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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Recipient Identifying Number if any	95-1642394
Project/grant Period (start, end date)	09/30/2013 – 09/30/2017
Reporting Period End Date	03/31/2017
Report Term or Frequency	PPPR for UTC. This report covers the period from October 1, 2016 to March 31, 2017, per Exhibit B, Grant Deliverables and Requirements for UTC Grants (June 2014)
Signature of Submitting Official	

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.

1.1.1 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 4 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 the Year 1 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, RFP 1 – all are completed and posted to website		
Theme 1	**Understanding Passenger-Freight Interactions**	**Funding**
Topic 1-2	Characteristics of Freight and Passenger Demand	
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
Theme 2	**Achieving System Efficiencies**	**Funding**
Topic 2-1	Integrated Management across Users and Modes	
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
Caltrans	**Transportation Planning Freight Planning**	**Funding**
15-01	*Investigations of the Effect of Humid Air on NOX & PM Emissions of a CNG Engine*	Caltrans
15-02	*Simulation of liquefaction-induced damage of the Port of Long Beach using the UBC3D-PLM model*	Caltrans
15-03	*Development of an Economic Framework to Evaluate Resilience in Recovering from Major Port Disruptions*	Caltrans
Caltrans	**Rail and Mass Transportation Rail Planning**	**Funding**
15-04	*Integration of Passenger and Freight Rail Scheduling*	Caltrans

Table 4: Year 2 Open Solicitation Projects, RFP 2 – 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

CSULB 15-01: Investigations of the Effect of Humid Air on NOX & PM Emissions of a CNG Engine (Rahai, CSULB) This project investigated the effect of a humid air system on nitrogen oxides (NOx) and Particulate Matter (PM) emissions of a compressed natural gas (CNG) engine. The results indicate that a humid air system is an effective approach for reducing NOx emissions of CNG engines without significant increases in PM emissions which could make CNG engines near net zero.

CSULB 15-02: Simulation of Liquefaction-Induced Damage of the Port of Long Beach Using the UBC3D-PLM Model (Arboleda-Monsalve, CSULB) Southern California has an extensive record of seismic events. The Port of Long Beach is located within a few miles of the San Andreas Fault, and is near the Newport-Inglewood and the Palos Verdes faults. We analyzed the likelihood of liquefaction under two earthquake scenarios. We conducted numerical modeling and evaluated liquefaction susceptibility. Liquefaction depends on type of earthquake and characteristics of the subsurface, including the amount and configuration of water in the subsurface layers. We find that there is a high likelihood of liquefaction in the port test area for the types of earthquake scenarios tested.

USC 15-03: Developing an Economic Framework to Evaluate Resilience in Recovering from Major Port Disruptions (Wei, USC) We developed an operational and analytical framework to evaluate the effectiveness of a comprehensive list of relevant resilience options that can help ports and related businesses in the supply chain recover more rapidly from port disruptions. We found that resilience can reduce these impacts by about 75% for California and about 89% for the nation as a whole. We also note that the port resilience analytical framework we developed in this study is readily generalizable to port disruptions from other causes and at other geographical scales.

USC 15-04: Integration of Passenger and Freight Rail Scheduling (Dessouky, USC) This project developed a methodology to integrate passenger and freight rail scheduling when they share the same tracks to reduce train delay on major corridors. We showed that by integrating passenger and freight train scheduling, passenger train punctuality is improved and freight train travel delays are reduced.

USC 15-08: Application of a Regional Multi-Modal Transportation System Performance Monitoring Framework (Giuliano, USC) This research examined the characteristics and explanatory factors associated with intra-metropolitan variation in highway and arterial system performance. We investigated performance variation across functionally comparable roadway sections, times of day, days of week, and time periods of the year, and then performed statistical tests to analyze and identify location and network factors that determine systematic or idiosyncratic variations. We find that accident frequency and local population density contribute most to performance variation with comparable roadway sections.

