Program Progress Performance Report for University Transportation Centers

Federal Agency and Organization Element to Which Report is Submitted:
U.S. Department of Transportation
Research and Innovative Technology Administration

Federal Grant or Other Identifying Number Assigned by Agency: DTRT12-G-UTC14

Project Title: National Center for Intermodal Transportation for Economic Competitiveness (NCITEC)

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Submission Date: July 31, 2016

DUNS and EIN Numbers: 64-6000819

Recipient Organization (Name and Address): U.S. Department of Transportation
Research and Innovative Technology Administration
(Denise Dunn, UTC Grant Administrator)
1200 New Jersey Ave, S.E.
Washington, DC 20590

Recipient Identifying Number or Account Number, if any: 363277-061300-021000

Project/Grant Period (Start Date, End Date): 1/1/2012 – 12/31/2016

Reporting Period End Date: June 30, 2016

Report Term or Frequency (annual, semi-annual, quarterly, other): Semi-annual, PPPR9

Signature of Submitting Official: 

1. Accomplishments

As indicated in our grant application, NCITEC's major goals are to address the economic competitiveness and safety of the national intermodal transportation system. Economic competitiveness and safety are two of the five strategic goals that U.S. Department of Transportation (USDOT) has identified. The next section provides more specific goals of NCITEC.

1.1. What are the major goals and objectives of the program?

- Develop, implement and maintain a comprehensive research program that addresses the economic competitiveness and safety of the national intermodal transportation center.
- Develop educational programs in intermodal transportation that incorporate the multidisciplinary nature of intermodal transportation by drawing upon the resources of each university.
- Utilize modern educational technologies, and develop effective professionals in intermodal transportation.
- Enhance the public awareness, understanding, and appreciation of intermodalism and its role in the modern world, including career opportunities in the field.
- Offer interdisciplinary programs and experiential training in intermodal transportation operations to provide a steady source of transportation professionals to public and private organizations.
- Ensure the availability of research results to potential users in a form that can be directly implemented, utilized, or otherwise applied.
- Strengthen the collaboration between NCITEC consortium members as well as between federal, state, and local agencies.
- Develop ties with other University Transportation Centers (UTCs) and USDOT's research clusters to create opportunities for collaborative activities.

1.2. What was accomplished under these goals?

- *Develop, implement and maintain a comprehensive research program that addresses the economic competitiveness and safety of the national intermodal transportation center*: Almost all of the final reports have been submitted for 2012 projects and over half of the 2013 projects have submitted final reports as well. The 2016 projects are ongoing and all projects are on schedule to be completed by December 31 of this year. These projects have spanned a wide variety of topics in the intermodal area.

- *Develop educational programs in intermodal transportation that incorporate the multidisciplinary nature of intermodal transportation by drawing upon the resources of each university*:
    - At Mississippi State University, the Industrial and Systems Engineering department and the Civil and Environmental Engineering Department work together to provide graduate programs that support the education and training of future transportation professionals.

- Continued support of the Master's Program in Intermodal transportation offered at the University of Denver through scholarships and other education activities. During the reporting period the program offered 15 transportation related courses.

- *Utilize modern educational technologies, and develop effective professionals in intermodal transportation*:
  - The project, "Sustainably Enhancing Intermodal Freight Operation of Ports using Geotextile Tubes," incorporated the material on stabilizing dredged soils and stability of slopes/walls constructed with geotextile tubes into courses the two undergraduate class Soil Mechanics (CE 3413) and split-level class Pavement Materials & Design (CE 4103/6103). The project previously enhanced a graduate class, but the lessons learned from the project were expanded to these two other courses this period.
  - The "RIDE & TRAC Modules to Bolster STEM Skills of K-12 Students to Solve Problems in Transportation Engineering" project as acquired training modules developed by AASHTO for STEM classes in grades K-12 and is planning a K12 teacher training session to take place in August.
  - The results of the project "Identify High Crash Risk Locations for Rural Roadways: A Systemic Approach to Reduce Severe and Fatal Traffic Crashes in Louisiana and Mississippi" will be added to the Highway Safety Engineering course (CIVE 437). The discoveries and methods developed in this project will be taught to students, helping them to better understand the different aspects and important factors of roadway safety.
  - As a part of the Mississippi Summer Transportation Institute, funding permitted the program to expand to 25 students. These students were provided opportunities to learn about the STEM skills needed for working in transportation and associated disciplines. They took tours of many different transportation related companies of the two week period some of which were:
    - Visited two UAS design, research and development facilities
    - Toured a concrete batching facility
    - Saw the air traffic control center and flight line of an Air Force base
    - Toured an asphalt research, development and design laboratory
    - Walked through a Tennessee-Tombigbee Waterway lock and dam, an operational port, and travel through a lock on a department research vessel
    - Visited an MDOT ITS command center
    - Experience a first flight in a general aviation aircraft through the EAA Young Eagles program.

