

# 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)

**Program Director (PD) Name, Title and Contact Information (e-mail address and phone number):**

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**Recipient Organization (Name and Address):** U.S. Department of Transportation  
Research and Innovative Technology Administration  
(Denise Dunn, UTC Grant Administrator)  
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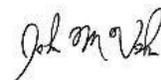
**Recipient Identifying Number or Account Number, if any:** 363277-061300-021000

**Project/Grant Period (Start Date, End Date):** 1/1/2012 – 6/30/2016

**Reporting Period End Date:** December 31, 2015

**Report Term or Frequency (annual, semi-annual, quarterly, other):** Semi-annual, PPR8

**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 several of the 2013 projects have submitted final reports as well. The remaining projects will be completing their work by June 30 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:*
  - 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.

- The “Development of a Highway Safety Fundamental Course” project provides a complete teaching packet with course materials for use with undergraduate and graduate students.
  
- *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. Uddin presented project overview and examples of on-going work to the visiting university delegations during their scheduled visits to the CAIT Transportation Modeling & Visualization Lab in UM Jackson Ave Center (JAC).
  - Section 2.2 provides a list of website 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 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 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:* NCITEC Director is participating on the planning committee for the 2016 UTC Conference for the Southeastern Region that will be hosted by University of Tennessee-Knoxville on behalf of the Southern Transportation Center (STC).

### **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 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):**

- Keynote speeches:
  - Sharma: Invited keynote speaker, International Conference on Agile Manufacturing, Sultanpur, UP, India, December 27-28, 2015.
  - Uddin, W. (2015). Flood Modeling & 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 14 – 16, 2015. [www.cbrcrbrasvias.com.br](http://www.cbrcrbrasvias.com.br) and [www.abcr.org.br](http://www.abcr.org.br)
- 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>
- Journal papers (published)
  - Shu Yang\*, Yao-Jan Wu, Bernadette Marion, and Isaac Moses (2015). Identification of Transit Farebox Data Errors: Impacts on Transit Planning. *Public Transport*, pp. 1-17.

- H. Li, M. Jin, R. Song, S. He, and J. Song, "Dynamic Railcar Connection Planning in Classification Yards," Accepted by Transportation Letters, The International Journal of Transportation Research, DOI: <http://dx.doi.org/10.1179/1942787515Y.0000000010>, 2015.
- H. Li, M. Jin, and S. He "Sequencing and Scheduling in Railway Classification Yards," Transportation Research Record, Journal of Transportation Research Board, Volume 2475, pp. 72-80, 2015.
- M. Jin and A. Yu, "Procurement Auctions and Supply Chain Performance," International Journal of Production Economics, 162, pp. 192-200, 2015.
- A.A. Khaled, M. Jin, D. Clarke, and M.A. Hoque, "Train Design and Routing Optimization for Evaluating Criticality of Freight Railroad Infrastructures," Transportation Research B, 71 (1) pp. 71-84, 2015.
- M. Roni, M. Jin, and S. Ekisoglu, "A Hybrid Inventory Management System Responding to Regular Demand and Surge Demand," OMEGA: The International Journal of Management Science, 52, pp. 190-200, 2015.
- Journal papers (submitted)
  - Bazne, M. O. A., Vahedifard, F., Howard, I. L., (in preparation). "Effects of Light Cement Stabilization on Properties of Fine Grained Dredged Soils." To be submitted to the Journal of Geotechnical and Geoenvironmental Engineering, ASCE (to be submitted January, 2016).
  - Rashidi, E., Medal, H., Parsafard, M., and X. Li (2015). A Mixed-Integer Bi-level Programming Model for Optimizing Traffic Calming in a Multi-Modal Transportation Network. Tech. rep. Starkville, MS: Mississippi State University. Submitted to Transportation Research Part E.
  - Yang Chen\*, Shu Yang\*, Mengqi Hu and Yao-Jan Wu, A Reliability-based Transit Trip Planning Model under Transit Network Uncertainty. Submitted to Public Transport.
  - Cui, J., Zhao, M., Parsafard, M. and Li, X. "Reliable Supply Chain Design with Expedited Shipment Service under Multiple Risk-Mitigation Strategies." Submitted to Transportation Research Part E
  - 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, accepted under minor revision.
- Conference Papers
  - Maheshwari, Sharad K. & D'Souza Kelwyn A. Impact of Education And Awareness Programs on The Usage And Attitude Towards Texting While Driving Among Young Drivers. Presented in Fall International Allied Academies Conference, Oct 2015, Las Vegas, NV.
  - 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.
  - P. Kelle, M. Jin, and C. Claypool, "Improving Performance Measures by Intermodal Freight Transportation Development", ISIR workshop on "Sustainable Logistics and Supply Chain Management", Lyon, France, October 2015.
- Presentations
  - Li, X., Zhao, M., Cui, J., and Parsafard, M. "Reliable Supply Chain Design with Expedited Shipment Service." Presented at the INFORMS Annual Meeting, Philadelphia, November 2015.
  - Li, X., Cui, J., Ghiasi, A., Ma, J. and Zhou, F. "A Continuum Approximation Model for Electric Vehicle Sharing." Presented at the INFORMS Annual Meeting, Philadelphia, November 2015.
  - Branch, V. 2015 – STEP Engineering/Robotics for Middle School - Entergy Community Foundation, Oct 5., Jackson, MS. (Contains a component dedicated to transportation education)
  - Kasu, Bishal and Guangqing Chi. 2015. "The Impact of Passenger Rails on Population and Employment Change in the United States, 2000-2010." Presented at the annual meeting of the Rural Sociology Society, August 6–9, 2015, Madison, WI.

