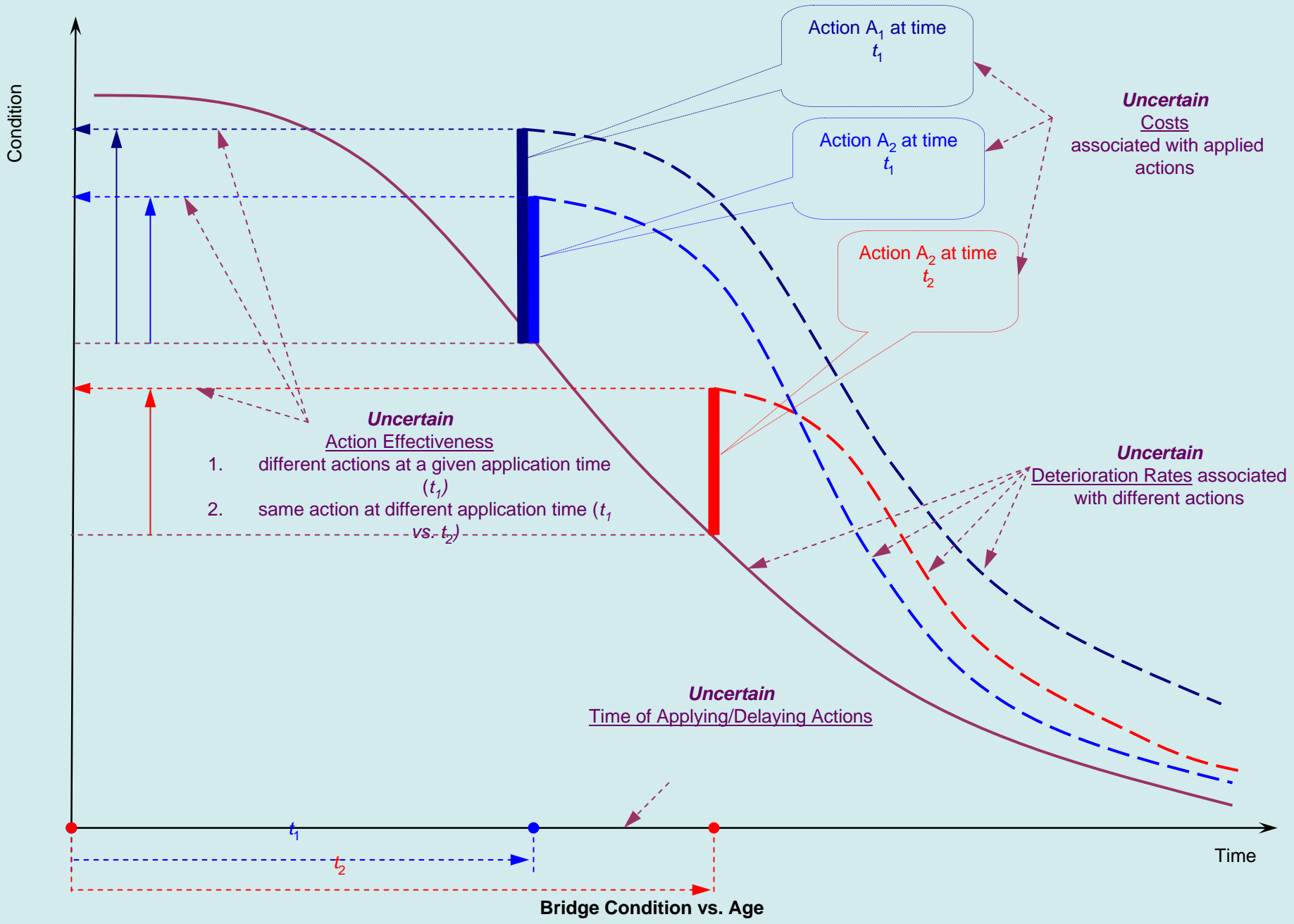
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Bridge Condition vs. Age

Measuring Performance

Moving Target !