    Many of the students indicated an interest in pursuing transportation related careers either by attending college or other career pathways (e.g., military service, manufacturing, etc.)

- *Enhance the public awareness, understanding, and appreciation of intermodalism and its role in the modern world, including career opportunities in the field*:
  - Section 2.1 lists recent publications and presentations made on research of support projects.
  - Section 2.2 provides a list of websites designed to inform the public and make data available for general use. This section also lists links for videos on topics related to transportation research findings.

- *Offer interdisciplinary programs and experiential training in intermodal transportation operations to provide a steady source of transportation professionals to public and private organizations*:
  - Projects have provided support and training of both undergraduates and graduate students who have gained experience that will make them valuable assets for work in the transportation industry.
  - The co-PI on the "Predicting Erosion Impact on Highway and Railway Bridge Substructures" project taught two courses this Spring semester, one focused on Bridge Engineering for seniors in the BSCE program and another focused on Design of Bridge Structures for students for CE student in the MS and PhD programs at UM. Both courses were the first of their type taught at UM and will enhance preparation for professional practice.
  - The University of Denver offers an executive intermodal transportation management master's degree designed to develop the next generation of leaders in the global transportation industry. Executive transportation management master's degree. (http://www.du.edu/transportation/masters-transportation/index.html).

- *Ensure the availability of research results to potential users in a form that can be directly implemented, utilized, or otherwise applied*: The completed projects reports have been posted on our website and on the TRID database. As listed later in this report, some of the methods and results of these projects have been presented at conferences and published in journals.

- *Strengthen the collaboration between NCITEC consortium members as well as between federal, state, and local agencies*: We continue to work in close collaborations with state DOTs. The Mississippi (MDOT), Louisiana (LADOTD), Colorado (CDOT), and Virginia (VDOT) Departments of Transportation with them being one source of matching funds for projects. The table in section 3.1 lists many federal, state, and local agencies that have been involved in support projects.

- *Develop ties with other University Transportation Centers (UTCs) and USDOT's research clusters to create opportunities for collaborative activities*: There have been a number of collaborative projects during this reporting period between institutions within and outside of the partner institutions. Example, currently active projects that include PIs from more than one institution include:

- Examination of Economic Competitiveness of Passenger Rail Service for Sustainable and Economically Efficient Intermodal Corridor Integration – Mississippi State University, University of Mississippi, and University of Denver.
- Macro-level Intermodal Capacity Modeling – University of Tennessee and Hampton University
- Passenger Rail and Freight Rail Partnerships: Case Studies in Boston, Chicago, and Denver – University of Denver and Salem State University
- A Simulation Model for Intermodal Freight Transportation in Louisiana – Louisiana State University and University of Tennessee
- Using a Typological Approach to Compare the Impact of Transit-Oriented Development on Travel Behavior in the United States – University of Denver and Salem State University

1.3. How have the results been disseminated? If so, in what way/s?

- Research results have been published in peer-reviewed publications and conference proceedings. See listing of items under section 2.1
- See list of webpages and social media sites used for posting results and news under section 2.2.
- Presentations have been made to stakeholders on results of projects.

1.4. What do you plan to do during the next reporting period to accomplish the goals and objectives?

- Work with PIs to ensure the completion of projects with final reports compiled and posted on the NCITEC website along with the TRID database.

2. Products

2.1. Publications, conference papers, and presentations (during this period of reporting):

- Keynote speeches:
- Book Chapters

- Journal papers (published)
  - Li, X., Ma, J., Cui, J. and Ghiasi, A. “Design framework of large-scale one-way electric vehicle sharing systems: A continuum approximation model.” Transportation Research Part B, 88, June 2016, 21-45.
  - Smith, Robert, and Waheed Uddin. 2016. A Rational Theory of Tire-Pavement Friction. Research Article 4858317, Advances in Tribology, Hindawi Publishing Corporation, Volume 2016. http://www.hindawi.com/journals/at/2016/4858317/ Accessed April 7, 2106.

