

# ***Federal Highway Administration***

---

***Research, Development & Technology***

***Presentation to***

***The American Society for Engineering Education  
Engineering Research Conference***

***March 4, 2013***



Michael F. Trentacoste, PE  
Associate Administrator for  
Research, Development & Technology

---

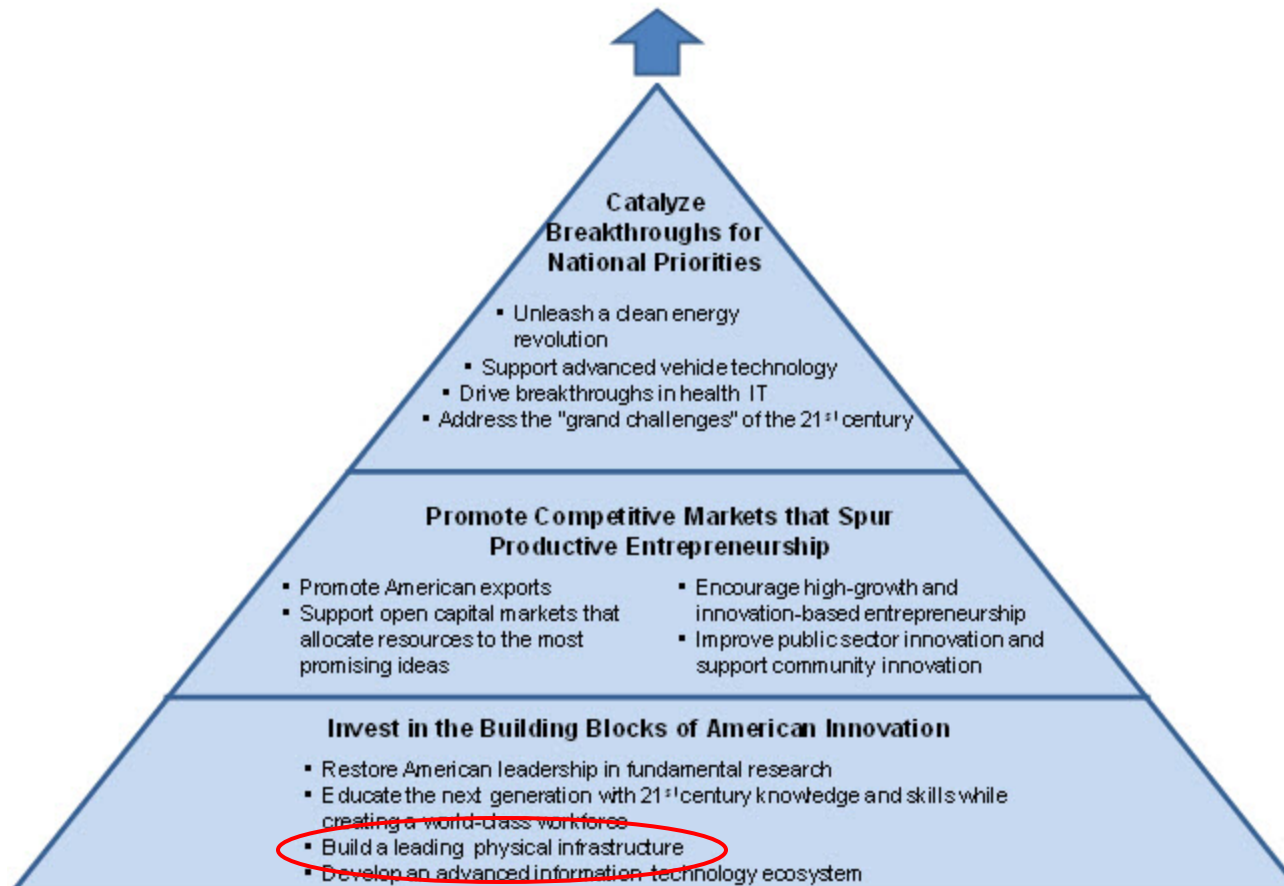


- **Context**
- **Research and Development**
  - **Infrastructure**
  - **Operations**
  - **Safety**
  - **Exploratory Advanced Research**
- **Technology and Innovation Deployment**
- **Training and Education**
- **Related Research Programs**



