

**Program Progress Performance Report for University  
Transportation Research Centers (PPPR #5)**

Prepared for the Research and Innovative Technology Administration (RITA);  
U.S. Department of Transportation (US DOT)

Grant Project Title:

**Advanced Operations Focused on Connected  
Vehicles/Infrastructure (CVI-UTC)**

Consortium Members:

**Virginia Tech Transportation Institute (VTTI),  
University of Virginia (UVA) Center for Transportation Studies,  
and Morgan State University (MSU).**

Submitted by:

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Grant Period: January 2012 – January 2014

Reporting Period End Date: April 2014

Semi-annual reporting periods

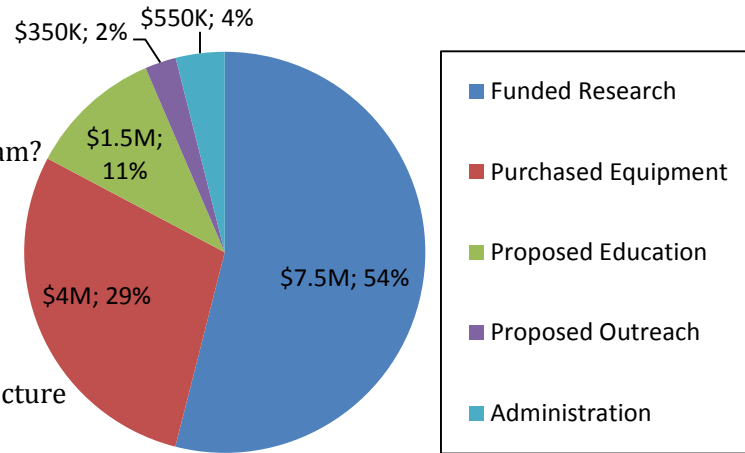
Summer: July 15, 2014

## Final Expenditures (Goal Seek)

### Accomplishments

What are the major goals and objectives of the program?

- Safety
- State of Good Repair
- Economic Competitiveness
- Livable Communities
- Environmental Sustainability
- All goals though connected vehicles/infrastructure



What was accomplished under these goals?

- Major activities:
  - CVI-UTC Research Presentations planned at ITS WC and TRB Annual Meeting
  - Major equipment manufacturer resource meetings with stakeholders
  - UGA and GRA direct tuition and work study funding
  - Applicant for winter banquet 2015 and summer meeting host 2016
  - Continued website development and content
  - VTTI School Days Outreach (K-12 students, teachers, parents)
  - VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)
  - UVA CTS Cooperative Transportation Systems
  - UVA Transportation Training Academy
  - Morgan State Electric Vehicle Infrastructure Council
  - Morgan State National Summer Transportation Institute (Baltimore HS Students)
  - Morgan State Teacher Transportation Institute (Baltimore HS Teachers)
  - Data Collection and Research on the Smart Road (Connected Motorcycles)
  - Data Collection and Research on the Virginia International Roadway (CV Bus)
  - Vehicle fleet delivery in NOVA for "Emergency V2V" research project
  - Connected Vehicle Derby at Moss Center for the Arts
  - Institute for Creativity Arts and Technology Open House
  - US DOT Datapalooza/GMAT Conference in Washington DC
  - Virginia Tech Staff Appreciation Day Connected Vehicle Demonstration
  - VDOT/VCTIR Connected Vehicle Demonstration
  - Institute for Industrial Engineers Conference
  - Kids Tech University at Virginia Tech Cassell Coliseum
  - Speak Out/YOVASO Connected Vehicle Demonstration
  - Rally for Road Safety for the County of Roanoke, VA
  - VDOT High School Career Fair in Manassas, VA
  - Virginia Science Festival Connected Vehicle Demonstration
  - Blacksburg Community Day Connected Vehicle Demonstration
  - Transportation Undergraduate Research Fellowship (TURF) Program

- Specific objectives:

<b>Major Activities:</b>	Safety	State of Good Repair	Economic Competitiveness	Livable Communities	Environmental Sustainability
CVI-UTC Research Presentations planned at ITS WC and TRB Annual Meeting	X	X	X	X	X
Major equipment manufacturer resource meetings with stakeholders	X		X	X	
UGA and GRA direct tuition and work study funding	X		X	X	
Applicant for winter banquet 2015 and summer meeting host 2016	X	X	X	X	X
Continued website development and content	X	X	X	X	X
VTTI School Days Outreach (K-12 students, teachers, parents)	X			X	
VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)	X			X	
UVA CTS Cooperative Transportation Systems	X			X	X
UVA Transportation Training Academy	X			X	X
Morgan State Electric Vehicle Infrastructure Council	X	X	X	X	X
Morgan State National Summer Transportation Institute (Baltimore HS Students)	X			X	
Morgan State Teacher Transportation Institute (Baltimore HS Teachers)	X		X	X	
Data Collection and Research on the Smart Road (Connected Motorcycles)	X	X	X	X	X
Data Collection and Research on the Virginia International Roadway (CV Bus)	X	X	X	X	X
Vehicle fleet delivery in NOVA for "Emergency V2V" research project	X	X	X	X	X
Connected Vehicle Derby at Moss Center for the Arts	X			X	
Institute for Creativity Arts and Technology Open House	X			X	
US DOT Datapalooza/GMAT Conference in Washington DC	X			X	
Virginia Tech Staff Appreciation Day Connected Vehicle Demonstration	X		X	X	
VDOT/VCTIR Connected Vehicle Demonstration	X	X	X	X	X
Institute for Industrial Engineers Conference	X			X	
Kids Tech University at Virginia Tech Cassell Coliseum	X			X	
Speak Out/YOVASO Connected Vehicle Demonstration	X			X	
Rally for Road Safety for the County of Roanoke, VA	X	X	X	X	
VDOT High School Career Fair in Manassas, VA	X			X	
Virginia Science Festival Connected Vehicle Demonstration	X			X	
Blacksburg Community Day Connected Vehicle Demonstration	X			X	
Transportation Undergraduate Research Fellowship (TURF) Program	X		X	X	

- Significant results, including major findings, developments, conclusions (+ and -):
  - Nothing to report – Research that was funded in Summer 2013 and Fall 2013 will be completing final reports of their research projects in Fall 2014.
- Key outcomes or other achievements:
  - Starting research on the Smart Road testbed, participating in the Northern Virginia testbed demonstration with VDOT, and releasing connected motorcycle and CV school bus and pedestrian research and work have been our three major outcomes/achievements during this reporting period.
- Discussion of stated goals not met:
  - While we have improved greatly with the UTC's reach and scope in education and outreach, we must once again pick up the pace and do more research – especially since our currently funded research will be writing final reports in the fall of 2014. We have been able to successfully make great strides in releasing technology and general innovation in part of the UTC at events like ITS America and Datapalooza – but we would like to have more concrete research findings to present and to be able to complete educational programming based on our new research findings funded by the UTC program.

What opportunities for training and professional development has the program provided?

These are research presentations from the CVI-UTC that were completed this summer (2013) and this upcoming academic fall semester (2013) and featured at IEEE and ITS conferences:

- *Public Perception on Increasing Use of Technology in Automobiles: Survey Findings* (Kishore/Rakha)
- *Inclement Weather Impact on Autonomous Vehicle Management at Intersections* (Zohdy/Rakha)
- *Fuel-Optimal Vehicle Throttle Control: Model Logic and Preliminary Testing* (Rakha)
- *Public Perception on Increased Use of Technology in Automobiles: Survey Findings* (Rakha)
- *Dynamic Travel Time Prediction using Pattern Recognition* (Rakha)
- *Safety and Human Factors of Adaptable Stop Displays Using Connected Vehicle Infrastructure* (Noble)
- *Women's Acceptance of and Willingness to Pay for Connected Vehicles* (Farkas, et al.)
- *Technology to Cost-Effectively Transport People and Freight Using all Modes* (Lee)
- *Applications of Connected Vehicle Infrastructure Technology for Public Transportation* (Lee)
- *Connected Vehicle Enabled Freeway Merge Assistance System Field Test: Preliminary Results of Driver Compliance to Advisory* (Hayat/Park/Smith)
- *Development of an Advisory Response Model for a Connected Vehicle Enabled Freeway Merge Assistance System: Interim Status* (Hayat/Park/Smith)
- *A Connected Vehicle-Based Application to Estimate Pavement Roughness* (Zeng/Smith)

Other educational programming completed this reporting period includes:

- Morgan State National Summer Transportation Institute for Baltimore-area high school students
- Morgan State Teacher Transportation Institute for Baltimore-area high school teachers
- VTTI School Days Outreach (K-12 students, teachers, parents)
- VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)
- UVA Transportation Training Academy
- Connected Vehicle Derby at Moss Center for the Arts
- Institute for Industrial Engineers Conference
- Kids Tech University at Virginia Tech Cassell Coliseum
- Speak Out/YOVASO Connected Vehicle Demonstration
- VDOT High School Career Fair in Manassas, VA
- Virginia Science Festival Connected Vehicle Demonstration
- Transportation Undergraduate Research Fellowship (TURF) Program

Because this is last two years (2014-16) of the CVI-UTC under the FY2011, with no additional funding currently being awarded, we have not been planning any additional programming at this time. Although we anticipate that many of the outreach and educational programs listed here will continue through other funding sources beyond the UTC, the majority of funding and planning have been diverted into the research side of the UTC.

How have the results been disseminated? If so, in what ways?

- Our main source of dissemination has been through virtual sources, such as our UTC website, the TRB database, and social media like a CVI-UTC Twitter account. We have also utilized invitations to speak at conferences, conference presentations, and general attendance in professional conferences and networking events hosted by consortium universities or large scale industry events to disseminate research results to a professional audience. Some major special events we have taken part of is a testbed demonstration with the Virginia Governor, Bob McDonnell at MPSTOC in Fairfax, VA and at the White House champions of Change and Datapalooza programs.

What do you plan to do during the next reporting period to accomplish the goal's end objectives?

- Currently we are still in the process of holding an additional research call for Fall 2014 research and evaluating and selecting the research through the Advisory Board, we are looking at funding 5-6 projects with an emphasis on additional outside collaboration from universities outside of the consortium. Also, we are fulfilling our education goals by funding the new short courses and using the resources at each of the consortium universities to attract students and transportation professionals. These short courses are something that will continue throughout 2014-15 and then we hope to be able to make them into "courses in a box" where we can further use these courses in the future and expand the audience either through travel with the course, or through a virtual classroom, like iTunes U, podcasting, or online courses offered through the consortium universities. By offering the short courses and then evolving them to "courses in a box", we feel that this is the best value for the investment for the funding and allows a great education and outreach opportunity. Another outreach goal will be accomplished within the CVI-UTC in in 2014 at the ITS World Congress in Detroit and our major UTC/Connected Vehicle booth, showcase and demonstration; as well as participation in

2015 at the TRB conference in January – these are our next major national outreach goals. We will also continue looking for similar opportunities where we can gain a large influence of our research for a low investment of funding; one hosting event that is particular interest to our group is hosting the CUTC Summer Conference in 2016, especially since it will be our last opportunity as a UTC, so that we may collaborate with other UTCs and to feature our connected vehicle and infrastructure research and work. We are currently unsure about the future of the CVI-UTC for the next funding period in 2015, if the UTC decides to move ahead and apply again to sustain the UTC through FY2015 funding, we can also consider additional academic and professional research and direct student support for research, education, and workforce development.

## Products

What has the program produced?

- Publications, conference papers, presentations:
  - *Public Perception on Increasing Use of Technology in Automobiles: Survey Findings (Kishore/Rakha)*
  - *Inclement Weather Impact on Autonomous Vehicle Management at Intersections (Zohdy/Rakha)*
  - *Fuel-Optimal Vehicle Throttle Control: Model Logic and Preliminary Testing (Rakha)*
  - *Public Perception on Increased Use of Technology in Automobiles: Survey Findings (Rakha)*
  - *Dynamic Travel Time Prediction using Pattern Recognition (Rakha)*
  - *Safety and Human Factors of Adaptable Stop Displays Using Connected Vehicle Infrastructure (Noble)*
  - *Women’s Acceptance of and Willingness to Pay for Connected Vehicles (Farkas, et al.)*
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  - *Development of an Advisory Response Model for a Connected Vehicle Enabled Freeway Merge Assistance System: Interim Status (Hayat/Park/Smith)*
  - *A Connected Vehicle-Based Application to Estimate Pavement Roughness (Zeng/Smith)*
- Websites; other Internet (<http://www.connectedvehicleinfrastructure-utc.org>)
- Technologies, techniques: Nothing to report
- Inventions, patent applications, licenses: Nothing to report
- Other: the Northern Virginia and Southwest Virginia Highly Instrumented Test Beds.

