

SHRP2 MILESTONES

SHRP2 Salutes National Transportation Week — May 16–20

National Transportation Week presents an opportunity to recognize the importance of our Nation's transportation infrastructure and acknowledge the contributions of those dedicated professionals who build, operate, and maintain it.

Through the second Strategic Highway Research Program (SHRP2), transportation agencies across the country are deploying SHRP2 Solutions and sharing valuable project experience – the results of their participation in the Implementation Assistance Program (IAP). The seventh and final round of formal assistance under the IAP closed April 2016.

Projects are ongoing, and agencies are urged to share their expertise with other agencies through webinars, peer exchanges, workshops, and training sessions. Knowledge sharing is a key tenet of the SHRP2 IAP, and is naturally woven throughout the SHRP2 Education Connection initiative.

10 UNIVERSITIES



are recipients of an estimated total

\$100,000

in cooperative agreements to incorporate **SHRP2 Solutions** into the classroom.

Transportation Projects Powered by SHRP2

Building a Connection Between SHRP2 and the Academic Community

A Message from the Chief Technical Services Officer, Federal Highway Administration

Since the inception of the SHRP2 Implementation Assistance Program (IAP) in February 2013, we've seen great success in putting innovations into the hands of transportation agencies, enabling them to work on more than 350 SHRP2 projects across the country. Next month, we'll be announcing the recipients of our final IAP round, which includes 13 SHRP2 products or product bundles. I'm proud of this program and especially proud of our very strong partnership with the American Association of Highway Transportation Officials (AASHTO). Together, the Federal Highway Administration (FHWA) and AASHTO are furthering the implementation of the SHRP2 Solutions that emerged from the Transportation Research Board's (TRB) research.

In 2015, we decided to build on the success of the IAP by seeking a connection between SHRP2 and the academic community. Thanks to the great foresight of Dr. Kumares Sinha, Professor of Civil Engineering at Purdue University and a member of our SHRP2 Implementation and Advisory Committee, we were able to frame a program that would foster this connection. We knew that deploying the SHRP2 Solutions through the IAP was a good way to help transportation agencies learn about and use these innovations, and we wanted to leverage that opportunity in a way that would truly embed them into transportation culture. Our goal was to arm the next generation of transportation professionals with SHRP2 Solutions while they were still in school. By doing this, we would not only boost their learning experience but also equip them with innovative, cutting-edge solutions to the real-world situations they would surely encounter in their careers. The SHRP2 Education Connection was the link.

We were pleased with the response to our first round of SHRP2 Education Connection and with the work of the grant recipients who were announced in August 2015. We were even more thrilled in January 2016 when we saw the fruits of our efforts. In two sessions at the 2016 TRB Annual Meeting, the universities shared the amazing work they did with their SHRP2 Education Connection awards. Their enthusiasm for this initiative proved what we hoped to be true – that the SHRP2 Education Connection was a viable link to academia. In the following articles, you'll learn more about the individual efforts from the first round of SHRP2 Education Connection. This is just the tip of the iceberg; we plan to announce Round 2 next spring, offering universities across the country another opportunity to capitalize on the success of SHRP2. Thanks for your interest and support of SHRP2.



Amy C. Lucero

Chief Technical Services Officer
Federal Highway Administration

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SHRP2 Education Connection Equips Students with New Innovations and Technologies

The [SHRP2 Education Connection](#) has begun to broaden the reach of SHRP2 innovations into university classrooms. In 2015, the FHWA awarded 10 universities with \$10,000-cooperative agreements to integrate their choice of one or more SHRP2 Solutions into their existing curriculum. As a result, undergraduate and graduate students across the country were exposed to a broad spectrum of products from three focus areas: Renewal, Reliability, and Capacity.



The products fit not only into traditional transportation curricula such as engineering and transportation planning, but also into disciplines such as urban planning, economics, government, and human resources.

The teaching approaches were as diverse as the products themselves. Some universities added a lecture covering a specific SHRP2 Solution, while another created an all-day workshop in order to maximize the students' exposure to multiple products. Still another institution chose to use case studies and conducted site visits to actual SHRP2 projects in the field. The varied approaches to this initiative showcased the forward-thinking creativity of the professors involved. To help spur SHRP2 Solution adoption in academia, the participating universities will make their materials, experiences, and insights available to peers across the Nation.

Focus Areas



RENEWAL

Enabling faster, minimally disruptive, and longer-lasting infrastructure improvements.



