

Program Progress Performance Report for University Transportation Centers

Federal Agency and Organization Element to Which Report is Submitted:

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Research and Innovative Technology Administration

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

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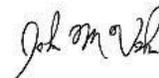
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Signature of Submitting Official:



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:* Most of the final reports have been submitted for 2012 projects and just a couple for the 2013 projects. The remaining projects will be completing their work in the remaining six months of the year. These projects span 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:*
 - 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.
 - MSU-CEE conducts the Mississippi Summer Transportation Institute (MSTI): a three week summer camp for high school students to provide them with overall exposure to civil

- engineering. Taught students about sustainability, geotextile tubes and PLC in particular, when opportunities present themselves.
- The “Development of a Highway Safety Fundamental Course” project provides a complete teaching packet with course materials for use with undergraduate and graduate students.
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 - *Utilize modern educational technologies, and develop effective professionals in intermodal transportation:*
 - Several concepts explored in the “Sustainably Enhancing Intermodal Freight Operation of Ports using Geotextile Tubes” project were incorporate into courses such as Soil Behavior (CE 8443) and Material Characterization (CE 8303) at MSU.
 - For the computer workstations in the CAIT Remote Sensing and Geospatial Analysis Laboratory and the CAIT Transportation Modeling and Visualalization Laboratory (at the University of Mississippi):
 - IAVO Research and Scientific has provided the GeoSPHERIC software package
 - IAVO has also provided training data for use by the students
 - Intergraph provides academic license of GeoMedia Pro
 - *Enhance the public awareness, understanding, and appreciation of intermodalism and its role in the modern world, including career opportunities in the field:*
 - Dr. Sherry (DU) made a presentations to rail stakeholders who are involved in his center’s advisory panel. He solicited stakeholder survey feedback at OPERATION STIMULUS 2015 conference on January 29-31, 2015, organized by Denver Transportation Club, Colorado.
 - Dr. Sherry invited rail industry executives at 2015 TRB annual meeting exhibit hall on January 13, 2015 to share the project results of rail-highway integration. Dr. Uddin presented the background on exhaustive commodity flow data analysis and key findings of the Colorado-California corridors.
 - Dr. Uddin and CAIT students presented project overview and example results to visiting delegates during their visits to the CAIT Transportation Modeling & Visualization Lab in UM Jackson Ave Center (JAC).
 - Dr. Uddin distributed the passenger train revival white paper to public transportation agencies and state legislators in Mississippi, USDOT, road agency contacts in Louisiana and Alabama, and Gulf Coast Mayors Association.
 - Dr. Sherry and Dr. Uddin interacted with the following organizations during the NCIT & MTI workshop co-organized by Dr. Patrick Sherry on Oct 25, 2012 at San Jose University campus: Mineta Transportation Institute (MTI), BNSF Railways, California, Port of Oakland, California, San Mateo County Transit District, California, Reconnecting America, California, and Association of American Railroads
 - Dr. Puryear (CAVSE) made a presentation as a part of an intermodal summit, sponsored by the Franklin Furniture Institutes of MSU in March 2015.

- *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 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>). Fifteen transportation-related courses were offered under this program during the last reporting period.
- *Ensure the availability of research results to potential users in a form that can be directly implemented, utilized, or otherwise applied:* The projects that began in 2012 and some from 2013 have been completed and their results 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:* In cooperation with University of Alabama at Birmingham, NCITEC successfully hosted the University Transportation Centers Conference for the Southeastern Region on March 26-27, 2015. All eight UTCs in Region 4 participated representing 22 Universities. Details about the conference and presentation are located at the link: <http://www.ncitec.msstate.edu/2015-utc/>. The 2016 UTC Conference for the Southeastern Region will be hosted by University of Tennessee-Knoxville on behalf of the Southern Transportation Center (STC). We also participated in the CUTC Summer meeting at Rutgers in June 2015.

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.
- Other mechanisms include:
 - Dr. Uddin has been invited to make a presentation to Association of Toll Roads in Brazil in September 2015.

- Uddin, W. (2016). Disaster Resilience Management of Infrastructure Systems. Book under contract to publish in 2016. The motivation of this book is largely based on natural disaster impacts on global supply chain disruptions and related adverse economic impacts of 2011 - 2014 worldwide extreme tsunami, hurricane, and flood disasters.

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

- Work with PIs to support 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):

- Book Chapters
 - Chapter 77 "Climate Change Adaptation for the Built Environment," *Handbook of Climate Change Mitigation and Adaptation*, edited by Wei-Yin Chen, John M. Seiner, Toshio Suzuki and Maximilian Lackner, Springer. (The reference book will be available in early 2016).
<http://www.springer.com/energy/renewable+and+green+energy/book/978-3-319-14408-5>
- Journals
 - Garriott, P. O., Mazzotta, E., Norris, S. J., & Zucker, K. (2015) Predicting transportation career intentions across male and female high school students. *Journal of Career Development*. Manuscript submitted for publication.
 - Ratner, Keith and Goetz, Andrew, "The reshaping of land use and urban form in Denver through transit-oriented development," *Cities*, v 30, n 1, p 31-46.
 -
- Conference Papers
 - Bazne, M. O., Vahedifard, F., and Howard, I. L. (2015). "Beneficial Reuse of Fine Grained Soils for Port, River, and Shoreline Applications." 2015 International Foundations Congress and Equipment Exposition, IFCEE 2015, San Antonio, Texas, March 17-21, 2015 .
 - Hill, T. W., Holt, R. E., and Smith D., "Supply Chain and Inventory Management through Intermodal Logistics Analysis". 2015 IIE Annual Conference and Expo, Nashville, TN.
- Presentations
 - Uddin, W., 2015 Critical Infrastructure Symposium: The Infrastructure Security Partnership (TISP) and the Society of American Military Engineers (SAME), April 20-21, Baltimore, Maryland.
 - Uddin, W. (2015). Appraisal of Mechanistic-Empirical Pavement Design Guide for Highways Being Implemented in United States and Complimentary Needs for Pavement Asset Management. 6th ICONF BMP, 6th International Conference Bituminous Mixtures and Pavements, Aristotle University of Thessaloniki (AUTH), June 10-12, 2015, Thessaloniki, Greece.
 - Uddin, W. (2015). Aircraft Safety on Airfield Pavements with Standing Water and Slush. Workshop 143- Influence of Airfield Surface Irregularity on Aircraft Life, Presented at the 94th Annual Meeting of The Transportation Research Board, Washington, DC, January 10-15, 2015.
 - Puryear, S., "Innovations in Transportation through Increased Intermodal Use," Center for Logistics Trade and Transportation, Trent Lott Center, Hattiesburg, MS, May 6, 2015.
 - Puryear, S., "Trucking's View of Increased Intermodal Use in Mississippi," Make it in America Workshop, Franklin Furniture Institute, April 23, 2015.