Have other collaborators or contacts been involved? (Can be “nothing to report”, if so.)

- Nothing to report.
  - Collaborations with others within the lead or partner universities, especially interdepartmental or interdisciplinary collaborations: Brian Smith (UVA) and Gerardo Flintsch (VTTI) Research: “Infrastructure Pavement Assessment and Management Applications Enabled by the Connected Vehicles Environment Research Program - Phase I:

Proof-of-Concept” (CONTINUING); Young Jae Lee (Morgan State) and Kathleen Hancock and Hesham Rakha (VT) Research: “Connected Vehicle-Infrastructure Application Development for Addressing Safety and Congestion Issues Related to Public Transportation, Pedestrians, and Bicyclists” (CONTINUING); Byungkyu (Brian) Park and Jia Hu (UVA) and Young Jae Lee (Morgan State) Research: “Next Generation Transit signal Priority with Connected Vehicle Technology” (CONTINUING).

- Collaborations or contact with others outside the UTC: Nothing to report. We have been reaching out to other universities that do similar connected research work such as Carnegie Mellon and Clemson University, but nothing has been established between those universities and the UTC as of this reporting period.
- Collaborations or contacts with others outside of the United States or with an international organization: countries of collaborations or contacts: Nothing to report. We are currently working with and looking at Netherlands and South Korea collaboration from interest in our testbeds, but nothing has been established between those universities and the UTC as of this reporting period.

## Impact

What is the impact of the program?

- The biggest impact of this report is the completion and showcase of the testbeds, the connected motorcycle fleet and the connected vehicle enhancements through CVI-UTC technology and installation and collaboration with institutions and companies like Savari and Iteris and VDOT. Other important impacts have been moving in the area of pedestrian safety from connected technology research and the start of the connected bus research that focus on school buses and general public transportation. The secondary impacts from the UTC program are our ability to complete outreach, education and workforce development programming within and between the consortium universities, and interest from outside groups, and seeking outside collaboration and participation. Other important impacts the program has had during this reporting period has been the outreach efforts at the ITS World Congress, as well as, being able to support undergraduate and graduate students in the field of transportation, engineering, and psychology who assist in the UTC research.

How has it contributed to transportation education, research and technology transfer?

- The test beds and connected vehicle, new buses and pedestrian research, and connected motorcycle fleets will influence the way connected vehicle/infrastructure research is conducted for our UTC, and in the future, incorporated into the national connected vehicle test bed. The test beds will also be able to be used not only by our specific UTC, but to any institution or university that desires to do simulation and real-world connected vehicle/infrastructure research.
- The research, outreach and student education and workforce funding that is accomplished through our UTC is designed to educate future engineers, STEM educators, and current engineers (civil, mechanical, electrical, etc.)/human factors (psychology, social sciences, etc.) practitioners; and even mechanics, dispatchers, and technicians who will be installing and repairing connected vehicle-infrastructure technology.

- The ultimate goal is to expand our current CVI-UTC efforts more educationally based and focused online/virtually to affect a broader national audience and to complete more research using the developed test beds to enable professional conference attendance, publication, and presentations. Research is the primary goal, education secondary, and outreach as a final component since it will have a more local reach where events are hosted and led.

How has the program provided opportunities for research and teaching in transportation and related disciplines?

- This reporting period we are still working with the eighteen research projects that were established on over the initial year of the UTC grant funding program, however, after two years of research, we are finally in the final reporting state for the majority of all of the UTC research projects. For the next reporting period, we are looking for expanding the research opportunities both to universities inside and outside of the UTC consortium and we are looking to do broader outreach and education. Unfortunately, many of the research proposals that the UTC Advisory Board received over the past year were not really determined to be currently suitable during that time for funding, so during this current reporting period a new research call was issued. At the end of this reporting period, it is likely that 5-6 research projects will be funded between September 2014 and December 2016; there is the possibility that more projects could be funded depending on the cost and expense for each research project.

How has the program 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?