RELIABILITY

Championing predictable travel times.



CAPACITY

Bringing greater collaboration to road building.



SAFETY

Identifying the behaviors that cause and avert collisions.

The fourth SHRP2 focus area, Safety, was not included in this first round of SHRP2 Education Connection. Learn about ongoing activities in the Safety focus area on [GoSHRP2](#).

Universities Employ Innovative Approaches Integrating SHRP2 into Classroom Studies

Buoyed by the response from the first offering of the SHRP2 Education Connection, the FHWA's application review team got down to work to narrow the field and select the 10 universities that would receive grants. The team looked for those universities that presented the best scenarios for incorporating SHRP2 technologies into their curricula, and that could do so in a timely manner. The applications were impressive – covering a wide range of SHRP2 products and teaching approaches. Each institution employed a unique method to integrate and teach the SHRP2 subject matter to their students. Most taught the new material in the 2015 fall semester; others are in the process of exposing students to SHRP2 in the current (2016 spring) semester.

The stories of four of the universities are featured in this issue. These highlights provide a good glimpse into the variety of innovative teaching approaches the recipients employed. The FHWA is extremely proud of the work of all 10 of the universities selected, and appreciates their efforts to bring SHRP2 Solutions into the classroom.



Highlights: Teaching Approaches

IN THE FIELD

Bradley University selected six SHRP2 Solutions to incorporate into its course structure. These SHRP2 Solutions are being implemented by agencies in 30 states.

GeoTechTools (R02)

www.GeoTechTools.org is a web-based decision-making tool with information on more than 50 geotechnical solutions.

New Composite Pavement Systems (R21)

Read the [Tennessee DOT Field Report](#) on two-lift (wet-on-wet) concrete composite pavement.

Pavement Renewal Solutions (R23)

[rePave](#) is an interactive web-based design scoping tool that provides options for rehabilitating pavements based on existing pavement conditions.

Innovative Bridge Design for Rapid Renewal (R04)

View a [time-lapse video](#) of a bridge replacement that only took 23 days to complete.

Nondestructive Testing for Concrete Bridge Decks (R06A)

View [20 videos](#) of the tested technologies and the final [research report](#) on GoSHRP2.

Service Life Design for Bridges (R19A)

Read the final research report, [Design Guide for Bridges for Service Life](#).

Bradley University | Peoria, Illinois

Introducing Renewal Solutions into Four Existing Courses

Principal Investigator: Dr. Mohammad Hossain
Co-Principal Investigators: Dr. Yasser Khodair, Dr. Yoon-Si Lee,
Dr. Sihyun Kim, and Dr. Fayez Moutassem

SHRP2 Solutions:

GeoTechTools (R02)
New Composite Pavement Systems (R21)
Pavement Renewal Solutions (R23)
Innovative Bridge Design for Rapid Renewal (R04)
Nondestructive Testing for Concrete Bridge Decks (R06A)
Service Life Design for Bridges (R19A)

At Bradley, a private university in Illinois, the SHRP2 Education Connection solicitation gained the attention of professors in the Civil Engineering and Construction Program. A team of five professors in the pavement, structural, and geotechnical engineering disciplines combined forces to integrate applicable SHRP2 technologies into four existing undergraduate and graduate classes in the fall and spring semesters of the 2015-16 academic year. The class formats were lectures and hands-on application of the SHRP2 web tools. The courses covered the areas of geotechnical engineering, pavement design, soil mechanics, and foundation analysis and design. Additionally, a new lecture devoted to pavement design was developed to be taught in the 2016 fall semester.

Bradley professors conducted one-day workshop for students and local practitioners

In December 2015, the Bradley professors developed and conducted a one-day workshop entitled *State-of-the-Practice Solutions in Civil Engineering*, which covered five of the SHRP2 products. The workshop was designed to advance the knowledge of students who had already taken prerequisite coursework, thereby maximizing the exposure of SHRP2 to a broader student audience, as well as to local practitioners. A certificate was provided to students who attended three or more workshop sessions, and 7.5 professional development hours were given.

The student response to the classes and one-day workshop was quite positive across the board. The Bradley professors plan to incorporate the SHRP2 information into future undergraduate and graduate courses to be taught in the next academic year.

Students' Comments

"...new topic I did not know much about and was very interesting."

"I learned something new and interesting about bridge construction, and I really enjoyed that."

"Learned multiple new ideas/concepts about bridge materials/design which increase bridge life."