- 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](http://www.cbrbrasvias.com.br) [www.abcr.org.br](http://www.abcr.org.br)
- 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.
- Chris Mullen (presenter), Kim Tanner and Amir Irhayyim, “3D FE simulation of aging bridges on soil and rock foundations,” Simulia South Regional Users Meeting, Houston, TX, October 15, 2015
- Swain, K.A., “*News Blackout and Social Media Invisibility after Toxic Transportation Spills,*” National Public Health Information Coalition’s National Conference on Health Communication, Marketing and Media in Atlanta in August 2015.
- W. Uddin, S. Cobb, T. McCarty, and J. Sharma, “Environmental and Energy Concerns for Life Cycle Analysis of Transportation Systems, International Symposium on Systematic Approaches to Environmental Sustainability in Transportation”, August 2-5, 2015, Fairbanks, Alaska. ASCE Special Publication pp. 227-240, August 2015.
- Ishak, S., “BR Video Calibration,” GRITS Fall Workshop, McNeese State University, SEED Center, Lake Charles, LA. November 12, 2015

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

All products will be published on NCITEC’s web site ([www.ncitec.msstate.edu](http://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](http://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 “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/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.leadershipsuccessfactors.com/rtd/>
- The Safety Culture Survey for the “Effects of Safety Culture & Leadership on Accident Rates Among Transportation Workers” project is: <http://www.leadershipsuccessfactors.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](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://www.cavse.msstate.edu/outreach/K12/STEP_MiddleSchool.php)
- 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> - This website will highlight key findings from the social media and news media and link to relevant news stories and social media posts.
- SlideShare: Over 13,960 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 5,000 views of project related nine YouTube videos were reported to date. <http://youtu.be/8JjM2QEexFE>
- The top viewed slide presentation (10,526 views in the last one year) 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 738 views.

### **2.3. Technologies or techniques:**

- 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.
- 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. In addition, a technique to examine changes in regional growth patterns over time has been created.
- 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 “A Real-time Online Decision Support System for Intermodal Passenger Travel” project created a custom computer program that automatically reads and saves GTFS data. A Python based decision support tool was developed to assist passengers for the intermodal travel decision. A database schema is developed in MS SQL Server to store the information of static and dynamic transit schedules and transit performance measures. The database could be shared and accessed by authorized users. A Python based decision tool prototype is developed.
- The “Predicting Erosion Impact on Highway and Railway Bridge Substructures” project created some ABAQUS CAE tutorials describing the step-by-step construction of one of the bridge FE models was developed for use in classes.
- The project “Risk framing of U.S. intermodal transportation toxic spills in news and social media” developed a way to measure and correlate the social media presence of transportation companies with the characteristics of the transportation incidents they were involved in. This method will be shared via a future refereed journal article or conference paper.
- 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 at selected ports.