- Morgan State's participation in our UTC has been able to majorly affect underrepresented groups through their research projects and outreach and education opportunities. By inner-consortium research work with Morgan State, this has allowed UVA and VTTI to participate in influencing underrepresented groups. Morgan State also directly offers programs for Baltimore-area high school students and teachers, which include underrepresented populations, and has allowed UTC research to directly affect future generations of potential engineers and human factors professionals.

How has the program developed and disseminated new educational materials or provided scholarships?

- Yes, these students are currently working and being educated under the grant:
- **Tanveer Hayat** (GRA, UVA) Working on "Connected Vehicle Enabled Freeway Merge Management - Field Test" under the direction of Dr. Brian L. Smith.
- **Arash Jahangiri** (GRA, VTTI) tuition and work study funded through the CVI-UTC grant, works at VTTI, studies Civil Engineering at Virginia Tech and advised by Dr. Tom Dingus.
- **Robert Kluger** (GRA, UVA) Working on "Infrastructure Safety Assessment Using Connected Vehicle Data" under the direction of Dr. Brian L. Smith.
- **Alex Noble** (GRA, VTTI) Working on "Safety and Human Factors of Adaptive Stop/Yield Signs Using Connected-Vehicle Infrastructure" as a PI with Dr. Tom Dingus.
- **Annabel St. Louis** (UGA, VTTI) Working on "Infrastructure Pavement Assessment" with Dr. Gerardo Flintsch



- **Kayla Sykes** (UGA, VTTI) Working on Adaptive Stop/Yield and Connected Motorcycle Projects under the direction of Dr. Zachary Doerzaph
- Also it is estimated that 12 additional GRAs and 6 additional URAs currently unidentified, but funding has been set aside for tuition and work study employment, and these students will be funded on the CVI-UTC research projects – there is just no names attached to these positions at this time.

How has the program provided exposure to transportation, science and technology for practitioners, teachers, young people, or other members of the project?

- The major education and outreach events that effected exposure of the CVI-UTC technology and research has been: the summer transportation institute sponsored by Morgan State for High School students, and the teacher transpiration institute sponsored by Morgan State for High School teachers, the annual VTTI Open House and School Days event with a special partnership with the Institute for Creativity Arts and Technology in Blacksburg, VA, the UVA Transportation Training Academy and the start of their web series on new transportation and connected vehicle technology, participation in the second annual US DOT Datapalooza, the Roanoke County Parks and Recreation Rally for Road Safety event, and various other Virginia state events featured by VDOT or in Blacksburg and Charlottesville, VA. We have worked really hard at our educational and outreach events to make practical application and exposure to students and teachers this past year.
- Major Outreach Events During This Past Reporting Period:
  - o Morgan State National Summer Transportation Institute for Baltimore-area high school students
  - o Morgan State Teacher Transportation Institute for Baltimore-area high school teachers
  - o VTTI School Days Outreach (K-12 students, teachers, parents)
  - o VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)
  - o UVA Transportation Training Academy
  - o Connected Vehicle Derby at Moss Center for the Arts
  - o Institute for Creativity Arts and Technology Open House
  - o US DOT Datapalooza/GMAT Conference in Washington DC
  - o Virginia Tech Staff Appreciation Day Connected Vehicle Demonstration
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  - o Institute for Industrial Engineers Conference
  - o Kids Tech University at Virginia Tech Cassell Coliseum
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  - o Transportation Undergraduate Research Fellowship (TURF) Program

Has the grant money or research done impacted physical resources at the university, institutional resources or information resources?

- The grant money has absolutely been instrumental in developing and installing the highly instrumented test beds in Northern Virginia and Southwest Virginia. As well as our connected vehicle and connected motorcycle fleets which we use to perform research and collect data. Without the UTC funding, it would be unlikely that these projects could have been completed with the velocity that they have been propelled. It has offered the consortium universities opportunities for research that would not have been possible this year without the grant. The grant money has also indirectly created several short-term job opportunities at consortium universities via the opportunities for reach and the equipment construction and installation. As the UTC progresses, it is anticipated that many of these job opportunities may become longer term as research progresses and value of CVI is heightened within the field of transportation. Also, the grant funding has allowed educational and outreach programs to continue at consortium universities that would not have been possible otherwise.

Describe ways in which the program made an impact, or is likely to make an impact, on commercial technology or public use.