- Uddin, W. (2015). Flood Modelling & Evaluation of Impact in Infrastructure. Panel on Innovated Technological Trends in Highways, 9th Congress and Exhibition, CBR&C 2015 and BRASVIAS 2015, ABCR – The Brazilian Association of Highway Concessionaires, Brasília, Brazil, September from 14 – 16, 2015. www.cbrbrasvias.com.br www.abcr.org.br
- Durmus, A., Nguyen, Q., McGrath, M.Z., Altinakar, M.S., and Uddin, W. (2015). Numerical Modeling and Simulation of Extreme Flood Inundation to Assess Vulnerability of Transportation Infrastructure Assets. Paper No. 15-1606, On-line Proceedings, Paper Presented at the 94th Annual Meeting of The Transportation Research Board, Washington, DC, January 10-15, 2015.
- Uddin, W. (2015). Aircraft Safety on Airfield Pavements with Standing Water and Slush. Workshop 143- Influence of Airfield Surface Irregularity on Aircraft Life, Presented at the 94th Annual Meeting of The Transportation Research Board, Washington, DC, January 10-15, 2015.
- Uddin, W., Cobb, S., Sherry, P. and Eksioglu, B. (2015). Economically Viable Intermodal Integration of Surface and Waterway Freight Transport for Sustainable Supply Chain. University Transportation Center (UTC) Conference for the Southeastern Region, University of Alabama at Birmingham, March 26-27, 2015, Birmingham, Alabama.
- Durmus, A., Nguyen, Q., McGrath, M.Z., Altinakar, M.S., and Uddin, W. (2015). Numerical Modeling And Simulation of Extreme Flood Inundation To Assess Vulnerability of Transportation Infrastructure Assets. University Transportation Center (UTC) Conference for the Southeastern Region, University of Alabama at Birmingham, March 26-27, 2015, Birmingham, Alabama.
- Uddin, W, Altinakar, M.S. and Durmus, A. (2015). Extreme Flood Simulations to Assess Inundation Impacts and Structural Integrity of Transportation Infrastructure Assets. The 2015 Critical Infrastructure Symposium, The Infrastructure Security Partnership (TISP) and the Society of American Military Engineers (SAME), April 20-21, 2015, Baltimore, Maryland.
- Uddin, W. (2015). Appraisal of Mechanistic-Empirical Pavement Design Guide for Highways Being Implemented in United States and Complimentary Needs for Pavement Asset Management. 6th ICONF BMP, 6th International Conference Bituminous Mixtures and Pavements, Aristotle University of Thessaloniki (AUTH), June 10-12, 2015, Thessaloniki, Greece.
- Uddin, W., McCarty, T., and Sharma, J. (2015). Environmental Sustainability and Energy Considerations for Life-Cycle Analysis of Transportation Infrastructure Systems. International Symposium on Systematic Approaches to Environmental Sustainability in Transportation (ISSAEST), University of Alaska Fairbanks, August 2-5, 2015, Fairbanks, Alaska.
- Sherry, P., “Corporate Safety Culture Scale: Identification of Safety Behaviors and Values,” 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- K. Swain, “Direct and Indirect Public Communication about Toxic Transportation Spills,” 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- Tyrus A. McCarty, and Jagdish Sharma, “Harvesting Vibrational Energy Due to Intermodal Transport Systems Via Nano Coated Piezo Electric Devices,” 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- Charles T. Swann and Christopher L. Mullen, “Preliminary Evaluation of North Mississippi Bridge Vulnerability to Natural Hazards,” 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- Vitali Khaikine, Vadivel Jagasivamani, and Eric Sheppard, “Using the Acoustic Emission Technology for Highway Bridge Monitoring Applications,” 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- Mustafa Altinakar, Marcus McGrath, Vijay Ramalingam, and Waheed Uddin, “Two-Dimensional Flood Modeling for the Assessment of Impacts on Critical Infrastructures,” 3rd Annual University

- Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- Chris L. Mullen and Elizabeth K. Ervin, "Bridge Damage Detection using Deck Level Vibrations- Preliminary Findings from FE Analysis and Shake Table Tests," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
- Swain, K., "Media Blackout and Reputation Management: A Decade of Transportation Toxic Spills," University of Mississippi Research Day, April 2015
- Posters
 - Keaton Zucker, Patrick Sherry, David Colarossi, "Confirmatory Factor analysis of Factor Structures of the Safety Culture Survey in the Transportation Industry: The Relationship between Safety Culture and Employee Accidents," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
 - Jessica Mantia, Keaton Zucker, Patrick Sherry, "Safety & Health in Intermodal Transportation: The Prevalence and Consequences of Operator Assault," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
 - Lei Zhang, Yi Wen, Li Zhang, Xiaopeng Li, "Real-Time Transit Vehicle Routing Optimization in Intermodal Emergency Evacuations," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
 - Seth Cobb and Waheed Uddin, "Economic Viability of Mississippi Gulf Coast Commuter Rail Service," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
 - Waheed Uddin, "Flood disaster simulation," 2015 Annual Meeting of the Transportation Research Board (TRB), Washington DC, January 11-14, 2015.
 - William Case Fulcher, Li Zhang, Xiaopeng Li, Lei Zhang, "Intermodal Transportation Systems Risk Analysis and Resilience in New Madrid Seismic Zone: the Impact to Mississippi," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.
 - Altinakar, M.S., McGrath, M.Z., Ramalingam, V.P., and Uddin, W., "Numerical Modeling and Simulation of Extreme Flood Inundation to Assess Vulnerability of Transportation Infrastructure Assets," 3rd Annual University Transportation Centers Conference for the Southeastern Region, Birmingham, AL, March 26-27, 2015.

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:

- 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 Center
(<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 “Managerial Workforce Development and Economic Competitiveness” project URL for their leadership competency surveys are:
http://www.leadershipsuccesfactors.com/transport/csx_self.cfm
<http://www.leadershipsuccesfactors.com/uprr/>
- The “Optimizing the Mobility and Safety of Walk-and-Ride Systems” project website is:
<http://walkandrideoptimization.msstate.edu/>
- The assessment instruments available to industry from the “Factors Affecting Recruitment and Retention of the Intermodal Transportation Workforce: Inclusion, Advancement & Selection” project are at: <http://www.leadershipsuccesfactors.com/rtd/>
- The Safety Culture Survey for the “Effects of Safety Culture & Leadership on Accident Rates Among Transportation Workers” project is: <http://www.leadershipsuccesfactors.com/safety/>
- The “Intermodal Logistic System Network Design with Expedited Transportation Services” project website is: <http://biofuel.msstate.edu/>
- The URL for the Women in Transportation Survey is listed below:
https://www.surveymonkey.com/r/Women_In_Transportation
- Blog: <http://infrastructureglobal.com/> - *InfrastructureGlobal* is a blog site created by Dr. Uddin after the devastating floods of the Mississippi River basin in May 2011. Several posts are related to efficient mass transit and benefits of intermodal integration, and freight supply chain, as well as community and supply chain disruptions from floods. Twitter is very effective for outreach and for accessing the latest data and info on project related topics. Over 2,300 followers in 46 countries see tweets by @drwaheeduddin and many more see through retweets (RTs) and mentions from over 91 countries.
- <http://biofuel.msstate.edu/>
- <http://walkandrideoptimization.msstate.edu/>
- Webpage posting: http://www.cavse.msstate.edu/outreach/K12/STEP_MiddleSchool.php
- <http://esitac.biz.hamptonu.edu/> - the Eastern Seaboard Intermodal Transportation Applications Center (ESITAC) website.
- Blog: <http://infrastructureglobal.com/>
- Twitter: <https://twitter.com/drwaheeduddin> Started in 2012; several lists and “Global Infrastructure” timeline created; over 3,800 tweets.
- Twitter: <https://twitter.com/disasterglobal> Started in 2012 on topics of protection from natural disasters and managing infrastructure assets; over 2,200 tweets.
- Twitter: <https://twitter.com/InfrastructureG> Started in January 2014 to focus on built infrastructure and transportation assets; several lists on specific categories such as sustainable transportation.
 - Media Framing of Transportation Accidents: <http://www.tumblr.com/blog/mediaframing>

- SlideShare: Over 10,780 SlideShare views of all presentations. Recent SlideShare presentations, based on 2014 workshop presentations and 2015 TRB paper, were posted.
<http://slidesha.re/1CiiDnK>
- Another slide presentation was posted on “NCITEC Intermodal Transportation and Disaster Safeguard Research Projects at CAIT.” <https://www.slideshare.net/waheeduddin/uddin-caitncitecprojects11-oct2013slsh>
- The top viewed slide presentation (7,876 views in the last seven months) is “Mississippi Gulf Coast Rail Revival: NCITEC White Paper Background – CAIT”
<http://www.slideshare.net/waheeduddin/mississippi-gulf-coast-rail-revival-ncitec-white-paper-background-cait> and “Dr. Uddin/CAIT Infrastructure and Environment Research Areas” with 613 views.
- YouTube Videos: Over 1,690 views of project related seven YouTube videos were reported to date.
<http://youtu.be/8JjM2QEexFE>