# Strategy for American Innovation

Innovation for Sustainable Growth and Quality Jobs



<http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation/>

*Turner-Fairbank Highway Research Center*



# ***USDOT Strategic Goals***

---

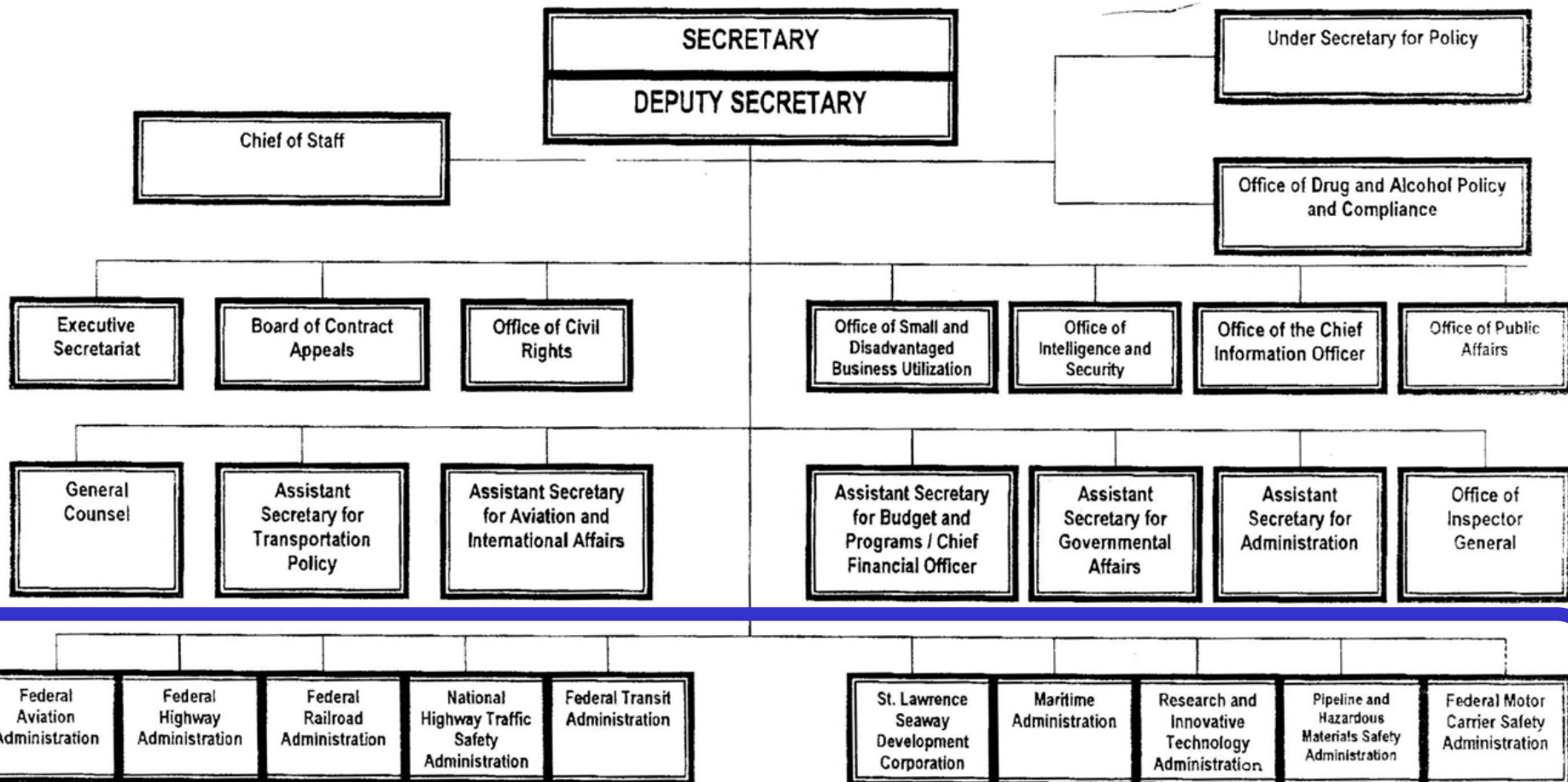
- **SAFETY**
- **STATE OF GOOD REPAIR**
- **ECONOMIC COMPETITIVENESS**
- **LIVABLE COMMUNITIES**
- **ENVIRONMENTAL SUSTAINABILITY**

[http://www.dot.gov/stratplan/dot\\_strategic\\_plan\\_10-15.pdf](http://www.dot.gov/stratplan/dot_strategic_plan_10-15.pdf)



# USDOT Organization

## U.S. DEPARTMENT OF TRANSPORTATION





# ***USDOT Research, Development & Technology***

---

- **RD&T coordinated across the Department**
- **Research and Innovative Technology Administration (RITA)**
  - **Leads coordination of RD&T**
  - **Develops research policy**
  - **Administers crosscutting, high-profile programs**
- **Modal administrations**
  - **Coordinate with other modes and RITA**
  - **Guide, oversee, manage research**
  - **Implement research results**



# *University Transportation Centers*

---

- **Administered by RITA**
- **Advances research and education**
- **Focuses on USDOT priorities**
- **Requires non-federal matching funds**
- **2013 - 2014 Grant Solicitation**
  - **Opened December 2012 - Closes March 19, 2013**
  - **Five National Centers**
  - **Ten Regional Centers**
  - **Up to 20 Tier I Centers**
  
- **<http://utc.dot.gov/>**



# ***Federal Highway Administration (FHWA)***

---

## **FHWA Vision**

- **Our agency and our transportation system are the best in the world.**

## **FHWA Mission**

- **To improve mobility on our Nation's highways through national leadership, innovation, and program delivery.**





# ***FHWA Research, Development and Technology***

---

- **Infrastructure**
- **Operations**
- **Safety**
- **Planning and Environment**
- **Policy**
- **Exploratory Advanced Research (EAR)**



