Innovation in Lean Times
A Brief History of SHRP 2

- Role of special-purpose research programs: focused, large-scale program of limited duration
- Success of first SHRP: Superpave, winter maintenance
- SHRP 2 proposed 2001; NCHRP with matching funds from FHWA develop detailed research plans
- SAFETEA-LU authorized the program
- $218 million, 9 years, ends 3/31/15

- AASHO Road Test and first SHRP are examples of special-purpose research programs.
- First SHRP research was about 1987-1993; implementation activities seem to have begun around 1992 with funds from subsequent authorization legislation.
- TEA-21 study is TRB Special Report 260—recommends the basic approach of what was called future SHRP (F-SHRP) at the time but became SHRP 2 once it was funded.
SHRP 2 Origin & Philosophy

- Needs identified by State DOT and industry leaders—driven by customer-oriented goals:
  - Make highways safer: revolutionary change
  - Fix highways: address epidemic of aging infrastructure
  - Reduce congestion: increase physical and operational capacity

- Success requires non-traditional approach:
  - Multiple disciplines
  - Collaboration with non-DOT stakeholders
  - Portfolio: from new knowledge to practical tools to allow existing innovations to be more widely used

• NRC committee that recommended the program had 13 members, the majority of whom were CEOs and chief engineers from state DOTs.

• In contrast to the first SHRP, which focused on cost-saving approaches for the DOTs, this committee focused on what users of the highway system were telling them in customer surveys. Users want safe highways, in good condition, and (ideally) no congestion.

• Successfully addressing these needs requires doing things that are not so common in highway research programs, including bringing in other disciplines (such as economics, psychology, machine vision, IT, etc.) and explicitly acknowledging the role of non-DOT entities (resource agencies, MPOs, railroads, etc.)

• The range of issues called for a range of research types. Some research is closer to the “basic” end of the spectrum in areas where we don’t have enough understanding (driver behavior, travel time reliability) and other work is more focused on identifying and addressing the practical gaps that need to be filled for existing innovations to be more widely used (user guides, standard specifications, etc.)
To address the three basic customer-focused outcomes (safety, infrastructure in good repair, and reduced congestion) the NRC committee conducted a nationwide outreach effort that involved hundreds of stakeholders, asking what the critical needs were that could be addressed by research. They gathered and synthesized the input and went through several iterations of potential research topics. These four were the final focus areas. The congestion goal is addressed by 2 focus areas.

- Safety: fielding the largest-ever naturalistic driving study to reduce crashes and save lives through understanding driver behavior
- Renewal: making rapid, innovative construction possible for “ordinary” projects
- Reliability: Providing management and technical tools to reduce congestion through operations
- Capacity: Systematizing collaborative decision making to achieve better, faster project decisions

The words in parenthesis are the short-hand titles of the four focus areas.
The outreach to the safety community resulted in a very clear message: we’ve done a lot about the road and the vehicle but the driver’s behavior is the main factor in crashes and we know relatively little about this behavior.

Simulators and test tracks give us some good information but we don’t know what really goes on in real-world driving scenarios.

What we do have about real-world driving is data about crashes; we need to know about near crashes, safety-related incidents, and “uneventful” driving if we want to understand risk and how crashes can be avoided.

The evolution of sensing and computing technology has given us relatively inexpensive, inconspicuous data gathering equipment that can collect data during ordinary driving—the technique is relatively new and is called a naturalistic driving study.

A study conducted by Virginia Tech in the early 2000s, using 100 vehicles, demonstrated that the technique works. Since then VT has conducted several additional small studies (with teenagers, truck drivers, teens and parents). Canada is now designing an NDS based on SHRP 2’s design. So the method is now well-tested.

What SHRP 2 can do that virtually no other organize could is focus substantial
resources on conducting a scaled-up study that would be more representative and therefore provide more robust results. It could also be designed with state DOT safety questions in mind (and thus the inclusion of roadway data for example).
This slide shows what the camera views are on the instrumented vehicles:

The 4 views in the image at the upper left are the 4 video camera views:
- Forward (large color view of what the driver sees out the front windshield
- Face (driver face and out the driver window—this view would be rotated up for a researcher to use it)
- Rear (looks out the rear window and slightly to the passenger side)
- Steering column/dashboard (view straight down from the rear view mirror to see drivers hands, steering wheel)

The image at the lower right is a “permanently blurred” still photo of the inside of the cabin. This photo is taken periodically while the car is driven so that researchers can see if and how many passengers there are in the vehicle without being able to identify the passengers (because they did not have the opportunity to consent to be in the study).
Safety Highlights