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
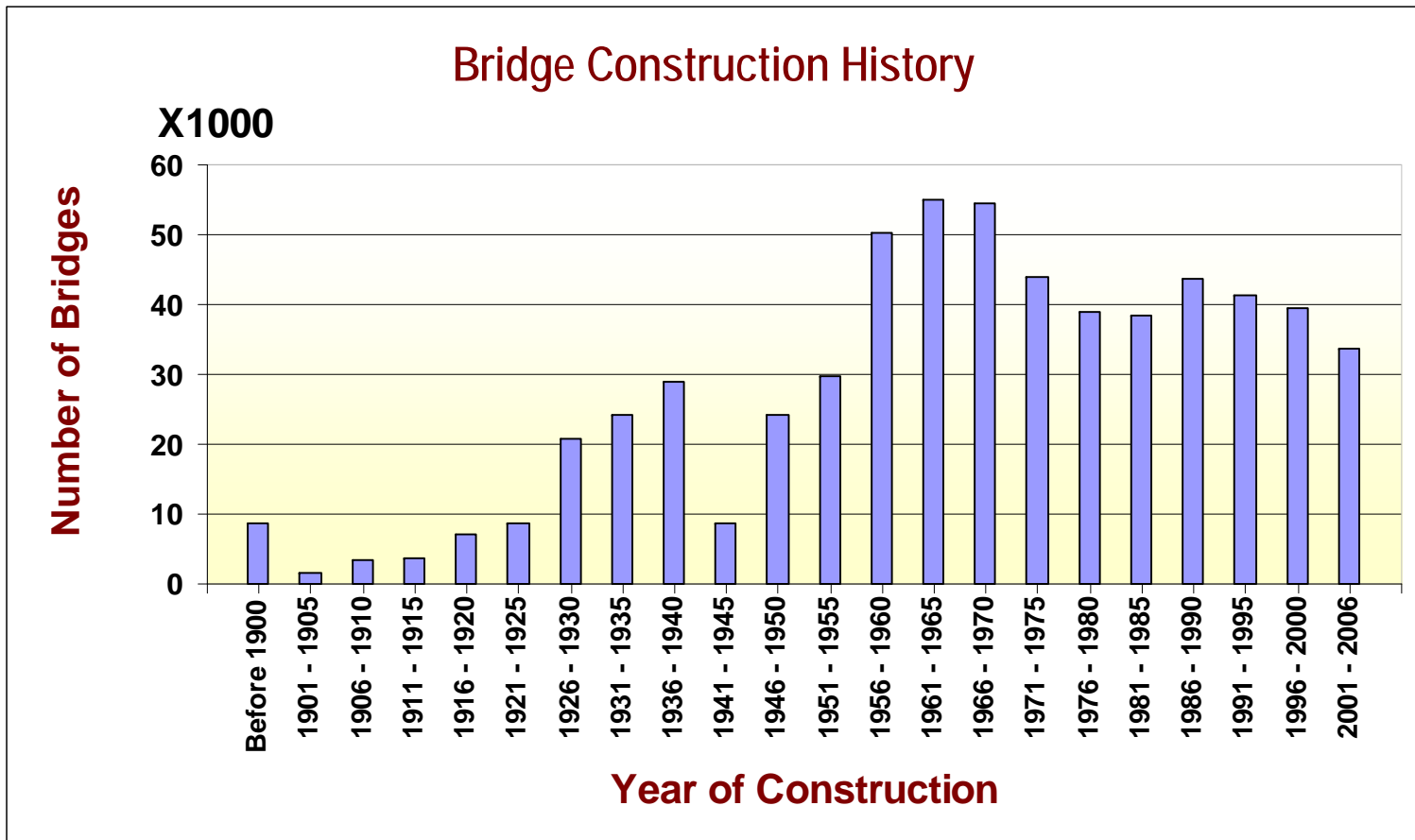 - Initial costs
  - Maintenance and rehabilitation costs

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NBI

~ 600,000
Mean Age: 40 yrs

PONTIS

Bridge Construction History

X1000

Number of Bridges

Year of Construction	Value
Before 1900	~9
1901 - 1905	~2
1906 - 1910	~3.5
1911 - 1915	~3.5
1916 - 1920	~7
1921 - 1925	~9
1926 - 1930	~21
1931 - 1935	~24
1936 - 1940	~29
1941 - 1945	~9
1946 - 1950	~24
1951 - 1955	~30
1956 - 1960	~50
1961 - 1965	~55
1966 - 1970	~54
1971 - 1975	~44
1976 - 1980	~39
1981 - 1985	~38
1986 - 1990	~44
1991 - 1995	~41
1996 - 2000	~39
2001 - 2006	~33

