FHWA Research and Technology Update

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Federal Highway Administration
Discussion Topics

• Bridge Research Overview
  – Bridge Research & Technology Programs
• FHWA Focus and Capabilities
• Selected Examples of FHWA RD&T
• FHWA Infrastructure R&D Strategic Plan
• The Future…
Bridge Research & Technology Mechanisms

- Federal Agencies
- State DOTs (NCHRP, SP&R, self-sponsored)
- Universities and Research Consortiums
- Private Industry and Associations
Federal Agencies Sponsoring Bridge R&T

- FHWA (including SHRP2)
- National Science Foundation
- NIST – Technology Innovation Program (TIP)
- Department of Homeland Security
- Department of Defense
- Other…..
Research Mechanisms

In-house research at FHWA laboratories

• Structures
• Geotechnical
• Hydraulics
• Aerodynamics
• Non-Destructive Evaluation (NDE)
• Durability (Paint/Coatings)
Research Mechanisms, continued

- Competitive/contract research
  - Academia
  - University Transportation Centers (UTCs)
  - Professional (practice & research) organizations
  - Other.....
Ensuring Research Quality

- FHWA Chief Scientist
- Laboratory Peer/Expert Panel Reviews
- Technical Working Groups
- Advisory Committees
FHWA Research & Technology Funding

• Congressionally authorized (discretionary R&D funding)
• Congressionally directed (earmarks, designations)
FHWA Research Programs

- In-house & contract at Turner-Fairbank (including Exploratory Advanced Research Program)
- Small-Business Innovative Research (SBIR)
- Transportation Pooled Funds (TPF)
- State Planning & Research (SP&R)
- Innovative Bridge Research & Deployment (IBRD)
- Highways for LIFE (HfL)
- SHRP2 (conducted by TRB)
FHWA’s Bridge R&T Initiatives

Current focus areas include:

- The “Bridge of the Future”
- Multi-hazard/extreme event
- Inspection and NDE technologies
- Bridge durability
- Bridge preservation
FHWA’s Bridge R&T Initiatives, cont’d

Technical assistance:

- Forensic evaluations (e.g., I-35W, premature deck failures, galvanized pole fatigue/failure)
- Longer-term studies (e.g., strand & rebar corrosion mechanisms)
Selected R&T Projects
Ultra-High Performance Concrete (UHPC) in the U.S. Highway Transportation System
UHPC
\[\pi\]-Girder

UHPC Closure Pour

- 1.553 m
- 1.041 m
- 152 mm
- 19 mm rebar
- 13 mm rebar

Closure Pour (UHPC)
Deck Bulb Tee
Prestressed Girder

New York State DOT
Iowa DOT
Corrosion in Concrete Bridges

**Objective:**
Characterize corrosion in RC structures by multi-probe periodic NDE measurements

**Methodology:**
- Reference specimen
- Artificially induce corrosion
- Periodic NDE measurements

**NDE Methods:**
- Microwave (Thermo) Reflectometry
- Ground Penetrating Radar (GPR)
- Ultrasonic Echo / Impact Echo
- Infrared (IR)
- Half Cell / Linear Polarization
Initial results - IR
Initial results - GPR
Inundated/Submerged Bridge Deck Studies

• Physical Modeling at TFHRC Hydraulics Laboratory
• High Performance Computing at the Argonne National Laboratories
Inundated/Submerged Bridge Deck Studies, cont'd

Hydrodynamic Forces on Inundated Bridge Decks (FHWA-HRT-09-028)

Bridge Pressure Flow Scour for Clear Water Conditions (FHWA-HRT-09-041)
To be posted in July 09
Bridge Durability and Preservation

A range of studies focused in infrastructure durability, in support of the FHWA bridge preservation R&D roadmap. Roadmap available from www.tsp2.org/roadmap
Laboratory Evaluation of 12 Rebar Materials

In-house study to determine mean chloride threshold values and time-to-corrosion initiation for twelve types of reinforcing steel embedded in concrete slabs; develop a concrete bridge deck design guideline.

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NDE & Bridge Inspection Technologies

• External post-tensioning inspection (MFM)
• Steel bridge testing (fatigue crack characterization and crack growth rate)
• NDE Web Manual (online guides and reference materials)
• Prestressing strand (internal) inspection (pending)
• Gusset plate inspection (pending)
• Rapid load testing/load rating (pending)
Transportation Pooled Fund Studies
TPF Solicitation 1236 – Laser Based Steel Bridge Fabrication for Complex Structures

- Develop virtual fit-up of complex structures
- Produce on-line system for fabricator(s)
- Follow-on to NCHRP-IDEA Project
- Sponsoring agency: Virginia DOT
TPF Solicitation 1236 – Laser Based Steel Bridge Fabrication for Complex Structures

Measure splice holes and girder dimensions

Measure girders in fabrication shop

Virtual Fit-Up

Documentation
TPF Solicitation 1239 – Steel Suspension Bridge Vulnerability and Countermeasures
### TPF Solicitation 1239 – Steel Suspension Bridge Vulnerability and Countermeasures

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<td>Salvage, Removal &amp; Shipping</td>
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<td>DHS interagency transfer to FHWA</td>
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<td>Draft and Final Reports</td>
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TPF Solicitation 5(131) – Underwater Inspection of Bridge Substructures Using Underwater Imaging Technology

- Evaluate acoustic imaging technology in order to satisfy FHWA Level I underwater inspection requirements of FHWA
- Improve methods to assess underwater condition of transportation structures
- Reduce staff exposure to hazards encountered while performing underwater inspections
TPF Solicitation 5(131) – Underwater Inspection of Bridge Substructures Using Underwater Imaging Technology

• Technical Lead – Caltrans
• Contract lead – FHWA
• Participating agencies – CA, MO, ND, TX, WI, SC, FHWA
What About ARRA?
FHWA Infrastructure R&T Strategic Plan

- Long Term Infrastructure Performance (LTIP)
- Durable Infrastructure (DS)
- Accelerated Construction (AC)
- Highway Infrastructure and the Environment (HIE)
- Performance-Based Design and Construction (PBDC)
- Infrastructure Asset Management (IAM)
What Does the Future Hold?
• A new multi-year surface transportation reauthorization bill?
• Short- or long-term extension of SAFETEA-LU?
• Other....?