- Journal papers (submitted)
  - Bazne, M. O. A., Vahedifard, F., Howard, I. L., (2016). "Effects of Light Cement Stabilization on Properties of Fine Grained Dredged Soils." Journal of Materials in Civil Engineering, ASCE (In Review, submitted March 1, 2016, # MTENG-4759).
  - Smith, B. T, Howard, I. L., Vahedifard, F., (2016). "Lightly Cementing Dredged Sediments for Sustainable Reuse." Environmental Geotechnics, ICE (In Review, submitted June 22).
  - S. R. Mousa, J. Codjoe, O. A. Osman, S. Jenkins, P. R. Bakhit, S. Ishak, and J. Bonnette. Impact of Geometric, Traffic, and Environmental Conditions on Video Detection Performance: A Case Study in Baton Rouge Metropolitan Area. In press for publication in the Journal of Traffic and Logistics Engineering (JTLE).

- Conference Papers
  - Minn, Michael, Andrew Goetz, Keith Ratner, and Sylvia Brady. 2016. Case Studies in Passenger Rail and Freight Rail Partnerships. Paper Presentation at the American Association of Geographers annual conference, San Francisco, CA, March 29, 2016.
  - Howard, I. L., Vahedifard, F., and Bazne, M. O. A. (2016). "Integrating Lightly Cemented Very High Moisture Content Fine Grained Soils into a Vegetated Landscape." Geo-Chicago 2016: Sustainability, Energy, and the Geoenvironment, Chicago, Illinois, August 14-18, 2016, ASCE (accepted).
  - Bazne, M. O. A., Vahedifard, F., Howard, I. L., and Smith, B. T., (2016). "Engineering Properties of Lightly Cemented Dredged Soil." Geo-Chicago 2016: Sustainability, Energy, and the Geoenvironment, Chicago, Illinois, August 14-18, 2016, ASCE (accepted)..
  - Mohamed Jaafar, Z.F., Y. Najjar, and W. Uddin. " Asphalt Pavement Roughness Modeling using the Artificial Neural Network and Linear Regression Approaches for LTPP Southern U.S. States." Compendium, 95th Annual Meeting of Transportation Research Board, Washington, DC, January 11, 2016. (Peer reviewed)
  - S. Ishak, J. Codjoe, S. Mousa, S. Jenkins, and J. Bonnette. Traffic Counting Using Existing Video Detection Cameras. Presented at the 2016 Louisiana Transportation Conference. Baton Rouge, Louisiana.
  - S. R. Mousa, J. Codjoe, O. A. Osman, S. Jenkins, P. R. Bakhit, S. Ishak, and J. Bonnette. Impact of Geometric, Traffic, and Environmental Conditions on Video Detection Performance: A Case Study in Baton Rouge Metropolitan Area. Presented at the 5th International Conference on Traffic and Logistic Engineering. 2016. Dubai, United Arab Emirates.

- Presentations
  - Mullen, C. and Powell, T. "Subsurface damage and scour detection using deck level vibrations to enhance highway bridge maintenance and resilience," Mini-symposium PMC-MS-11: Objective Resilience in Engineering Mechanics, EMI/PMC 2016 Conference Abstracts Proceedings, ASCE Engineering Mechanics Institute, Nashville, TN, May 22-25, 2016
  - Mullen, C., Swann, C., Powell, T. "Effects of scour on bridge vulnerability and damage detection in highway bridges using vibration response." Poster session, 2016 University Transportation Centers Conference for the Southeast Region, Knoxville, TN, April 1-2, 2016.
  - Uddin, W. 2016. Pavement Design, Construction & Asset Management – Lessons Learned. Presentation, Airfield Engineering and Asset Maintenance summits (AEMS), Dubai, UAE, 1-4 February 2016. (Invited presentation) (all expenses supported by the host).
  - Uddin, W. 2016. Managing Disaster Resilience of City Public Infrastructure Assets. Presentation, 2016 Critical Infrastructure Symposium, TISP, Tech Session 2B Infrastructure Protection and