Year of Construction
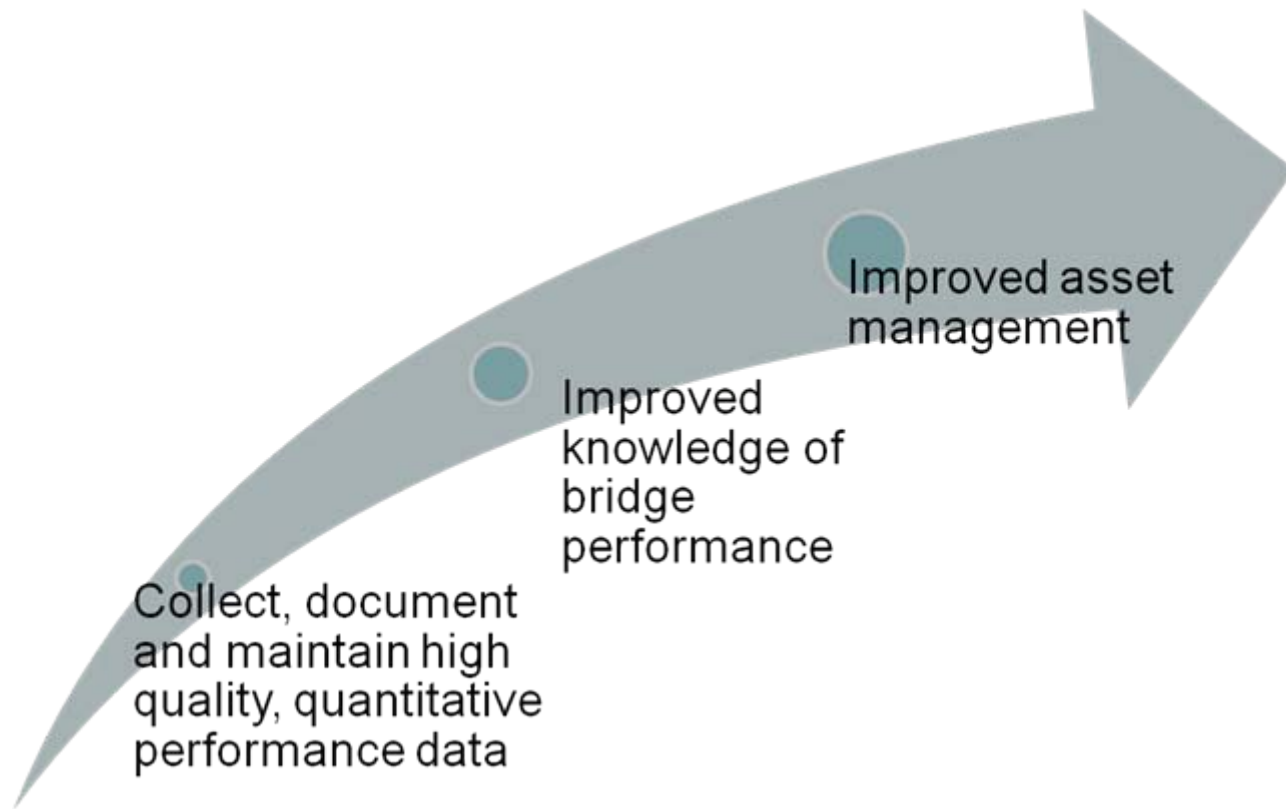
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Stewardship and Management

- Quantitative Database
- Better information
- Sensor Technology (i.e., NDE, SHM)
- Training and education
- Deployment
- Improved Bridge management

