NTC Program Progress Performance Report (PPPR) Information Form

For P.I.'s Use

On a semi-annual basis the NTC sponsored P.I. must report Program Progress Performance Report (PPPR) using the format specified in this PPPR Information Form. The form must be submitted electronically to the corresponding NTC Associate Director by 3/10/2015.

Cover Period: 10/1/2014 – 3/10/2015

NTC Funded Project Information (Round/Year 1, 2013-2014)	
University Name	North Carolina State University
Project Title	Vehicle Trajectory Tool (VTT): Application Pilot for AMS Test bed
Principal Investigator	Nagui M. Rouphail, PhD, Director, ITRE, NC State University
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The form includes the following six parts:

- Part I – Accomplishments: What was done? What was learned?
- Part II – Products: What has the program produced?
- Part III – Participants & Collaborating Organizations: Who has been involved?
- Part IV – Impact: What is the impact of the program? How has it contributed to transportation education, research and technology transfer?
- Part V – Changes/Problems

Supplementary documents/materials can be attached to this form with the submission.

Part I – Accomplishments: What was done? What was learned?	
The information provided in this section allows the OST-R grants official to assess whether satisfactory progress has been made during the reporting period.	
Reporting Period	**10/1/2014 – 3/10/2015**
1. What are the major goals of the program?	The National UTC aims to promote strategic transportation policies, investment, and decisions that bring lasting and equitable economic benefits to the U.S. and its citizens. The Center is concerned with the integrated operations and planning of all modes serving the nation's passenger and freight transportation system, including the institutional issues associated with their management and investments. A balanced multi-modal approach will be used that considers freight and passenger travel mobility, reliability, and sustainability, as well as system operations during periods of both recurring and non-recurring incidents, including response to major emergencies. The modes in this theme include highway, transit, rail, and inter-modal interfaces including ports, terminals and airports. In particular, the center focuses on research, education, and technology transfer activities that can lead to (1) Freight efficiency for domestic shipping and for our international land, air, and sea ports; (2) Highway congestion mitigation with multi-modal strategies; and (3) Smart investments in intercity passenger travel facilities such as high speed rail. Major center activities are as following: • **Advanced & Applied Research Promoting Economic Competitiveness:** Our research activities are multimodal/intermodal and multidisciplinary in scope, with the aims of addressing nationally and regionally significant transportation issues pertinent to economic competitiveness and providing practice-ready solutions. • **Education, Workforce Development, Technology Transfer, & Diversity** The consortium is committed to providing high-quality transportation education and workforce development programs for a broad and diverse audience. Center's efforts will support the development of a critical transportation knowledge base and a transportation workforce that is prepared to design, deploy, operate, and maintain the complex transportation systems of the future.

2. What was accomplished under these goals?	Major Activities that are done are mainly focused on tasks 3 and 4 of the project: 1. Conduct and analyze off-line Database Experiments (Task 3) 2. Develop and Test V-I-V capability (Task 4) Specific Objectives: The key objective of this research is to upgrade and pilot-test an existing vehicle trajectory collection tool (VTT) for testing the feasibility of a V-I-V system in communicating timely and spatially sensitive messages to vehicles upstream of a recurring or non-recurring bottleneck queues. Significant Results: 1. Off-line tests through collected high resolution vehicle trajectories by controlled field experiments 2. Develop VIV events and its threshold for giving information to driver on real time 3. Test and evaluate predesigned VIV events' list with its thresholds
3. How have the results been disseminated?	The project team has presented a paper at the Transportation Research Board Annual meeting in Washington DC in January 2015. The poster (No. 15-4991) has been attached to this document as a reference.
4. What do you plan to do during the next reporting period to accomplish the goals? (10/1/2014 – 3/10/2015)	The project team is planning to work primarily on tasks 5 and 6 during the next period of the project. The activities will mainly include VIV experiments and drafting final report. The tasks 5 and 6 of the project are: • V-I-V Experiments (Task 5) • Draft Final Report (Task 6)

Part II – Products: What has the program produced?	
Publications are the characteristic product of research projects funded by the UTC Program. OST-R may evaluate what the publications demonstrate about the excellence and significance of the research and the efficacy with which the results are being communicated to colleagues, potential users, and the public, not the number of publications. Many research projects (though not all) develop significant products other than publications. OST-R may assess and report both publications and other products to Congress, communities of interest, and the public.	
Reporting Period	**10/1/2014 – 3/10/2015**
1. Journal publications:	N/A [List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like. A publication in the proceedings of a one-time conference, not part of a series, should be reported under "Books or other non-periodical, one-time publications."] [Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).]
2. Books or other non-periodical, one-time publications	Nothing to report [Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.] [Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).]

3. Other publications, conference papers and presentations	Song, T., S. Kim, N. Rouphail, B. Aghdashi, A. Amaro and G. Goncalves, "*Exploring the Association of Crash Propensity and Micro-Scale Driver Behavior*", presented at the 94th Annual Meeting of TRB, August 2014 (15-4991). [Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication as noted above.]
4. Website(s) or other Internet site(s)	N/A [List the URL for any Internet site(s) that disseminates the results of the research and/or program activities. A short description of each site should be provided. It is not necessary to include the publications already specified above in this section.]
5. Technologies or techniques	We are developing an alert-based messaging system with the i2d device to enable connected vehicle communications.
6. Outreach activities	N/A
7. Courses and workshops	N/A
8. Inventions, patent applications, and/or licenses	N/A
9. Other products	1. High resolution driving behavior database (with over 16 million second by second records) 2. Real time VIV events' list and its thresholds [Identify any other significant products that were developed under this program. Describe the product and how it is being shared. Examples of other products are: Databases • Physical collections • Audio or video products • Software or NetWare • Models • Educational aids or curricula • Instruments or equipment • Data & Research Material • Other]