Resilience, Society of Military Engineers, Charleston, South Carolina, April 3 - 5, 2016. (Peer reviewed)
- Durmus, Alper and W. Uddin. "Assessing Structural Integrity of Bridge Superstructure Subjected To Extreme Flood Simulation." Bridge Data Analysis Working Group (BDAWG) Forum on Pavement Data Analysis, 95th Annual Meeting of Transportation Research Board, Washington, DC, January 9, 2016. (Peer reviewed)
- Mohamed Jaafar, Z.F. and W. Uddin. " Development of Asphalt Pavement Roughness and Rutting Models by using LTPP Database and Considering Maintenance and Rehabilitation History." Data Analysis Working Group (DAWG) Forum on Pavement Data Analysis, 95th Annual Meeting of Transportation Research Board, Washington, DC, January 9, 2016. (Peer reviewed)
- Swain, K., "Toxic Transportation Spills: Invisible or Ignored?" presented at the University Transportation Center Conference for the Southeastern Region in Knoxville, Tennessee, in March 2016.

- Reports
  - Nguyen, Quang and W. Uddin. Applications of Shuttle Radar Data and Landsat-8 Satellite Imagery for HEC-RAS Floodplain Modeling. The National Hydrologic Warning Council (NHWC), *The NHWC Transmission*, January 2016. http://www.hydrologicwarning.org/docs.ashx?id=241424 Accessed February 10, 2016.

2.2. Website(s) or other Internet site(s):

All products will be published on NCITEC's web site (www.ncitec.msstate.edu).

Mission Intermodal Excellence project websites:
- Overview: http://www.bagley.msstate.edu/outreach/mission-eggcellence/2013-mission-intermodal-excellence/
- Video: http://www.bagley.msstate.edu/outreach/mission-eggcellence/2013-mission-intermodal-excellence/mission-intermodal-overview/
- Resources: http://www.bagley.msstate.edu/outreach/mission-eggcellence/2013-mission-intermodal-excellence/mission-intermodal-resources/

Other project websites:
- Construction Materials Research Center (CMRC) http://www.cee.msstate.edu/cmrc/ contains photos of a workshop hosted at MSU on Dredged Soil, Geosynthetics, and PLC Technology.
- The NCITEC project tab on the University of Mississippi CAIT web site: http://www.olemiss.edu/projects/cait/ncitec/
- Intermodal Transportation Institute, University of Denver (www.du.edu/transportation)
- Hampton University School of Business – Eastern Seaboard Transportation Applications Center (ESITAC) website (http://esitac.biz.hamptonu.edu/)
- University of Mississippi CAIT web page: http://www.olemiss.edu/projects/cait/ncitec/ The NCITEC project tab on CAIT web site provides useful background of NCITEC goals and university partners.
- The "Intermodal Logistic System Network Design with Expedited Transportation Services" project website is: http://biofuel.msstate.edu/

2.3. Technologies or techniques:

- In order to enhance the use of rail for transportation, the "Northern Mississippi Railways Intermodal Alternatives Assessment" project created an Excel file that provides a mechanism for scoring the goodness-of-fit for a company to utilize rail for their transportation needs. This scoring mechanism weighted the proximity of the business to the railway, the type of product the business produces, the proximity of the business to another railway, and the distance the freight travels.
- The project – "Intermodal Transportation Systems Risk Analysis and Resilience in New Madrid Seismic Zone: the Impact to Mississippi" created a framework that visualizes transportation system risk profiles, with a particular focus on earthquakes, to be used in concert with a model that uses the information to optimize recovery strategies.
- The project "A Simulation Model for Intermodal Freight Transportation in Louisiana" developed a system-level simulation model to be used as a tool to study the freight flow over all three major surface modes (highways, railways, and waterways) and their connections and, in turn, to help DOTD identify the best way to increase freight transportation capacity and improve flow efficiency.
- The "Supply Chain and Inventory Management through Intermodal Logistics Analysis" project developed a web-based system (software and hardware) to help reduce costs though collaboration between trucking, rail and industry for domestic transportation. To achieve this, the concept of Vendor Managed Inventory (VMI) was be applied to the liquid and dry bulk freight industry. A software system called eVMI was developed to help decision makers alleviate issues with labor by reducing the number of long haul drivers required, reducing logistics cost by providing the logistic companies with data in a timely manner, improve safety by relying on rail for long distance transfers as opposed to using trucks, and help to smooth both logistic requirements and supplier demand patterns.

