Federal Agency	U.S. Department of Transportation
Federal Grant Number	Grant No: DTRT12-G-UTC57
Project Title	METRANS UNIVERSITY TRANSPORTATION CENTER (UTC)
Program Director Name, Title, Contact Information	Genevieve Giuliano Director, METRANS Transportation Center Professor and Ferraro Chair in Effective Local Government Sol Price School of Public Policy University of Southern California (USC) RGL 216 Los Angeles, California 90089-0626 213-740-3956 213-740-0001 (fax) giuliano@price.usc.edu
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Submission Date	April 30, 2018
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Recipient Organization (Name and Address)	University of Southern California
Recipient Identifying Number if any	95-1642394
Project/grant Period (start, end date)	9/30/13 – 9/30/18
Reporting Period End Date	3/31/2018
Report Term or Frequency	PPPR for UTC. This report covers the period from October 1, 2017 to March 31, 2018, per Exhibit B, Grant Deliverables and Requirements for UTC Grants (June 2014)
Signature of Submitting Official	

Contents

1. Accomplishments

METRANS UTC is a partnership of the University of Southern California (USC) and California State University, Long Beach (CSULB). Its purpose is to conduct a multidisciplinary program of research, education, and technology transfer to increase the economic competitiveness of large metropolitan areas through improved transportation system performance across all surface transportation modes.

1.1 RESEARCH

The METRANS research program aims to generate knowledge that makes a significant contribution to solving urban transportation problems. Our approach is uniquely integrative: we address passengers and freight across all surface transportation modes. By designing policy incentives to implement effective strategies to address the needs of freight and passengers, system efficiency outcomes are achieved

Research Program Themes

Theme 1 is Understanding Passenger-Freight Interactions, the basic forces underlying transport supply and demand, in three topic areas: relationships between spatial patterns and transportation, characteristics of freight and passenger demand, and better data for analysis of passenger-freight interactions. Theme 2 is Achieving System Efficiencies within and across modes and user classes and policy strategies that facilitate and promote these efficiencies. It includes two topic areas: integrated management across users and modes, and policies for more efficient urban transportation.

1.1.2 Research Program Selection and Management

Tables 1 through 3 list research projects from Years 1 and 2. All projects are completed and final reports are posted on the website. Given space limitations, we do not include descriptions for these projects.

Table 1: Pre-selected Launch Projects – all are completed and posted to website	
Theme 1	**Understanding Passenger-Freight Interactions**
Topic 1-1	Spatial Patterns and Transportation
1-1a	*Urban Spatial Structure, Employment Sub-Centers, and Passenger and Freight Travel*
1-1b	*The Freight Landscape: Using Secondary Data to Describe Metropolitan Freight Flows*
Topic 1-3	Better Data for Analysis of Passenger-Freight Interactions
1-3a	*Tracking Truck Flows with Programmable Mobile Devices*
Theme 2	**Achieving System Efficiencies**
Topic 2-1	Integrated Management Across Users and Modes
2-1a	*Efficiencies in Freight and Passenger Routing and Scheduling to Reduce VMT*
2-1b	*Design and Evaluation of Impact of Traffic Light Priority for Trucks on Traffic Flow*
Topic 2-2	Policies for More Efficient Urban Transportation
2-2	*Mitigating Urban Freight Through Effective Management of Truck Chassis*

Table 2: Year 1 Open Solicitation Projects, RFP – all are completed and posted to website	
Theme 1	**Understanding Passenger-Freight Interactions**
Topic 1-3	Better Data for Analysis of Passenger-Freight Interactions
14-06	*Development of Micro Wireless Sensor Platforms for Passenger-Freight Interactions*.
14-13	*Smart Truck Driver Assistant: Real Time Management of Container Delivery to Trucks*
Theme 2	**Achieving System Efficiencies**
Topic 2-1	Integrated Management Across Users and Modes
14-09	*A Dynamical Framework for Integrated Corridor Management*
14-11	*Vehicle-to-Vehicle Communications in Mixed Passenger – Freight Convoys*
Topic 2-2	Policies for More Efficient Urban Transportation
14-04	*Analysis and Prediction of Spatiotemporal Impact of Traffic Incidents for Better Mobility and Safety in Transport. Systems*

Table 3: Year 2 Open Solicitation Projects – all are completed and posted to website		
Theme 1	**Understanding Passenger-Freight Interactions**	**Funding**
Topic 1-1	Relationships Between Spatial Patterns and Transportation	
15-27	*Spatial Dynamics of Warehousing and Distribution in California*	Caltrans
Topic 1-2	Characteristics of Freight and Passenger Demand	
15-01	*Investigations of the Effect of Humid Air on NOX & PM Emissions of a CNG Engine*	Caltrans
15-10	*Route Choice Characteristics of Owner-Operated Trucks in Southern California Freeways*	Caltrans
15-15	*The Decline in Inter- and Intra-Urban Mobility and its Impact on Passenger Travel*	Caltrans
Topic 1-3	Better Data for Analysis of Passenger-Freight Interactions	
15-02	*Simulation of liquefaction-induced damage of the Port of Long Beach using the UBC3D-PLM model*	Caltrans
Theme 2	**Achieving System Efficiencies**	**Funding**
Topic 2-1	Integrated Management across Users and Modes	
15-03	*Development of an Economic Framework to Evaluate Resilience in Recovering from Major Port Disruptions*	Caltrans
15-04	*Integration of Passenger and Freight Rail Scheduling*	Caltrans
15-08	*Application of a Regional Multi-Modal Transportation System Performance Monitoring Framework*	DOT