"rePave web tool was very informative and helpful."

IN THE FIELD

Methodist University's course focuses on the Eco-Logical solution.

Learn more information from the [Implementing Eco-Logical website](#).

Read the [2014/2015 Implementing Eco-Logical Program Annual Report](#), which includes accomplishments, findings, and recommendations.



Visit the *Implementing Eco-Logical* (C06) [product page](#) on GoSHRP2.



Methodist University | Fayetteville, North Carolina

Using Eco-Logical Framework in Capstone Undergraduate Class on Environmental Assessment

Professor: Dr. Deb Branson

SHRP2 Solution:

Implementing Eco-Logical (C06)

Developing new ways to merge theory and real-world application is right up Dr. Deb Branson's alley. As the director of Methodist University's Environmental and Occupational Management Program, and a recipient of a SHRP2 Education Connection grant, Dr. Branson introduced her environmental science students to the SHRP2 Solution *Implementing Eco-Logical* through real-world road building projects. Dr. Branson picked the Eco-Logical solution because it was directly tied to her field of study – her dissertation was on public participation in the environmental process. She incorporated three, 2 ½-hour sessions on Eco-Logical into a capstone Environmental Assessment course for seniors, adding a field trip to view a major bypass under construction on Interstate 295 around Fayetteville, North Carolina. The spring semester course will apply Eco-Logical to a new route just getting under construction. She also plans to prepare and present a certificate course.

Methodist University's approach offers students the opportunity to visit actual project sites

The case study approach was a favorite among her students, who got to see real projects in action. The students are documenting the progress on existing roadwork, and will apply Eco-Logical principles (in theory) to parts that have yet to begin, thereby gaining firsthand knowledge of the challenges of expanding infrastructure to meet population needs. She explains, "The site visits personalized the concepts for the students by showing them the actual application of Eco-Logical and connecting them to real people involved."

The Eco-Logical methodology provides a framework for environmental planning in multiple disciplines such as biology, sociology, community planning, and engineering. In the future, Dr. Branson would like to partner with other universities to teach Eco-Logical from the combined perspectives and applications of engineering and environmental studies. "Many institutions teach environmental assessment, but they are usually short certificate courses. There isn't much opportunity to overlap between disciplines. I'd like to find that ability through a partnership." Dr. Branson plans to stay engaged in the future – continuing to teach the tenets of Eco-Logical and also actively following the work of the SHRP2 Eco-Logical team.



Agencies Implementing the Eco-Logical Solution

IN THE FIELD

The 16 SHRP2 Solutions selected by Rowan University are being implemented across the Nation. Learn more about each of these products by visiting the [GoSHRP2 website](#).



7 Renewal solutions are being implemented in

32 states.



4 Capacity solutions are being implemented in

20 states.



5 Reliability solutions are being implemented in

50 states, Washington, D.C. and Puerto Rico.

Rowan University | Glassboro, New Jersey

Taking on the Challenge to Incorporate 16 SHRP2 Solutions into 7 Courses

Professors: Dr. Yusuf Mehta, Dr. Parth Bhavsar, and Dr. Ayman Ali

RENEWAL SOLUTIONS:

- *Innovative Bridge Designs for Rapid Renewal* (R04)
- *Precast Concrete Pavement* (R05)
- *Nondestructive Testing for Concrete Bridge Decks* (R06A)
- *Technologies to Enhance Quality Control on Asphalt Pavements* (R06C)
- *Service Life Design for Bridges* (R19A)
- *New Composite Pavement Systems* (R21)
- *Pavement Renewal Solutions* (R23)

CAPACITY SOLUTIONS:

- *PlanWorks* (C01)

- *Planning Process Bundle* (C02/C08/C15)
- *EconWorks* (C03/C11)
- *TravelWorks* (C04/C05/C16)

RELIABILITY SOLUTIONS:

- *Reliability in Simulation and Planning Models* (L04)
- *National Traffic Incident Management Responder Training Program* (L12/L32A/L32B)
- *Framework for Improving Travel-Time Reliability* (L17)
- *Reliability Data Archive* (L13A)
- *Regional Operations Forum* (L36)

At Rowan University in New Jersey, the mission of the Civil Engineering department is to equip the next generation of civil engineers with skills to tackle existing and future transportation challenges. So for the team of Yusuf Mehta, Parth Bhavsar, and Ayman Ali, the link to the SHRP2 Education Connection could not be more obvious. The professors took on the challenge of incorporating 16 SHRP2 Solutions into their Civil and Environmental Engineering (CEE) curriculum.