2.4. Inventions, patent applications, and/or licenses:

None

2.5. Other products, such as data or databases, physical collections, audio or video products, software or NetWare, models, educational aids or curricula, instruments, or equipment

None

3. Participants & Other Collaborating Organizations

3.1. What other organizations have been involved as partners?

Organization Name	Location	Partner's Contribution to Project
American Short Line Railroad Association	Washington DC	Collaboration on identification of work schedules at risk for safety issues
Aurora Flight Sciences	Columbus, MS	Provide facility tour and presentation to students
Colorado DOT	Denver, CO	Exploration of components of an effective safety culture.

Columbus Air Force Base	Columbus, MS	Provide facility tour and presentation to students
Denver Regional Transportation District	Denver, CO	
DriveSquare, Inc.	Alexandria, VA	Provide technical support and help resolve issues
Ergon, Inc.	Jackson, MS	Provide facility tour and presentation to students
Holcim, Inc.	Artesia, MS	Technical support and supplies
Innovate Mississippi	Ridgeland, MS	Financial support, facilities, collaborative research and personnel exchanges.
Institute for Systems Engineering Research	Vicksburg, MS	Staff time
Itawamba Community College	Fulton, MS	Financial support, facilities, collaborative research and personnel exchanges.
Louisiana Dept. of Transportation	Baton Rouge, LA	Collaborative research
Louisiana Transportation Research Center	Baton Rouge, LA	Financial support
Miller Intermodal Logistics	Ridgeland, MS	In-kind support, collaborative research and personnel exchanges
Mississippi DOT	Jackson, MS	Support, expertise, and data
Mississippi Transportation Institute	Starkville, MS	Support
Mississippi World Trade Center	Jackson, MS	Staff time
Mistras Group, Inc.	Princeton Jct, NJ	Acoustic emissions equipment, consulting, and training
OmniTrax Railroads	USA	Staff time
Paragon Technical Services	Richland, MS	Provide facility tour and presentation to students
Port of Long Beach	Long Beach, LA	Staff time
Regional Transportation District (RTD)	Denver, CO	Identification of intersections and crossing that have high risk for pedestrians
Ryder Trucking	Miami, FL	Staff time
Tennessee-Tombigbee Waterway Authority	Columbus, MS	Provide facility tour and presentation to students
TenCate	Dayton, TN	Technical support and supplies
Union Pacific Railroad	Omaha, NE Houston, TX	Staff time
University of Southern Mississippi	Hattiesburg, MS	Financial support, facilities, collaborative research and personnel exchanges.
US Army Corp of Eng.	Vicksburg, Memphis, Mobile, New Orleans, Jacksonville	Data collection
Virginia DOT	Richmond, VA	Coordination, support, expertise, testing, and data

3.2. Have other collaborators or contacts been involved?

- Association of American Railroads
- Association of Short Line Railroads
- Burlington Northern Railroad
- Colorado Rail Partnership & Alliance, Denver, CO
- Denver Regional Council of Governments, Denver, CO
- John Robert Smith - president and CEO of Reconnecting America, Former mayor of Meridian, MS. www.reconnectingamerica.org
- Miller Transporters, Inc.
- Mississippi Trucking Association; Jackson, MS
- Northeast Mississippi Community College; Fulton, MS
- Port of Fulton - Fulton, MS
- Quality Transportation Services, Mechanicsville, VA
- Three Rivers Planning and Development District Yellow Creek, MS

4. Impact

4.1. What is the impact on the development of the principal discipline(s) of the program?

- The "Traffic Counting Using Existing Video Detection Cameras" project provides a better understanding of the impact of the different site conditions on the accuracy of video detection. Recommendations for frequent and continuous calibration of the video cameras would improve the quality of the collected data using such a detection technology. Such work will also aid other research studies that depend on video detection as a main source of data.
- The "Innovative Solutions in Real Time Multimodal Origin Destination Data (O/D) Studies" project provides two real-time O/D models that can be used to replace traditional O/D estimation methods. Obtaining a real-time estimate of vehicle OD information can be used to establish delay/fuel consumption models and support the optimization of signal timings for signalized interchanges. The developed strategy appears to adapt well to traffic variations, increased throughput, and other uncontrollable events. It could be used to assist in minimizing delay, number of stops, emission, and fuel consumptions at signalized interchanges.
- The project "Status of Concrete Highway Bridges on Main Freight Routes in Mississippi" will help transportation officials make smart choices about where to spend tight funds. Nationwide, a $17 billion annual investment is needed to substantially improve bridge conditions, but currently less than $11 billion is spent annually on the maintenance and replacement of bridges. With such an investment gap, the available funds must be spent very judiciously.
- The "Sustainably Enhancing Intermodal Freight Operation of Ports using Geotextile Tubes" projects determined that decision makers at ports and harbors should consider geotextile tubes and/or LC-VHMS for applications at their facilities. It was observed that applications that made use of geotextile tubes provided economic advantages. The project provides a detailed set of engineering properties to allow more informed decisions regarding when to consider lightly cemented very high moisture soils (LC-VHMS) and/or geotextile tubes.
- The "Macro-level Intermodal Capacity Modeling" project developed a comprehensive model capable of estimating the capacity of intermodal freight transportation with an example provided