15-12	*Optimum Routing of Freight in Urban Environments under Normal Operations and Disruptions using a Co-simulation Optimization Control Approach*	DOT
15-14	*Quantifying the Impact of Next-Generation Modes of Delivery*	DOT
Topics 2-1 and 2-2	Integrated Management across Users and Modes and Policies for More Efficient Urban Transportation	
15-13	*Developing Affordable Housing Guidelines Near Rail Transit in Los Angeles*	Caltrans

Table 4 lists the Year 3 projects, funding source, and status. Six of these projects are scheduled for completion in the next quarter. Abstracts for the Year 3 projects were presented in the previous PPPR.

Table 4: Year 3 Open Solicitation Projects

Theme 1	**Understanding Passenger-Freight Interactions**	**Funding**	**Status**
Topic 1-2	Characteristics of Freight and Passenger Demand		
16-13	*Fine grained "automatic vehicle classification" system development for accurately measuring passenger-freight interactions*	Caltrans	Active
Theme 2	**Achieving System Efficiencies**	**Funding**	**Status**
Topic 2-1	Integrated Management across Users and Modes		
16-02	*A Cost Allocation Model for Horizontal Supply Chains*	Caltrans	Active
16-05	*Evaluating Economic Mobility and Resilience of Multimodal Freight Operations in a Connected Vehicle Environment*	Caltrans	Active
16-07	*Sustainable and Affordable Housing Near Rail Transit: Refining and Expanding a Scenario Planning Toll*	Caltrans	Active
16-16	*A Computational Framework for Data-Driven Distributed Resilient Control of Traffic Corridors*	DOT	Active
16-17	*Evaluating Freight Efficiency Metrics*	Caltrans	Active
Topic 2-2	Policies for More Efficient Urban Transportation		
16-08	*Innovating on Job Accessibility with General Transit Feed Specification Data*	DOT	Active
16-06	*Trajectory Data Mining for Performance Measurement of Public Transportation Systems*	Caltrans	Active

We issued our Year 4 RFP (http://www.metrans.org/research-projects/metrans-utc) to allocate remaining research funding from the METRANS Tier 1 funds, both USDOT and Caltrans match, including

remaining funds from previous years. All research funds have now been allocated. The Year 4 RFP was issued on March 17, 2017, with proposals due April 19, 2017 We received 14 proposals and funded six of them. Table 5 lists the Year 4 projects, and abstracts are presented following the table.

Table 5: Year 4 Open Solicitation Projects			
Theme 1	**Understanding Passenger-Freight Interactions**	**Funding**	**Status**
Topic 1-3	Better Data for Analysis of Passenger-Freight Interactions		
17-11	*Smart Sensing System for Real-time Automatic Traffic Analysis of Highway Rest Areas*	DOT	Active
Theme 2	**Achieving System Efficiencies**	**Funding**	**Status**
Topic 2-1	Integrated Management across Users and Modes		
17-01	*Optimizing Combined Truck Routing and Parking based on Parking Availability Prediction*	DOT	Active
17-02	*Investigating Impact of Crowdsourcing on Smart Freight Mobility*	DOT	Active
17-05	*Socially Optimal Personalized Routing with Preference Learning*	DOT	Active
Topic 2-2	Policies for more efficient urban transportation		
17-09	*Institutional Response to Transit Oriented Development in the Los Angeles Metropolitan Area: Understanding Local Differences Through the Prism of Density, Diversity, and Design*	DOT	Active
17-14	*Measuring Congestion Costs of Car Commuters and Their Determinants: A Counterfactual Approach*	DOT	Active

Year 4 Open Solicitation Project Progress Abstracts

USC 17-01 Optimizing Combined Truck Routing and Parking based on Parking Availability Prediction (Ioannou, USC) In this project we plan to investigate the development of Optimum Routing and Scheduling Algorithms for Trucks based on Parking Availability Prediction. The purpose of this proposal is to develop truck routing and scheduling algorithms that incorporate predicted parking

availability along possible routes that minimize cost which may include travel time, environmental costs etc under several constraints that include restrictions on hours of service and other possible government regulations as well as imposed time windows for service. An algorithm for predicting parking availability developed under a different project will be modified to be part of the overall optimization procedure. We plan to use real data currently available at several internet sites to come up with realistic scenarios to test the developed algorithms. Our focus for evaluation will be California which is one of the states with a truck parking problem however routes and parking places of neighboring states will also be considered for demonstrating the results.