# *Transportation Infrastructure*

---

- **Transportation system is a vital part of the nation's economic engine**
- **Transportation system is aging and deteriorating**
  - ~30% of the nation's bridges are structurally deficient or functionally obsolete
- **Service life goals:**
  - Pavement – 50 years
  - Bridges – 100 years
- **2011 FHWA Infrastructure Research And Technology Strategic Plan**  
<http://www.fhwa.dot.gov/publications/research/infrastructure/12028/12028.pdf>



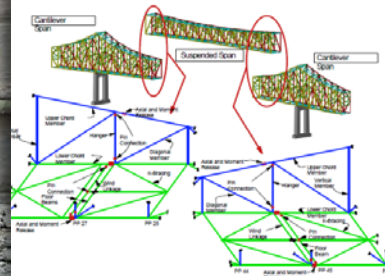
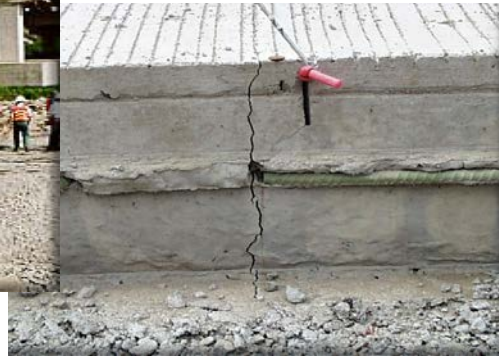
# Infrastructure R&D Focus Areas

**Design**

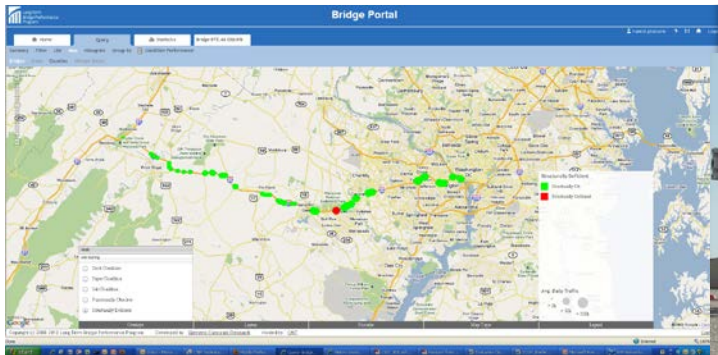
**Construction**

**Analysis**

**Verification**



**Forecasting**



**Assessment**



**Materials**

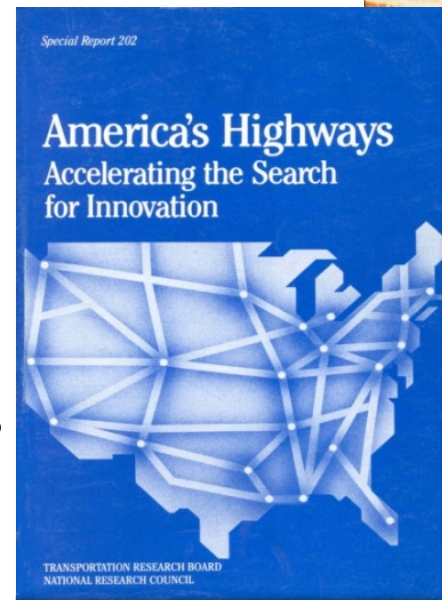
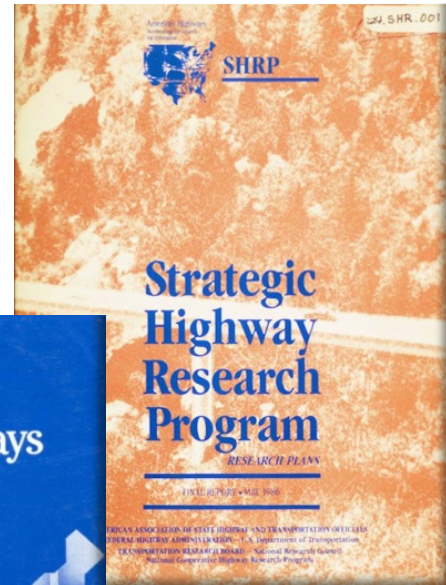


**Cradle To Grave Sustainability**



# Long Term Pavement Performance

- The **GOAL** is to answer **HOW** and **WHY** pavements perform as they do.
- **LTTP Mission**  
Increase pavement life by investigation of pavement structure designs & rehabilitations using different:
  - materials
  - loads
  - environments
  - subgrade soil
  - maintenance practices