2.3. Technologies or techniques:

- The project “Using a Typological Approach to Compare the Impact of Transit-Oriented Development on Travel Behavior in the United States” has developed a typology for assessing the development and use of land around transit facilities.
- The project “Factors Affecting Recruitment and Retention of the Intermodal Transportation Workforce: Inclusion, Advancement & Selection” has developed survey items and a tool for assessing inclusiveness and retention that can be used by industry and governmental agencies.
- The project “Disaster Protection of Transport Infrastructure and Mobility Using Flood Risk Modeling and Geospatial Visualization” has resulted in techniques for: geospatial planimetrics and mapping of built infrastructure assets using aerial imagery, geospatial mapping of floodplains using NCCHE’s two dimensional flood simulation models, and a simple to use approach to assess structural integrity of concrete girder bridges subject to extreme flood inundation
- The project “Integrated Intermodal Transportation Corridors for Economically Viable and Safe Global Supply Chain” has provided geospatial mapping of Mississippi River barge freight, inland surface transportation integration, and highway and rail networks in NAFTA countries
- The Driver Simulator at Hampton was used to conduct studies on distracted driving and Texting-While-Driving. The research team visited several schools in Hampton Roads and demonstrated the Driver Simulator application to high school students and staff.
- Several AE monitoring technologies including the Sensor Highway II AE monitoring equipment, a portable 1284 Wireless AE system, and a Pocket AE system are available to faculty and students at Hampton University.
- The SSI modeling procedure applied to the bridges in the “Predicting Erosion Impact on Highway and Railway Bridge Substructures” project is an extension of the technique developed by the Mullen (Univ. of Miss.). Explicit examination of the effect of local deterioration on deck level vibrations through SSI FE models is considered novel in the PI’s opinion.
- The “Intermodal Optimization for Economically Viable Integration of Surface and Waterborne Freight Transport” project provides geospatial mapping of commodity flow from and to states, the Mississippi River ports and barge freight data, and highway and rail networks in the Middle American states and Western states.

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

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

- The project “Safe and Competent Intermodal Transportation Workers” developed survey items and a tool for assessing the likelihood of having difficulty with shift work that can result in health problems or accidents.
- ACCESS Databases created for Intergraph’s GeoMediaPro geospatial software include: 2014 United States (including Alaska and Hawaii), US-Mexico-Canada, 2014 World, Buffer-Mississippi-River-States. (These databases include the 2010 population data of states and counties; highway and rail inventory maps of US-Canada, and Mexico; river port inventory maps and commodity maps for 2014 United States.)
- A web-based logistics analyzer tool was developed in the “Supply Chain and Inventory Management through Intermodal Logistics Analysis” project to help evaluate a portfolio of intermodal transportation requests for a given customer. A request is a single intermodal contract to move product from a supplier to a customer and the current evaluation method is primarily manual with each portfolio containing hundreds of requests. This tool evaluates all defined intermodal (truck and rail) routes to determine the intermodal combination that results in the route which delivers the lowest monetary cost. In addition, this system be utilized to help identify key transportation hubs that would be candidates for inventory holding locations to support the overall VMI system.
- In the project, “Predicting Erosion Impact on Highway and Railway Bridge Substructures,” photographic surveys of field geologic, site, scour, and structural conditions have been assembled for multiple bridge sites throughout the study region. This will provide a useful supplement to National Bridge Inventory and MDOT data collected during typical maintenance inspections.

3. Participants & Other Collaborating Organizations

3.1. What other organizations have been involved as partners?

Organization Name	Location	Partner’s Contribution to Project
Amalgamated Transportation Workers Union		Staff time
American Short Line Railroad Association	Washington DC	Collaboration on identification of work schedules at risk for safety issues
Center for Advanced Vehicular Systems Extension	Canton, MS	Financial support, facilities, and personnel exchanges
City of Starkville Transportation Committee and City Engineer	Starkville, MS	Consultation
Coast Transit Authority	Gulfport, MS	Provide evacuation data and support software testing
Colorado DOT	Denver, CO	Exploration of components of an effective safety culture.

Denver Regional Transportation District	Denver, CO	
DriveSquare, Inc.	Alexandria, VA	Provide technical support and help resolve issues
Hocim Inc.	Vicksburg, MS	Technical support and supplies
IAVO Research & Scientific	Durham, NC	Provided in-kind support via licenses of the GeoSPHERIC package that embeds a new version of the GeoGenesis® geospatial software
Industry Workforce Incumbents	Denver, CO	
Innovate Mississippi	Ridgeland, MS	Financial support, facilities, collaborative research and personnel exchanges.
Itawamba Community College	Fulton, MS	Financial support, facilities, collaborative research and personnel exchanges.
Louisiana Dept. of Transportation	Baton Rouge, LA	Collaborative research
Louisiana State Police Crime Lab	Baton Rouge, LA	Provide database of blood test results for analysis
Louisiana Transportation Research Center	Baton Rouge, LA	Financial support
Miller Intermodal Logistics	Ridgeland, MS	In-kind support, collaborative research and personnel exchanges
Mississippi Automated Resource Information System	Jackson, MS	Landsat imagery and DEM data sources of selected counties in Mississippi
Mississippi DOT – Bridges and Structures	Jackson, MS	Provide drawings and photos for the I-55/US-51 highway bridges on the Sardis site and updated geospatial database of all state maintained highways and bridges
Mississippi DOT – Planning Division	Jackson, MS	Access to overlapping aerial imagery scenes
Mississippi DOT – Roadway Design Division	Jackson, MS	Financial support and providing expertise and data. Provided aerial imagery, superstructure and foundation design drawings and soil data for selected bridges.
Mistras Group, Inc.	Princeton Jct, NJ	Acoustic emissions equipment, consulting, and training
Norfolk Southern	Atlanta, GA	Provide data
Population Research Institute	State College, PA	Equipment, software, and facilities.
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
St. Louis Metro Transit	St. Louis, MO	In-kind support, collaborative research, facilities, and personnel exchanges
TenCate	Dayton, TN	Technical support and supplies
Univ. of Tennessee	Knoxville, TN	Provide help with modeling
Union Pacific Railroad	USA	Staff time

University of Arizona	Tucson, AZ	Providing expertise and data support, collaborative research, and personnel exchanges
University of Southern Mississippi	Hattiesburg, MS	Financial support, facilities, collaborative research and personnel exchanges.
US Army ERDC Hydraulics Lab	Vicksburg, MS	Support
Virginia DOT	Richmond, VA	Coordination, support, expertise, and data