### **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**

- The project “Integrated Intermodal Transportation Corridors for Economically Viable and Safe Global Supply Chain” has created ACCESS databases using Intergraph’s GeoMediaPro geospatial software but it can be exported to other geospatial/GIS programs:
  - 2014 United States All (including Alaska and Hawaii)
  - 2013 Buffer of Mississippi-River-States
  - 2014 Gulf Coast commuter rail alignments
  - US-Mexico-Canada Geospatial database of NAFTA transportation networks
  - 2014 Word spatial map (includes Tibet and new countries of Timor and South Sudan)
  - 2015 Brazil and South America Buffer

These databases include the 2010 population data of states and counties; highway and rail inventory maps of US-Canada- Mexico, NAFTA corridors, and Brazil’s map of Amazon forest region and two major commercial areas of Rio de Janeiro and Sao Paulo state.
- 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.
- The project “A Simulation Model for Intermodal Freight Transportation in the State of Louisiana” has produced a simulation program system using the Arena simulation package. The program works for the Louisiana multimodal transportation network but it can be adopted to other state networks.

**3. Participants & Other Collaborating Organizations**

**3.1. What other organizations have been involved as partners?**

| <b>Organization Name</b>                        | <b>Location</b> | <b>Partner’s Contribution to Project</b>                                    |
|---|-----------------|---|
| Amalgamated Transportation Workers Union        | National        | 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                      |
| 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   |   |
| Denver Transportation Club               | Denver, CO   | Staff time  |
| DriveSquare, Inc.                        | Alexandria, VA   | Provide technical support and help resolve issues                                     |
| 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 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  |
| 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      |
| Salem State University                   | Salem, MA  | Staff time  |
| St. Louis Metro Transit                  | St. Louis, MO  | In-kind support, collaborative research, facilities, and personnel exchanges          |
| TenCate                                  | Dayton, TN   | Technical support and supplies  |
| Union Pacific Railroad                   | Omaha, NE<br>Houston, TX                                       | 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 Corp of Eng.                     | Vicksburg,<br>Memphis,<br>Mobile, New Orleans,<br>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
- American Public Transportation Association (APTA)
- Biloxi Port, Biloxi, MS
- Brookhaven High School, Brookhaven, MS
- Burlington Northern Railroad
- Camden Elementary School, Camden, MS
- Center for Logistics Trade and Transportation, University of Southern Mississippi
- Colorado Rail Partnership, Denver, CO
- Denver Regional Council of Governments, Denver, CO
- East Flora Middle School, East Flora, MS
- Federal Highway Administration (FHWA)
- Franklin Furniture Institute; Starkville, MS
- Goodloe Elementary School, Canton, MS
- Gulf Coast Transit Authority, Biloxi, MS
- Gulfport Port, Gulfport, MS
- Hocim, Inc.
- Huey Porter Middle School, Canton, MS
- Itawamba Community College, Belden, MS
- John Robert Smith - president and CEO of Reconnecting America, Former mayor of Meridian, MS.  
[www.reconnectingamerica.org](http://www.reconnectingamerica.org)
- Lego Education, Pittsburg, KS
- 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.
- Mineta Transportation Institute, San Jose, CA
- Mississippi Trucking Association; Jackson, MS
- National Association of Railroad Passengers (NARP)
- Nissan Motors, Canton, MS
- Northeast Mississippi Community College; Fulton, MS
- Oxford-University Transit service, Oxford, MS
- Port of Fulton - Fulton, MS
- Portland State University, Portland, OR
- Puget Sound Regional Council, Seattle, WA
- TenCate Corp.
- 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

## 4. Impact

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

- The project “Harvesting Vibrational Energy Due to Intermodal Transport Systems Via Nano Coated Piezo Electric Devices” demonstrated that the power output of the traditional PZT can be significantly increased by enhancing the PZT piezoelectric material with the addition of a special nano coating.
- The research of the “Development of an Optimal Ramp Metering Control Strategy for I-12” project advanced the knowledge in the area of adaptive traffic control strategies. The comparative analysis between various ramp metering algorithms revealed the advantages and disadvantages of each strategy and the traffic condition boundaries in which each strategy yields best performance.
- The project “Effects of Safety Culture & Leadership on Accident Rates Among Transportation Workers” has had an impact as other agencies have begun using the instrument, specifically, the MBTA operated by Keolis.
- 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 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 beneficial items together.
- 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.
- The recommendations from the “Traffic Counting Using Existing Video Detection Cameras” project are likely to impact on how traffic counts are undertaken in the city of Baton Rouge, with potential implications to the entire state. The project recommended a more readily available means of data collection which will save costs and time needed to collect traffic counts the traditional way.
- The “Drugged Driving in Louisiana” study provides a baseline of the state of knowledge regarding drugged driving in the US in general and the state of testing in Louisiana specifically. Specifically, the Louisiana Safety Coalition has an Impaired Driving Emphasis area and uses the information to develop plans for impaired driving, changes in law, enforcement and education.