# *Evolution of Long Term Pavement Performance*

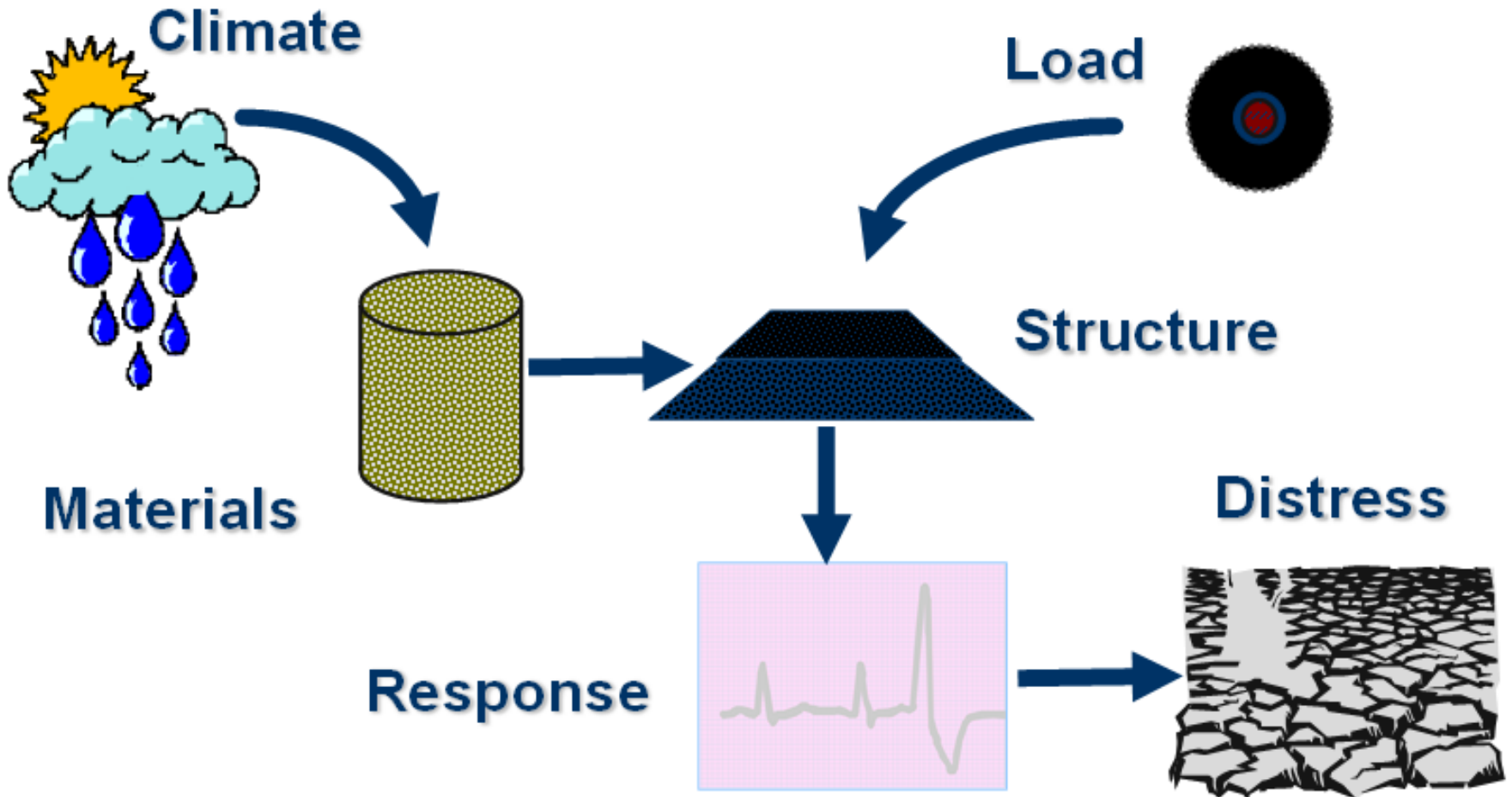
- Began in 1987 – SHRP
- 1992 FHWA assumed management of the program
- Longest running highway research program in history
- 260 terabytes of data
  - 16 data modules
  - 430 tables
  - 8,000 data elements