Part III – Participants & Collaborating Organizations: Who has been involved?	
OST-R needs to know who has worked on the project to gauge and report performance in promoting partnerships and collaborations.	
Reporting Period	**10/1/2014 – 3/10/2015**
1. What organizations have been involved as partners?	• Institute for Transportation Research and Education (ITRE), North Carolina State University, Raleigh, NC • Idmec (Technical University of Lisbon), providing technical support • iTds (software company in Lisbon, Portugal), providing technical support to the project • https://www.i2d.co/i2dpubportal/home.xvw [Describe partner organizations – academic institutions, other nonprofits, industrial or commercial firms, state or local governments, schools or school systems, or other organizations (foreign or domestic) – that have been involved with the program. Partner organizations may provide financial or in-kind support, supply facilities or equipment, collaborate in the research, exchange personnel, or otherwise contribute.] [Provide the following information for each partnership: Organization Name: Location of Organization: (if foreign location list country) Partner's contribution to the project (identify one or more) • Financial support; • In-kind support (e.g., partner makes software, computers, equipment, etc., available • to project staff); • Facilities (e.g., project staff use the partner's facilities for project activities); • Collaborative research (e.g., partner's staff work with project staff on the project); and • Personnel exchanges (e.g., project staff and/or partner's staff use each other's • facilities, work at each other's site).] •

2. Have other collaborators or contacts been involved?	[Some significant collaborators or contacts within the lead or partner universities may not be covered by "What people have worked on the project?" Likewise, some significant collaborators or contacts outside the UTC may not be covered under "What other organizations have been involved as partners?" For example, describe any significant: • Collaborations with others within the lead or partner universities; especially • interdepartmental or interdisciplinary collaborations; • Collaborations or contact with others outside the UTC; and • Collaborations or contacts with others outside the United States or with an international organization. • Country(ies) of collaborations or contacts.]

Part IV – Impact: What is the impact of the program? How has it contributed to transportation education, research and technology transfer?	
DOT uses this information to assess how the research and education programs: • **increase the body of knowledge and techniques;** • **enlarge the pool of people trained to develop that knowledge and techniques or** • **put it to use; and,** • **improve the physical, institutional, and information resources that enable those people to get their training and perform their functions.**	
Reporting Period	**10/1/2014 – 3/10/2015**
1. What is the impact on the development of the principal discipline(s) of the program?	Connected vehicles are coming. The discipline of transportation will move from infrastructure based traveler information (VMS, HAR) to in-vehicle messaging from the infrastructure or other vehicles. This research paves the way for understanding the impact of and response to this type of messaging.
2. What is the impact on other disciplines?	Mostly on the big-data schemes needed to support the high resolution information coming from the vehicles, mostly in the areas of computer science and engineering.
3. What is the impact on the development of transportation workforce development?	Significant impact, as the field is moving more into the electric/ computer science field, and less on brick and mortar and concrete. Will have an impact on the way we teach transportation.
4. What is the impact on physical, institutional, and information resources at the university or other partner institutions?	1- An extensive database of second by second equipped vehicle trajectories synchronized in time and space as they traverse freeway/arterial facilities over a period of six months. This database will be used to understand fundamental traffic flow phenomenon at a resolution and scale that is unprecedented. It will also deliver key driver behavioral data.

	2- A demonstration of V-I-V concepts and messages in near real time, and an assessment of their effectiveness [Describe ways, if any, in which the program made an impact, or is likely to make an impact, on physical, institutional, and information resources that form infrastructure, including: • Physical resources such as facilities, laboratories, or instruments; • Institutional resources (such as establishment or sustenance of societies or organizations); or • Information resources, electronic means for accessing such resources or for scientific communication, or the like.]
5. What is the impact on technology transfer?	This research might be the first trial on real experiment for testing and evaluating real time V-I-V information (events and thresholds). This predesigned events' list and threshold will be very useful source for connected vehicle environment. [Describe ways in which the program made an impact, or is likely to make an impact, on commercial technology or public use, including: Transfer of results to entities in government or industry; • Instances where the research has led to the initiation of a start-up company; or • Adoption of new practices.]
6. What is the impact on society beyond science and technology?	As part of the project tasks, this research team is investigating the Vehicle to Vehicle communication (VIV).
7. Additional impacts	The impact of this projects outcome will increase the understanding of transportation issues in the area of safety and conceptualism of transportation. By collecting a vast amount of data from i2D devices, it is expected that the body of knowledge of transportation engineering will improve.

Part V – Changes/Problems	
If not previously reported in writing to OST-R through other mechanisms, provide the following additional information or state, "Nothing to Report, if applicable:	
Reporting Period	**10/1/2014 – 3/10/2015**
1. Changes in approach and reasons for change	Nothing to report
2. Actual or anticipated problems or delays and actions or plans to resolve them	We are likely to request a 90 days no-cost extension from the current termination date of June 30, 2015 to September 30, 2015. This is primarily due to delay in receiving i2d equipment which was necessary to carry out the VIV experiments. [If there is nothing significant to report during this reporting period, state "Nothing to Report."] [Describe problems or delays encountered during the reporting period and actions or plans to resolve them.]
3. Changes that have a significant impact on expenditures	"Nothing to Report."
4. Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards	"Nothing to Report."