<table>
<thead>
<tr>
<th>Federal Agency</th>
<th>U.S. Department of Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Grant Number</td>
<td>DTRT13-G-UTC33</td>
</tr>
<tr>
<td>Project Title</td>
<td>MID- ATLANTIC TRANSPORTATION SUSTAINABILITY UNIVERSITY TRANSPORTATION CENTER (UTC)</td>
</tr>
<tr>
<td>Program Director Name, Title, and Contact Information</td>
<td>Brian Smith, Ph.D., P.E. Professor and Chair, Civil and Environmental Engineering MATS UTC Director University of Virginia 351 McCormick Dr. P.O. Box 400742 Charlottesville, VA 22904-4742 Phone: 434-243-8585 Fax: 434-982-2951 Email: <a href="mailto:briansmith@virginia.edu">briansmith@virginia.edu</a></td>
</tr>
<tr>
<td>Name of Submitting Official, Title, and Contact Information</td>
<td>Robert Merhige Director of Grants and Contracts University of Virginia <a href="mailto:ospnoa@virginia.edu">ospnoa@virginia.edu</a> 434-924-4270</td>
</tr>
<tr>
<td>Submission Date</td>
<td>April 2015</td>
</tr>
<tr>
<td>DUNS/EIN Numbers</td>
<td>065391526</td>
</tr>
<tr>
<td>Recipient Organization (Name and Address)</td>
<td>University of Virginia Office of Sponsored Programs 1001 North Emmet Street P.O. Box 400195 Charlottesville, VA 22904-4195 Phone: 434-924-4270 Fax: 434-982-3096</td>
</tr>
<tr>
<td>Recipient Identifying Number, if any</td>
<td>Federal Entity Number 54-6001796</td>
</tr>
<tr>
<td>Project/Grant Period (Start Date, End Date)</td>
<td>6/30/14 to 9/30/17</td>
</tr>
<tr>
<td>Reporting Period End Date</td>
<td>3/31/15</td>
</tr>
<tr>
<td>Report Term or Frequency</td>
<td>Generally, six months, but this first PPPR is for the first nine months of our contract.</td>
</tr>
<tr>
<td>Signature of Submitting Official</td>
<td></td>
</tr>
</tbody>
</table>

Michael P. Ludwick MA CRA Associate Director of Grants and Contracts Office of Sponsored Programs The Rector and Visitors of the University of Virginia
1. Accomplishments
The Mid-Atlantic Transportation Sustainability University Transportation Center (MATS UTC) is a regional consortium of six universities led by the University of Virginia. Our consortium includes Marshall University, Morgan State University, University of Delaware, Old Dominion University, and Virginia Polytechnic and State University. The MATS UTC serves the region through applied research, education, workforce development, and technology transfer focused on environmental sustainability.

1.1 Research
MATS UTC strives to address research problems related to environmental sustainability and transportation.

1.1.1 Research Program Themes
Our research program is organized around five focus areas:

- Sustainable Freight Movement (SF)
- Coastal Infrastructure Resiliency (IR)
- Energy Efficient Urban Transportation (EU)
- Enhanced Water Quality Management (WM)
- Sustainable Land-Use Practices (LU)

We have core projects in all five of these focus areas. We have competitive collaborative projects in most of the focus areas.

1.1.2 Research Program Selection and Management
Our research program has two parts. Each university in the consortium has been allocated a base amount to spend on research, education, and outreach including technical transfer, diversity, and communications. This base money funds the core projects we select collaboratively as a center—guided by our advisory board.

We selected 12 mostly collaborative, multiple-university core projects during the proposal preparation process. Each of these projects started in Fall 2014 and have a May 2016 or earlier end date. The table below (and Appendix A) includes one additional project started by March 31, 2015.

Table 1 Core Projects Utilizing Base Fund and Matching Fund Allocations

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Lead U</th>
<th>PI</th>
<th>Other Investigators</th>
<th>Other U</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR</td>
<td>MU</td>
<td>Shand</td>
<td>Corbett</td>
<td>UD</td>
<td>Alternative Fuels Usage in Maritime Transportation System</td>
</tr>
<tr>
<td>FR</td>
<td>ODU</td>
<td>Cetin</td>
<td>Ng, Talley, Park, Rakha</td>
<td>ODU, UVA, VT</td>
<td>Multimodal Freight Distribution to Support Increased Port Operations</td>
</tr>
<tr>
<td>FR</td>
<td>ODU</td>
<td>Paleti</td>
<td>Cetin</td>
<td>ODU</td>
<td>Performance Measures for Freight Transport and General Traffic: Investigating Similarities and Differences Using Alternative Data Sources</td>
</tr>
</tbody>
</table>
Appendix A includes progress reports for the core projects.

We also held a competition in fall 2014 for competitive collaborative projects. These projects required participation from at least two universities and were limited to $150,000 in federal funding requiring full match. The proposals were reviewed by at least three external reviewers. Twenty-one proposals were submitted and five projects were awarded for the period: January 1, 2015-May 31, 2016. We expect another competitive collaborative competition in fall 2015.

Table 2 Competitive Collaborative Projects Awarded Fall 2014 (January 1, 2015-May 31, 2016 projects)
### New Activities Associated with Degree Programs
The MATS UTC Education Steering Committee has put a lot of effort into developing a semester long graduate course in Transportation Sustainability to be offered asynchronously at all six consortium universities in Fall 2015. We have developed nine one or two week module outlines for this course which are listed along with the instructor and their university in Table 3.

<table>
<thead>
<tr>
<th>WM</th>
<th>UD</th>
<th>Chiu</th>
<th>Imhoff, Culver</th>
<th>UVA</th>
<th>Simultaneous Removal of Nitrogen and Phosphorus from Stormwater by Zero-Valent Iron and Biochar in Bioretention Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR</td>
<td>UVA</td>
<td>Goodall</td>
<td>Sridhar</td>
<td>VT</td>
<td>Impact of Climate Change and Sea Level Rise on Stormwater Design and Reoccurring Flooding Problems in the Hampton Roads Region</td>
</tr>
<tr>
<td>EU</td>
<td>ODU</td>
<td>Iftekharuddin</td>
<td>Cetin, Rakha</td>
<td>VT</td>
<td>LiDAR for Air Quality Measurement</td>
</tr>
<tr>
<td>EU</td>
<td>UD</td>
<td>Prasad</td>
<td>Advani, Shin</td>
<td>MSU</td>
<td>Connected Vehicle Technologies for Energy Efficient Urban Transportation</td>
</tr>
</tbody>
</table>

Appendix B includes progress reports for the five competitive collaborative projects awarded in Fall 2014 and started January 1, 2015.