for the Hampton Road Area. The model is able to predict congestion areas and identify critical links within the system network. The analysis also proved the demonstrated necessity of integration of waterway/seaway to rail and truck transportation in order to face the increasing pressure in export and import volume.

4.2. What is the impact on other disciplines?

- The research of the "Development of an Optimal Ramp Metering Control Strategy for I-12" project recommends the modification of the existing ramp metering control strategy on I-12 from fixed time to adaptive control requiring the implementation of advanced detection technologies that will require the work of electrical engineers to make it happen. Additional programming of the traffic control units, which is normally performed by computer scientists, may also be required to achieve coordination between ramp meters along the corridor. The additional control functions required to operate the ramp meters and monitor the traffic conditions are administered by traffic engineers at the traffic management centers.
- The "Risk framing of U.S. intermodal transportation hazardous spills in news and social media" project found that the public affairs practice of many freight companies defies conventional corporate public relations practice to "get out in front" of a crisis with their own broadcast, instead relying on news organizations to generate a story. Social media provides them the opportunity to do this. As well, this project found that over a 12-year period, U.S. newspaper coverage of serious transportation spills was almost non-existent.

4.3. What is the impact on the development of transportation workforce development?

- The work on the "Predicting Erosion Impact on Highway and Railway Bridge Substructures" project motivated development of, and facilitated implementation of three new courses at UM (offered through the CE department). One course on Bridge Engineering had 11 upperclassmen (mostly seniors) enroll, and the other course on FE based Design of Bridge Structures had 8 MS and one PhD students enroll. One independent study based course on Advanced Steel Design covering seismic design and FE modeling had two MS students enroll. Several of these students graduated and are pursuing careers at state DOT's and consulting firms specializing in bridge design, maintenance, or construction.
- The results of the project "Identify High Crash Risk Locations for Rural Roadways: A Systemic Approach to Reduce Severe and Fatal Traffic Crashes in Louisiana and Mississippi" will be added to the Highway Safety Engineering course (CIVE 437). The discoveries and methods developed in this project will be taught to students, helping them to better understand the different aspects and important factors of roadway safety.
- Students who worked on the "Experimental Studies and Theoretical Analysis on Concrete Structures to Evaluation Structural Integrity of Highway Bridge Concrete Columns" project gained experience with technologies involved in monitoring and maintenance of bridge structures.
- As a part of the Mississippi Summer Transportation Institute, 25 students were provided opportunities to learn about the STEM skills needed for working in transportation and associated disciplines. Many of the students indicated an interest in pursuing transportation related careers either by attending college or other career pathways (e.g., military service, manufacturing, etc.).

- The "Port Utilization Measurement of Mississippi's Intermodal Ports" project brought to light how the shipping industry also affects trucking and rail jobs. Additional research is needed to better correlate the tons shipped thorough the state to the number of jobs created or retained in each transportation sector.

4.4. What is the impact on physical, institutional, and information resources at the university or other partner institutions?

- The project "Predicting Erosion Impact on Highway and Railway Bridge Substructures" provided funds to purchase a high-performance computer workstation. This equipment proved invaluable in completing the FE modeling and analysis work. Older workstations could not perform the analysis with the soil features added to the structural components.
- The "RIDE & TRAC Modules to Bolster STEM Skills of K-12 Students to Solve Problems in Transportation Engineering" project provides 15 training platforms (developed by AASHTO) that will be used for STEM classes in grades K-12.
- The "Experimental Studies and Theoretical Analysis on Concrete Structures to Evaluation Structural Integrity of Highway Bridge Concrete Columns" and the "Steel Girder Supporting Bridges: An Experimental Study and Theoretical Analysis to Evaluate Structural Integrity of Steel Girders" projects provided additional special acoustic emission probes and accessories for the materials testing laboratory at Hampton University. These included several acoustic emission (AE) monitoring systems including Sensor Highway II, a portable 1284 Wireless AE system, and a Pocket AE system. These will benefit current and future students providing hands-on experience to better understand the concepts behind the test procedures.