Rowan University inserts SHRP2 lectures into course curriculum from freshman to senior year

The faculty used a vertical integration approach, inserting SHRP2 lectures into seven courses covering the full 4 years of the CEE curriculum. The level of technical complexity increases from the freshman to senior year, with each course beginning with a brief review of the prior level's material. This model allowed the team to cover great breadth of material at the various levels. Dr. Yusuf Mehta explains, "We plan to continue the lectures on the SHRP2 products as we integrate them into our overall curriculum. Our integration approach will reach its full potential as the current freshmen are introduced to the products early in the program, and the level of complexity will increase as the students progress."

The SHRP2 lectures were recorded, and the professors will use those videos to build future, more in-depth courses. The videos, as well as feedback from student evaluations, provided an important reference for the professors as they fine-tuned the spring semester coursework. Selected senior and graduate-level courses will ultimately focus on application of the SHRP2 products, perhaps adding a hands-on or field component to view SHRP2 projects in the vicinity. This level of instruction will provide students the opportunity to master the technologies. The department plans to continue growing the SHRP2 initiative at Rowan. They are considering incorporating the SHRP2 material into future continuing education courses, developing a website for the SHRP2 courses, bringing in SHRP2 product experts as guest speakers, and disseminating their results as widely as possible.

IN THE FIELD

More than 180,000 responders across all 50 states, the District of Columbia, and Puerto Rico have participated in the Traffic Management Responder Training (TIM). The University of Idaho selected the TIM training to integrate into its course study.

Videos

View the [Virginia State Police video](#) describing its use of the SHRP2 TIM Responder Training.

View video, [National TIM Responder Training](#), to learn why TIM training is so important.

Media

Read the *Public Roads* features on TIM:

- [May/June 2015](#)
- [March/April 2015](#)
- [July/August 2014](#)
- [November/December 2013](#)
- [July/August 2013](#)

Web-based course

Register for a [web-based course](#) offered by the National Highway Institute.

Responder training statistics

See the increasing number of TIM trainings across the country by reviewing the [training status map and statistics](#).

Every Day Counts (EDC)

TIM is a SHRP2 and EDC product. Learn more about TIM in the [Innovator](#).

University of Idaho | Moscow, Idaho

Emphasizing Real-World Applications in Traffic Incident Management (TIM) Responder Training

Professor: Dr. Kevin Chang

SHRP2 Solution: *National Traffic Incident Management (TIM) Responder Training Program (L12/L32A/L32B)*

For Dr. Kevin Chang, Professor of Civil Engineering at the University of Idaho, the decision to compete for a SHRP2 Education Connection grant was an easy one. “The seed money accessible through the grant was a great incentive, and the choice of the TIM training program was a natural fit for me.” Coming from a career on the practitioner side, specifically having run the traffic management center for King County, Washington, Dr. Chang saw the importance of providing students with the link between traffic operations concepts and real-world applications. Dr. Chang embedded the online TIM training concepts and several local case studies into a fall semester course on public transportation, as well as a spring class covering the fundamentals of transportation engineering.



Students favor interactive approach used to teach TIM training in classroom

Feedback from the students was universally positive, and they particularly favored the interactive nature of Dr. Chang’s lectures. The future engineers were exposed to the critical role that traffic management centers (TMC) play and learned that TMC operators typically have a wide variety of important responsibilities, depending on the jurisdiction. Although the online TIM training is specifically targeted to practitioners, Dr. Chang was excited to add the TIM components to his lectures, so that his students could benefit from the exposure and potentially apply the concepts several years down the road in their careers as civil and transportation engineers.

Dr. Chang will continue to include TIM training in his future lectures. “We’re not developing materials for a one-time use. The hope is that there will be some lasting, recurring element to this that other educators will take and add on to in the future.” Dr. Chang is also exploring ways the academic community can work collaboratively with DOTs and responders to support the training needs of practitioners.

Academic Courses:

CE 574 – Public Transportation

- Fall Semester 2015

CE 372 – Fundamentals of Transportation Engineering

- Spring Semester 2016

Right: During TIM training tabletop exercises, responders exchange discipline roles and learn optimal placement of emergency vehicles at a crash scene to ensure safety of responders and drivers while expediting roadway clearance.