3.2. Have other collaborators or contacts been involved?

- Association of State Dam Safety Officials (ASDSO)
- Burlington Northern Railroad
- Center for Logistics Trade and Transportation, University of Southern Mississippi
- Denver Regional Council of Governments
- Department of Homeland Security – Science and Technology Directorate
- Director of Parking and Transit at Mississippi State University
- Dr. Mustafa Altinakar of UM’s National Center of Computational Hydroscience
- Franklin Furniture Institute; Starkville, MS
- IAVO Research & Scientific (Durham, North Carolina)
- International Cybernetics Corporation, Tampa, Florida (UM Consultant Dr. Robert Smith facilitated this collaboration on field testing to evaluate pavement/tire interaction, 2013.)
- Itawamba Community College, Belden, MS
- John Robert Smith - president and CEO of Reconnecting America, Former mayor of Meridian, MS. www.reconnectingamerica.org
- Maritime Information Systems, Inc., Warren, Rhode Island (Mr. Karl Y. Petrow of MIS) - access to their extensive online data related to vessel movements. This company operates a large scale Automatic Information System (AIS) network to track vessel movements in all Navigable North American Waterways.
- Memphis Urban Area Municipal Planning Organization
- Miller Transporters, Inc.
- Mississippi Department of Marine Resources
- Mississippi Emergency Management Agency
- Mississippi Trucking Association; Jackson, MS
- Northeast Mississippi Community College; Fulton, MS
- Port of Fulton - Fulton, MS
- Quality Transportation Services in Mechanicsville, VA provide collaborative research and personnel exchanges.
- Southern Rural Development Center; Starkville, MS
- Starkville, MS City Engineer
- Three Rivers Planning and Development District Yellow Creek, MS
- Transit Cooperative Research Program (TCRP) of the National Academies/TRB, Washington DC.
- US Army Corps of Engineers (USACoE) – project related data
- US Army ERDC Hydraulics Lab, Vicksburg, Mississippi (Dr. Kenneth Ned Mitchell)
- US Army Research Office (ARO)
- USDA Agricultural Research Service (ARS)

4. Impact

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

- The project “Effects of Safety Culture & Leadership on Accident Rates Among Transportation Workers” has begun to have impact as other agencies have begun using the instrument, specifically, the MBTA operated by Keolis.
- It is expected that the research accomplishments of the “Disaster Protection of Transport Infrastructure and Mobility Using Flood Risk Modeling and Geospatial Visualization” project will lead to specialized transportation course and disaster mitigation and safeguard courses, as well as trained geospatial workforce.
- The “Macro-level Intermodal Capacity Modeling” project defines intermodal capacity models and relationship functions between transportation volume and travel time (or speed) at the macro level that can be used in intermodal transportation management and planning. At the operational level, they can be used to efficiently guide congested traffic to alternative routes and other transportation modes that have extra capacity.
- The modeling approach demonstrated in the “Assessing Sustainability Effect of Infrastructure Transportation Projects Using Systems-Based Analytic Framework” project provides an optimization approach that allows transportation infrastructure managers to predict which intersections will be key concerns in managing the flow of traffic during a variety of conditions (e.g., accidents, construction, congesting events). This grid-based network analysis approach is objective and provides clear identification of critical infrastructure zones.
- The findings of the “Economic and Demographic Impacts of Passenger Rail Systems” research project will be used to fill the gap in transportation geography and sociology of transportation by studying the economic and demographic impacts of passenger rail systems. The economic and demographic impacts of highways, airways, and public transportation have been studied in several disciplines, resulting in an assortment of theoretical and empirical studies. However, little work has been undertaken to study the economic and demographic impacts of passenger rail systems, especially in the U.S. To the best knowledge of the PI, no existing studies have examined intermodal passenger transportation accessibility as provided by passenger rails, highways, and airways as well as their collective impacts on the economy and population change.
- The “A Real-time Online Decision Support System for Intermodal Passenger Travel” project creates an Intermodal Passenger Travel Decision Support System that can provide fruitful data support for intermodal passenger travel decision making.
- The “Effective Utilization of Innovation Techniques within Mississippi’s Intermodal Professional Workforce” project recommends how to better utilize the Tenn-Tom Waterway for transportation of bulky and oversized/ overweight/over dimensional goods that do not move well by road, air or rail. Additionally, with the better utilization of barge traffic comes increased employment opportunities for those that cater to transportation, port access, support services, and business development along the Tenn-Tom Waterway.
- The “Intermodal Logistic System Network Design with Expedited Transportation Services” project offers an integrated methodological framework that takes advantage of optional expedited transportation services and addresses decision components in both planning and operational stages simultaneously. This framework bridges the gap between planning models of network logistics systems and operational models of multimodal transportation configuration and inventory management decisions in the logistics system design literature. It enables logistics planners to ponder all the involved critical decisions in an integrated manner and design a system that performs

more reliably and runs at a lower cost compared to traditional results. The resultant model framework can efficiently and accurately solve an integrated logistics system design problem, and the optimal design solution can balance all cost components (including initial investment, regular and expedited transportation cost, and inventory management cost) and thus yields a minimum expected net cost.