#### 1.1.3 Dissemination

Research reports will be published to the MATS UTC website and results will be further disseminated in multiple ways including website updates and news posts, academic publications, project descriptions in quarterly newsletters, Facebook posts, Twitter tweets, monthly emails, MATS UTC webinars, and conference presentations. Our Center started in July and our projects started in fall 2014 or spring 2015 so it’s too early for project presentations and papers to be reported in this PPPR.

#### 1.1.4 Plans for Next Reporting Period

Plans for the next reporting period include continuing these projects and starting a few new core projects. We anticipate another competitive collaborative solicitation in Fall 2015. We will continue the dissemination and tech transfer of our research results.

### 1.2 Education and Workforce Development

The MATS UTC education goal is to foster education and training to contribute to the development of the transportation workforce. Traditional discipline-based education and training is not sufficient for current and future workforce demands; our approach is multi-disciplinary, multimodal, and incorporates both passenger and freight. Under this grant we are developing a series of education activities, from K-12 to PhD and professionals. These programs build on the education and training programs available at all consortium universities.

#### 1.2.1 New Activities Associated with Degree Programs

The MATS UTC Education Steering Committee has put a lot of effort into developing a semester long graduate course in Transportation Sustainability to be offered asynchronously at all six consortium universities in Fall 2015. We have developed nine one or two week module outlines for this course which are listed along with the instructor and their university in Table 3.
Table 3 Modules, Length, Instructor and University for the Semester-Long Graduate Course in Transportation Sustainability to be Offered in Fall 2015

<table>
<thead>
<tr>
<th>Module</th>
<th>Number of Weeks</th>
<th>Instructor</th>
<th>Instructor’s University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>1</td>
<td>Parkany</td>
<td>UVA</td>
</tr>
<tr>
<td>Energy Efficient Urban</td>
<td>2</td>
<td>Rakha/Ahn</td>
<td>VT</td>
</tr>
<tr>
<td>Urban Freight</td>
<td>2</td>
<td>Shin</td>
<td>MSU</td>
</tr>
<tr>
<td>Coastal Infrastructure Reliability</td>
<td>2</td>
<td>Tahvildari</td>
<td>ODU</td>
</tr>
<tr>
<td>Sustainable Materials</td>
<td>1</td>
<td>Zatar</td>
<td>MU</td>
</tr>
<tr>
<td>Enhanced Water Quality Management</td>
<td>2</td>
<td>Goodall</td>
<td>UVA</td>
</tr>
<tr>
<td>Land Use</td>
<td>1</td>
<td>Mondschein</td>
<td>UVA</td>
</tr>
<tr>
<td>Healthy Communities</td>
<td>2</td>
<td>Scott</td>
<td>UD</td>
</tr>
<tr>
<td>Finance and Policy</td>
<td>2</td>
<td>Mix</td>
<td>UD</td>
</tr>
</tbody>
</table>

1.2.2 Non-degree Programs
MATS UTC encompasses formal training programs for transportation professionals at the University of Virginia (Transportation Training Academy (TTA), Virginia’s Local Technical Assistance Program (LTAP), Marshall University and the University of Delaware (Delaware’s LTAP). Morgan State University ran a Teacher Transportation Institute during the reporting period.


MATS UTC is developing two TTA workshops:
- Overview of Transportation Sustainability, scheduled April 14 in Charlottesville
- Infrastructure Impacts of Sea-Level Rise, scheduled May 5 in Virginia Beach

Marshall (RTI) conducted four levels of GIS training for the WV Department of Transportation September – December. 22 students completed 48 hours of instruction.

RTI’s Transit Training Partnership initiative conducted training for drivers and supervisors employed by transit authorities throughout the state. Training completed:
- Procurement for Small and Medium Transit Systems (National Transit Institute course) 34 participants
- Advanced Mobility Device Securement 21 participants
- Drug and Alcohol 25 participants
- Passengers with Intellectual Disabilities 28.

1.2.3 Attracting New Entrants to Transportation
MATS UTC has made a conscious effort to attract new entrants to transportation. This includes K-12 efforts and undergraduate efforts focused on transportation in general and specifically addressed to attract diverse audiences including women and under-represented minorities.
Highlights of our activities in this area include:

- **Summer Undergraduate Research Program.** A flyer was distributed at the end of February asking for March 20 applicants. We received 24 applicants from 13 universities, made 9 offers, and have 7 coming to summer research positions at University of Virginia.

- **VDOT Diversity Career Fair, October 2, 2014.** MATS UTC attended this annual career fair in Manassas, VA attracting 1000 high school students to learn about careers in transportation.

- **MSU Summer internships at MSHA.** Maryland State Highway Administration selected and placed nine junior and senior level students in headquarters and district offices for 10 weeks. Internship ranged from positions in civil engineering, finance, information systems, and communications. SHA and Morgan State, using UTC funds, shared the costs of the program.

- **MSU Teacher Training Institutes.** MSU Teacher Training Institutes. Morgan State’s National Transportation Center conducted a STEM-related institute for middle and high school teachers during fall semester. Six teachers participated in program to apply STEM fields to transportation and engineering topics.

- “**Working in the Transportation Industry**” panel presented by Parsons Brinckerhoff at Morgan State University February 12, 2015. Parson Brinckerhoff conducted its second annual workshop for students in transportation fields. The workshop focused on disciplines utilized by and career opportunities within an international consulting firm.

- **MATS UTC has developed learning modules related to sustainable materials and structures testing to use for K-12 students visiting the University of Virginia.** These modules were used with two groups of Bedford County Virginia students on visits to UVA on March 20 and 27, 2015.

- **Promoting Careers in Transportation.** Our first webinar featuring FHWA’s Tennessee Division Administrator Pamela Kordenbrock was March 24, 2015. The event included questions and answers from graduate and undergraduate students attending the webinar and attending in person at University of Virginia.

- **A special presentation to the University of Delaware RISE program was made on March 21.** The Resources to Insure Successful Engineers (RISE) program’s mission is to recruit and encourage academically prepared students who are native-born African American, Hispanic American, and Native American, as well as others who, as a group, are underrepresented in engineering. The presentation was to encourage participation as MATS UTC summer undergraduate researchers.

### 1.2.4 Dissemination

We use a variety of methods including email “blasts”, website posts, Facebook posts, Twitter tweets, and a quarterly newsletter to disseminate information about our research and education and training activities.