CSULB 15-10: Route Choice Characteristics of Owner-Operated Trucks in Southern California Freeways (Kim, CSULB) We developed a full research design to evaluate route choice characteristics used by owner-operated truck drivers when choosing from different types of roads. The problem of truck routing and the choices associated with it is a major focus of concern in transportation agencies. The research findings can be used as a stepping stone to for further research that is necessary for comprehensive benefit-cost analyses concerning toll roads or truck only lanes.

USC 15-12: Optimum Routing of Freight in Urban Environments under Normal Operations and Disruptions using a Co-Simulation Optimization Control (Ioannou, USC) The complexity and dynamics of multimodal freight transportation together with the unpredictability of incidents, disruptions and demand changes make the optimum routing of freight a challenging task. The purpose of this project was to use complex real time simulation models to estimate the states of the transportation network and integrate that knowledge with optimization and load balancing techniques in an iterative feedback configuration that would lead to much more efficient routing decisions during normal operations and disruptions. The results demonstrate the potential of the approach for practical freight routing. They also raise many more research and practical problems that need be addressed in subsequent projects.

USC 15-13 Development of Affordable Housing Guidelines near Rail Transit in Los Angeles (Bostic, USC) We developed models to estimate changes in vehicle miles travelled and affordable housing units produced and revised them based on continued feedback received from seminar and conference presentations about this project. We found that TOD living does promote emissions reduction. Specifically, living in a half-mile station-area TOD can reduce daily VMT by 14.9 miles for the average household. Further, the data suggest a tradeoff between environmental and equity goals. Relatively more affluent households reduce their VMT more than lower-income households when moving to a TOD. Hence making progress on equity and environmental goals would imply a mix of incomes in TOD areas.

USC 15-14: Quantifying the Impact of Next-Generation Modes of Delivery (Carlsson, USC) The purpose of this project was to apply quantitative tools from geospatial analysis, geometric probability theory, and mathematical optimization to predict the impacts that new delivery paradigms will have on traffic congestion and carbon emissions. We modeled this change within a mathematical optimization framework to determine the circumstances under which these services can provide the greatest social benefit. We found that delivery services can reduce carbon emissions in a region, although we estimate that the overall rate of adoption much be quite high – roughly 15% – for these benefits to be realized.

USC 15-15: The Decline in Inter- and Intra-Urban Mobility and its Impact on Passenger Travel (Painter, USC) We analyzed the characteristics and implications of declining US migration trends, conducted empirical analyses to determine how the current trend affects urban passenger travel demand, and discussed strategies to help achieve national/regional transportation policy goals considering current population dynamics. We developed the methodology, reviewed the literature, and considered data availability and accuracy. We performed geospatial data collection and preparation, and addressed a major geospatial incongruency problem. We conducted a longitudinal analysis of the determinants of transit ridership across US urbanized areas, isolating how inter-urban migration affects ridership by altering demographic landscapes. The estimated effect is expected to help forecast demand for transit use across select cities that are most affected by the decline in mobility. Finally, we explored and discussed various supply and demand side strategies aimed at managing auto demand and encouraging transit use.

USC 15-27: Spatial Dynamics of Warehousing and Distribution in California (Giuliano, USC) The purpose of this research is to document and analyze the location patterns of warehousing and distribution (W&D) activity in California. The location of W&D activities has implications for freight demand and flows, and thus is a critical element in statewide transportation planning. First, we conduct a descriptive analysis of W&D trends from 2003 – 2013 using Zip Code Business Pattern data. We find that: 1) the W&D industry in California has grown much faster than the transport sector or the economy as a whole; 2) W&D activity is distributed approximately with the population and total employment; the four largest metro areas in California account for about 88% of all jobs and all W&D jobs; 3) at the sub-metropolitan level we observe significant decentralization of W&D employment for the largest metro areas, suggesting that larger facilities are locating further from the center. Second, we examine possible explanatory factors associated with W&D location trends. We find that the correlation between employment density and W&D activity decreased significantly over the decade, whereas the effect of labor force access is consistently significant. We also find that the effect of regional market attributes decreased significantly over the time period. This suggests the responses of the W&D industry to changing market conditions take place quickly. However, the overall pattern of W&D activity appears to be stable.