Showcase: University Courses

PRODUCT HIGHLIGHTS

Technologies to Enhance Quality Control on Asphalt Pavements (R06C)

Read the final research report, [Using Infrared and High-Speed Ground-Penetrating Radar for Uniformity Measurements on New HMA Layers](#).

Pavement Renewal Solutions (R23)

Read the research report, [Using Existing Pavement in Place and Achieving Long Life](#), and learn more at the [rePave website](#).

Guidelines for the Preservation of High-Traffic-Volume Roadways (R26)

See the [R26 brochure](#) for information on state activities.



COLORADO STATE UNIVERSITY | FORT COLLINS, COLORADO

PROFESSOR: Dr. Scott Shuler

FOCUS AREA: Renewal

SHRP2 SOLUTIONS:

- *Technologies to Enhance Quality Control on Asphalt Pavements (R06C)*
- *Pavement Renewal Solutions (R23)*
- *Guidelines for the Preservation of High-Traffic-Volume Roadways (R26)*

CURRICULUM TOOLS: Lectures and case studies

The SHRP2 Solutions were incorporated into the Colorado State University Construction Management undergraduate curriculum. Students improved their understanding of three SHRP2 pavement Renewal solutions through lectures, case studies, and field trips. They learned about the latest options for concrete and asphalt pavement rehabilitation, asphalt pavement nondestructive quality control testing, and pavement preservation and maintenance techniques.

In addition to incorporating new SHRP2 Solutions into existing curriculum at Colorado State University, the legacy of SHRP2 products will remain long after the individual instruction has concluded. Two courses were modified to include Renewal solutions.

CON 270 – Roadway Construction

- Three lectures covering concrete paving construction, asphalt pavement construction equipment and methods, and maintenance repair and rehabilitation.
- Field trip to asphalt production facility and paving operation.
- Field trip to Portland cement manufacturing plants.

CON 370 – Asphalt Pavement Materials and Construction

- Two lectures covering asphalt delivery systems and procedures and asphalt paving laydown, compaction, and maintenance.
- Field trip to asphalt production facility and paving operation.

Implementation: These three SHRP2 Solutions currently are being implemented in more than 26 states and Washington, D.C.

PRODUCT HIGHLIGHTS

Reliability in Simulation and Planning Models (L04)

The *Reliability in Simulation and Planning Models* SHRP2 Solution is designed to assist state departments of transportation, metropolitan planning organizations, and other transportation agencies in moving reliability into their business practices.



UNIVERSITY OF WISCONSIN | MADISON, WISCONSIN

INVESTIGATORS: Dr. David Noyce, Dr. Soyoung Ahn, and Dr. Madhav Chitturi

FOCUS AREA: Reliability

SHRP2 SOLUTION: *Reliability in Simulation and Planning Models (L04)*

CURRICULUM TOOLS: Lectures and laboratory exercises

Graduate and undergraduate students gained experience working with Reliability concepts. Through lectures and laboratory exercises, the University of Wisconsin offered students hands-on experience with data requirements, data processing, analysis techniques, and modeling procedures. Students analyzed several travel-time reliability indices using rich traffic data. In addition, students engaged in network/regional-level travel-time reliability analysis or used micro-simulation to analyze travel-time reliability using regional planning and operations models. In fall 2015, two courses were presented — one at the undergraduate level and a second at the graduate level. The courses included the following student learning activities:

Undergraduate Course

- One-hour lecture covering the basics of reliability.
- One lab session for computing various reliability performance measures.
- One course project for analyzing reliability of multiple corridors in Wisconsin and developing recommendations for corridor performance.

Graduate Course

- One-hour lecture covering the basics of reliability.
- One-hour lecture on incorporating reliability in operations and planning tools.
- One homework for computing various reliability performance measures.
- One project for planning a trip to Washington, D.C. considering multimode and time choices.

Implementation: The SHRP2 Solution, *Reliability in Simulation and Planning Models (L04)*, is a Round 7 Implementation Assistance Program product. Round 7 recipients will be announced in June 2016.

PRODUCT HIGHLIGHTS



Reliability in Simulation and Planning Models (L04)

The FHWA is conducting pilot tests focused on two metropolitan areas in Portland, OR and Phoenix, AZ.

Reliability Data Archive (L13A)

The [Reliability archive](#) provides over 2 terabytes of structured and unstructured data from more than 45 SHRP2 Reliability-related projects.

Organizing for Reliability (L01/L06)

Read about *Organizing for Reliability* in [SHRP2 Moving Us Forward](#).