### 1.2.5 Plans for Next Reporting Period

In the next reporting period, we will continue to develop the semester-long graduate course in transportation sustainability and student participation in the course will commence. We will present additional sessions of the developed professional development workshops in accordance with participant demand. Additionally, we plan a half-day training session as part of our Annual Meeting scheduled in August in Wilmington.
1.3 Technology Transfer

The goal of the MATS UTC technology transfer program is to broaden our reach and effectively disseminate research results. Appendices A and B include the technology transfer and outreach efforts of researchers affiliated with individual projects. These include seminars and conference poster/podium presentations about specific research projects.

In the section below, we describe our conducted and planned technology transfer and outreach events and media and communications efforts.

1.3.1 Technology Transfer/Outreach Events

MATS UTC Technology Transfer/Outreach Events in this reporting period include:

- Co-sponsorship of Seminar Series at ODU on Coastal Resilience and Sustainability, Spring 2015

1.3.2 Planned Technology Transfer/Outreach Events

Planned general technology transfer/outreach events for MATS UTC include:

- Blue and Green Highways Sustainability Symposium, May 6, Arlington, VA
- MATS UTC Annual Meeting, August 6-7, Wilmington, DE
- Transportation Sustainability Series including webinars from May 6 and August 6 along with additional sustainability-related webinars of regional interest

1.3.3 Media and Communications

The MATS UTC award has been mentioned in several media outlets including the Augusta Free Press, the University of Delaware UDaily, University of Delaware Civil and Environmental Engineering Outlook Newsletter, issue no. 6 Winter 2014/2015, and the University of Virginia Department of Civil and Environmental Engineering Winter Newsletter.

Our research efforts are too nascent to have had mentions of specific MATS UTC projects in external sources.

We have developed several outlets for disseminating MATS UTC research, education, diversity, and technology transfer activities. These include the MATS UTC website www.matsutc.org, email blasts to our list of over 300 (and growing) names, Facebook posts https://www.facebook.com/midatlantictransportationsustainability and Twitter feeds. Each participating university posts once a week on Facebook and many of the posts are copied as posts to the MATS UTC website and to Twitter.

We have sent emails of MATS UTC activities available to everyone in the region since mid-February. These emails include the launch of our MATS UTC outreach campaign, the announcement of our summer undergraduate research program, and a Save the Date for our Annual Meeting in August in Wilmington.

We plan the first issue of a quarterly E-Newsletter for April 1, 2015. The E-Newsletter will include news including details about our Blue and Green Highways Symposium, research spotlights for at least one core project and at least one other project, and education and training updates. The newsletter will be distributed to our MATS UTC email list and the articles available on our website.
1.3.3 *Disseminations*
Dissemination of research results are achieved through the events, media, and communication channels described in sections 1.3.1 and 1.3.2 and in the Appendices.

1.3.4 *Plans for Next Reporting Period*
Plans for the next reporting period include holding the technology transfer/outreach events described above. We will continue our communications and outreach efforts and continue to expand our email lists with new addresses of event attendees and other activity participants. Technology transfer related to each individual research project will continue and likely increase as the projects mature.

2. **Products**
MATS UTC products specific to each of our research projects are provided in the Appendices. Here we describe general products related to our Center.

2.1 **Publications**
No refereed publications from our UTC research program have been generated as yet, because no research project is sufficiently far along to have publishable research results. However, we are assembling an E-Newsletter to be released on April 1, 2015. We plan quarterly newsletters going forward.

Individual researchers are encouraged to submit papers related to their work to technical conferences and other avenues.

2.2 **Websites**
Our MATS UTC website was launched in August 2014: [www.matsutc.org](http://www.matsutc.org) Additional project-related websites are provided in the Appendices.

2.3 **Technologies**
Nothing to report.

2.4 **Inventions**
Nothing to report.

2.5 **Educational Products**
We are developing a semester-long graduate transportation sustainability course and at least two one-day professional development workshops as described in section 1.2.1 above.

2.6 **Other Products**
Here are examples of additional products that have resulted from this grant:

- Archive of March 24 Preparing for Careers in Transportation webinar with FHWA Division Administrator Pam Kordenbrock
- Website posts and Facebook posts of Center activities
3. Participants and Collaborating Organizations

MATS UTC is a consortium of six universities. In addition to these universities we collaborate with several match sources including state DOTs and local agencies. We also have an advisory board with 10 members from 10 different agencies and organizations covering multiple modes and our region.

3.1 Participants

MATS UTC participants include researchers, instructors and staff from the six universities; instructors and speakers for our workshops, seminars, and symposia; champions and other partners at our match funding agencies; and our 10 person advisory board.

Appendices A and B and the text in this report provide names of researchers, instructors, and other presenters affiliated with MATS UTC activities.

Table 4 presents the names, titles, affiliations, and location of our 10 advisory board members.

Table 4 MATS UTC Advisory Board Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Affiliation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jose Gomez, Chair</td>
<td>Director</td>
<td>Virginia Center for Transportation Innovation and Research</td>
<td>Charlottesville, VA</td>
</tr>
<tr>
<td>Damon Fordham</td>
<td>Principal</td>
<td>The Cadmus Group</td>
<td>Crozet, VA</td>
</tr>
<tr>
<td>Susan Handy</td>
<td>Director</td>
<td>National Center for Sustainable Transportation, University of California, Davis</td>
<td>Davis, CA</td>
</tr>
<tr>
<td>Camelia Ravanbakht</td>
<td>Interim Executive Director</td>
<td>Hampton Roads Transportation Planning Organization</td>
<td>Chesapeake, VA</td>
</tr>
<tr>
<td>Holly Rybinski</td>
<td>President</td>
<td>Rybinski Consulting</td>
<td>Wilmington, DE</td>
</tr>
<tr>
<td>Domini Scurti</td>
<td>Manager, Market Planning</td>
<td>Maryland Port Administration</td>
<td>Baltimore, MD</td>
</tr>
<tr>
<td>Donald Williams</td>
<td>Research and Special Studies</td>
<td>West Virginia DOT</td>
<td>Morgantown, WV</td>
</tr>
<tr>
<td>Tim Witten</td>
<td>ITS/Special Projects Manager</td>
<td>Blacksburg Transit</td>
<td>Blacksburg, VA</td>
</tr>
<tr>
<td>Hua Xiang</td>
<td>Office of Policy and Research</td>
<td>Maryland State Highway Administration</td>
<td>Hanover, MD</td>
</tr>
<tr>
<td>Tigist Zegeye</td>
<td>Executive Director</td>
<td>Wilmington Area Planning Council</td>
<td>Newark, DE</td>
</tr>
</tbody>
</table>

Our advisory board members participated along with the MATS UTC Executive Team with representation from all six consortium universities in a face to face meeting November 20-21 in Charlottesville, VA. The advisory board has had additional teleconferences and contributed specific topics to add to our Competitive Collaborative Request for Proposals issued in Fall 2015. They also commented on the winning proposals in November 2014.