We issued our Year 3 RFP (http://www.metrans.org/research-projects/metrans-utc) on March 11, 2016, with proposals due April 15, 2016 We issued this RFP to allocate remaining research funding from the METRANS Tier 1 funds, including remaining funds from previous years. Projects began in March 2017.

Table 5: Year 3 Open Solicitation Projects		
Theme 1	**Understanding Passenger-Freight Interactions**	**Funding**
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
Theme 2	**Achieving System Efficiencies**	**Funding**
Topic 2-1	Integrated Management across Users and Modes	
16-02	*A Cost Allocation Model for Horizontal Supply Chains*	Caltrans
16-07	*Sustainable and Affordable Housing Near Rail Transit: Refining and Expanding a Scenario Planning Toll*	Caltrans
Theme 3	**Policies for More Efficient Urban Transportation**	**Funding**
16-08	*Innovating on Job Accessibility with General Transit Feed Specification Data*	DOT
16-06	*Trajectory Data Mining for Performance Measurement of Public Transportation Systems*	Caltrans
Theme 4	**Integrated Management Across Users and Modes**	**Funding**
16-05	*Evaluating Economic Mobility and Resilience of Multimodal Freight Operations in a Connected Vehicle Environment*	Caltrans
16-16	*A Computational Framework for Data-Driven Distributed Resilient Control of Traffic Corridors*	DOT
16-17	*Evaluating Freight Efficiency Metrics*	Caltrans

Year 3 Open Solicitation Project Progress Abstracts

USC 16-02 A Cost Allocation Model for Horizontal Supply Chains (Carlsson, USC) This project addresses the cost allocation problem in a real-time cost sharing transportation system, which results from horizontal cooperation among multiple suppliers. The research will develop an online cost-sharing mechanism by adapting existing research for use in a dynamic environment. The mechanism works alongside a look-ahead vehicle routing framework, which has been developed in a previous project to efficiently solve the dynamic vehicle routing problem with different levels of uncertainty. In this problem, new customers become known in real time and the optimal total cost of service can only be approximated. Whereas traditional cost-sharing mechanisms are designed to solve static cost-sharing problems -- that is, where the set of players and the exact costs of serving any subset of the players are known -- in the dynamic vehicle routing problem, the set of players is not known as new customers may request service any time, and thus the optimal cost cannot be calculated. The resulting model will show how horizontal cooperation could reduce the total cost of transportation systems, and potentially lower the cost barrier for new businesses to enter the market.

CSULB 16-05: Evaluating Economic Mobility and Resilience of Multimodal Freight Operations in a Connected Vehicle Environment (Chandra, CSULB) This research evaluates the role of connected vehicle technology (CVT) in mobility and resilience building of multimodal freight operations, useful for freight planning purposes at the time when freight manufacturing companies are competing to roll out their next generation fleet of vehicles fully loaded with CVT features. This urgency in technological advancements for freight is in anticipation that soon vehicles constituting the multimodal system will be required to "talk to each other." We first understand the complexities associated with constituents/factors that directly or indirectly impact mobility and resilience of multimodal freight operations – independent of CVT. We evaluate the influence of CVT reliability on routing of freight vehicles for mobility and resilience in the multimodal operation. A probabilistic model is being developed for reliability of the communication network which will relate to travel time changes for mobility as well as for resilience during any network disruptions. This is also termed as CVT-induced route finding for multimodal operations in this research. Economic costs of CVT-induced routes are determined for commercial trucks, freight rail, seaports and airport at the spatial resolution of Traffic Analysis Zone. The research concludes

with examples of some multimodal routes which may or may not benefit with CVT significantly due to poor transportation infrastructure settings that prevail in Southern California.