- Results of the “Optimizing the Mobility and Safety of Walk-and-Ride Systems” project will allow intermodal infrastructure network planning for a community to be planned in an integrated and holistic manner. Promote safety in infrastructure network planning. Model formulation provides a methodological framework to model multi-modal networks into a unifying form.
- The largest potential impact of the “Sustainably Enhancing Intermodal Freight Operation of Ports using Geotextile Tubes” project is to assist ports in transitioning their operations to the larger ships and freight quantities from the Panama Canal expansion. Geotextile tubes have been used at ports in the past, though the manners being described in this project are somewhat unique in that they plan to simultaneously incorporate several potentially beneficially items together.
- New CAIT graduate and undergraduate student workers were trained for data analysis, geospatial analysis, and transportation demand modeling research. The contents of Transportation and Geospatial course are enhanced using the NCITEC project products.
- The contents of geospatial courses CE495 and ENGR597 courses, taught by Dr. Uddin in Spring 2015, were updated using NCITEC project work.
- Research results will be incorporated in the following existing courses at UM: CE 481 – Transportation Engineering I course (3 credit hours), CE 570 – Infrastructure Management course (3 credit hours), CE 590 – Airport Planning and Design, and ENGR 692 Section 2 – Numerical Methods and Optimization and Nonlinear Time Series Modeling in the department of Civil engineering. Dr. Uddin offered ENGR 692 in Spring 2015 and will be teaching CE 590 this Fall 2015.
- The project “Increasing recruitment and retention of women in the transportation industry” has resulted in the development of an instrument for the assessment of women’s interests in and attraction to the transportation industry.
- The project “Workforce Productivity: Schedules, Fatigue, & Health” has provided insight into the relationship between works schedules, fatigue, health and productivity in women transportation workers. By estimating these relationships managers and executives will be able to make more informed decisions about the productivity and costs associated with various work practices and policies. Second, the research identifies various factors related to work schedules which need to be monitored and observed.
- The intermodal simulation model from the “A Simulation Model for Intermodal Freight Transportation in the State of Louisiana” project is expected to have a significant impact on freight network planning and improvement, especially on project selection and prioritization and on demonstration the benefits of investment. The model will help to compare intermodal designs and improvement projects and select ones with best benefit-cost ratios.

4.2. What is the impact on other disciplines?

- The results from the “Disaster Protection of Transport Infrastructure and Mobility Using Flood Risk Modeling and Geospatial Visualization” project will be introduced in the computational hydroscience graduate program courses offered by Dr. Altinakar at UM.
- Projects at Hampton University
- The project “Economic and Demographic Impacts of Passenger Rail Systems” contributes to the field of transportation planning. It is important to study the impact of passenger rails because there is an

increasing debate over whether passenger rails, rail transit, and high-speed trains should be expanded or built in the U.S. It is also important to study them within the context of passenger intermodal transportation because intermodal systems have become increasingly important for transportation performance and efficiency, and planning practices are focusing more attention on intermodal systems as a whole rather than any single mode of transportation.

- The “Optimizing the Mobility and Safety of Walk-and-Ride Systems” project developments can potentially be used to analyze social and environmental impacts of community multimodal transportation infrastructure.
- The “Sustainably Enhancing Intermodal Freight Operation of Ports using Geotextile Tubes” project is investigating use of geotextile tubes to enhance intermodal freight operation of ports. Geotextile tubes enable beneficial re-use of degraded materials and in addition to positive technical impacts to the principle discipline, the project can lead to several environmental and economic impacts. This can also lead to a more sustainable solution where the structure built with geotextile tubes is in harmony with natural landscape.
- The “Assessing Sustainability Effect of Infrastructure Transportation Projects Using Systems-Based Analytic Framework” project demonstrates the applicability of a sociological networking construct to physical systems.
- Dr. Uddin has interacted with:
 - Dr. Mustafa Altınakar of the UM’s National Center of Computational Hydroscience who is collaborating on the flood modeling project.
 - UM’s Department of Public Policy Leadership through Dr. Jody Holland’s participation in the UM supply chain project team. As a result, Dr. Holland prepared the content of a new transportation related course in his department.
 - Dr. Tyrus McCarty of UM’s Mechanical Engineering Department who is PI of NCITEC project on harnessing energy from traffic.
 - Dr. Kristen Swain of UM’s Journalism Department who is risk framing transportation toxic spills in news media.
 - A YouTube video by Mason Herman (Public Policy/Journalism UG student), “Dr. Uddin Interview on Transportation and Air Quality Mitigation,” April 30, 2014. <http://youtu.be/ulcvqaOHVc4>
- Students in the Journalism department at the University of Mississippi often contact Dr. Uddin for their video projects on sustainability related topics for George Washington University’s Planet Forward web site every year. This is a part of the on-going collaboration of Dr. Uddin with another NCITEC project PI, Dr. Kristen Swain. Dr. Uddin discusses with potential journalism students the findings and significance of their project so that sustainable intermodal transportation integration topics can become one of their projects. Lakyn Birks, a journalism student, interviewed Dr. Uddin on November 18, 2014 on the topic of “Why trees on the University Campus are important to promote sustainability”. Ms. Birks posted her (planet forward) sustainability video assignment “Tree Recovery Sustainability video” on YouTube: <http://youtu.be/Qu48hmwUq20>

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

- Associated with each project is the support and training of graduate students who have gained experience that will make them valuable assets for work in the transportation industry.
- A new graduate course at MSU, Advanced Transit Operations and Planning, will be the directly resulted from this research project. As well, some of our project results will be shared in the undergraduate/graduate courses, CE 3113/4143/6143-Traffic Engineering, CE 8133-ITS and Traffic Control Systems.