Representatives from all six consortium universities participate in the MATS UTC Executive Team teleconference held biweekly on Fridays.
Another participant is Elise Barella of James Madison University. She has a subaward from the University of Virginia’s FY15 match grant from Virginia DOT to organize the Blue and Green Highways Sustainability Symposium May 6 in Arlington, VA.

3.2 Collaborating Organizations
In addition to the members of our advisory board, MATS UTC has collaborated with several individuals and organizations in conducting our research and other activities. These include research sponsors and presenters at MATS UTC events.

3.2.1 Research Sponsors
Our MATS UTC research sponsors include:

- Virginia Center for Transportation and Research, Virginia Department of Transportation
- Maryland State Highway Administration
- Maryland Department of Transportation
- Delaware Department of Transportation
- West Virginia Department of Transportation
- Hampton Roads Transportation Planning Organization

3.2.2 Presenters at MATS UTC Events
We plan several events including our Symposium on May 6 and a panel during our August Annual Meeting during the next reporting period with a variety of presenters external to MATS UTC. External presenters during this reporting period included:

- 50 managers from Maryland DOT visited Morgan State September 24
  http://www.matsutc.org/2014/10/mdot-leaders-tour-at-msu/
- Table 5 UVA Sustainability-Related Civil and Environmental Engineering Seminar Speakers

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elise Barella</td>
<td>James Madison University</td>
<td>Sustainable Transportation at Scale: Green Rating Systems for Planning and Design</td>
<td>October 7, 2014</td>
</tr>
<tr>
<td>Sarah Hernandez</td>
<td>University of California, Irvine</td>
<td>Intelligent Transportation System Technologies to Collect Commercial Vehicle Data</td>
<td>January 16, 2015</td>
</tr>
<tr>
<td>Avinash Unnikrishnan</td>
<td>West Virginia University</td>
<td>Transportation Network Models for Enhancing System Performance and Sustainability</td>
<td>January 21, 2015</td>
</tr>
<tr>
<td>Andreas Malikopoulos</td>
<td>Oak Ridge National Laboratory</td>
<td>Optimal Control for Complex Sustainable Systems in Transportation</td>
<td>February 20, 2015</td>
</tr>
</tbody>
</table>

- Parsons Brinckerhoff panelists at Morgan State career event, February 12, 2015
Coastal Resilience and Sustainability seminar speakers at Old Dominion Spring 2015

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doug Bellomo</td>
<td>FEMA</td>
<td>Sea Level Rise and Flood Risk Management</td>
<td>February 20, 2015</td>
</tr>
<tr>
<td>Martin Schultz</td>
<td>US Army Corps of Engineers</td>
<td>Risk Analysis for Naval Station Norfolk</td>
<td>March 6, 2015</td>
</tr>
<tr>
<td>Kate White</td>
<td>US Army Corps of Engineers</td>
<td>Federal Policy and Sea Level Rise</td>
<td>March 20, 2015</td>
</tr>
<tr>
<td>Billy Edge</td>
<td>North Carolina State University</td>
<td>Renewable Energy from the Ocean—Strategic Directions</td>
<td>April 3, 2015</td>
</tr>
</tbody>
</table>

Pam Kordenbrock, FHWA Tennessee Division Administrator at Careers in Transportation webinar, March 24, 2015

4. Impact

Each of the projects summarized in the Appendices have included impacts in the principal discipline and some include impacts on other disciplines. In the sections below, we provide general impacts and describe how this project has impacted the principal and other disciplines, human resources, resources at the University of Virginia and the other consortium universities, technology transfer, and society beyond science and technology.

4.1 Development of the Principal and Other Disciplines

MATS UTC researchers, instructors, and staff represent multiple disciplines including civil engineering (transportation, water resources, structures, and geotechnical engineering), electrical engineering, transportation planning, public policy, and business. Our emphasis on collaboration among universities and disciplines for all of our programs including research, education, and outreach leads to development of students, professionals and faculty in all of these disciplines.

Specific examples include:

- Cross-listing our graduate transportation sustainability course in engineering and public policy schools at University of Delaware
- Researchers from at least six different academic departments involved in MATS UTC projects.

4.2 Development of Human Resources

MATS UTC has directly impacted graduate students in terms of Graduate Student Research Assistantships, Fellowships, and our graduate course in transportation sustainability, undergraduate students applying for our summer undergrad research program and attending our Careers in Transportation series, professionals attending our workshop and symposium, and faculty at all six consortium universities involved in research and teaching our semester long graduate course.

4.3 Resources at University and Partner Institutions

MATS UTC resources have expanded the offerings at the University of Virginia, our consortium universities, and our match sources such as the Virginia Department of Transportation. Examples of activities directly enabled by MATS UTC include:
• Environmental sustainability research projects funded by federal funds and match funds that would not be possible without MATS UTC
• Professional development training workshops related to environmental sustainability
• MATS UTC summer undergraduate research program
• Graduate class in transportation sustainability offered at all six universities in the consortium

4.4 Technology Transfer
We expect our research results and dissemination to continue after the period funded by the grant has elapsed. In the meantime, we intend to present preliminary and initial results during seminars, webinars, and conferences.

4.5 Society beyond Science and Technology
Sustainability issues will impact all of us. By promoting our activities, disseminating our results, and encouraging our match sources (such as regional DOTs) to spend resources on sustainability, we are increasing awareness of this nascent area.

5. Changes
There are no changes in the scope or objectives of this grant.

Individual projects may have changed a bit since inception as reported in the Appendices.