- Because our UTC has been fortunate enough to work closely with automotive, technology, and wireless communication professionals through assembling our advisory board with these types of professionals, how closely our consortium university leaders works with these professionals, and through our test bed installations – we believe that this allows our UTC a unique opportunity not only to have this commercial technology and public use influence on the direction of our research goals, but also an opportunity to do work that is directly practically applicable and has a great deal of potential for commercial marketing and public use, probably a lot faster than the majority of university research may have an impact on the commercially viable aspects of transportation. We also anticipate that as our research progresses, particular physical artifacts like connected school buses, work zone safety vests, or adaptive stop yield displays in cars, have the potential for commercial technology and public use – just to name a few projects that are working towards immediate practical safety applications.

Describe how results from the program made an impact, or are likely to make an impact, beyond the bounds of science, engineering, and the academic world.

- The CVI-UTC is likely to make an impact beyond STEM or academia because it is a field and a UTC that encourages safety, affordability, and practicality for every transportation consumer in America. This may sound grandiose, but through the research this UTC is completing, the outreach and education opportunities, and the technical development of aftermarket safety devices that use CVI technology for naïve drivers, these are practical applications that are occurring right now in Maryland and Virginia because of the UTC funding. We know that we can expand these current activities to a broader audience in future reporting periods. The CVI-UTC has the advantage of working in a very practical field – transportation and human factors – the goal is to use CVI technology to positively affect all drivers; and this could even be said to be making an impact currently via the Northern Virginia Connected Vehicle testbed where

millions of drivers utilize I-66 on a daily basis and have been exposed to the UTC research in that manner.

## **Changes/Problems**

- Changes in approach and reasons for change. – We have gone back to focusing on our research side of the UTC because our outreach and education ventures have really been able to blossom and flourish. However, there has not been a lot of new research funded between the last reporting periods until now. We have attempted to focus on current research projects instead of funding additional ones, although a new research call has been issued and 5-6 research projects will be funded and continuing between September 2014 to December 2016. By focusing on our current research projects and guiding those to completion we have been able to: 1) perform not just lots of research, but high quality and well executed research projects; 2) move away from single-use events, where we have been successful at them, we want to reach broader, national audiences with all of our work; and 3) be able to reach broader audiences with our educational programs, we want to not just access university-level academic courses, but move towards more workforce development, and larger, maybe virtual, audiences with broad topics on CVI technology, not just specialized topics. We hope that these adjustments and changes will help us reach our UTC goals better and use funds in a more far reaching manner.
- Actual or anticipated problems or delays and actions or plans to resolve them. – Our major delays have been with our technology and making appropriate research selections to make the most out of our remaining funding. A lot of the equipment has proven problematic in execution and installation. We have been able to overcome that with our UTC workforce within our consortium universities and through partnerships with collaborators like VDOT, Iteris and Savari. We are trying to catch up from after a year of delay in research because of installation, programming and resolving bugs in the equipment and technology, however, we know that our experience through these delays will not only solve problems further down the line when it comes to commercial technology development, but also in workforce development problems, as future careers can be made from learning how to install and program connected technology in vehicle and roadways. We are moving forward on the research selections since the majority of the technology issues have been overcome to the point that research can be conducted on live roadways with our testbeds, so it is anticipated that both of these major concerns will not be problematic over the last two years in completing the last of the UTC goals with our FY2011 funding.
- Changes that have a significant impact on expenditures. – Nothing to report.
- Significant changes in use or care of animals, human subjects, and biohazards. – Nothing to report.

## **Outputs**

- Research projects awarded:

<b>Research Projects under UTC Funding:</b>	Safety	State of Good Repair	Economic Competitiveness	Livable Communities	Environmental Sustainability
Safety and Human Factors of Adaptive Stop/Yield Signs Using Connected-Vehicle Infrastructure	X	X	X	X	X
Connected Vehicle Applications for Adaptive Overhead Lighting	X	X	X	X	X
Intersection Management Using In-Vehicle Speed Advisory/Adaptation	X		X		X
Field Testing of Eco-Speed Control Using V2I Communication	X		X		X
Innovative "Intelligent" Awareness System for Roadway Workers Using Dedicated Short-Range Communication	X	X		X	
Emergency Vehicle-to-Vehicle Communication	X			X	
Connected Vehicle Enabled Freeway Merge Management - Field Test	X				
Infrastructure Safety Assessment Using Connected Vehicle Data	X	X	X	X	X
Infrastructure Pavement Assessment and Management Applications Enabled by the Connected Vehicles Environment Research Program - Phase I: Proof-of-Concept	X	X	X	X	X
Connected Vehicle-Infrastructure Application Development for Addressing Safety and Congestion Issues Related to Public Transportation, Pedestrians and Bicyclists	X	X	X	X	X
Connected Motorcycle Crash Warning Interfaces	X				
Connected Motorcycle System Performance	X				
Developing and Evaluating a Smartphone Application Aimed at Reducing Crashes Involving Bicycles	X			X	
Develop and Test Connected Vehicle Freeway Speed Harmonization Systems	X		X		X
Reducing School Bus/Light-Vehicle Conflicts Through Connected Vehicle Communication	X			X	
Next Generation Transit Signal Priority with Connected Vehicle Technology	X		X		X
Prototyping and Evaluating a Smart Phone Dynamic Message Sign Application in the CVI-UTC Testbed	X	X	X	X	X
Measuring User Acceptance of and Willingness to Pay for CVI Technology	X	X	X	X	X

- Publications, conference papers, presentations:
  - *Public Perception on Increasing Use of Technology in Automobiles: Survey Findings (Kishore/Rakha)*
  - *Inclement Weather Impact on Autonomous Vehicle Management at Intersections (Zohdy/Rakha)*
  - *Fuel-Optimal Vehicle Throttle Control: Model Logic and Preliminary Testing (Rakha)*
  - *Public Perception on Increased Use of Technology in Automobiles: Survey Findings (Rakha)*
  - *Dynamic Travel Time Prediction using Pattern Recognition (Rakha)*
  - *Safety and Human Factors of Adaptable Stop Displays Using Connected Vehicle Infrastructure (Noble)*
  - *Women's Acceptance of and Willingness to Pay for Connected Vehicles (Farkas, et al.)*
  - *Technology to Cost-Effectively Transport People and Freight Using all Modes (Lee)*

- *Applications of Connected Vehicle Infrastructure Technology for Public Transportation (Lee)*
- *Connected Vehicle Enabled Freeway Merge Assistance System Field Test: Preliminary Results of Driver Compliance to Advisory (Hayat/Park/Smith)*
- *Development of an Advisory Response Model for a Connected Vehicle Enabled Freeway Merge Assistance System: Interim Status (Hayat/Park/Smith)*
- *A Connected Vehicle-Based Application to Estimate Pavement Roughness (Zeng/Smith)*
- Websites: (<http://www.connectedvehicleinfrastructure-utc.org>)
- Technologies or technology assessments; databases, software or models: Nothing to report yet – still developing things for the highly connected vehicles and the two test beds.
- Outreach activities:
  - ITS World Congress Participation
  - TRB Annual Meeting
  - VTTI School Days Outreach (K-12 students, teachers, parents)
  - VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)
  - Connected Vehicle Derby at Moss Center for the Arts
  - Institute for Creativity Arts and Technology Open House
  - US DOT Datapalooza/GMAT Conference in Washington DC
  - Virginia Tech Staff Appreciation Day Connected Vehicle Demonstration
  - VDOT/VCTIR Connected Vehicle Demonstration
  - Institute for Industrial Engineers Conference
  - Kids Tech University at Virginia Tech Cassell Coliseum
  - Speak Out/YOVASO Connected Vehicle Demonstration
  - Rally for Road Safety for the County of Roanoke, VA
  - VDOT High School Career Fair in Manassas, VA
  - Virginia Science Festival Connected Vehicle Demonstration
  - Blacksburg Community Day Connected Vehicle Demonstration
- Courses and workshops; patents filed or issues, licenses:
  - Nothing to report in this time period