Framework for Improving Travel-Time Reliability (L17)

This SHRP2 Solution served as a framework to establish the National Operations Center of Excellence and its [corresponding website](#). The center supports the transportation systems management and operations (TSM&O) community.

NORTH DAKOTA STATE UNIVERSITY – UPPER GREAT PLAINS TRANSPORTATION INSTITUTE | FARGO, NORTH DAKOTA

PROFESSOR: Dr. Diomo Motuba

FOCUS AREA: Reliability

SHRP2 SOLUTIONS:

- *Reliability in Simulation and Planning Models* (L04)
- *Reliability Data Archive* (L13A)
- *Organizing for Reliability* (L01/L06)
- *Framework for Improving Travel-Time Reliability* (L17)

CURRICULUM TOOLS: Lectures and case studies

North Dakota State University's Upper Great Plains Transportation Institute chose to integrate Reliability solutions into its graduate level courses to help students learn about state-of-the-art traffic congestion management. Through the use of lectures and case studies, students examined the reliability tools and simulation and planning models using real situations and data sets.

Three courses were modified to include SHRP2 Solutions:

TL 754-Urban Transportation System Analysis (Fall 2015)

- Focused on archived Reliability data that could be used for both planning and operations levels.
- Required students to choose, extract, and evaluate at least two archived datasets from the L13A product.
- Discussed use of these datasets in the real world and the methods students will use to develop these archived data from scratch.

TL 752-Transportation Planning and Environmental Compliance (Fall 2015)

- Incorporated L01/L06 and L17 in a discussion on the impacts of congestion on Reliability and a framework for improving travel-time reliability, and provided a guide to integrating business processes to improve travel-time reliability.

TL 785-Spatial Analysis in Transportation Systems (Spring 2016)

- Used SHRP2's L13A data sets to extract geolocation information in order to analyze traffic to improve reliability and create reliable routes to guide logistics and transportation decision makers and planners.
- Used SHRP2's L17 output from the Knowledge Transfer System as case studies for students to review how transportation systems management and operations (TSM&O) tools can be used to enhance the movements of goods and people.
- Discussed incident response and management using GIS, detection of incidents using ITS, spatial tools such as GPS and remote sensing, and predictive models using GIS and statistics.

Implementation: The SHRP2 Solution, *Reliability in Simulation and Planning Models* (L04), is a Round 7 Implementation Assistance Program product. Round 7 recipients will be announced in June 2016. Forty-seven transportation agencies at the state, local, and regional levels participated in the self-assessment exercise and developed action items under *Organizing for Reliability* (L01/L06).

PRODUCT HIGHLIGHTS

NDToolbox

Nondestructive testing (NDT) methods are automated, quantitative, and rapid; they provide substantially more complete coverage than conventional visual inspections. The web-based, open-source [NDToolbox](#) helps identify and characterize testing technologies that are available to locate primary deficiencies. With the toolbox, users can explore different NDT technologies and examine their use in detecting deterioration for conditions relevant to the project.



UNIVERSITY OF MISSOURI | COLUMBIA, MISSOURI

PROFESSOR: Dr. Glenn A. Washer

FOCUS AREA: Renewal

SHRP2

SOLUTIONS:

- *Nondestructive Testing for Concrete Bridge Decks (R06A)*
- *Technologies to Enhance Quality Control on Asphalt Pavements (R06C)*
- *Nondestructive Testing for Tunnel Linings (R06G)*

CURRICULUM

TOOL:

Hands-on experimentation

The University of Missouri used hands-on experimentation to introduce undergraduate students to three new nondestructive evaluation (NDE) technologies from the Renewal focus area. This allowed the students to develop practical knowledge of the use and limitations of the technologies. Graduate students examined the issues associated with engineering decision making related to NDE (for example, reliability issues, or cost benefit analysis).

Following are two examples of the course structure:

Cv Eng 4360/7360 Bridge Engineering

This course syllabus includes:

- Design approaches.
- Loads and load combinations.
- Superstructure design and systems.
- Highway bridge evaluation and more.

Cv Eng 8311

This is a problem-based course that used case studies as a vehicle for developing knowledge of the current state of the art, the underlying physics of NDE technologies, and their integration with engineering judgment, management of facilities and safety.

Implementation: The three NDE technologies are being implemented in 17 states.