- Progress on data collection:
  - 2,748 participants so far
  - 3 million trips; 5 veh-yrs of data per day
  - 9,023 center-line miles of roadway data
  - Approval to collect cell phone records and “supplemental” data

- First four analysis projects begun

- Interest in using data from outside of SHRP 2 (FHWA, NHTSA, auto mfrs, academics, IIHS, AAA FTS, etc.)
Initial Analysis Projects

- **Rural 2-lane curves** – Iowa State University
  - Ex. App: more cost-effective roadway measures to prevent crashes

- **Offset left-turn bays** – MRI Global
  - Ex. App: cost-effective intersection design

- **Driver inattention** – SAFER, Chalmers Univ.
  - Ex. App: vehicle technology to track driver attention, warn distracted drivers

- **Crashes on congested freeways** – U. of MN
  - Ex. App: effective methods to warn drivers of downstream congestion
The Renewal focus area directly addresses the need to facilitate the spread of innovations. Most of the work performed under the Renewal area does not involve inventing new technologies or techniques. It is aimed at addressing the obstacles to more wide-spread use of existing innovations.

State DOTs use an array of innovative approaches to speed up construction including innovative contracting methods, specialized equipment, and high-performance materials. However, these usually require a greater than average effort and are therefore mostly used on high-profile projects. SHRP 2 looked at what could be done to make innovative approaches more feasible on the hundreds of ordinary roads and bridges that need to be repaired or rehabilitated. Some of the problems we found include:

- Some innovative approaches require special equipment or special contracting expertise, so local contractors have difficulty using them.
- Some innovative technologies do not yet have standard design methods, specifications, connection details, etc.
- There is relatively little information to help a state navigate through all the new technologies and judge which ones would be best for their projects.
- Some new approaches shift the risk of a project more toward the contractor but
there is little understanding of how to manage this risk.

• Knowing how to do rapid reconstruction on individual projects is not enough—states need methods for planning renewal work throughout corridors and networks.

• Some innovative methods involve unusual work schedules (overnight, all weekend, etc.) which can lead to fatigue issues for workers and managers, which can adversely affect safety and quality.

• A rapid method does little good if you get held up by utility location/relocation issues or by unproductive interactions with railroads whose facilities cross or abut the highway.

• SHRP 2’s Renewal program addressed many of these issues. (more details in Renewal presentations).
Renewal Projects in 3-Yr. Plan

• Bridges
  – R04  Bridge Designs for Rapid Renewal
  – R19A  Bridges Beyond 100 Years

• Pavements
  • R05 Modular Pavement Solutions
  • R21 Composite Pavement Systems
  • R23 Long-Life Pavements
  • R26 Preservation on High Volume Roadways
Renewal Projects in 3-Yr. Plan

• **Project Management Tools**
  – R09 Managing Risk in Rapid Renewal Contracts
  – R10 Managing Complex Projects

• **Non-Destructive Testing**
  – R06 Web Tool for Non-destructive Testing

• **Utilities and Railroads**
  – R15B Integrating Utility/Transportation
  – R16 Railroad Agreements
SHRP 2’s approach to congestion mitigation looks at two basic sources of congestion:

1. Recurring congestion that results from repeated and largely predictable conditions where the physical capacity of the roadway is inadequate for the volume of vehicles (i.e., “rush hour”). The Capacity focus area addresses this side of the coin.

2. Non-recurring congestion that results from occasional or unpredictable events or conditions that temporarily restrict capacity or increase volume, such as crashes, special events, inclement weather, work zones, etc. The Reliability focus area addresses this side of the congestion coin.

A number of projects in Reliability and Capacity are connected in one way or another: information from one focus area may be incorporated into a product in the other area or work defined in one focus area may be carried out under a contract in the other focus area where it can be incorporated into a final product.
A large percentage of congestion results from non-recurrent events, such as crashes, work zones, special events, and weather events. Preventing and/or mitigating the effects of these events is an operational way of reducing congestion by preventing the temporary capacity restrictions that result from these events, quickly restoring this capacity when it is lost, and/or managing traffic flow (through communication with drivers for example) to reduce the volume on the restricted capacity.

SHRP 2 identified “travel time reliability” (TTR) as a useful tool to achieve these goals.

From a driver’s point of view, the reliability of travel times means the ability of the driver to count on a given trip having a particular during each time the trip is taken. A lack of travel time reliability would mean that a trip could take 20 minutes one day and 45 minutes another day, for example, for reasons that the driver cannot predict or control.