USC 16-06: Trajectory Data Mining for Performance Measurement of Public Transportation Systems (Demiryurek, USC) The main objective of this research is to develop a system that can process massive amounts of GPS trajectories from public transportation vehicles and implement statistical algorithms to analyze a variety of public transportation system performance metrics such as travel-time reliability, on-time performance, bus bunching and travel-time estimation. To this end, we will conduct fundamental research in mining and correlation of real-time and historical bus GPS trajectory datasets in LA County, which we have collected and archived in our database over the past four years. This research will exploit the real-world Los Angeles traffic sensor and bus GPS datasets collected from Regional Integration of Intelligent Transportation Systems (RIITS) under Archived Traffic Data Management System (ADMS) project. Such analysis of trajectories from our research can help to increase the efficiency of the public transportation systems. The output from our research can be used by city transportation agencies to identify the problem with bus lines, quantify the delays caused by various reasons. Even long-term policy decisions can be made to rearrange bus timetables. Our research can also benefit riders to have a better understanding and access to travel-time delays and reliability.

USC 16-07: Sustainable and Affordable Housing Near Rail Transit: Refining and Expanding a Scenario Planning Toll (Bostic, USC) In previous research, we showed that promoting transit-oriented development (TOD) to achieve greenhouse gas (GHG) emission reduction in Los Angeles could be at odds with providing access to affordable housing near transit, because higher income households tend to reduce driving the most when living near transit. Results from that study show how both goals can be met through development that favors density over inclusionary zoning. This project builds on that research to broaden it by assessing how changes in emission reduction technology relate to household vehicle miles travelled (VMT), expanding the generalizability of the previous study beyond Los Angeles, and addressing residential self-selection and its impact on household VMT. As before, we will create development scenarios, but this time will work to add the San Diego and Sacramento geographies to Los Angeles. We will enhance the precision of our planning tool estimates of the GHG implications of different development typologies by coupling information on the types of autos used by people of different income levels with emissions models. These data allow us to directly estimate actual changes in emissions. The third contribution of this research is its consideration of residential self-selection into neighborhoods. Very little is known about how the supply of TODs matches the latent demand for this type of neighborhood. The general argument is that residential selection may or may not be part of the total effect. We anticipate bounding the residential effect by using a propensity score match method to be able to quantify VMT change, accounting for all selection and, alternately, for none of the selection effect. The results will inform our overall model to assess net VMT and emission effects.

USC 16-08: Innovating on Job Accessibility with General Transit Feed Specification (GTFS) Data (Painter, USC) Physical access to economic opportunity is still a factor dominated by geography. Job growth often happens in places away from the populations that need the new jobs: also known as spatial mismatch. Currently, cars are the primary barrier to entry in bridging that gap for job seekers in metropolitan areas. Cars provided access to an order of magnitude larger number of jobs than transit access. We argue that public transportation could and should play a role in providing access to jobs. This study extends the research on the geography of opportunity in two important ways. First, we use a new open data tool, General Transit Feed Specification data, to dynamically analyze travel times that exist within public transit networks. We are then able to link these data to job sub-centers across the LA metropolitan area using Census tract data to determine the accessibility of jobs to high poverty neighborhoods. We can further distinguish job clusters by industry type to highlight if there are differences in accessibility between emerging economy jobs in the information technology (IT) sector and the general job market. Finally, we can create transit access measures that can be widely used and rapidly

deployed in a broad range of contexts. We plan to make these measures available in an online environment (i.e. web maps) as a proof-of-concept based on the Los Angeles area.

CSULB 16-13 Fine Grained "Automatic Vehicle Classification" System Development for Accurately Measuring Passenger-Freight Interactions (Mohammad Mozumdar, CSULB) We target the design of vehicular road sensing networks used in the framework for Intelligent Transportation Systems. We will develop machine-learning models, optimized power-saving algorithms, communications protocols, and a low-power sensing platform to yield a novel and modular multi-node system for "automatic vehicular detection and classification" (motorcycles, passenger cars, buses, trucks, etc.). We propose to create smart highways by implanting wireless Micro-Electro-Mechanical System sensors, which will act like neurons to collect traffic data for vehicular movement. The proposed smart sensing and data interpretation system for smart roadways will be scalable, cost-effective, maintain a small foot-print, and capable of detecting and classifying a vehicle in real-time. We will focus on all levels of system design from architecture to computation to communication design.