4.5. What is the impact on technology transfer?

- The goal of the project "Beneficial Reuse of Dredged Soil – Transferring Portland-Limestone Cement and Geosynthetics Technology toward Sustainable Solutions to Dredged Material Management" was to hold a workshop for technology transfer to practicing professionals. The attendees came from a very diverse background. With ports being such a multimodal location, the impact of the knowledge transfer will be wide ranging.
- The "Effective Utilization of Innovation Techniques within Mississippi's Intermodal Professional Workforce" project held a series of "Intermodal Transportation Innovation Summits" that brought together transportation professionals representing organizations throughout the extended supply chain (e.g., manufacturers, truck, rail, water, and ports). These Summits were held across the state - centering on the North, Central, and Southern regions of Mississippi. These innovation sessions generated a set of actionable projects. The ultimate goal was to enhance the region's economic competiveness through greater cooperation across transportation modes.
- The "Intermodal Logistic System Network Design with Expedited Transportation Services" project developed a reliable logistics network design framework that integrates one-time location selection decisions and long-term operational strategies of shipment expedition and inventory management in an uncertain environment. One result was the creation of a user friendly web-based interface for biofuel logistics network design available at http://biofuel.msstate.edu/

4.6. What is the impact on society beyond science and technology?

- The company, Miller Intermodal Logistics Systems, adopted and modified the web-based logistics analyze developed as a part of the "Supply Chain and Inventory Management through Intermodal Logistics Analysis" project. This tool evaluates a portfolio of intermodal transportation requests to determine the intermodal combination that results in the routes delivering the lowest monetary cost.
- The project "Intermodal Optimization for Economically Viable Integration of Surface and Waterborne Freight Transport" offers geospatial products for land use mapping, terrain classification, and traffic flow management policies.
- Some of the content in this technology transfer event of project "Beneficial Reuse of Dredged Soil – Transferring Portland-Limestone Cement and Geosynthetics Technology toward Sustainable Solutions to Dredged Material Management" was related to a more sustainable way of thinking regarding dredged materials. The beginning of the workshop couched the event in terms of a triple bottom line (i.e. environment, economics, and social well-being). Thinking about problems in this manner stands to go beyond just science and technology and impact society from an overall sense.
- The current reliance on over-the-road transportation is heavy. The results from the "Northern Mississippi Railway Intermodal Alternatives Assessment" project has potential to influence industry in Mississippi that rail transportation is a more efficient alternative. It should assist Grenada Economic Development District in efficiently establishing transportation contracts with Mississippi manufacturing companies. The results optimize the potential for finding business partnerships for the railway and airport.
- The "Toxic Transportation Spills: Invisible or Ignored?" project identified implications for changing practices in crisis communications about future transportation accidents, to improve crisis communications practice, increase public understanding, and minimize the economic and environmental impact of future accidents. Recommendations for improved news coverage of transportation incidents will be shared through a public website and by publishing articles in journals in both the journalism and transportation fields.
- The "Steel Girder Supporting Bridges: An Experimental Study and Theoretical Analysis to Evaluate Structural Integrity of Steel Girders" project affects the passenger and freight transportation network by trying to predict and analyze potentially critical highway structure deficiencies therefore lowering the repair and maintenance costs and minimizing traffic flow disruptions that occur when elements of transportation network need to be closed down for major repairs. Therefore, beyond science and technology, this study directly influences the Economic Competitiveness goal of the USDOT.

5. Changes/Problems

5.1. Changes in approach and reasons for change:

None

5.2. Actual or anticipated problems or delays and actions or plans to resolve them:

- All of the projects associated with the University of Denver have been delayed and given a "no-cost" extension to August 31, 2016.

5.3. Changes that have a significant impact on expenditures:

None

5.4. Significant changes in use or care of animals, human subjects, and/or biohazards:

None

6. Special Reporting Requirements

None