From a technical point of view, TTR has the advantage of being something that can be quantified and measured. Therefore it can be used in performance measurement and monitoring; it can be included in algorithms in traffic simulation and other models; and it can be incorporated into highway planning.
and design methods.

• SHRP 2 is addressing these technical areas, but also recognizes that for the technical tools to be used effectively they must fit into an institutional setting that is oriented toward operational management of the highway system. So SHRP 2 also addresses institutional factors, such as business practices, intuitional capacity, interorganizational collaboration, and training.
Reliability Projects in 3-Yr. Plan

• L12 Training for Traffic Incident Responders
• Organizing for Reliability
  – L31 CEO Workshop on Operations
  – L17 Knowledge Transfer System
  – L06 Organizing Agencies for Systems Operations and Mgt.
  – L01 Business Processes for Reliability
• Reliability Analysis Tools
  – L02 Monitoring Programs for Reliability
  – L05 Planning/Programming for Reliability
  – L08 Reliability in the Highway Capacity Manual
• L36 Regional Operations Forum
The Capacity program addresses the situation in which congestion is reduced most effectively through development of new physical infrastructure. Building highways is clearly something states know how to do; technical ability is not usually the obstacle to new construction or the cause of delay. Typically, obstacles and delays result from institutional issues, such as: poor communication, failure to address all stakeholders’ concerns at the appropriate times, decisions or actions in one part of the development process that contradict or change decisions made in other stages of the process. SHRP 2 addresses these institutional issues through a combination of improved information sharing and decision making approaches and improved data and analysis methods to better inform decisions.
Capacity Projects in 3-Yr Plan

• C06 Integrating Ecosystem & Highway Planning
• TCAPP
  – C01 TCAPP
  – C02 Performance Measures
  – C19 Expedited Project Delivery
• Economic Impact Tools
  – C03 Economic Impact Case Studies
  – C11 Economic Impact Analysis Tools
• C10 Travel Demand and Network Models
• C15 Freight Planning Guide
TRB managed more than 90 unique research projects. In some cases, research resulted in products and processes that have been field tested and are now being systematically adopted by FHWA and AASHTO for implementation.
MAP 21 and SHRP 2

- MAP 21 authorized funding for SHRP 2 implementation
- $11 million of additional FFY 2012 funding
- FFY 2013 and 2014 funding had to come from Statewide Planning and Research (SPR) funds agreed to by 3/4 of the states
- 4% of SPR funds being used for SHRP 2 implementation
- FHWA is providing additional funding
- Funding for implementation is expected to approximately double to about $160 million
- FHWA and AASHTO are in the process of developing a new plan
- More products will be added, as well as additional funding for products already in the three-year plan
Now moving on to the products ready for first round implementation. These 6 products are slated for immediate implementation:

**Capacity**
Implementing *Eco-Logical* (C06)

**Renewal**
Next-Generation Project Management Tools
- Managing Risk in Rapid Construction Projects (R09)
- Managing Complex Projects (R10)
Bridge Designs for Rapid Renewal (R04)
Preservation on High-Volume Roadways (R26)

**Reliability**
Organizing for Reliability Tools (L01/L06)
There will be opportunities for States to apply for three different types of assistance. The assistance types will vary by product and by solicitation depending on the status of product development and next steps to make the product market ready.

For some products, **Proof of Concept Pilot Assistance** will be offered. Funding will be used to pilot and evaluate the product. Contractor support will be provided to collect data and analyze the effectiveness of the product.

**Lead Adopter Incentive** will be offered for early adopters to offset implementation costs and mitigate risks; recipients will be expected to provide specific deliverables designed to further refine the product. Some recipients may be asked to champion the product to other states. Funds for this level of engagement might range anywhere between $50K to $500K.

Finally, **User Incentives** will be offered when products are ready for wide-spread deployment and funding is needed to support implementation activities in the jurisdiction. These can be used to conduct internal assessments, build capacity and other implementation costs. Funding for this level of activity will typically range between $20K - $30K.
Questions?

Email: goSHRP2@dot.gov
[Add “Contact your FHWA Division?”]

SHRP2 Research:
www.TRB.org/SHRP2

SHRP2 at AASHTO:
http://SHRP2.transportation.org

Note to presenter:
Remind participants that they can access research reports on the TRB site and factsheets on the AASHTO site if they need additional product specific information.

Remind participants where this presentation will be posted online in case they want to share it with others.