USC 16-16 A Computational Framework for Data-Driven Distributed Resilient Control of Traffic Corridors (Savla, USC) In this project, we develop algorithms for distributed control and model parameter estimation for traffic flow over freeway and arterial networks, with provable guarantees. The research will lead to rigorous tools for online calibration of key traffic model parameters such as turn ratios and origin-destination matrices from traffic sensors, and scalable computational tools for real-time traffic management of integrated freeway-arterial networks. Our approach relies on a combination of tools from traffic engineering, control theory, optimization, dynamical systems, and signal processing. Our analysis and algorithm development is supplemented with case studies relevant to the LA area, especially with regards to traffic management under incidents, using a microscopic traffic simulator.

USC 16-17 Evaluating Freight Efficiency Metrics (Giuliano, USC) The purpose of this project is two-fold: to conduct an evaluation of the freight efficiency metric adopted in the California Sustainable Freight Action Plan (CSFAP), and to develop a set of supportive measures consistent with the FAST Act and California's Freight Mobility Plan that captures more traditional efficiency performance measures for the freight sector. The research will examine the consistency and reliability of the freight efficiency metric, GDP (freight sector)/GHG (freight sector). Based on the literature, the research will develop a set of supportive freight efficiency and performance measures. Potential measures will be evaluated with respect to transparency, sensitivity to changes in freight logistics activities, sensitivity to costs and savings resulting from implementation of the CSFAP, and scalability.

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 are under review or under preparation for a journal submission: (19)

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

Boarnet, M., Giuliano, G., Hou, Y., & Shin, E-J. *First/last mile transit access as an equity issue* R&R submitted, Transportation Research A. (Price CSI grant)

Bostic, R., Boarnet, M., Rodnyansky, S., & Santiago-Bartolomei, R. *Environmentally Sustainable and Affordable Housing Near Transit in Los Angeles* under submission at the Journal of the American Planning Association

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

Choi, J-H., & Painter, G. *Self-Reported vs. Market Estimated House Values: Are Homeowners Misinformed or Are They Purposely Misreporting*, Submitted to Real Estate Economics.

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

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*.

Fu, L., & Dessouky, M. *Algorithms for a Special Class of State-Dependent Shortest Path Problems with an Application to the Train Routing Problem* under revision to Journal of Scheduling

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*

Li, S., Dessouky, M., Yang, L. & Gao, Z. *Joint Optimal Train Regulation and Passenger Flow Control Strategy for High-Frequency Metro Lines* to appear *Transportation Research Part B: Methodological*

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

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

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 published: (6)

Ba, Q. and Savla, K. *On Distributed Computational Approaches for Optimal Control of Traffic Flow over Networks*, Proceedings of the Allerton Conference on Communication, Control and Computing

Fu, L., & Dessouky, M., (2017, January) *Models and Algorithms for Dynamic Headway Control for Rail Operations, Computers & Industrial Engineering* 103, 271-281

Giuliano, G. & Hanson, S., eds., (2017, April) *The Geography of Urban Transportation*, fourth edition New York: Guilford Press

He, S. & Giuliano, G. (2017, March) *School choice: Understanding the tradeoff between travel distance and school quality*, Transportation.

Zhang, Y.; Ioannou P. (2016, November) *Combined Variable Speed Limit and Lane Change Control for Highway Traffic* in IEEE Transactions on Intelligent Transportation Systems, vol. PP, no.99, pp.1-12

Zhao, Y., Ioannou, P., & Dessouky, M. (2017, January) *Routing of Multimodal Freight Transportation Using a Co-Simulation Optimization Approach* in Conference Proceedings TRB, 2017

The following were submitted for conference presentation (6):

Ban, X., Dessouky, M., Pang, J.S., (2016, December) *A General Equilibrium Model for Transportation Systems with e-Hailing Services and Flow Congestion*, submitted to Operations Research

Chandra, S. (2017, September 18-20) *Multimodal freight operations in a connected vehicle environment*, ITS California Annual Conference and Exhibition

Mercado, J., Arboleda-Monsalve, L., Zapata-Medina, D, & Star, L. (2017, June 4-7). *Probabilistic Evaluation of Earthquake-Induced Settlements of the Port of Long Beach using Classical Approaches*. Lecture presented at GeoRisk 2017: Geotechnical Risk from Theory to Practice in Geo-Institute-ASCE, Denver.