CSULB 17-02 Investigating Impact of Crowdsourcing on Smart Freight Mobility (Chandra, CSULB) This research will develop such analytical models that leverage both crowdsourced data on traffic conditions and data such as commodity flows, fuel consumption etc. of conventional freight to design operations of a smart freight system. The contribution of crowdsourcing in improving transportation efficiency in real time is evolving rapidly and qualitatively, creating the need to develop models that characterize smart freight mobility. Several smartphone applications related to traffic information and communications have seen a surge in recent times, however, with missing developments in artificial intelligence needed to cause forward looking solutions to smart transportation needs, particularly for freight. A sequence of four interrelated objectives aptly define the approach, which are as follows: (1) Identifying sources of available conventional freight data – such as commodity flow, truck volume, air cargo volume etc. across all modes, (2) Integrating crowdsourced data with conventional freight truck data for model building, (3) Building stochastic models for mobility that characterize smart freight, and finally, and (4) Estimating efficiency (in fuel consumption, ton-miles traveled etc.) from the predictive capabilities of the models for smart freight system.

USC 17-05 Socially Optimal Personalized Routing with Preference Learning (Vayanos, USC) The objective of this project is to improve routing efficiency (e.g., minimize aggregate delay, congestion, or pollution) in real-world transportation networks by proposing personalized socially optimal routes that are likely to be adhered to by the commuters. Spurred by rapid population growth and city development, traffic congestion has become inescapable in metropolitan areas across the U.S. and its direct and indirect effects can be dire. Indeed, congestion can severely impede quality of life, negatively impact health and productivity, and increase commuting costs and pollution. At the same time, support for increased taxation to fund expansion of the existing road network to meet current and future needs is in short supply. For these reasons, it is imperative to find novel ways to improve routing efficiency over the existing infrastructure. We propose to (a) develop a machine learning framework for learning individual driver preferences over time, (b) devise a mathematical model and solution scheme for computing personalized equilibrium routes given limited and imperfect information on the driver preferences, (c) leverage this model to compute personalized implementable socially optimal routes, (d) quantify the reduction in the Price of Anarchy achieved by our framework in stylized problems, and (e) showcase the performance of our approach on real data.

USC 17-09 Institutional Response to Transit Oriented Development in the Los Angeles Metropolitan Area: Understanding Local Differences Through the Prism of Density, Diversity, and Design (Banerjee, USC) The objective of the proposed study is to examine local initiatives and institutional responses to transit developments, their evolution over the last 25 years, and the extent to which institutional responses to promote transit neighborhood idea have been explored, developed, and implemented. Drawing on Los Angeles County's diverse institutional, political, and socio-economic

landscape, what inferences can be drawn about local governments' response to the design and planning of transit-oriented developments (TODs), their relative success, and future outlook? What lessons might we glean about the essential performance characteristics for designing a transit neighborhood from the short yet dynamic history of transit expansion in metropolitan Los Angeles? We are interested in knowing how city governments have responded to usual expectations of commensurate TOD in the Los Angeles metropolitan region. Ultimately, this research will result in identifying locally driven best practices in station area development and a better understanding of institutional and policy responses and the role of community values and participation affecting land use near transit stations.

CSULB 17-11 Smart Sensing System for Real-time Automatic Traffic Analysis of Highway Rest Areas (Mozumdar, CSULB) This research proposal targets the design of smart sensing system for real-time automatic traffic analysis of highway rest areas. We will develop low-power sensing platforms, optimized power-saving algorithms, communications protocols, and machine-learning models to yield a novel and modular multi-nodal sensing systems that will help traffic analysis of highway rest areas efficiently. This will be a part of nationwide efforts of Intelligent Transportation Systems (ITS) for smart connected roads. To the best of our knowledge, Caltrans (or similar entity at nationwide) doesn't have any installed ITS that can perform "automatic" and "real time" vehicle identification and classification for highway rest areas. Our proposed system will reveal high grained traffic data such that user will be able to know for "each" vehicle the time of entry and exit in the rest area and, it's classification (based on axles). The proposed smart sensing and data interpretation system will maintain small foot-print, significantly cost-effective (compare to existing available systems), and will be capable of automatic identifying and classifying each vehicle in high way rest area in real-time. This research will focus on all levels of system design from architecture to computation to communication design.

CSULB 17-14 Measuring Congestion Costs of Car Commuters and Their Determinants: A Counterfactual Approach (Kim, CSULB) Although the theory of traffic congestion has become one of the main themes in the field of transportation economics, empirical research quantifying the social cost of congestion is relatively rare. The main goal of this research is to fill that gap by providing new evidence on the social costs of traffic congestion, and to identify their determinants for guiding congestion-reduction policies. In this project, we measure commuters' wasted time due to traffic congestion using a unique dataset that measures the trips and characteristics of individual commuters. We develop a new approach to measuring congestion delays, which is simple to estimate and widely applicable. Specifically, we first estimate how much time each commuter would have spent if she had experienced no congestion delays on her route. We then compare this counterfactual travel time to the commuter's actual travel time and compute the difference. We exploit recent developments in econometrics to measure congestion costs in this manner.

1.1.3 Dissemination

Research reports are published to the METRANS website and presented at METRANS research seminars, open to the public. Preliminary results are often presented at conferences. All projects are expected to result in refereed publications.

The following papers were published in refereed journals: (4)

Boarnet, M., G. Giuliano, Y. Hou and E-J Shin (2017) "First/last mile transit access as an equity issue," forthcoming, Transportation Research A.

