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: 4/1/2014 – 9/30/2015

NTC Funded Project Information (Round/Year 1, 2013-2014)	
University Name	University of Maryland, College Park
Project Title	Efficiency and Reliability in Freight Transportation Systems
Principal Investigator	Paul Schonfeld
PI Contact Information	Tel: 301-405-1954; pschon@umd.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?	[For this reporting period describe: 1) major activities; 2) specific objectives; 3) significant results, including major findings, developments, or conclusions (both positive and negative); and 4) key outcomes or other achievements. Include a discussion of stated goals not met. As the program progresses, the emphasis in reporting in this section should shift from reporting activities to reporting accomplishments.] [Generally, the activities and expected outputs, outcomes and impacts should not change from one reporting period to the next. However, if there are changes, please list the revisions and explain the reason(s) for the changes.] --- Several methods have been formulated for analyzing and optimizing various aspects of freight logistics, including design of networks and schedules, optimization of slack times within schedules and real-time dispatching decisions applicable when some connecting vehicles are late in arriving at the transfer terminals. The emphasis in these methods is in quantitatively analyzing reliability in freight logistics and optimizing controllable variables such as slack times in schedules, reserve vehicle capacity, service frequencies and real-time dispatching decisions. A particular method for improving the reliability of intermodal and intramodal transfers of freight among vehicles at hub terminals has been developed fully enough that a paper documenting it has been submitted to a journal and is currently under review. This paper specified a mixed integer nonlinear programming problem (MINLP) for assisting intermodal logistics operators with coordination decisions in freight transfer scheduling. A hybrid technique combining sequential quadratic programming and genetic algorithms (GA-SQP) was developed to solve the proposed MINLP. An optimization model was formulated for coordinating vehicle schedules and cargo transfers at intermodal freight terminals, which was done primarily by optimizing coordinated service frequencies and slack times, while also considering loading and unloading, storage and cargo processing operations. This study also provided flexibility in managing general and perishable cargos with different cargo value functions that depend on dwell times. Numerical results indicated that the developed algorithm was capable of producing optimal solutions efficiently for both small and large intermodal freight networks.
3. How have the results been disseminated?	[Describe how the results have been disseminated. Include any outreach activities that have been undertaken to reach members of communities who are not usually aware of these program activities, for the purpose of enhancing public understanding and increasing interest in learning and transportation careers.] --- A paper documenting the newly developed method and results obtained with it has been submitted to the Journal Transportation

	Planning and Technology in October 2014 but no review has been received by Sept 25, 2015. That paper is entitled "A Dispatching Decision Support System for Countering Delay Propagation in Intermodal Logistics Networks". An additional paper on the subject has been submitted in July 2015 to the International Journal of Shipping and Logistics, entitled "A Hybrid Heuristic techniques for Optimal Coordination in Intermodal Logistics Scheduling". The methods developed in those two papers have been influencing the work of additional graduate students working on this subject. After the journal decisions are received we expect to revise and resubmit these two papers.
4. What do you plan to do during the next reporting period to accomplish the goals? (10/1/2014 – 3/10/2015)	[Describe briefly what you plan to do during the next reporting period to accomplish the goals and objectives.] The work in Round 1 has been completed. Extensions of that work are being pursued in Round 2.

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:	[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).] None yet accepted for publication.
2. Books or other non-periodical, one-time publications	[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	[Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the

presentations	publication as noted above.]
4. Website(s) or other Internet site(s)	[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	[Identify technologies or techniques that have resulted from the research activities. Describe the technologies or techniques and how they are being shared. Such as Technologies or technology assessments] The new methods are briefly described in Section 2 ("Accomplishments")
6. Outreach activities	
7. Courses and workshops	The new methods are being introduced in two graduate courses at the Univ. of Maryland.
8. Inventions, patent applications, and/or licenses	[Identify inventions, patent applications with date, and/or licenses that have resulted from the research. Submission of this information as part of an interim research performance progress report is not a substitute for any other invention reporting required under the terms and conditions of an award; as of the date of this document, UTC Program inventions may not be submitted to the Federal

	government's Interagency Edison (iEdison) invention-reporting system, but OST-R is working to make that available and will notify UTCs. For additional requirements pertaining to Patents and Copyrights, refer to General Provisions of Grants for University Transportation Centers, Section III, 14.]
9. Other products	[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	**4/1/2015 – 9/30/2015**
1. What organizations have been involved as partners?	[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).] Professors George List at North Carolina State University and Hyeonshic Shin at Morgan State University are working on closely related projects on freight transportation reliability. The methods developed and results obtained are shared by the three universities and used in their related research activities.

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.] The University of Maryland is collaborating in these freight reliability activities with National Dong Hwa University in Taiwan. Dr. Frank Chen at NDHU is continuing some research on freight logistics which he started a few years ago at the Univ. of Maryland as a Ph.D. student advised by Prf. Paul Schonfeld.

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?	[Describe how findings, results, techniques that were developed or extended, or other products from the program made an impact or are likely to make an impact on the base of knowledge, theory, and research and/or pedagogical methods in the principal disciplinary field(s) of the program. Summarize using language that an intelligent lay audience can understand (Scientific American style).] [How the field or discipline is defined is not as important as covering the impact the work has had on knowledge and technique. Make the best distinction possible, for example, by using a "field" or "discipline", if appropriate, that corresponds with a single academic department (i.e., physics rather than nuclear physics).]
2. What is the impact on other disciplines?	[Describe how the findings, results, or techniques developed or improved, or other products from the program made an impact or are likely to make an impact on other disciplines.]
3. What is the impact on the development of	[Describe how the program made an impact or is likely to make an impact on transportation workforce development. For example,

transportation workforce development?	how has the program: • Provided opportunities for research and teaching in transportation and related disciplines; • 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; • Developed and disseminated new educational materials or provided scholarships; or provided exposure to transportation, science and technology for practitioners, teachers, young people, or other members of the public?]
4. What is the impact on physical, institutional, and information resources at the university or other partner institutions?	[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?	[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?	[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 on areas such as: • Improving public knowledge, attitudes, skills, and abilities; • Changing behavior, practices, decision making, policies (including regulatory policies), or social actions; or • Improving social, economic, civic, or environmental conditions]
7. Additional impacts	[NTC encourages to consider identifying program results by outcomes or impacts, as suggested by the examples below. Impacts should be linked to National goals expressed in the Secretary's Strategic Goals.] [Outcomes are broader changes that are expected to result from the products, such as: • 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; • Other impacts. Impacts are the longer-term, fundamental changes intended as a result of your activities, such as: • Safer driver behavior; • Increased travel time reliability;

	• Increased intermodal transportation operations; • Reduction in carbon and other harmful emissions from transportation sources; • Other impacts.]

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	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] [Describe any changes in approach during the reporting period and reasons for these changes. Remember that significant changes in objectives and scope require prior approval of the OST-R grant administrator.]
2. Actual or anticipated problems or delays and actions or plans to resolve them	[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	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] [Describe changes during the reporting period that may have a significant impact on expenditures, for example, delays in hiring staff or favorable developments that enable meeting objectives at less cost than anticipated.]

4. Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] [Describe significant deviations, unexpected outcomes, or changes in approved protocols for the use or care of human subjects, vertebrate animals, and/or biohazards during the reporting period. If required, were these changes approved by the applicable institution committee and reported to the agency? Also specify the applicable Institutional Review Board/Institutional Animal Care and Use Committee approval dates.]
5. Change of primary performance site location from that originally proposed	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] [Identify any change to the primary performance site location identified in the proposal, as originally submitted.]