#### **4.2. What is the impact on other disciplines?**

- 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 “Student Technology Exchange Program (STEP) for Engineering/Robotics in Middle School Students” project introduced middle school students to intermodal transportation logistics and engaged them in problem solving activities.
- As a part of the “Intermodal Optimization for Economically Viable Integration of Surface and Waterborne Freight Transport” project, Dr. Uddin has interacted with:
  - Dr. Mustafa Altinakar 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 previous YouTube video by Mason Herman (Public Policy/Journalism UG student) interview of Dr. Uddin on the topic “Transportation and Air Quality Mitigation” was updated Nov. 2015 and is now incorporated in a new YouTube presentation. <https://youtu.be/wCJQiXaV3gc>

#### **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.
- 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
- A new graduate course at MSU, Advanced Transit Operations and Planning, was created 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 survey from the project “Safe and Competent Intermodal Transportation Workers” resulted in stakeholders using the instrument to look at a number of ways to improve selection and retention. As well, one railroad company has adopted the use of the instrument.
- 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 project “Restoration of Gulf Coast Passenger Rail Service for Sustainable and Economically Efficient Intermodal Corridor Integration” provided the opportunity for two Brazilian exchange students to intern in the CAIT Transportation Laboratory and for two Mexican students to receive training in data processing and visualization during July-August 2015.
- 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, Seth Cobb, completed his M.S. thesis (July 2015) using his geospatial and CO<sup>2</sup> prediction results accomplished in passenger train and freight mobility projects.
- 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 has provided a web-based tool available to the public that will be maintained by the Transportation Lab in the CE department at MSU.
- 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.

- The project, “Predicting Erosion Impact on Highway and Railway Bridge Substructures” provided funding for a high-performance computer workstation that has proved invaluable in the modeling process. Older workstations could not perform the analysis with the soil features added to the structural components.
- Physical infrastructure resources at UM: Computing facilities, geospatial laboratory, geospatial software, and transportation corridor/traffic flow simulation capabilities. The eight 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.
- 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 “Traffic Counting Using Existing Video Detection Cameras” project made recommendations on the maintenance of video detection systems in Louisiana. If followed, this could impact on budget requirements for these maintenance functions but could also save the state agency money and time in collecting accurate traffic count data.
- 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 technology from the “Harvesting Vibrational Energy Due to Intermodal Transport Systems Via Nano Coated Piezo Electric Devices” project can be applied to underdeveloped countries who can take advantage of the many positives associated with this type of energy harvesting.
- The investigated ramp metering techniques and research results of the “Development of an Optimal Ramp Metering Control Strategy for I-12” will be shared with the transportation community at local and national meetings. The methodology can be widely applied to other corridors with similar geometric and traffic characteristics.
- The “Real-Time Transit Vehicle Routing Optimization in Intermodal Emergency Evacuations” project provides a web-based tool 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.
- 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?**

- Use of the software tool developed in 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 “Acoustic Emission Safety Monitoring of Intermodal Transportation Infrastructure” 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.
- 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 “Student Technology Exchange Program (STEP) for Engineering/Robotics in Middle School Students” project encouraged students to pursue educational opportunities in STEM careers including transportation.
- The “Traffic Counting Using Existing Video Detection Cameras” project recommendations allows for the collection of accurate traffic count data that can be used to develop the AADT required for decision and policy making regarding the road network of the State.
- 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 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 provided insight into associations between drugged drivers and the history of unsafe behavior including DUI arrests and speeding. Law and policy changes are currently being discussed by the Louisiana Safety coalition on impaired driving. The project made an impact by improving public knowledge about drugged driving and affecting practices and policies regarding drugged driving.

## **5. Changes/Problems**

### **5.1. Changes in approach and reasons for change:**

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

- The remaining open projects have all been given “no-cost” extended to May 31, 2016 due to various research delay issues.

### **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**