Giuliano, G. and S. Kang (2018) "Spatial dynamics of the logistics industry: Evidence from California," Journal of Transport Geography, forthcoming

Rodrigue, J-P, L. Dablanc, G. Giuliano (2017) "The freight landscape: Convergence and divergence in urban freight distribution," *Journal of Transport and Land Use,* 10(1), https://jtlu.org/index.php/jtlu/article/view/869.

Schuetz, J., G. Giuliano, E-J Shin (2017) "Is Los Angeles becoming transit oriented?", under review, *Cityscape.*

The following papers are under review or under preparation for a journal submission: (18)

Ba, Q. & Savla, K. *Optimal Control of Traffic Flow over Networks: Distributed Computation & Sparsity*

Carlsson, J. *Bounds for the Euclidean generalized TSP* submitted to Operations Research.

Chiang, Y., Shahabi, C., (et al.) *LA-Metro Bus Data Analysis Using GPS Trajectory Data and Schedule Data*

Dessouky, M., & Zou, H. *A Look-Ahead Routing Strategy for Solving the Dynamic Vehicle Routing Problem.*

Eisenlohr, A., Webb Jamme, H-T, Bahl, D. and Banerjee, T. "Planning for safe walking to school in inner city neighborhoods: What have we learned from children's experience in Los Angeles and San Diego?" Journal of the American Planning Association.

Englert, B. (n.d.). *A Smartphone-Based Truck Monitoring System for the Ports of LA and Long Beach*.

Englert, B., Aliasgari, M., & Asgari, S. *Smart Truck Driver Assistant: A Cost Effective Solution for Real Time Management of Container Delivery to Trucks*.

Hosseini, P. and Savla, K. *Steady-state Computation and Offset Optimization using Rectangular Approximation for Signalized Arterial Networks*

Hou,Y., Giuliano, G., Kang, S., Shin, J-S. *Polycentricity and the evolution of metropolitan spatial structure* presented at WRSA 2016 and in preparation for journal submission.

Lam, S. *Tracking Truck Flows for Drayage Efficiency Analysis*

Liu, L., & Dessouky, M. (n.d.). *A Decomposition Based Hybrid Heuristic Algorithm for Integrated Passenger and Freight Train Scheduling* submitted to *Computers & Operations Research.*

Shao, Y. & Dessouky, M. *A Hybrid Heuristic Method for the Compressed Natural Gas (CNG) Truck Routing Problem with Fueling Stations,* under revision to Transportation Research Part E: Logistics and Transportation Review

R. Wang et al., *Optimal Array Switching Sequence for the TDM Channel Sounding in a Fast Time-varying Channel.*

Webb Jamme, H-T, Rodriguez, J. Barrow, K., Bahl, D. and Banerjee, T. "What is in the D of TOD: Evolution of a concept based on a systematic review" Journal of Planning Education and Research.

Wei, D., Chen, Z., & Rose, A. *Evaluating the Role of Resilience in Recovering from Major Port Disruptions*. Targeted for *Papers in Regional Science*

Zhang, Y., & Ioannou, P. *Comparison of Feedback Linearization and Model Predictive Techniques for Variable Speed Limit Control*.

Zhao, Y., Ioannou, P., & Dessouky, M. *Multimodal Freight Routing Using a Hierarchical Co-Simulation Optimization Approach.*

Zhao, Y., Vital, F. & Ioannou, P. *Traffic Light Priority System for Trucks and Its Impact on Traffic Flows.*

The following were presented (6):

Boarnet, M., Bostic, R., (et al.) (2017, October 12-17) *The Joint Effects of Income, Vehicle Technology, and Transit-oriented Development on Greenhouse Gas Emission.* Association of Collegiate Schools of Planning Annual Conference.

Carlsson, J., Dessouky, M., & Zou, H. (2017, October 22-25) *An Online Cost-sharing Mechanism for Horizontal Supply Chains.* INFORMS 2017 Annual Meeting in Houston, TX.

Wang, R., Renaudin, O. (et al) (2017, October 8-13) *Vehicle-to-Vehicle Propagation Channel for Truck-to-Truck and Mixed Passenger Freight Convoy.* International Symposium on Personal, Indoor and Mobile Radio Communications, IEEE 2017. Montreal, QC, Canada

Wei, D., Chen, Z., & Rose, A. (2017, October 17-20) *Evaluating the Role of Resilience in Recovering from Major Port Disruptions.* For 7th METRANS International Urban Freight Conference, Long Beach, CA.

Zhang, Y., & Ioannou, P. (2017 Oct. 16-19). *Comparison of Feedback Linearization and Model Predictive Techniques for Variable Speed Limit Control*. IEEE 20th International Conference on Intelligent Transportation Systems, Yokohama, Japan.

Zhao, Y., & Ioannou, P. (2017 Oct. 16-19). *A Hierarchical Co-Simulation Optimization Control Framework for Multimodal Freight Transportation Routing*. IEEE 20th International Conference on Intelligent Transportation Systems, Yokohama, Japan

1.1.4 Plans for Next Reporting Period

Plans are to complete work on the Year 3 and 4 RFP projects and continue dissemination of research results via our website, other publications, papers, conference presentations, and our seminar series. Our goal is to complete all projects by September 30, 2018.