PRODUCT HIGHLIGHTS

TravelWorks (C04/C05/C16)

Advanced Travel Analysis Tools address today's transportation planning and modeling challenges. Learn more on the [TravelWorks website](#).

- Quickly compare the broad impacts of various land use, investment and policy scenarios on travel demand using a Rapid Policy Analysis Tool.
- Improve the sensitivity of a travel demand model to congestion, travel-time reliability and pricing.
- Understand how operational improvement strategies affect highway capacity.
- Build an activity-based model integrated with dynamic traffic/transit assignment (Integrated Dynamic Travel Model).

Utility Bundle

(R01A/R01B/R15B)

The Round 7 IAP featured the SHRP2 *Utility Bundle*, a related group of SHRP2 products that addresses elements of utility locating techniques and technologies. It is composed of three SHRP2 solutions:

- [3D Utility Location Data Repository \(R01A\)](#): 3D modeling helps agencies design optimum transportation solutions.
- [Utility Locating Technologies \(R01B\)](#): Advancing technologies to help agencies detect subsurface utilities.
- [Managing Utility Conflicts \(R15B\)](#): Improving cooperation among highway agencies and utilities for faster project delivery.

UNIVERSITY OF NORTH CAROLINA – CHARLOTTE | CHARLOTTE, NORTH CAROLINA

PROFESSOR: Dr. Wei (David) Fan **CURRICULUM TOOLS:** Lectures

FOCUS AREA: Capacity **SHRP2 SOLUTION:** *TravelWorks* (C04/C05/C16)

Students learned the fundamentals of three SHRP2 Capacity solutions. The University of North Carolina – Charlotte chose the bundle, *Advanced Analysis Tools for Integrated Travel Demand Modeling* (C04, C05, and C16) – now entitled *TravelWorks*. Through a series of lectures, students learned the fundamentals of *TravelWorks* for integrated travel demand modeling. After attending this course, students were equipped to improve the understanding of how highway congestion and pricing affect travel demand; the understanding of the contributions of operations, technology, and design to meeting highway capacity needs; and the understanding of the effect of smart growth policies on travel demand.

15 PowerPoint Lectures Developed

The goal was to provide the students with a solid foundation in understanding advanced traffic engineering, operations, and travel analysis tools. The course was taught January through May 2016. The project team for the university developed 15 PowerPoint lectures with commentary in the notes section for the lecturer and opportunity for student involvement with in-class exercises.

Implementation: The SHRP2 Solution, *TravelWorks*, is a collection of tools to improve modeling and transportation analysis available on the [TravelWorks website](#).

UNIVERSITY OF NEBRASKA | LINCOLN, OMAHA, NEBRASKA

PROFESSOR: Dr. Asregedew Woldeesenbet **CURRICULUM TOOL:** Lectures

FOCUS AREA: Renewal **SHRP2 SOLUTION:** *Encouraging Innovation in Locating Utilities* (R01)

This Renewal SHRP2 Solution was incorporated into the University of Nebraska-Lincoln's course, Construction Methods and Equipment I. Students benefited by learning about actual construction issues as well as the construction methods and equipment used in locating underground utilities. The university used this SHRP2 product in its curriculum to help disseminate research findings and knowledge of the physical principles behind utility location and characterization. The course curriculum was designed to achieve the following learning objectives:

Introduction to Innovation in Locating and Characterizing Utilities

- Provide overview of SHRP2.
- Describe subsurface utility engineering (SUE).
- Identify challenges and utility issues in transportation projects.

Determine Utility Location Technologies

- Acquire geophysical methods and their characteristics.
- Learn excavation methods of locating utilities.
- Understand how to manage data.