Currently monitoring 759 active test sections out of 2509 original sections



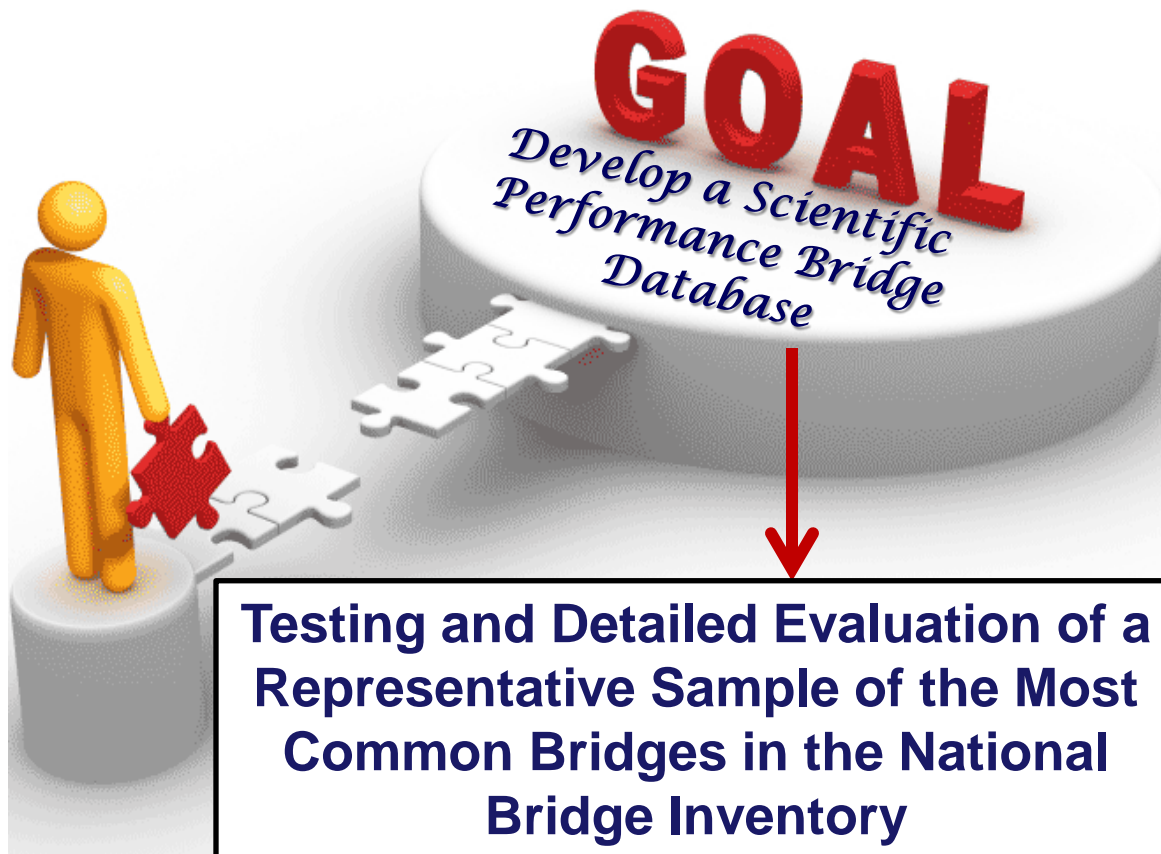


# Type of Data Collected





# Long Term Bridge Performance Program



Desired/Anticipated Outcomes

Improved Deterioration Models

Reliable Life-Cycle Cost & Forecasting Models

Help Improve Existing Design Procedures

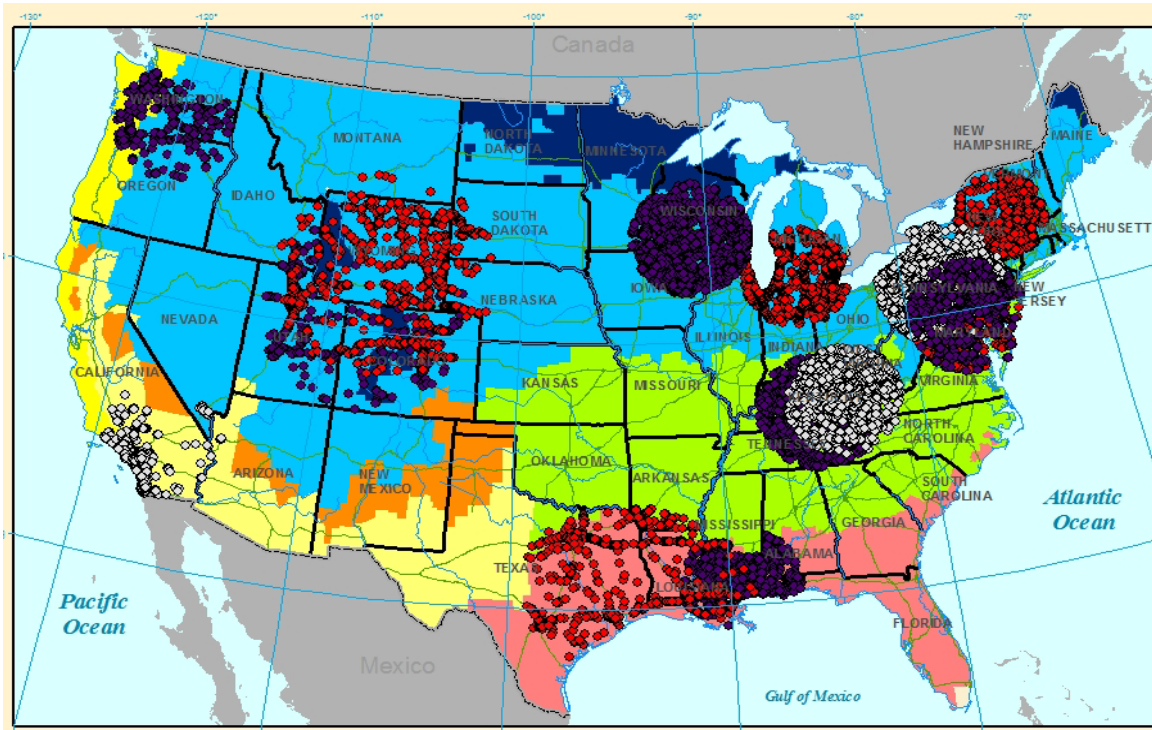
Benefits of NDE Techniques

Means to Quantify Preservation Strategies

Data-Driven Decision Tools



# Long Term Data Collection Plan



- Steel-Girder Cluster
- Pre-stressed Girder Cluster
- Adjacent Box & Cast-In-Place Concrete Girders Cluster
- Goal: inspect & evaluate > 100 bridges / cluster
- Initiate data collection in Mid-Atlantic: March 2013
- Initiate data collection in remaining clusters: November 2013