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LTBP Program Objective

Improved asset management

Improved knowledge of bridge performance

Collect, document and maintain high quality, quantitative performance data

Anticipated Impacts of the LTBP Program

- Improved knowledge of bridge performance

- Advances in deterioration and predictive models

- Effective use of Life-Cycle Cost Analysis

- Improved inspection/condition information thru NDE and SHM

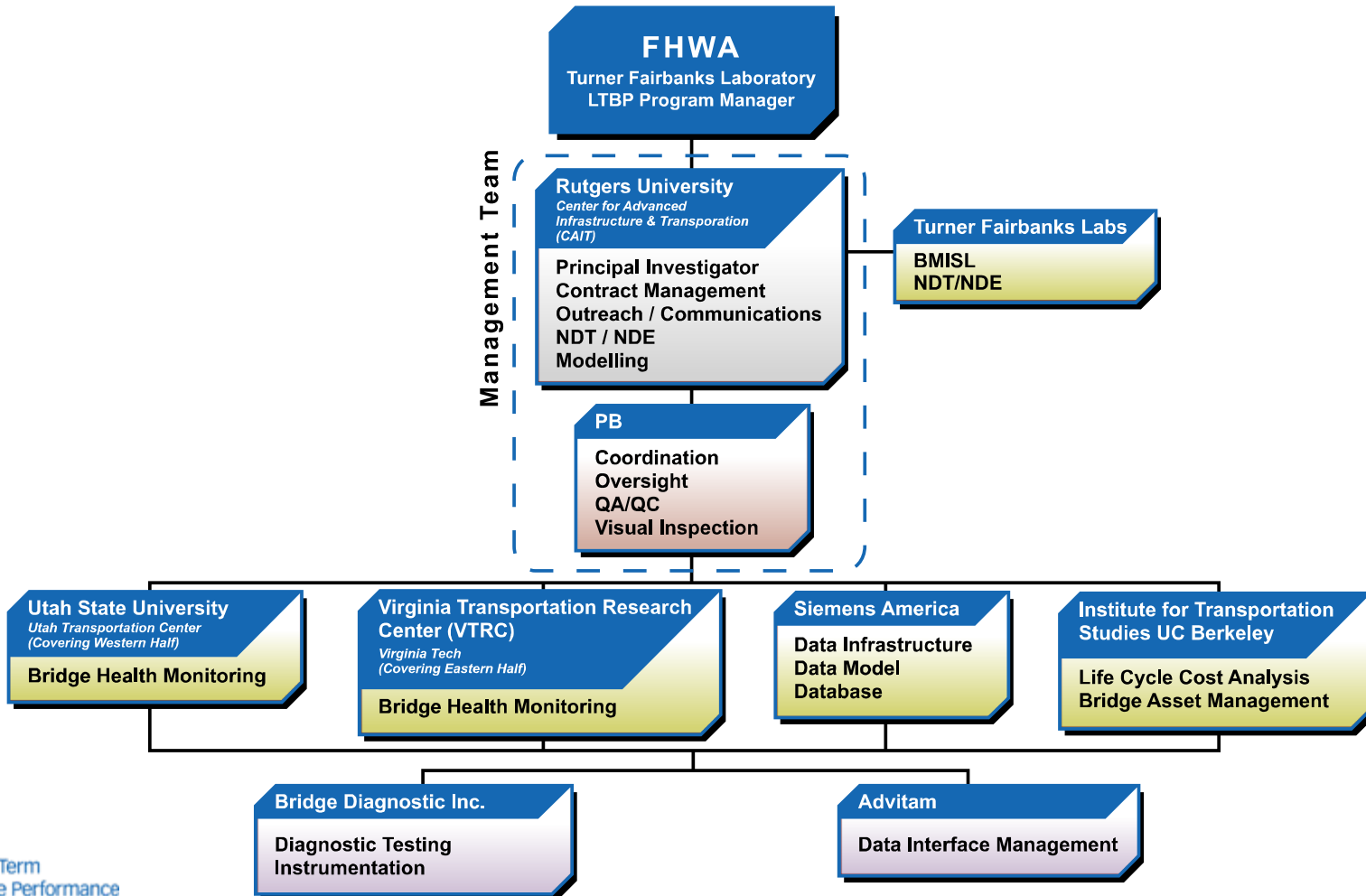- Help foster the next generation of bridge and asset management systems

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Vision

- Detailed inspection, *periodic* objective evaluation and monitoring (Representative sample of bridges, excluding long-span bridges)