1.2 EDUCATION AND WORKFORCE DEVELOPMENT

METRANS' education goal is to foster education and training to contribute to the development of the transportation workforce. Our approach is multi-disciplinary, multimodal, and incorporates both passengers and freight. Under this grant we are developing a series of education activities, from K-12 to PhD. These programs build on the education and training programs available at both universities.

1.2.1 New and Continuing Activities Associated with Degree Programs

Graduate Research Assistantships: We continue to support PhD students on METRANS research projects.

Postdoctoral Fellowships: Two postdoctoral fellowships were awarded for the 2017-18 academic year. Sanggyun Kang, 2017 USC PhD, is conducting research on warehouse location and impacts, and on freight flow optimization. Yanbo Zhao, 2017 USC PhD, is conducting research on freight flow optimization.

New Graduate Courses: The new CSULB Master of Science in Supply Chain Management Degree (MSSCM) launched in the fall of 2015. The program has two parallel tracks, one for practicing professionals, which is an evening and weekend program completed in 24 months. The other is an accelerated track for those not working in the industry as well as for international students. This track is completed in 21 months. The first cohort of MSSCM (Professional) and the second cohort of the Accelerated track graduated in December of 2017.

1.2.2 Facilitating Connections between Students and Employers

Professional Development: We continue to partner with WTS-LA to promote student participation in the resume book and to facilitate and sponsor membership and attendance at WTS events. METRANS Associate Director Victoria Deguzman is the WTS-LA chapter University Liaison and a Special Advisor to the President of Workforce Development, and conducts outreach for WTS to both high schools and institutions of higher learning throughout the greater LA region; a graduate level transportation student at USC serves as the chapter Student Liaison. A student in the CSULB Master of Science in Supply Chain Management Program serves as student liaison for the local Roundtable of the Council of Supply Chain Management Professionals and facilitates coordination between the organization and student groups including the Society for the Advancement of Management and the Graduate Business Association. We also continue to offer career services to students interested in a transportation related career, and facilitate connections with students and industry. CSULB also designs the employer engagement programs for the Port of Long Beach Academy of Global Logistics at Long Beach Cabrillo High School.

METRANS Mentor Program: In this program, transportation practitioners (mentors) guide students to make informed career decisions and to develop into well-rounded professionals. Twenty-one students were mentored during the reporting period (16 female, 13 both female and members of underrepresented groups - Hispanic/Latina and Asian/Pacific Islander).

METRANS Lunch with a Practitioner Series: Designed to facilitate career planning and provide guidance from and connections with practice, these events allow current transportation students to meet and learn from active transportation practitioners.

METRANS Internship and Employment Assistance: We collect and disseminate information regarding transportation internship and employment opportunities. Internships provide professional experience and often lead to jobs. Students in the MPL, MPA, and MPP degrees at USC and in the MSSCM Accelerated program at CSULB completed internships prior to graduating. During the reporting period, students were placed at LA Metro, LA DOT, Port of LA, Port of Long Beach, Caltrans, LA Department of Water and Power, Foothill Transit, City of LA, Fehr and Peers, Culver City, Southern California Association of Governments (SCAG), KOA, Hyperloop, USC DOT, California State Legislature, Google, City of Anaheim; County of Orange; Congressman Alan Lowenthal's Long Beach office; Mobile Programming LLC, Boeing; Sony, CEVA Logistics; CSULB Advanced Technology Services; Jimway; and SSG.

CITT Job and Internship Post: CITT has established a job and internship post on its website at https://www.ccpe.csulb.edu/TheManifest/JobPostings.aspx and works with the CSULB Career Development Center matching students to employment and internships. CITT also includes trade and transportation-related job postings in its email blasts and news updates.

1.2.3 Non-degree Programs

Metropolitan Transportation Management Certificate (MTMC): Curriculum development was coordinated with LA Metro and designed to cover multi-modal transportation planning fundamentals, with a focus on passenger-freight conflicts. The class was conducted in four sessions which started on Feb. 10 and concluded on March 3. The success of this pilot program has motivated the METRANS team to further develop its curriculum and share it as an educational tool for planning and transportation professionals around the country.

Caltrans Freight Academy: CITT offers a four-day freight academy designed for planners and engineers as part of a regular series of Caltrans-specific classes. During the reporting period, one workshop focusing on intermodal transport was held in Ontario CA; and a second workshop on agricultural supply chains was scheduled for April 2018 in Sacramento.

Introduction to Logistics and Supply Chain Management (CITT 180): a self-paced 30-hour online class that can serve as a gateway class for a number of CITT programs or as an independent self-paced training program was completed in 2016 and is now part of CITT's course offerings. Students who complete the class are eligible for a waiver of the introductory module in the Global Logistics Specialist program.

Certificate in Transportation Systems: This is an interdisciplinary program administered by the USC Department of Civil Engineering, open to graduate-level student campus-wide, combining engineering with policy, planning, and project management. During the reporting period, two students were enrolled - Meiduo Ji and Keenan Zhang.