- ✓ 14 clusters identified for detailed inspection & periodic evaluation using advanced NDE technologies and visual inspection





# *Long Term Bridge Program Products*

---

- **Bridge Portal – Web based bridge data warehouse and analysis tool**
- **Over 60 protocols for gathering research-quality data**
- **Refined deterioration models**
- **Refined life-cycle cost models**
- **Bridge condition index**
- **Automated advanced data collection tools**



# *Collaboration Effort*



**FHWA & Rutgers U:  
envision, plan, design,  
& built a robotic  
system for concrete  
bridge deck  
assessment by  
integrating multiple  
NDE technologies**



# *Transportation Operations R&D*

- **Emerging communication technology can enable the future**



## **Focus Areas**

**Enabling Technologies**

**Operations Applications**

**Concepts & Analysis**

- **Technology is needed to connect vehicles, roadways, travelers, & terminals and solve operations & safety challenges**



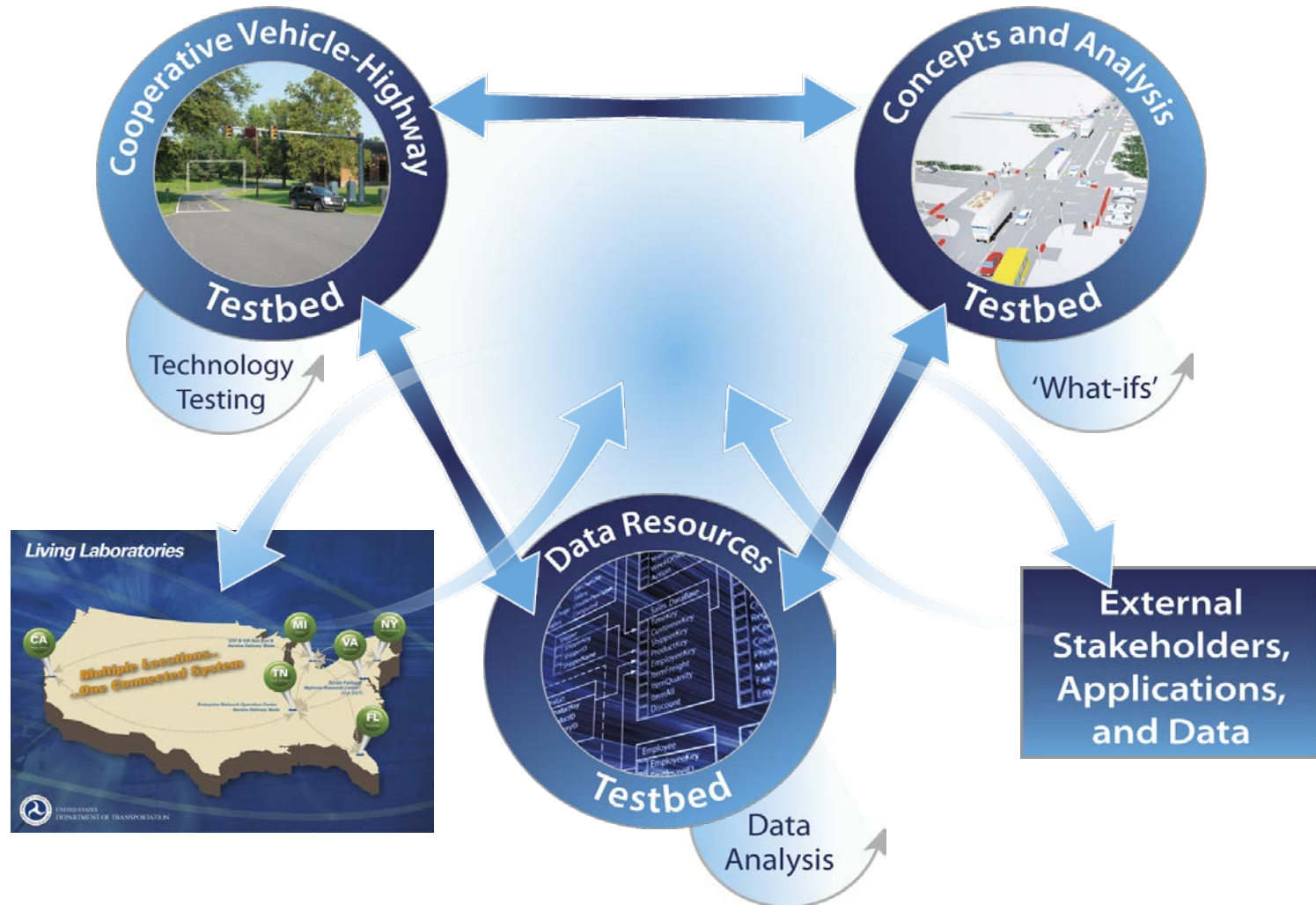
# *Cooperative Vehicle-Highway Testbed*

- Vehicles instrumented for wireless connectivity
- Vehicle preparation bay
- Intelligent Intersection