6. Special Reporting Requirements
No special reporting requirements. Nothing to report.

Appendix A Core Research Projects

Project: Alternative Fuels Usage in Maritime Transportation System
PIs: Jennifer Shand, Marshall University, shandj@cbermu.org; James Corbett, University of Delaware, jcorbett@udel.edu
Period of Performance: January 1, 2015—December 31, 2015
Accomplishments:
• Project scope developed
• Research in progress
Changes/Problems:
• Persistent communication problems among potential collaborators
• Smaller scale project than initially anticipated with only two participants instead of three
• Marshall continuing to pursue own scope as initially defined

Project: Multimodal Freight Distribution to Support Increased Port Operations
PIs: Mecit Cetin, Old Dominion University, MCetin@odu.edu; Manwo Ng, Old Dominion University, mng@odu.edu; Wayne Talley, Old Dominion University, wktalley@odu.edu; Brian Park, University of Virginia, bpark@virginia.edu; Hesham Rakha, Virginia Tech, HRakha@vti.vt.edu
Period of Performance: November 1, 2014—April 30, 2016
Accomplishments:
• A literature review was conducted by ODU team on studies related to port and rail operations.
• The Virginia Inland Port in Front Royal, VA was visited to see any operational problems related to rail connectivity.
• The ODU team is going to start developing models for port-rail interactions in the summer of 2015.
• The VT team has been working on developing models for truck fuel consumption and emissions.
• To support the modeling work, the VT team is generating some data from MOVES and compiled truck fuel consumption and emission data originally collected by US Riverside.
• The UVA team developed a multimodal freight (i.e., rail, vessel and truck) optimization formulation considering freight transport cost, facility cost, and environmental cost and solved it using a MATLAB program.
• The optimization formulation will be enhanced to consider transportation cost under time-of-day and shadow price analysis will be conducted to determine investment decisions on mode or facility capacity enhancement.

Products: A poster was presented by the UVA team at the 2015 University of Virginia CEE Graduate Research Symposium.

Project: Performance Measures for Freight Transport and General Traffic: Investigating Similarities and Differences Using Alternative Data Sources
PIs: Rajesh Paleti, Old Dominon University, rpaleti@odu.edu; Mecit Cetin, Old Dominion University, mce tin@odu.edu
Period of Performance: February 6, 2015 – May 24, 2015
Accomplishments:
1. Speed/travel time data for the months of July 2012 and September 2014 were obtained from three different probe data sources – INRIX, HERE, and American Transportation Research Institute (ATRI)
2. The temporal and spatial coverage of these data sources was explored to identify specific corridors for subsequent comparison analysis.
3. Given that the INRIX and HERE data sources have different TMCs, travel times between two points along a corridor (instead of speeds) are found to be better metrics for comparison across the datasets.
4. The GPS streams from the ATRI data are superimposed on the roadway network and speeds/travel times are being computed.

Impact: The end goal of the project is to explore if there are any corridor segments in the Hampton Roads region where the passenger and freight performance measures are significantly different. Also, the research will provide VDOT valuable feedback on the quality and usability of the three different data sources.

Changes/Problems:
1. INRIX freight data stream provides data every 15 minutes for each average day (e.g., average Monday, Tuesday, etc.). HERE data, on the other hand, provides data every 5 minutes for all 30 days of the month. Also, ATRI data is available for the entire month. So, we aggregated HERE & ATRI data to 15 minutes for 7 average days of the week to ensure consistency between the two data sources.
2. HERE data for the month of 2012 was a partial sample containing travel time information only for 1 or 2 epochs (5 minute intervals out of 288 epochs) for the entire day. So, this data cannot support the detailed temporal and spatial comparison analysis proposed in this research. Instead, the following data will be used for the analysis:
   i) July 2012: INRIX (Freight and General Traffic) and ATRI
   ii) September 2014: INRIX (General Traffic), HERE (Freight and General Traffic) and ATRI

Project: Infrastructure Resilience and Adaptation for Hurricanes in Coastal Areas
PIs: Pamela Murray-Tuite, Virginia Tech, murraytu@vt.edu; Ihab El-Shawarby, Virginia Tech IEI-Shawarby@vti.vt.edu; Hesham Rakha, Virginia Tech, hrakha@vti.vt.edu; Brian Smith, University of Virginia, briansmith@virginia.edu
Accomplishments:
• Drs. Rakha and El-Shawarby created and tested a microscopic modeling tool for the evacuation of a nuclear plant in the Knoxville area.
Dr. Murray-Tuite has begun investigating multi-hazard concerns through discussions with a variety of stakeholders.

**Project: Multimodal Transportation Facility Resilience Index**  
**PIs:** Nii Attoh-Okine, University of Delaware, okine@udel.edu; Lindsay Ivey-Burden, University of Virginia, lindsay.ivey@virginia.edu  
**Period of Performance:** October 1, 2014 – December 31, 2016  
**Accomplishments:**  
- Background and literature review, over 30 articles and reports.  
- Different definitions and metrics for Resilience  
- In depth case study of one type of transportation facility (in progress)  
**Products:**  
- Abstract submitted to 2nd International on Resilient Critical Infrastructure during Resilience Week 2015  
- “Multimodal Transportation Facility Resilience Index” poster presentation at TRB International Transportation Sustainability Conference in Washington, DC, May 7  
**Impact:** Training graduate student in the area of Resilience Engineering and related research

**Project: Structural Enhancements to Adapt to Impacts of Climate Change**  
**PIs:** Osman Ozbulut, University of Virginia, ozbulut@virginia.edu; Devin Harris, University of Virginia, dharris@virginia.edu  
**Period of Performance:** October 1, 2014 – May 31, 2016  
**Accomplishments:**  
- **Shape memory alloy fiber reinforced polymers:**  
  - SMA-FRP panels were fabricated using the vacuum assisted hand lay-up technique.  
  - Multiple trials to produce the SMA-FRP coupons with different SMA layers were performed. Mainly, two coupons with one layer and four layers of SMA wires were prepared.  
  - The coupons were then tested under uniaxial tensile loads in order to investigate the tensile behavior of the SMA-FRP. Although the premature failure of the coupons at the gripping region, SMA wires showed the potential to work with the used polymer to produce the SMA-FRP. Moreover, ductility and large failure strain were detected from the test results.  
- **Shape memory alloy fiber reinforced concrete:** Here, the use of randomly distributed shape memory alloy (SMA) fibers in concrete is studied.  
  - Five types of beam specimens with the dimensions of 76mmX76mmX280mm are planned for flexural tests. First beam specimen is a plain concrete beam that serves as benchmark. The second specimen is a steel fiber reinforced concrete beam and includes 0.6% of steel fiber by volume. The steel fibers are 0.90 mm in diameter and 60 mm in length and are designed to have high bond strength and ultra high tensile strength. For the other specimens, 25%, 50% and 100% of steel fibers respectively are replaced with the NiTi SMA fibers. The SMA fibers are made of NiTi and have a diameter of 0.58 mm and length of 60 mm. The SMA fibers possess a roughened surface for improved bond behavior.  
  - SMA fibers have been ordered and received. The preparation of the specimens will start soon.  
- **Ultra high performance concrete:** As an alternative to conventional concretes, ultra-high performance concrete (UHPC) represents a new class of cementitious materials with significant enhancements to both strength and durability. In this investigation, both proprietary commercially available formulations and research-developed mixtures will be evaluated for both form and function in transportation applications.  
  - Initial studies have been initiated with Ductal, a proprietary Lafarge formulation, with a focus on adapting form to the material characteristics. This initial study has been conducted in collaboration with the UVa School of Architecture, which has a history and experience with design optimization using UHPC.  
**Products:**  
Advanced Smart Materials and Smart Structures Technology (11ANCRiSST), Urbana-Champaign, IL, To be presented on August 1-2, 2015.