1.2.4 Research Seminars

METRANS Transportation Research Seminar Series: This serves as a forum for faculty, guest presenters, and advanced graduate students to present their research. Seminars take place during the fall and spring semesters, are open to the public, and are often a collaborative effort of METRANS and cosponsors such as student, academic, and professional groups. Most are recorded and made available through social media. Seminars are well attended. The research seminars held during this period were funded through the new Pacific Southwest Region UTC.

1.2.5 Educational Enrichment

METRANS offers support to groups who represent and serve underrepresented, female, and transportation-related student populations to assist them with education and skills training, strategic planning, event planning and execution, membership recruitment and retention, awards, scholarships, and operations. These groups include WTS-LA, WTS-OC, USC and CSULB Student Chapters of the Institute for Transportation Engineers (ITE), USC Student Chapter of the American Planning Association (APA), Price Sol Global (graduate-level students of planning policy), Associated Students of Planning and Development (ASPD), Price Women Leading Policy, Planning, and Development (WLPPD), Young Professionals in Transportation (YPT), Price Partnership for an Equitable Los Angeles (PELA), International Public Policy and Management Program (IPPAM), CSULB Society for the Advancement of Management (SAM) and Graduate Business Association, the USC student chapter of the National Society of Black Engineers (NSBE) the USC and CSULB student chapters of the Society of Women Engineers (SWE), USC Asian Pacific Islander Caucus (APIC), Price Latino Student Association (PLSA) and the Price Graduate Policy and Administration Community (GPAC), USC Women in Management, and the Girl Scouts of Los Angeles and Orange Counties. We also provide opportunities for students to experience transportation outside the classroom, such as field trips, resource and guest speaker referrals, and opportunities for publication of their written work and accomplishments.
Field Trips and Site Visits: These are a regular component of our enrichment programming. The field trips are now being offered as part of the PSR UTC.

1.2.6 Attracting New Entrants to Transportation

Academy of Global Logistics: In summer of 2016, CITT partnered with the Port of Long Beach and Long Beach Unified School District to develop the Port of Long Beach Academy of Global Logistics (AGL) at Cabrillo High School. The AGL is a four-year small learning community which combines an academic curriculum with industry-relevant training and information to support academic and career development.

The Academy introduces high school students to career opportunities in global trade and logistics and shows them how to prepare for those careers through a wide range of training and education programs including certificates, certifications, and degrees offered by Long Beach City College and CSULB. CITT is responsible for developing an academy to prepare teachers to incorporate transportation and logistics-related materials into lesson planning. During the reporting period, CITT worked on curriculum development for the summer 2018 Academy to be held in June on the CSULB campus. CITT also conducts industry-teacher-student mixers throughout the year.

1.2.7 Dissemination

Dissemination is via courses and certificate programs, assistance regarding internships, employment opportunities, and professional development, seminars and educational series, our website, student research opportunities, support and outreach to student groups, research and career fair support and presentations, and our mentor program. We also use our Facebook, LinkedIn, and Twitter accounts to disseminate information and our podcasts to highlight our programs. This reporting period we had 623 Twitter followers and 42 tweets. We had 651 Facebook "Likes" and 69,812 Facebook visits, as measured by "impressions" (the number of times people have encountered a post from CITT or the page itself). Our LinkedIn page has grown to 1,375 members. We also feature METRANS related events at the CITT blog, which is available at https://www.ccpe.csulb.edu/citt/blog/blogposts.aspx?pID=125.

1.2.8 Plans for Next Reporting Period

In Fall 2017 we began transitioning the METRANS UTC education and workforce development activities to PSR. There will be no further reporting of education and workforce development under the METRANS UTC grant.

1.3 TECHNOLOGY TRANSFER

The goal of the technology transfer program is to broaden our reach and disseminate research results. All technology transfer activities were transitioned to PSR as of Fall 2017. These include:

- Continuation of signature events: International Urban Freight Conference, held in October 2017; CITT State of Trade and Transportation Industry Town Hall, held in March 2018
- Outreach: Working and Living in a Port City Series
- Media and Communications: METRANS News, Research Briefs, website and social media; METRANSInfo, ContainterCasts, TransCasts, Student podcasts, YouTube, and Trade Talks

These activities are now reported in the PSR UTC PPPR.

1.3.1 Dissemination

Dissemination is achieved through the events, media, and communication channels described above.

1.3.2 Plans for Next Reporting Period

None

2. Products

2.1 PUBLICATIONS

In this reporting period, the Tier 1 projects resulted in 4 peer-reviewed publications (with 18 under review) and 6 presentations. See Section 1.1.3.

2.2 WEBSITES

Our website is at http://www.metrans.org.

2.3 TECHNOLOGIES

Nothing to report.

2.4 INVENTIONS

Nothing to report.

2.5 EDUCATIONAL PRODUCTS

We introduced six new graduate courses.

2.6 OTHER PRODUCTS

Other products are 1) podcasts of METRANS seminars; 2) internship and employment database; 3) Long Beach Business Journal column publications and related podcasts; 4) podcast of Industry Outlook; 5) METRANS news, and 6) expansion of the Monitoring the Ports database.

3. Participants and Collaborating Organizations

Participants contribute to the work of the Center through financial or other support, or directly in research. Collaborating organizations participate in Center activities, provide advisement, or support the center.