Zhang, Y., & Ioannou, P. (2017 July 9-14). *Coordinated Variable Speed Limit, Ramp Metering and Lane*

Change Control of Highway Traffic. Accepted by IFAC 2017 World Congress, Toulouse, France.

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

The following were presented (7):

Arboleda-Monsalve, L., Mercado, J., Sover, A., & Zapata-Medina, D. (2017, March 12-15). *Liquefaction of a Major U.S. Port Facility using the UBC3D-PLM Constitutive Soil Model* presented at GeoFrontiers 2017, Orlando, FL.

Bostic, R., Boarnet, M., Rodnyansky, S., & Santiago-Bartolomei, R. *Environmentally Sustainable and Affordable Housing Near Transit in Los Angeles*. (2016, October). Lecture presented at North American Regional Science Conference, Minneapolis, MN. (2017, February) Presented at the Western Regional Science Association, Santa Fe, NM.

Giuliano, G. & Kang, S. (2017, January) *Spatial dynamics of the logistics industry: Evidence from California* poster presentation at TRB 2017; under revision for different journal submission.

Painter, G., & Chakrabarti, S. (2016, November 3-6). *How Does Population Migration Affect Travel Demand? An Analysis of Transit Ridership across U.S. Metropolitan Areas Over 2006-2013*. Lecture to be presented at 56th Annual Conference of the Association of Collegiate Schools of Planning.

Preciado, D., & Arboleda-Monsalve, L. (2016, October 13-15). *Probabilistic Evaluation of Earthquake-Induced Settlements in the Port of Long Beach*. Lecture presented at Conference SACNAS, the National Diversity in STEM Conference in Convention Center, Long Beach.

Wei, D., Chen, Z., & Rose, A. (2017, January 8-12) *Evaluating the Role of Resilience in Recovering from Major Port Disruptions* presented at Transportation Research Board 96th Annual Meeting, Washington DC

Wei, D., Chen, Z., & Rose, A. (2017, February 15-18) *Evaluating the Role of Resilience in Recovering from Major Port Disruptions:* A Multi-Regional Analysis presented at Western Regional Science Association 56th Annual Meeting, Santa Fe, New Mexico

1.1.4 Plans for Next Reporting Period

Plans are to: 1) continue work on the Year 3 RFP projects; 2) select and begin the Year 4 RFP projects; and 3) continue dissemination of research results via our website, other publications, papers, conference presentations, and our seminar series.

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 reserved Year 2 funds for graduate research assistantships to support dissertations not tied to a specific research grant and to attract new PhD students. We were able to support our PhD students on other grants, and recruit new students without offering separate assistantships. These funds were therefore shifted into the research project funds.

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 international students. This track is completed in 21 months. The first cohort of MSSCM (Accelerated) graduated in December 2016.

Undergraduate Programs: During the reporting period, CITT's Global Logistics Specialist Program was approved for 6 units of 400-level undergraduate study as part of CSULB's degree-completion Bachelor of Arts in Liberal Arts (BALA) program. The program is targeted at students who have accumulated 70 units of community college credits. The GLS tie-in provides working professionals without an undergraduate degree an opportunity to secure a BA while studying industry-specific content.

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 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.

METRANS Mentor Program: In this program, transportation practitioners (mentors) guide students to make informed career decisions and to develop into well-rounded professionals. Of the 21 students matched with mentors during the reporting period, 16 are female, and 13 are 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. Eight were held during this reporting period. See below.