Comments:
- The SMA-FRP coupons failed at the gripping area and some wires slippage was detected from the grips indicating invalid failure mode. A better gripping method will be used for future testing.
- The Department of Civil and Environmental Engineering has recently acquired a new mixer well suited for mixing and preparing UHPC, but currently the mixer is not installed. We anticipate having the mixer function in the early months of the summer (May 2015).

Project: Enhancing Traffic Control Systems to Reduce Emissions and Fuel Consumption
PIs: Andrew Nichols, Marshall University, andrew.nichols@marshall.edu; Brian Park, University of Virginia, brianpark@virginia.edu; Hesham Rakha, Virginia Tech, hrakha@vti.vt.edu; Montasir Abbas, Virginia Tech, abbas@vt.edu
Period of Performance: October 1, 2014 – March 31, 2016
Accomplishments: Traffic signal preemption data from the Morgantown, WV signal system has been collected and analyzed, which allowed the research team to determine that the preemption was not functioning at a number of traffic signals. This information has been communicated to the WVDOT to initiate necessary repairs. An expected outcome of this research has been the development of troubleshooting metrics that can be used to assess preemption functionality without field testing. The same system has been simulated in VISSIM to produce similar preemption data. The simulated data is being used to derive mobility performance measures so that changes in preemption algorithms can be quantified. The preemption algorithms will be tested on the Morgantown simulation network, as well as another network in Virginia that has been modeled using both VISSIM simulation and hardware-in-the-loop simulation.
Products: No products have been generated by the project to date, but there are plans for at least one paper to be submitted to the Transportation Research Board for the 2016 Annual Meeting.
Impact: Although no impact is anticipated until the completion of the project, it seems likely that the results of the analysis of traffic signal controller preemption data and settings could provide better guidance for engineers to program preemption settings. There may also be recommendations provided for new traffic control algorithms to minimize motorist delay when a traffic signal is preempted.

Project: Network-wide Impacts of Eco-routes and Route Choice Behavior/Evaluation of AERIS Applications
PIs: Hesham Rakha, Virginia Tech, hrakha@vti.vt.edu; Kyoungho Ahn, Virginia Tech, kahn@vti.vt.edu; Mecit Cetin, Old Dominion University, mcetin@odu.edu; Brian Park, University of Virginia, brianpark@virginia.edu
Period of Performance: November 1, 2014 – April 30, 2016
Accomplishments:
1. Designed survey questionnaire and driving simulation scenarios on route choice behavior. Factors considered are trip purpose, travel time, travel time variance and fuel efficiency.
2. Conducted both stated preference survey and revealed preference survey using driving simulator on route choice behavior. Based on the responses from 18 participants, it was found that SP and RP results did not match (about 50% match). This suggested that route choice behavior should be studied using revealed preference data.
3. Conducted field evaluation of driver route choice behavior and dynamics of the route choice behavior. The results of the analysis was presented at TRB in January 2015. VT researchers are currently working on publishing the paper in a journal.
4. Developing forecasting algorithms to predict flow rates in the short term, e.g., 15-30 minutes in the future. A non-parametric and data-driven methodology is used for short-term traffic forecasting based on identifying similar traffic patterns using an optimized K-nearest neighbor (K-NN) algorithm. Also, the research team tested the performance of the algorithm on data sets from various sites. The preliminary results show that the proposed algorithm is giving more accurate predictions than the competing advanced filtering and time-series methods.
5. Incorporated the various AERIS applications in the INTEGRATION software. These applications include: eco-routing, eco-drive, eco-cooperative adaptive cruise control systems (e-CACC) in the vicinity of traffic signalized intersections.
6. Currently constructing sample networks to test the various AERIS applications individually and collectively.
Products:
The papers below have been submitted for publication:

Impact: We have developed a unique modeling tool that can model a number of the AERIS applications, including: eco-routing, eco-driving, eco-adaptive cruise control in the vicinity of traffic signals, and speed harmonization.

Project: Environmental and Safety Attributes of Electric Vehicle Ownership and Commuting Behavior: Public Policy and Equity Considerations
PIs: Z. Andrew Farkas, Morgan State University, andrew.farkas@morgan.edu; Hyeon-Shic Shin, Morgan State University, hyeonshic.shin@morgan.edu; Christine Risch, Marshall University, christine.risch@marshall.edu; Kent Sowards, Marshall University, sowardsk@njrati.org; Jianhe Du, Virginia Tech, jianedu@vt.edu
Period of Performance: October 1, 2014 – September 30, 2015
Other Participants/Collaborating Organizations: Maryland Maryland Motor Vehicle Administration (MVA), Glen Burnie, MD
Accomplishments:

- Non-disclosure Agreement between MSU and MVA was agreed to. MVA identified EV numbers by county.
- PI’s and co-PIs met at TRB Annual Meeting to discuss survey questions and next steps. Survey questionnaires were developed and tested with assistance of co-PIs at collaborating universities.
- Draft informed consent letters were written, which would be mailed to registered vehicle owners for survey purposes.
- Discussed logistics with MVA of mailing letters to two large samples of registered vehicle owners.

Project: A GIS-based Tool for Tracking Transportation Infrastructure Impacts on Water Resources (formerly Regional Infrastructure Impacts on Water Quality)
PIs: Jon Goodall, University of Virginia, goodall@virginia.edu
Period of Performance: October 1, 2014 – May 31, 2016
Other Participants/Collaborating Organizations: VCTIR (Mike Fitch); VDOT (Roy Mills)
Accomplishments:

- We have reviewed the new Virginia Stormwater Management Handbook.
- We have reviewed the new Virginia Runoff Reduction Method spreadsheet.
- We have begun prototyping a decision support tool for identifying hydrologic proximity of waterbodies to proposed project sites, properties of waterbodies (including if it is on the EPA 303(d) list), estimate loading from the project, and identify available banks within the watershed.