- Instrument and continuously monitor

- Forensic autopsies of decommissioned bridges
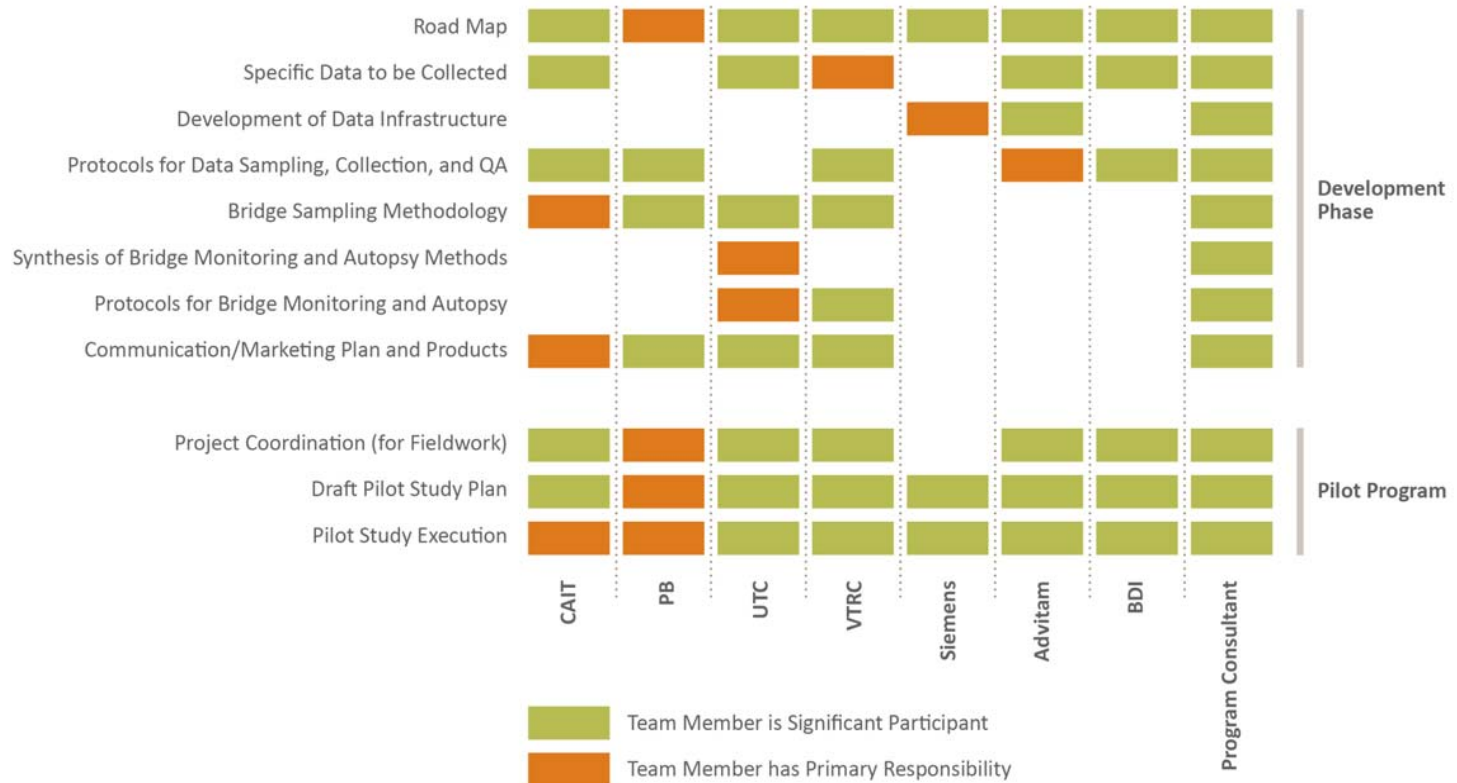
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LTBP Overview Map

Identify Specific
Data to be Collected

Data Collection
Inspection and
Monitoring

Database

Data Infrastructure
and Management

Data
Interface

Data Mining
and Analysis

Advisory
Board

Program Admin and
Management

Stakeholder
Communications and
Public Education

Feedback Loop

Sampling
Methodology and
Implementation Plan

Lifecycle Cost and
Deterioration
Models

Maintenance and
Repair Verification
and Optimization

**Data Collection,
Inspection & Monitoring**

Including the use of NDE/NDT, visual inspections,
instrumentation, diagnostics, and forensic autopsy