- The materials from the Real-Time Transit Vehicle Routing Optimization in Intermodal Emergency Evacuations project will help students obtain the skills and experiences of state-of-the-art transit planning and operation practice.
- The survey from the project “Safe and Competent Intermodal Transportation Workers” has resulted in stakeholders using the instrument to look at a number of ways to improve selection and retention.
- Many of the projects across the participating university improved the performance, skills, or attitudes of members of underrepresented groups that will improve their access to or retention in transportation research, teaching, or other related professions
- The “Acoustic Emission Safety Monitoring of Intermodal Transportation Infrastructure” project provided student education and training on the use of acoustic emission devices in both the laboratory and field, and has helped to build a foundation for its use in transportation related courses within the department.
- The projects at University of Mississippi have had significant impacts on transportation workforce development. For example, the project:
 - Provided opportunities to both undergraduate and graduate students, other participating specialists for research in transportation management of commodities, supply chain logistics, intermodal network optimization, geospatial visualization, and related disciplines.
 - Enhanced intermodal transportation education by providing project related assignments for various courses at UM.
 - One M.S. student completed his graduating research report by using his geospatial and CO² prediction results accomplished in passenger train and freight mobility projects. He implemented the research framework for his own country, Indonesia, by analyzing traffic related emissions and impacts of the loss of tropical forest cover on CO₂ production.
 - Improved the performance and modern computer modeling and visualization skills of main stream professionals and members of underrepresented groups (minority students) that will improve their access to, or retention in, transportation research, teaching, supply chain management, or other related professions.
 - Developed and disseminated new educational/training materials and provided exposure to transportation, science and technology for practitioners, public works professionals, teachers, young people, media, supply chain stakeholders, and general public. This has been accomplished through geospatial workforce training in the teaching lab, classroom, tweets, YouTube videos, and SlideShare presentations, as listed in section 2.2.
 - Involved both undergraduate and graduate students of the student chapter of Institute of Transportation Engineers (ITE) in project activities. A major goal to support undergraduate students is to motivate them to pursue graduate studies in transportation systems and professional careers in transportation engineering discipline.
- The Eastern Seaboard Intermodal Transportation Applications Center (ESITAC) located in Hampton Roads utilized resources of the University in partnership with state and city governments, local transit companies, private industries, and regional universities to conduct research on current transportation problems facing this Region, and provide students with special emphasis on minorities and women, the opportunities to pursue transportation careers.
- A new course “Spatial Analysis of Social Data” grew out of the project “Economic and Demographic Impacts of Passenger Rail Systems.” Transportation is one element of this course as transportation plays an important role in spatial dynamics of social phenomena.

- The “A Real-time Online Decision Support System for Intermodal Passenger Travel” project will provide engineering students with training in data analytics and help them understand the advantage of green transportation, e.g. transit.
- The “Increasing recruitment and retention of women in the transportation industry” project will add to the understanding of how women are interested in the transportation industry and what types of factors should be considered when attempting to recruit or attract them.

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

- The “Real-Time Transit Vehicle Routing Optimization in Intermodal Emergency Evacuations” project will provide a web-based tools that will be maintained by the Transportation Lab in the CE department at MSU.
- Physical infrastructure resources at UM: Computing facilities, geospatial laboratory, geospatial software, and transportation corridor/traffic flow simulation capabilities. Additionally, 8 new computer workstations and visualization equipment were procured using project funds and installed in CAIT Transportation Modeling & Visualization Laboratory in UM Jackson Center after approval by the DOT RITA sponsors. These facilities are used by project staff and graduate students.
- The Mississippi DOT’s Intelligent Transportation System (ITS) section is collaborating with the University of Mississippi to provide traffic video display wall and extend the fiberoptic backbone to JAC building and CAIT Transportation Modeling & Visualization Laboratory facility in order to establish a model ITS lab. This will permit monitoring real-time traffic flow on roads and barge under bridges over the Mississippi River. The lab will be used for real-time traffic data collection and flow attributes for use in this project and teaching UG and graduate students.
- The “Acoustic Emission Safety Monitoring of Intermodal Transportation Infrastructure” project helped to enhance the Hampton University Department of Engineering’s research, education, and training facilities with respect to the acoustic emissions (AE) technology. Several AE monitoring systems including Sensor Highway II, a portable 1284 Wireless AE system, and a Pocket AE system are now available at the university.
- Project purchases associated with “Detecting Weakened Highway and Railroad Bridge Substructures at Deck Level” included vibration testing commodities and a five-volume state-of-the-art reference book on bridge design, monitoring, and construction which are being used by the research team to complete the scope of work of the project.
- The purchase of Bluetooth Probe Detection System for the “Travel Time Estimation Using Bluetooth” project will add significantly to the existing instrument inventory and will likely lead to new studies that will open new fields of interdisciplinary research.

4.5. What is the impact on technology transfer?

- The “Real-Time Transit Vehicle Routing Optimization in Intermodal Emergency Evacuations” project will provide a web-based tools that will be maintained by the Transportation Lab in the CE department at MSU and can be used by any approved entity to schedule public transit routes for use in emergency evacuations. Once a user approved route schedule is planned, it can be sent directly to computers onboard the transit vehicles.
- The “Disaster Protection of Transport Infrastructure and Mobility Using Flood Risk Modeling and Geospatial Visualization” project had made positive impacts on technology transfer to students and transportation workforce, as well as public use, including:

- Transfer of flood risk maps and decision support system framework for disaster vulnerability reduction to local and state government agencies for enhancing flood related emergency management.
- Collaboration with geospatial industry and other stakeholders for enhancing modeling of built infrastructure and offer added value of flood disaster visualization.
- Presentation of research results at conferences and workshop and participation in other conferences will be used for government and industry outreach, implementation in practice, and future training courses for interested agencies and consulting service providers.
- The capacity models and findings for the “Macro-level Intermodal Capacity Modeling” project will be shared with transportation companies and local transportation agencies in Tennessee and Virginia.
- The major targeted audience of the “A Simulation Model for Intermodal Freight Transportation in the State of Louisiana” project is State DOTs, who are expected to use the developed simulation to evaluate their freight network and select network improvement projects. The simulation model will also be a good tool to demonstrate the benefits of investment on freight management. The results could also benefit USDOT for transportation planning and promotion of intermodal solutions.
- UM will share freight corridor spatial maps, related decision support system methodologies, and intermodal integration strategies to local and state government transportation and public works agencies. The implementation of these research products will result in more efficient, safer, less polluting, economically competitive, and sustainable freight corridors.
- From the “Intermodal Optimization for Economically Viable Integration of Surface and Waterborne Freight Transport” project intermodal freight corridor case studies will be used to develop a “best practice guide” for consideration by government transportation agencies, private transport operators, and all other stakeholders.
- From the “Restoration of Gulf Coast Passenger Rail Service for Sustainable and Economically Efficient Intermodal Corridor Integration” project will come a guide that incorporates all economic costs and benefits, traffic flow models, and LCA methodology. It will have default data from the rail corridor study. The practice guide and white paper will be shared with interested transportation agencies and city planners.
- The technology developed with the survey instrument for the “Workforce Productivity: Schedules, Fatigue, & Health” project may be of value to other transportation agencies.

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

- The “Real-Time Transit Vehicle Routing Optimization in Intermodal Emergency Evacuations” project can result in fewer fatalities during the next emergency evacuation. If the proposed service is used properly, the carless residents of large cities, such as New Orleans, will not be left stranded in their homes. Rather, the pertinent information of all residents in need of assistance during an evacuation will be maintained in a database, and evacuation routes will be developed for use by public transit vehicles that ensure these residents have the option to evacuate.
- The development of the survey instrument in the project “Safe and Competent Intermodal Transportation Workers” contributes to the improvement of safety across all of society not just transportation. Increasing awareness of the role of safety and the encouragement of a safety culture extends beyond just intermodal transportation and into the entire fabric of a modern mechanized society.
- The project “Using a Typological Approach to Compare the Impact of Transit-Oriented Development on Travel Behavior in the United States” demonstrates the usefulness of a typological approach to

the assessment of Transit Oriented development (TOD) planning and projects. In addition, it will continue to play a role in understanding ways to enhance economic growth and development.

- The development of a survey instrument in the project “Factors Affecting Recruitment and Retention of the Intermodal Transportation Workforce: Inclusion, Advancement & Selection” increases awareness of inclusion and diversity within intermodal transportation and offers a standard measure of inclusiveness managers will be able to manage more effectively.
- The “Disaster Protection of Transport Infrastructure and Mobility Using Flood Risk Modeling and Geospatial Visualization” project provides visualization products that enhance public understanding of flood disaster, prevention, and mitigation.
- The Integrated Intermodal Transportation Corridors for Economically Viable and Safe Global Supply Chain” project will enhance public understanding of supply chain transport impacts on urban communities and the environment through visualization products which are easy to understand and communicate with government stakeholders, businesses, media, and general public. For this project:
 - the developed approaches can be implemented for supply chain infrastructure, intermodal corridor integration, and logistics, and traffic demand management.
 - the geospatial products can be used for landuse planning, traffic flow control policies, and pavement safety evaluation for roads, airports, intermodal pavements, container parking, and ports.
 - the developed methodologies and web-based social networking tools can be used to build better public understanding of sustainable supply chain management and reduce degrading effects on the environment and communities
 - new approaches are offered for financing resources for infrastructure investments to reduce severe backlogs due to inadequate federal and state funds.
- The “Acoustic Emission Safety Monitoring of Intermodal Transportation Infrastructure” research study 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 a 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 U.S. D.O.T.
- The broader impacts of the “Economic and Demographic Impacts of Passenger Rail Systems” project include 1) involvement of various stakeholders of the potential New Orleans-Orlando Corridor (NOOC), 2) outreach of restoring the NOOC in relation to community livability and environmental sustainability, and 3) recommendation of strategies for optimizing intermodal transportation systems to better facilitate passenger travel and proposed resilience enhancement strategies, especially for evacuation purposes and providing relief services after disasters.
- The “Sustainably Enhancing Intermodal Freight Operation of Ports using Geotextile Tubes” project compares sustainability aspects of using geotextile tubes in ports versus other conventional structures, as appropriate. The use of geotextile tubes allows a beneficial re-use of soils dredged from nearby areas. Utilizing nearby resources will improve harmony between the man-made structure and natural landscape.
- The developed decision tool from the “A Real-time Online Decision Support System for Intermodal Passenger Travel” project will help passengers reduce travel time and cost, and to also improve the utilization of public transportation and environment sustainability.
- The “Increasing recruitment and retention of women in the transportation industry” and “Workforce Productivity: Schedules, Fatigue, & Health” projects point out the need to address the attractiveness of transportation jobs for women. Most women are looking for slightly different

types of interests, values and rewards. There will be a need to adjust the characteristics to be a better fit with the interests and values of women.

- The “Drugged Driving in Louisiana” study will provide insight into associations between drugged drivers and the history of unsafe behavior including DUI arrests and speeding.
- Results from the “Travel Time Estimation Using Bluetooth” project could potentially change route choice behavior. If the public have advance knowledge of congestion hot spots then they could use that information to adjust their route’s in real time and potentially save time that otherwise would be lost in traveling through congested corridors.

5. Changes/Problems

5.1. Changes in approach and reasons for change:

- For the project “Intermodal Transportation Systems Risk Analysis and Resilience in New Madrid Seismic Zone: the Impact to Mississippi” the scope had to be reduced to 3 counties to make the problem size manageable.

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

- Many of the project have been “no-cost” extended to December 31, 2015 due to various research delay issues.
- The PIs on two separate projects changed universities resulting in delays.

5.3. Changes that have a significant impact on expenditures:

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

6. Special Reporting Requirements