Products: None to date, but papers, presentations, and a website are planned for next year. The student working on this project will continue his research past the project completion date as this will be the basis for his MS thesis.
Impact:
We plan on presenting the work at a conference (possibly TRB) next year.
Jon is scheduled to teach a TTA workshop on stormwater management this summer and will incorporate this research into that training course.


PIs: James Hunter, Morgan State University, james.hunter@morgan.edu; Dong Hee Kang, Morgan State University, donghee.kang@morgan.edu; Teresa Culver, University of Virginia, tculver@virginia.edu

Period of Performance: October 1, 2014 – May 31, 2016

**Accomplishments:**

- Programmatic & Literature Review: Review of literature related to highway EMC values, stormwater BMPs, and agency actions. This has included outreach and discussion with VDOT, and Maryland SHA & MDTA.
- Initiated model development to estimate nutrient and sediment pollutant loading from highway infrastructure. Exploring the use of WinSLAMM model to understand pollutant deposition and impacts of street sweeping operations.
- From discussions with Maryland State Highway Administration, MSU researchers will focus on the characterization of pollutants accumulated from street sweeping and inlet cleaning operations. This study will be done with the Center for Watershed Protection and will start by June 2015.
- Dr. Culver is working with VDOT’s Virginia Center for Transportation Innovation and Research (VCTIR) on a research statement based on feedback.


**Impact:**

- This research would standardize specifications, parameters, calculations, and prescriptive actions to avoid adverse impacts from highways on the water quality of the Chesapeake Bay. An overall benefit is that by performing analysis of selected stormwater impacts and management strategies, this study may yield appropriate credit for the effective practices readily used for TMDL compliance and/or promote awareness for proper and further implementation.
- State highway agencies of Maryland and Virginia will have field-tested data and verification from various locations. This will allow for compliance with local and state water quality regulations and discharge permits, and reach the stewardship goals set with agencies’ business plans.
- Highway specific and watershed scale approach for targeting strategies for pollution control measures and identifying critical source areas. Critical sources are portions of the watershed that intensively contribute to non-point source pollution loading.
- Research will inform agencies of the relationship between highway maintenance activities with pollutant removal performance.
- Education: We currently have 3 undergraduate and 2 graduate students assigned/contributing to this effort.

**Changes/Problems:**

- Initial project partner, Andy Alden of Virginia Tech, has declined participation under this effort given funding level and research fit.
- UTC project partners deemed the original problem statement very broad. A more focused research effort is being finalized with input from interested stakeholders within MDOT and VDOT.
- Current funding level does not provide for extensive field research to be fulfilled within the performance period. However, the funding Center for Watershed Protection does provide for resources to be leveraged in conjunction very closely related research to be sponsored by Maryland SHA and Virginia DOT.

**Project: Investigation of Infrastructure and Development Patterns to Support Reduced Driving**

PIs: Andrew Mondschein, University of Virginia, mondschein@virginia.edu

Period of Performance: October 1, 2014 – May 31, 2016
Other Participants/Collaborating Organizations: Peter Ohlms, Virginia Center for Transportation Innovation and Research; Marcia Scott, University of Delaware

Accomplishments: Work began on this project at the end of 2014, and the primary objective during this period has been data assembly, with analysis and findings at their early stage. Specific accomplishments include:

- Assembly of travel data for the state of Virginia at small geographic scales (census tract and zip code levels), including commute length, VMT, mode choice, and auto ownership
- Assembly of land use and urban structure data for the state of Virginia at small geographic scales, including population, employment, and land use intensity measures
- Assembly of the above travel and land use data for multiple years (2006-2014 where available)
- Development of dataset on emerging travel patterns for focus area in Northern Virginia, specifically Capital Bikeshare expansion and associated land use and infrastructure data

Data assembly has largely completed and analysis is underway, with an emphasis on examining variability in the relationship between land use and travel behavior change across the state at small geographic scales, as well as the potential effects of emerging travel modes, such as bike share.

Products: So far, data has been assembled in tables and GIS maps and databases.

Impact: The project has engaged four graduate student researchers, learning methods for examining the changing relationship between travel patterns and land use, including its impacts on sustainability.

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Project: Land Use Master Planning for Environmental Sustainability

PIs: Marcia Scott, University of Delaware, msscott@udel.edu; Mingxin Li, University of Delaware, lmx@udel.edu; Sinaya Dayan, Marshall University, dayans@njrati.org

Period of Performance: September 1, 2014 – August 31, 2016

Accomplishments:

- Developed and distributed work plan to team members
- Established a Google Drive site to share documents among UD and Marshall U team members
- Conducted bi-monthly conference calls with team members to report research progress Conducted phone interviews with the Delaware Valley Regional Planning Commission and the New Sustainable Knowledge Corridor
- Completed a literature review of research on Smart Growth and scorecards
- Prepared a literature review matrix that summarized and categorized initiatives/research by federal and state entities, non-profit organizations, higher ed/academic institutions
- Compiled a list of Smart Growth scorecards; initiated assessment
- Developed an extensive spreadsheet of Mid-Atlantic Smart Growth organizations (MPOs, state DOTs, state planning agencies, regional planning commissions, and advocacy organizations), categorized by 7 states and Washington, D.C.
- Developed a draft survey protocol with “informed consent statement”; submitted protocol for IRB review and approval
- Circulated the draft survey for review and refinement; prepared “Survey Monkey” survey instrument
- Prepared a “MailChimp” campaign with link to Survey Monkey to distribute survey electronically
- Finalized and tested final draft survey among team members and Delaware transportation and land use planners
- Launched Survey Monkey via MailChimp campaign on 3/17/15; Contacted 15 organization/advocacy groups to request assistance distributing the survey to their Mid-Atlantic members
- Initiated a review and superficial analysis of EPA’s Smart Growth Index (SGI) GIS modeling tool

Products: Literature review matrix

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Appendix B Competitive Collaborative Projects
Project: Designing Bicycle and Pedestrian Traffic Count Program to Estimate Performance Measures on Streets and Sidewalks in Blacksburg, VA

PIs: Steve Hankey, Virginia Tech, hankey@vt.edu; Ralph Buehler, Virginia Tech, ralphbu@vt.edu; Andrew Mondschein, University of Virginia, mondschein@virginia.edu


Other Participants/Collaborating Organizations: Town of Blacksburg: Town staff provides crews to divert traffic during installations. Town planning staff has helped with assessing count location feasibility.