# Linking Test Beds to Living Laboratories





# *Safety R&D Focus Areas*

- **Comprehensive Approach To Safety**
- **Roadway Departure**
- **Intersections**
- **Pedestrian Safety**
- **Speed Management**





# **2<sup>nd</sup> Strategic Highway Research Program Naturalistic Driving Studies**

---

**SHRP2 Safety Focus Area: relationship between driver behavior & safety**

- **Driver behavior contributes to 90% of crashes**
- **Traditional approach to crash analysis**
  - Reconstruct events
  - Behavior considered only indirectly
- **NDS offers direct observation of driver behavior, and the impact on safety**
- **Benefits of NDS**
  - Develop new safety countermeasures
  - Update design guides and practices
  - Driver training programs
  - Vehicle design
  - Infrastructure improvements



# *Strategic Highway Research Program 2: Naturalistic Driving Study*

- Largest NDS ever conducted
- Data expected to be useful for 20+ years
- Unprecedented study range of research questions to be addressed through this data
- Very broad user community
  - Academia
  - Government researchers
  - Policy developers
  - Industry

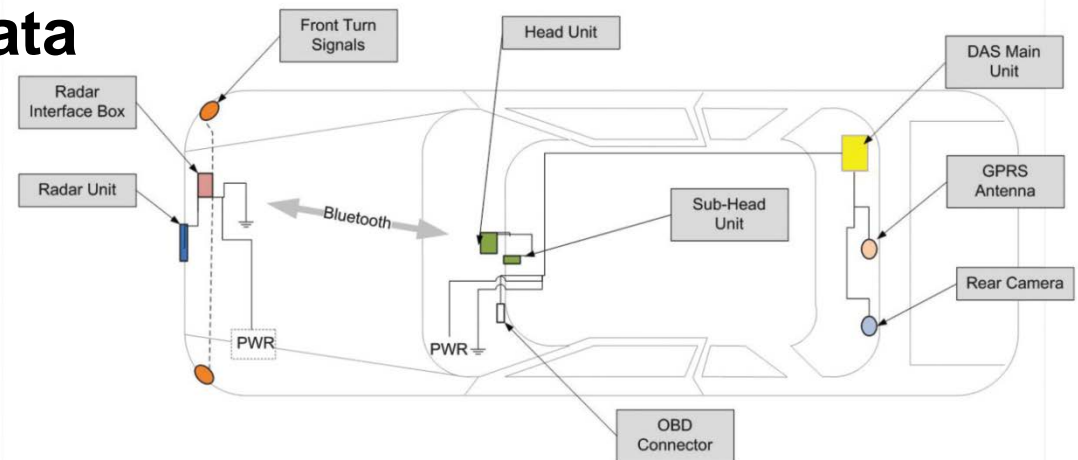






# SHRP2 NDS: what is it?

- 2,800 participants, ages 16 to 80
- Six sites across the US
- Volunteers' vehicles heavily instrumented
- Record all trips over one to two years
- Anticipated results
  - 18,000,000 travel miles
  - Over 1,000,000 driving hours
  - 4 petabytes of data