Table 6: Lunch with Practitioner Series

Date	Speaker(s)
October 18, 2016	Panel Discussion: "Measure M:Yes or No on Sales Tax Measure for LA Transit?" Moderator: Lisa Schweitzer, Associate Professor, USC Price School Speaker: Laura Nelson, Staff Writer, Los Angeles Times Speaker: Stephanie Wiggins, Deputy Chief Executive Officer, LA Metro Speaker: Damien Goodman, Executive Director, Crenshaw Subway Coalition Speaker: Jefferey Sellers, Associate Professor, USC Dornsife Speaker: Mark Philips, Assistant Professor, USC Price
October 9, 2016	Speaker: Monica Born, Vice President, WSP | Parsons Brinckerhoff
October 26, 2016	Speaker: Allen Yourman, Principal, Diaz Yourman & Associates
February 8, 2017	Speaker: Meredith Canterbury, Senior GIS Specialist, LSA Associates, Inc.
February 22, 2017	Speaker: Steven Mateer, Transportation Planning Manager, LA Metro
February 24, 2017	Speaker: Eric Plosky, Chief of Transportation Planning, USDOT Volpe Center
March 1, 2017	Panel Discussion: "Get the Job" Moderator: Dan Beal, Principal, Transportation Policy Consulting Panelists: Kate Amissah, Regional Rail Senior Transportation Planner, LA Metro Fred Chang, Associate Transportation Planner, Iteris Emily Finkel, Transportation Planner, Fehr & Peers Caitlin Shankle, Transportation Analyst, Kittelson & Associates
March 21, 2017	Juggling Crystal Balls: Tackling LA County's Transportation Future Speaker: Therese Mc Millan, Chief Planning Officer, LA Metro

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, Ports of New York and New Jersey, Caltrans, LA Department of Water and Power, Foothill Transit, Access Services, City of LA, CEVA Logistics, Guthy-Renker, Wrist Marine Logistics, Fehr and Peers, Iteris, City of Beverly Hills, Culver City, Southern California Association of Governments (SCAG), SpaceX, KOA, Hyperloop, USC DOT, California State Legislature, Mitsubishi, Target, Google, and Torrance Transit, among others.

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.

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 3Follow-up interviews will assess the strengths and weaknesses of MTMC and the feedback will be used to better plan a similar class for transportation consultants who work with public agencies.

Caltrans Freight Academy: In the spring 2016, CITT offered a four-day freight academy designed for planners and engineers as part of a regular series of Caltrans-specific classes. The class focused on inter-agency freight planning to reflect the role played by Caltrans in the development of a new Sustainable Freight Plan done in conjunction with the CA Air Resources Board and other state level agencies. The next class will be scheduled in the fall of 2017.

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 was completed and is now part of CITT's course offerings.

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, six students were enrolled.

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. Eight were held with combined attendance of over 400. See below.

Table 7: Research Seminars		
Date	**Speaker(s)**	**Title**
October 12, 2016	Maged Dessouky, Professor Wentao Zhang, PhD candidate Industrial Systems and Engineering, USC Viterbi School of Engineering	*Supply Chain Consolidation and Cooperation in the Agricultural Industry*
October 14, 2016	Sanggyun Kang, PhD Candidate, Price School, USC	*Why do Warehouse Decentralize More in Certain Metropolitan Areas?*
	Hue-Tamme Jamme PhD Candidate, Price School, USC	*The Ecology of Walking to School Experience: Children's and Parents' Perception from City Heights*
October 21, 2016	Quan Yuan PhD Candidate, Price School, USC	*A Longitudinal Analysis of Environmental Justice in Warehousing Location*
	Eun Jin Shin PhD Candidate, Price School, USC	*Access to Diverse Opportunities in Segregated Ethnic Neighborhoods: The Case of Los Angeles Metropolitan Area*
	Raul-Santiago Bartolomei, PhD Candidate, Price School, USC	*Sustainability and Displacement: Assessing the Spatial Pattern of Residential Moves Near Rail Transit in Los Angeles*
November 10, 2016	Haishan Xia, Professor/Dean Chun Zhung, Associate Professor School of Architecture and Design, Beijing Jiaotong University	*Co-sponsored by International Policy, Planning, and Management Program* *Case Studies on Land Use Effects of Rail Transit in China*
November 16, 2016	Thomas O'Brien Executive Director, CITT Associate Director of CSULB Programs, METRANS	*Co-sponsored by the Center for International Trade and Transportation* *Mitigating Urban Freight Through Effective Management of Truck Chassis*
January 18, 2017	John Carlsson, Assistant Professor, Industrial Systems Engineering, USC Viterbi School of Engineering	*Quantifying the Impact of Next-Generation Modes of Delivery*
February 1, 2017	Gary Painter Professor of Public Policy, USC Price School	*The Decline in Inter- and Intra-Urban Mobility and its Impact on Passenger Travel*
March 29, 2017	Lingqian Hu Associate Professor, School of Architecture and Urban Planning, University of Wisconsin-Milwaukee	*Commute Inequality in Chicago*