Accomplishments:
- Automated count equipment was sourced and purchased (12 MetroCount pneumatic tubes; 10 Pyro Infrared; 1 Chambers radiobeam).
- Six pilot locations were installed across Blacksburg (total devices deployed: 6 MetroCount; 9 Pyro Infrared; 1 radiobeam).
- Manual validation counts to assess counter performance are ongoing throughout the next month. To date, ~100 hours of manual counts have been collected; our target is ~250 hours of validation counts.
- Developed a stratified sampling approach (including information about street functional class and network centrality) to select short-duration count sites.
- Identified and deployed counters at three reference sites. These locations will remain for the entire sampling campaign.

Products: Developed a memo template and set of analyses to be updated and reported to Town of Blacksburg staff on a quarterly basis.

Impact:
- Manual counts and developing correction equations is the major component of a graduate level course taught by S Hankey this semester. Ten students have performed ~100 hours of validation counts to date. The course goal is to test accuracy of the automated counters and provide Town staff with sample output and example analyses of the count data.
- Regular reports on the progress of the project are being discussed at monthly meetings of the Town Greenway/Bikeway/Sidewalk/Corridor committee.

Project: Simultaneous Removal of Nitrogen and Phosphorus from Stormwater by Zero-Valent Iron and Biochar in Bioretention Cells

PIs: Pei Chiu, University of Delaware, pei@udel.edu; Paul Imhoff, University of Delaware, imhoff@udel.edu; Teresa Culver, University of Virginia, tculver@virginia.edu


Other Participants/Collaborating Organizations:
- Dan Sweet and Kristel Riddervold, City of Charlottesville, VA
- Kip Mumaw, Ecosystem Services, LLC, VA
- Charles Hegberg, ReGenesis Global Solutions, LLC/Infinite Solutions L3C, PA

City of Charlottesville and Ecosystem Services were/will be instrumental in field site selection and construction, and will also be involved in the subsequent monitoring and performance assessment work. ReGenesis Global Solutions will assist in disseminating results of this project to transportation agencies and other stakeholders.

Accomplishments: Tasks performed/completed during January 1 – March 31, 2015:
- Project team meeting at UVa (Feb. 3–4, 2015): Dr. Chiu visited UVa, met with Dr. Culver and her colleagues, and presented a seminar titled "Microbial Reduction of Nitrate Promoted by ZVI and Black Carbon (Biochar)".
- Field site visit/selection and initial design meeting in Charlottesville, VA (Feb. 4, 2015): Drs. Chiu and Culver met with Dan Sweet, Kristel Riddervold, and Kip Mumaw, toured the Charlottesville High School site, and discussed various issues related to the design, construction, and schedule for the field work.
- Design of biochar-promoted nitrate degradation study at UD (Jan. 1 – March 31, 2015): Experiments are currently underway in Dr. Chiu’s lab to investigate the mechanism and evaluate the efficacy of biochar-supported microbial nitrate reduction.

Products: Seminar at UVa, "Microbial Reduction of Nitrate Promoted by ZVI and Black Carbon (Biochar)", Pei Chiu (Feb. 4, 2015)
Impact: Recruited one graduate and one undergraduate engineering student for this work. These students will apply their knowledge in research and/or engineering practice following graduation.

Project: Impact of Climate Change and Sea Level Rise on Stormwater Design and Reoccurring Flooding Problems in the Hampton Roads Region
PIs: Jonathon Goodall, University of Virginia, goodall@virginia.edu; Venkat Sridhar, Virginia Tech, vsri@vt.edu
Other Participants/Collaborating Organizations: Hampton Roads Planning District Commission, Chesapeake, VA; Hampton Roads Transportation Planning Organization, Chesapeake, VA
Accomplishments: Initial assessment of climate change impacts is being done. Part of the time from postdoc and a grad student is pooled for this project to investigate the available climate model and NOAA observed precipitation data. Work to begin LiDAR data collection for the region has begun.
Products: We are presenting the initial results of our general precipitation analysis at the National Capital Region American Water Resources Association on April 10th, 2015. It involves quantifying precipitation shifts for the historic period from the gaging stations in the Hamptons Roads Region. We also plan on presenting the work at TRB in January.
Impact: For the design of transportation infrastructure, the value of return period analysis and how it is changing over the past and into projected future through scenario analysis can be valuable. We will concentrate our efforts to share some aspect of this outcome during the first week of May. We are also co-teaching a TTA course on this topic in Virginia Beach in May and will incorporate outcomes of this research at that workshop.

Project: LiDAR for Air Quality Measurement
PIs: Khan Iftekharuddin, Old Dominion University, iftekhar@odu.edu; Mecit Cetin, Old Dominion University, MCetin@odu.edu; Hesham Rakha, Virginia Tech, hrakha@vtti.vt.edu
Accomplishments:
1. Performed literature review on the capabilities of the existing LiDAR systems in detecting smoke and soot emitted from vehicle emissions.
2. Researched and identified possible high-speed digitizer solution that will increase the LiDAR's resolution in profiling aerosol.
3. Researched possible methods to enhance Lidar’s capabilities by incorporating the depolarization ratio measurement to distinguishing minute particles of aerosol.
Impact: The end goal of the project is to improve the LiDAR resolution in profiling the aerosol in Hampton Roads area and adding new capability for the instrument to measure the depolarization ratio such that the new acquired measurements will be excellent source for analyzing the air quality and the identifying the sources of the aerosol in the area of study.

Project: Connected Vehicle Technologies for Energy Efficient Urban Transportation
PIs: Ajay Prasad, University of Delaware, prasad@udel.edu; Suresh Advani, University of Delaware, advani@udel.edu; Hyeon-Shic Shin, Morgan State University, hyeonshic.shin@morgan.edu
Period of Performance: January 1, 2015 – March 31, 2015
Accomplishments: During this three-month period (January 1, 2015 – March 31, 2015) a simulated traffic network with 16 nodes was built to test the traffic assignment algorithm, and to optimize the control algorithm of the UD fuel cell hybrid bus by incorporating congestion information. A traffic flow model was integrated into the network model to simulate real time traffic. A randomly generated origin-destination traffic demand table was fed into the model to calculate travel times for a large cohort of individual vehicles. For illustration purposes, the traffic network and corresponding travel-time distribution for all vehicles are shown below. The congestion ratio for each road segment within the 16-node network is color-coded (red- high; yellow- medium; green- low) and individual vehicles are labeled with their origin-destination. Ongoing research includes improved algorithms for optimal dynamic traffic assignment, optimization control algorithms, and a two-way communication system for the hybrid bus.
Products: A simplified traffic network simulation model has been built within Matlab for ongoing research.