3.1 PARTICIPANTS

Table 8: METRANS UTC Partners and Contributions		
Name	**Location**	**Contribution**
AAA (The Auto Club)	Los Angeles	Financial contribution
BNSF Railway	Long Beach	Financial contribution
CITT	CSULB	Home of CSULB METRANS, training and prof programs
Ceres Terminals	Los Angeles	Associate, financial contribution
Caltrans	Sacramento	Match fund sponsor, financial contribution of full required
Economics Dept.	CSULB	Participating faculty, education programs, students
Engineering (COE)	CSULB	Participating faculty, education programs, students
KOA	Monterey	Financial contribution
Foothill Transit	West Covina	Associate, financial contribution
LA Customs Brokers & Freight Forwarders Association	Los Angeles	Financial contribution
Majestic Realty	Industry	Associate, financial contribution
Metro	Los Angeles	Assoc., financial contribution, internships, research funding
Metrolink	Los Angeles	Associate, financial contribution
Port of Long Beach	Long Beach	Assoc., financial contribution, internships, scholarships
Port of Los Angeles	Los Angeles	Assoc., financial contribution, internships, scholarships
Sol Price School of Public Policy	USC	Home of Center, education programs, financial contribution for admin; indirect cost share; offices, labs
SCAG	Los Angeles	Assoc., financial contribution, internships, data sharing
SCAQMD	Diamond Bar	Financial contribution
Viterbi School of Engineering	USC	Participating faculty, education programs, students; indirect cost and tuition cost share, METRANS labs
Watson Land Co.	Carson	Financial contribution
WTS LA Chapter	Los Angeles	Financial contribution

Caltrans is the major funding partner. Additional financial support is provided by METRANS Associates, and by individual corporate contributions.

3.2 COLLABORATING ORGANIZATIONS

METRANS has extensive relationships with other universities, public agencies, and private industry. The METRANS UTC has access to these relationships.

3.2.1 Advisory Organizations

METRANS Advisory Board: The board meets annually, and provides overall policy guidance for the Center. It suggests research priorities, identifies funding opportunities, assists in student job placements, and participates in outreach activities. Members are leaders and serve as liaisons to their agencies and industries. They are appointed by the Director with the advice of the Executive Committee. Gold and Silver level METRANS Associates are members of the Board; others are appointed to represent the broad

constituency of stakeholders. A list of members is available at http://www.metrans.org/advisory-board. The Board met in November 2017.

The Center for International Trade and Transportation (CITT): CITT is dedicated to delivering education programs, innovative research, and community outreach in goods movement and is the Long Beach home for METRANS. CITT Executive Director, Thomas O'Brien serves as a METRANS Associate Director. The CITT has several noteworthy educational programs directly related to the Tier One Center, including the Academy of Global Logistics teacher course and the recently launched *Introduction to Logistics and Supply Chain Management*, a 30-hour online class that can serve as a gateway class for a number of CITT programs or as an independent self-paced training program. CITT also continues to offer *Principles of Supply Chain Management,* a 36-hour class offered in partnership with Long Beach City College as part of a Trade Adjustment Act grant from the Dept. of Labor. The class is targeted at potential entry-level supply chain employees who have lost their jobs as a result of economic restructuring, and helps prepare them for a certification recognized by the Council of Supply Chain Management Professionals.

CITT Policy and Steering Committee: The CITT Policy and Steering Committee (PSC) consists of representatives from modal transportation sectors, units of government, organized labor, and other individuals in international trade and transportation, as well as from academia. The PSC helps direct the outreach activities of CITT, including those sponsored by METRANS. The PSC also serves as the advisory body on the development of the structure and content of the Town Hall Meeting. NO CHANGE

Other Relationships: We have extensive relationships with industry and government. SCAG provides regional planning and transportation modeling data. LA Metro funds a major research project to develop a data archive from real-time transportation system monitoring data and develop applications for planning and system management. Several trade organizations offer scholarships and other assistance, including the Los Angeles Transportation Club (LATC), Harbor Transportation Club (HTC), Harbor Association for Industry and Commerce (HAIC), and Council of Supply Chain Management Professionals (CSMCP). The HAIC, LATC and HTC have endowed scholarship funds for students in CITT-related programs. During the reporting period, the Foreign Trade Association established another scholarship for students at CSULB in trade and transportation-related programs. O'Brien serves as a Board member for the Southern California Roundtable of the CSCMP, LATC, Foreign Trade Association, HAIC and National Transit Institute. He also serves as Chair of the Southern CA Regional Transit Training Consortium.

3.2.2 Relationships with Other Universities

Council of University Transportation Centers (CUTC): Giuliano is a past president and executive committee member. O'Brien is Secretary and lead for the CUTC workforce development efforts. MetroFreight (MF) Center of Excellence: METRANS is the home of the Volvo Research & Educational Foundations (VREF) Center of Excellence on urban freight. The consortium includes the University Transportation Research Center (Region 2 UTC) in New York, the Institute of Science and Technology for Transport in Paris, and the Korean Transport Institute (KOTI) in Seoul.