Better Bridge
Management

Development and Pilot Tasks and Responsibilities

LTBP Pilot Program
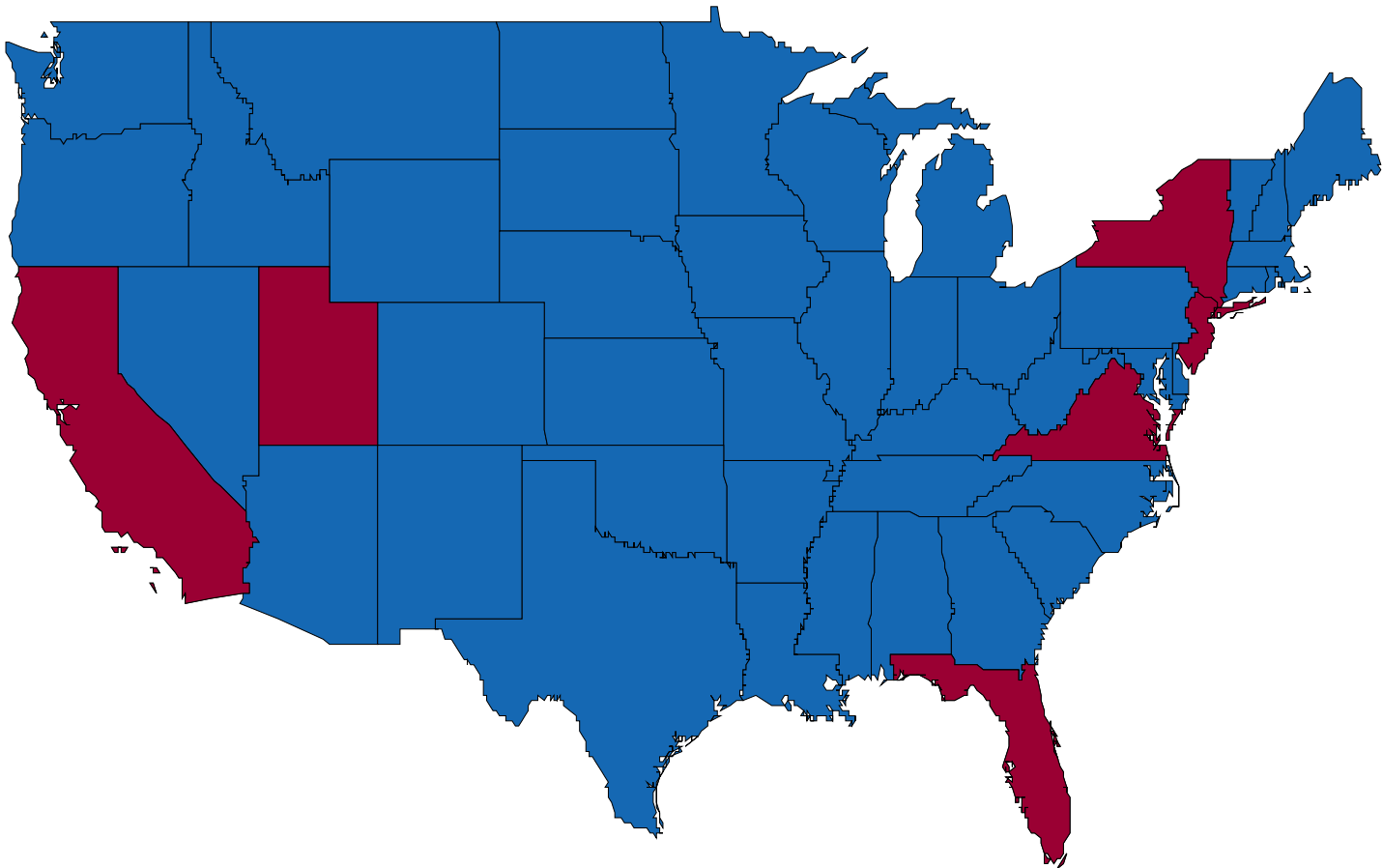
Concluding Remarks

- Current bridge performance assessments are based on subjective data and generalization

- There is a broad consensus in the bridge community that the state-of-the-knowledge about bridge performance can and should be greatly improved

- There is need for a quantitative bridge database

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Concluding Remarks Continued …..

- Quantitative data and knowledge learned from the LTBP program could lead to

  – Better understanding of bridge performance

  – Improved knowledge of bridge deficiencies

  – Design and construction of bridge of the future

  – Improvements in the effectiveness of the NBI and PONTIS

  – Efficient management of highway systems

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LTBP Program Information

LTBP Program Web site

www.tfhrc.gov/structur/ltbp.htm

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Thank You!

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