## Outcomes

	Increased understanding and awareness of transportation issues:	Improved body of knowledge:	Improved processes, techniques and skills in addressing transportation issues:	Enlarged pool of trained transportation professionals:	Greater adoption of new technology:
CVI-UTC Research Presentations planned at ITS WC and TRB Annual Meeting	X	X	X	X	X
Major equipment manufacturer resource meetings with stakeholders	X		X	X	
UGA and GRA direct tuition and work study funding		X		X	
Applicant for winter banquet 2015 and summer meeting host 2016			X	X	
Continued website development and content			X		
VTTI School Days Outreach (K-12)	X			X	X

students, teachers, parents)					
VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)	X			X	X
UVA CTS Cooperative Transportation Systems	X	X	X	X	X
UVA Transportation Training Academy	X	X	X	X	X
Morgan State Electric Vehicle Infrastructure Council	X	X	X		X
Morgan State National Summer Transportation Institute (Baltimore HS Students)	X	X		X	X
Morgan State Teacher Transportation Institute (Baltimore HS Teachers)	X	X		X	X
Data Collection and Research on the Smart Road (Connected Motorcycles)	X	X	X		X
Data Collection and Research on the Virginia International Roadway (CV Bus)	X	X	X		X
Vehicle fleet delivery in NOVA for "Emergency V2V" research project	X	X	X		X
Connected Vehicle Derby at Moss Center for the Arts	X	X	X	X	X
Institute for Creativity Arts and Technology Open House	X	X	X	X	X
US DOT Datapalooza/GMAT Conference in Washington DC	X	X	X	X	X
Virginia Tech Staff Appreciation Day Connected Vehicle Demonstration	X				X
VDOT/VCTIR Connected Vehicle Demonstration	X	X	X	X	X
Institute for Industrial Engineers Conference	X	X	X	X	X
Kids Tech University at Virginia Tech Cassell Coliseum	X	X	X	X	X
Speak Out/YOVASO Connected Vehicle Demonstration	X	X	X	X	X
Rally for Road Safety for the County of Roanoke, VA	X				X
VDOT High School Career Fair in Manassas, VA	X	X	X	X	X
Virginia Science Festival Connected Vehicle Demonstration	X	X	X	X	X
Blacksburg Community Day Connected Vehicle Demonstration	X				X
Transportation Undergraduate Research Fellowship (TURF) Program	X	X	X	X	X

## Impacts

	Safer driver behavior:	Increased travel time reliability:	Increased intermodal transportation operations:	Reduction in carbon and other harmful emissions from transportation sources:
CVI-UTC Research Presentations planned at ITS WC and TRB Annual Meeting	X		X	
Major equipment manufacturer resource meetings with stakeholders	X	X	X	X
UGA and GRA direct tuition and work	X			

study funding				
Applicant for winter banquet 2015 and summer meeting host 2016	X		X	
Continued website development and content	X			X
VTTI School Days Outreach (K-12 students, teachers, parents)	X		X	
VTTI Open House (Virginia Tech, Blacksburg, Southwest Virginia residents)	X		X	
UVA CTS Cooperative Transportation Systems	X	X	X	X
UVA Transportation Training Academy	X		X	X
Morgan State Electric Vehicle Infrastructure Council	X		X	X
Morgan State National Summer Transportation Institute (Baltimore HS Students)	X		X	
Morgan State Teacher Transportation Institute (Baltimore HS Teachers)	X		X	
Data Collection and Research on the Smart Road (Connected Motorcycles)	X	X	X	X
Data Collection and Research on the Virginia International Roadway (CV Bus)	X	X	X	X
Vehicle fleet delivery in NOVA for "Emergency V2V" research project	X	X	X	X
Connected Vehicle Derby at Moss Center for the Arts	X			
Institute for Creativity Arts and Technology Open House	X			
US DOT Datapalooza/GMAT Conference in Washington DC	X	X	X	X
Virginia Tech Staff Appreciation Day Connected Vehicle Demonstration	X			
VDOT/VCTIR Connected Vehicle Demonstration	X	X	X	X
Institute for Industrial Engineers Conference	X		X	
Kids Tech University at Virginia Tech Cassell Coliseum	X			
Speak Out/YOVASO Connected Vehicle Demonstration	X			
Rally for Road Safety for the County of Roanoke, VA	X	X	X	X
VDOT High School Career Fair in Manassas, VA	X			
Virginia Science Festival Connected Vehicle Demonstration	X			
Blacksburg Community Day Connected Vehicle Demonstration	X			
Transportation Undergraduate Research Fellowship (TURF) Program	X		X	

## Special Reporting Requirements

If there are any special reporting requirements specified in the award terms and conditions (do not think this is the case for CVI-UTC).