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 9/15/2015.

Cover Period: 4/1/2015 – 9/30/2015

NTC Funded Project Information (Round/Year 1, 2013-2014)	
University Name	Old Dominion University
Project Title	Combining Different Data Sources to Predict Origin-Destinations and Flow Patterns for Trucks in Large Networks
Principal Investigator	Mecit Cetin
PI Contact Information	mcetin@odu.edu

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	**4/1/2015 – 9/30/2015**
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?	This project is focused on developing and enhancing vehicle re-identification algorithms to anonymously match trucks between two detection sites by combining information from multiple sensors. To accomplish the goals of the project, data at the individual vehicle level are needed. For each vehicle crossing the sensors, its attributes, e.g., length and axle spacings, are needed. The PI had coordinated with VDOT (Virginia Department of Transportation) so that per-vehicle data are collected at two continuous count sites along I-64 in the Hampton Roads. Data spanning several weeks were collected by VDOT and made available to the PI. In addition, video from the VDOT surveillance cameras was recorded for the same time periods for manually verifying and validating the estimated matched pairs from the re-identification algorithm. Approximately, 250 trucks were manually matched based on the video files. These were then used for model calibration and testing. In addition, INRIX data for the same corridor and time period were obtained. A model was developed to adaptively change the search space while matching vehicles based on axle spacing attributes. The model was then tested on the manually matched vehicle pairs. It was found that incorporating external travel time information (e.g., INRIX) improved the accuracy of the re-identification algorithm significantly. The findings are documented in the project final report.
3. How have the results been disseminated?	The following papers related papers have been published/submitted: 1. A.P. Nichols and M. Cetin "Evaluation of Differential Calibration Accuracy between WIM Stations Using Reidentified Vehicles," Accepted for publication in *Transportation Research Record*, 2015. 2. G. Basar, M. Cetin, A. Nichols, and D. Nguyen, "Comparison of Vehicle Re-Identification Methods for Trucks Based on Axle Spacing Measurements" 95th Transportation Research Board Annual Meeting, Washington, D.C., January 10-14, 16-5030 (submitted)
4. What do you plan to	The project is completed.

do during the next reporting period to accomplish the goals? (10/1/2014 – 3/10/2015)	

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	**4/1/2015 – 9/30/2015**
1. Journal publications:	A.P. Nichols and M. Cetin "Evaluation of Differential Calibration Accuracy between WIM Stations Using Reidentified Vehicles," Accepted for publication in *Transportation Research Record*, 2015.
2. Books or other non-periodical, one-time publications	NA
3. Other publications, conference papers and presentations	A.P. Nichols and M. **Cetin** "Evaluation of Differential Calibration Accuracy Between WIM Stations Using Reidentified Vehicles," *The 94th Annual meeting of the Transportation Research Board*, Washington, D.C., January 11-15, 2015. G. Basar, M. Cetin, A. Nichols, and D. Nguyen, "Comparison of Vehicle Re-Identification Methods for Trucks Based on Axle Spacing Measurements" 95th Transportation Research Board Annual Meeting, Washington, D.C., January 10-14, 16-5030 (submitted) U. Ahmed and M. Cetin "Analyzing the Passenger Car Equivalencies for Trucks at Tunnels and the Impacts of Bottleneck Location" 95th Transportation Research Board Annual Meeting, Washington, D.C., January 10-14, 16-5030 (submitted)

4. Website(s) or other Internet site(s)	NA
5. Technologies or techniques	New vehicle re-identification methods for large trucks.
6. Outreach activities	NA
7. Courses and workshops	NA
8. Inventions, patent applications, and/or licenses	NA
9. Other products	NA

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	**4/1/2015 – 9/30/2015**
1. What organizations have been involved as partners?	This project is currently conducted at ODU. VDOT supported this research by collecting and providing vehicle-specific data from the sensors in the field.
2. Have other collaborators or contacts been involved?	The PI continues to collaborate on scholar publications with Dr. Andrew Nichols from Marshall University on further developing and applying the vehicle re-identification algorithms.

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	**4/1/2015 – 9/30/2015**
1. What is the impact on the development of the principal discipline(s) of the program?	The re-identification algorithms developed in this research are expected to benefit the larger community since the proposed approach improves their accuracy.
2. What is the impact on other disciplines?	NA
3. What is the impact on the development of transportation workforce development?	The PI is integrating the re- identification algorithms into the graduate courses in transportation (e.g., traffic flow theory, computational transportation class). The collected per-vehicle data are also used in class projects to analyze traffic flow behavior.
4. What is the impact on physical, institutional, and information resources at the university or other partner institutions?	The project helped ODU receive valuable datasets (e.g., per-vehicle data from traffic sensors) from VDOT.

5. What is the impact on technology transfer?	The PI is serving as a consultant on an FHWA SBIR Phase II project that is focused on vehicle re-identification. The methods developed within this UTC project will be potentially integrated into a system being developed for field testing and deployment planned for the SBIR project.
6. What is the impact on society beyond science and technology?	NA
7. Additional impacts	NA

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	**4/1/2015 – 9/30/2015**
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	Nothing to Report
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
5. Change of primary performance site location from that originally proposed	Nothing to Report