National Center for Sustainable Transportation (NCST): METRANS is a partner in the NCST consortium, led by UC Davis, and including UC Riverside, Georgia Tech, and University of Vermont. METRANS' role is sustainable freight transport.

Southwest Transportation Workforce Center (SWTWC): The Southwest Transportation Workforce Center (SWTWC) seeks to connect and empower the 21st century transportation workforce through research, education, and industry engagement. SWTWC is led by CSULB, with USC, Texas A&M Transportation Institute (TTI), ICF International, and the National Occupational Competency Testing Institute as

partners. The mission of SWTWC is to provide a more strategic and efficient approach to transportation workforce development. The SWTWC leads an FHWA-funded National Transportation Career Pathways initiative with partners from the other regional workforce centers at the University of Vermont, University of Memphis, University of Wisconsin, and Montana State University.

4. Impact

As the METRANS Tier 1 UTC approaches completion, it is appropriate to identify the impacts the UTC has had on knowledge creation, training of the next generation, public policy, and professional practice.

4.1 DEVELOLPMENT OF THE PRINCIPAL AND OTHER DISCIPLINES

METRANS is a multi-disciplinary research center that includes engineering, social sciences, urban planning and public policy. Our impact has been on developing interdisciplinary courses and degree programs. At USC, most graduate transportation courses are cross-listed between public policy and engineering. At CSULB, the masters level MS-SCM is an interdisciplinary degree. Employers recognize the value of our graduates' multidisciplinary training, which is reflected in high placement rates of our graduates. Regarding fields of research, METRANS has contributed to development of routing and scheduling methods to improve rail and truck efficiency; development of simulation models for truck and passenger flows; and establishing urban freight as a field of research within urban planning/public policy.

4.2 DEVELOPMENT OF HUMAN RESOURCES

Student Support: Student support is an important component of research project selection. At USC, active METRANS UTC research projects fund 47 student positions. Of those hired, there are four undergraduates, 19 masters, and 24 PhD students. At CSULB, METRANS UTC research funds 13 research assistants: eight undergraduate students and four master's students, and one doctoral student on research projects being undertaken by CSULB professors. In addition, 15 graduate students and undergraduate student are employed at CSULB's Center for International Trade and Transportation (CITT) on a variety of METRANS projects including social media, web management, conferences, non-credit training programs, and workforce development-related programs. We provide financial and administrative support to allow students to participate in transportation conferences and competitions.

Support for Underrepresented Groups: We are committed to promoting diversity. Of the eleven student administrative assistants at USC directly supported by METRANS funding, ten are members of underrepresented groups, nine are both female and a member of an underrepresented group. Of the eighteen research and student assistants at CSULB directly supported by METRANS funding, four are female and six are members of an underrepresented group. Of the 17 student and professional groups supported by METRANS, six are specifically devoted to women, and three are specifically devoted to underrepresented groups. The Academy of Global Logistics at Cabrillo High School in Long Beach serves a largely minority population

Scholarship Opportunities: METRANS regularly disseminates information regarding opportunities for scholarships to students and the general public via our website, social media, announcements at courses and events, and our email distribution list of over 3,000. Scholarships are generally awarded at the end of each academic year to facilitate the students' following year. Four endowments are dedicated to students in CITT-related programs, most of which serve professional students in non-credit programs who do not qualify for many other scholarship programs limited to degree granting programs. FY18-19 scholarships will be awarded in the next reporting period.

New Educational Materials and Programs and Opportunities for Teaching: We began development of the third session of the LBUSD Academy of Global Logistics teacher academy course to be offered June 2018 Several additional courses and programs are under development, and offer teaching opportunities for instructors from industry to share their experiences with students in both credit and non-credit programs.

4.3 RESOURCES AT UNIVERSITY AND PARTNER INSTITUTIONS

We continue support of transportation student and professional organizations, and to improve our Goods Movement Database, the Manifest Industry Outlook calendar, and the internship and employment databases. METRANS continues to develop the METRANS InfoShop/Blog. At USC, research facilities include staff offices, high capacity computing, spatial analysis laboratory, secure data servers, and a variety of statistical software.

4.4 TECHNOLOGY TRANSFER

Tech transfer is via reports, briefs, papers, and presentations.

4.5 SOCIETY BEYOND SCIENCE AND TECHNOLOGY

Our faculty are editors and on boards of several scholarly journals, and are members of state or local committees and task forces, providing advice on transport policy and practice. Giuliano is a former member of the National Freight Advisory Committee and contributed to recommendations for a national freight strategic plan, and for the freight provisions in the FAST Act. She is a member of the California Freight Advisory Committee, which provides advisement at the state level. Giuliano and and O'Brien are members of the TRB Intermodal Freight Transport Committee. O'Brien is also a member of the Urban Freight Committee. Tyler Reeb serves on the TRB Education and Training and Native American Transportation Issues Committees. O'Brien helps to raise the profile of transportation workforce development at the regional and national levels and brings together stakeholders from the public sector and private industry as Director of SWTWC and through the CUTC Workforce Development Committee.

5. Changes

No changes in the scope or objectives of this grant. This grant is scheduled to be closed out 9/30/18. The main remaining task is to complete all of the currently in progress research projects.

6. Special Reporting Requirements

No special reporting requirements.