# *Linking Data*

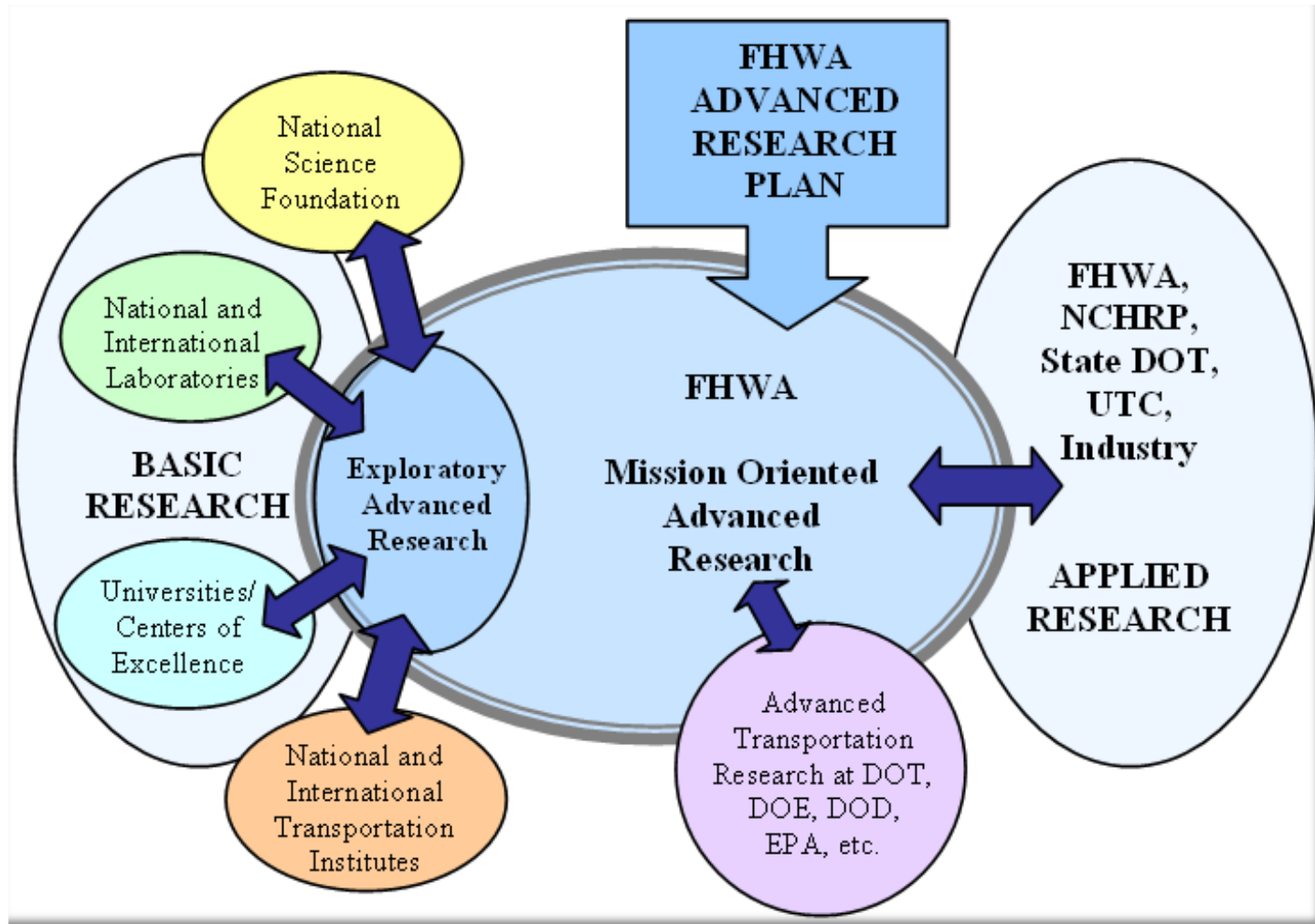
---

- **NDS and RID data sets will be linked**
- **Data sets geo-referenced**
- **Driver behavior can be indexed to physical environment**
  - **Signs and roadside hardware**
  - **Road design details**
  - **Transient elements: weather & work zones**
- **Other potential linkages**
  - **Study age groups (teens, older drivers)**
  - **Truck drivers**
  - **Study in Canada and other countries**



# Cross-Cutting R&D

## Exploratory Advanced Research





# ***Exploratory Advanced Research (EAR) Focus Areas***

---

- **Integrated highway system concepts**
- **Nanoscale research**
- **Human behavior and travel choices**
- **New technology and advanced policies for energy and resource conservation**
- **Information sciences**
- **Breakthrough concepts in material science**
- **Technology for assessing performance**

<http://www.fhwa.dot.gov/advancedresearch/>



# *Exploratory Advanced Research Status*

---

- **100+ Initial stage investigations**
  - Reference scans, convening workshops
  - 200+ external experts
- **Six solicitations resulting in**
  - 50 projects awarded; 37 ongoing
  - \$43M federal; \$17M match
- **7<sup>th</sup> Closed October 4 2012**
  - Topics: Novel binders; low-powered, wireless sensors
- **8<sup>th</sup> (DTFH61-13-R-00011) Closes March 15 2013**
  - Topics: Advanced Cooperative Highway and Vehicle Systems; Automation of Video Feature Extraction for Road Safety

[https://www.fbo.gov/index?s=opportunity&mode=form&id=0819fa7ea0d5b7f2bfb1557b2c39decb&tab=core&\\_cview=1](https://www.fbo.gov/index?s=opportunity&mode=form&id=0819fa7ea0d5b7f2bfb1557b2c39decb&tab=core&_cview=1)



# *Visiting Researchers*

---

- **National Research Council (NRC) Research Associateship Program**
  - Post-doctoral and senior-level research associates
  - FHWA identifies topics and funds
- **Intergovernmental Personnel Agreements (IPA)**
- **Sabbatical**
- **International Exchange**



# *Leveraging Innovation Through Partnership*

---

- **Federal – NSF, NIST, DoD, DoS, EPA, HUD, ACM topic**
- **State & Local – AASHTO, SPR, NCHRP**
- **Academia – UTC Advisory Boards**
- **Industry – CRADAs**
- **National Academies – TRB Core Program, SHRP2**
- **International – FEHRL, EC, PIARC, OECD**

# ***Federal Highway Administration***

---

***Research, Development & Technology***

***QUESTIONS???***

[\*\*http://www.fhwa.dot.gov/research\*\*](http://www.fhwa.dot.gov/research)



Michael F. Trentacoste, PE  
Associate Administrator for  
Research, Development & Technology

---