Determine Utility Characterization Technologies

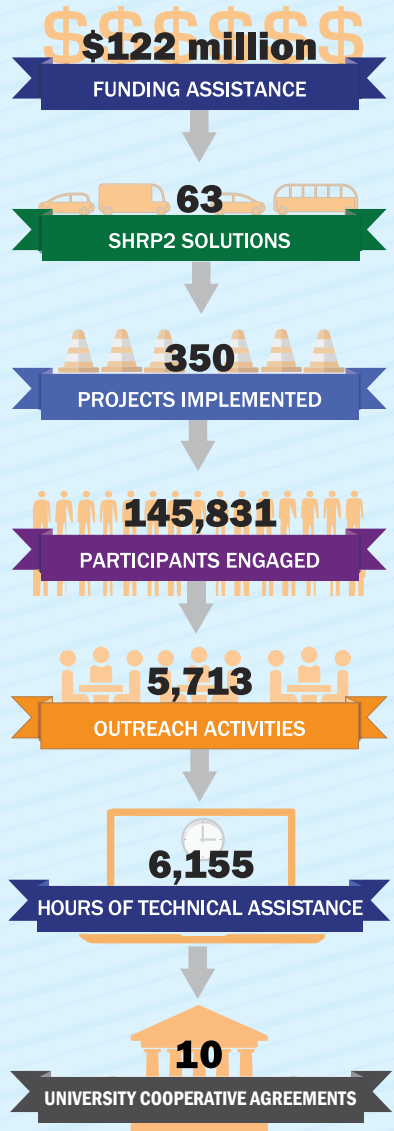
- Identify characteristics from physical inspection.
- Study inspection method of oil and gas pipelines.
- Learn nondestructive inspection tools.

Implementation: The SHRP2 Solutions for utility locating technologies (R01A, R01B, and R01C) are being implemented in 17 states.

SHRP2 SOLUTIONS

Big Impact, Real Results

From Research into Practice:
SHRP2's Implementation Progress

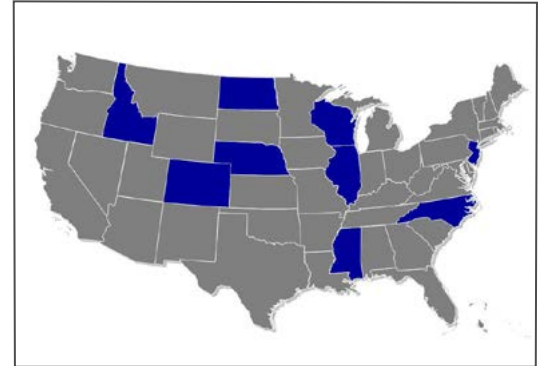


The data points shown here are as of November 1, 2015.

Building on Success

As the infographic to the left shows, SHRP2 has seen great successes in implementing processes and technologies to improve the state of the practice in highway transportation. As of late 2015, the Implementation Assistance Program – which is currently in its final round – had provided more than \$122 million in funding assistance. These funds, along with invaluable technical support – helped more than 350 projects get underway across the country. It is this success that drove the FHWA and AASHTO to create the SHRP2 Education Connection initiative as a complementary effort.

The first round of SHRP2 Education Connection was extremely successful in that it brought 22 SHRP2 products or product bundles into classrooms across the country. While some courses are still being taught and student evaluations are still being compiled, the professors involved in the initiative were effusive in their praise for the program.



Round 1 SHRP2 Education Connection Footprint:
10 awards at universities in 9 states

According to Dr. Kevin Chang of the University of Idaho, bridging the gap between classroom and real-world situations was crucial. “One of my main priorities was providing the link between the classroom and the real world – what’s taught plus what’s used. Students will learn better if they understand why it matters.” Dr. Chang incorporated the *National Traffic Incident Management Responder Training (L12)* product into his curriculum. “What I found very exciting about the SHRP2 opportunity was that it provided that link. Here was a product that had been developed to target the practitioner but with components from which a student can really benefit.”

The combination of funding incentive, technical support, and the ability to share their success in 2016 at the TRB 95th Annual Meeting proved to be a winning combination for the recipients of the SHRP2 Education Connection grants.

Dr. Yusuf Mehta of Rowan University reflected on the benefit of participating in SHRP2 Education Connection and presenting at the TRB session. “Going to TRB was very beneficial. The biggest take away was sharing information with the other recipients and seeing how each university implemented SHRP2 Solutions in its curriculum.”

Based on the enthusiasm surrounding the first round of SHRP2 Education Connection, the FHWA is planning to offer another round in spring 2017.

About SHRP2

SHRP2 is a partnership of the Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board (TRB). TRB completed the research, and now FHWA and AASHTO are jointly implementing the resulting SHRP2 Solutions that will help the transportation community enhance productivity, boost efficiency, increase safety, and improve the reliability of the Nation’s highway system. If you would like additional information or have questions about SHRP2, please contact Carin Michel, FHWA SHRP2 Implementation Manager, at GoSHRP2@dot.gov, (410) 962-2530, or Pam Hutton, AASHTO SHRP2 Implementation Manager at phutton@aaashto.org, (303) 263-1212. Visit the [GOSHRP2 website](#) for additional SHRP2 Milestones and updates.