1.2.5 Educational Enrichment. METRANS offers support to transportation-related student and professional groups at USC, CSULB, and in the community to assist them with 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). 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. During the reporting period, we held a field trip to ARTIC (Anaheim Regional Transportation Intermodal Center).

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 third academy as well as a 10th grade summer camp for Academy Ambassadors, both to be held in summer 2017. During the camp, students will be offered the opportunity to take a certification test in introductory supply chain management principles offered through Long Beach City College and CSULB. 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. We average over four posts a day on the Facebook page and two Tweets per day via Twitter. This reporting period Twitter followers grew to 540, and Facebook followers to 523. Our LinkedIn page has 116 members, and much of the information on METRANS programs are shared via the CITT LinkedIn site, which currently has 1,150 members and serves as the CITT alumni network. 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. To continue: 1) professional development, student recruitment and support, and educational enrichment programs; 2) development of the second class of the Metropolitan Transportation Management Certificate; 3) the Research Seminar Series; 4) the Lunch with

a Practitioner Series. Two postdoctoral positions will be advertised and filled for the 2017-2018 academic year.

1.3 TECHNOLOGY TRANSFER

The goal of the technology transfer program is to broaden our reach and disseminate research results.

1.3.1 Continuation of Signature Events

International Urban Freight Conference (I-NUF): I-NUF 2017 will occur from October 17-20 in Long Beach. We have released a call for abstracts. The link is available here.

The 2017 State of the Trade and Transportation Industry *Town Hall* occurred on March 30, 2017. The event was part of a series of activities tied to the 20th anniversary of CITT. The event drew approximately160 attendees. Information on the event, including an archived version of the event itself, can be found at the CITT website.

1.3.2 Outreach Events

Working and Living in a Port City Series: Introducing local decision makers and community residents to the port, its position in the global supply chain, and careers available in international trade and transportation, this three-part series is offered twice a year and is taught by industry professionals and a career advisor. It is supported by industry sponsorships and offered free of charge. CITT held one set of workshops in October 2016.

1.3.3 Media and Communications

Scholarly Venues: We conduct research that both contributes to knowledge and addresses transportation problems. We expect researchers to publish in scholarly journals, and require them to present at scholarly conferences. A proposal to *Transport Policy* for a special issue featuring papers presented at I NUF has been accepted and is currently in development.

The CITT Industry Event Calendar: The CITT Industry Event Calendar is an industry-sponsored portal where companies can share information with the broader community on events, internships, and employment opportunities and where we can reach an industry-focused audience via social media. We provide administrative support for the site. Seehttps://www.ccpe.csulb.edu/TheManifest/calendar.aspx

Research Briefs: A "Research Brief" that provides a short summary of research results suitable for a non-technical audience is required for all research projects. These briefs are widely circulated through both traditional and social media. During the reporting period, seven research briefs were produced.

METRANS News is a tri-annual newsletter that features our research, education and outreach activities in print and online. One issue was published during the reporting period, in the fall of 2016. Over 500 copies are mailed to university transportation centers and faculty throughout the US, to federal, state, and local public agencies, and to the transportation industry. Over 1,700 recipients are emailed the link for each issue. Issues are posted on the METRANS website and on the TRB e-newsletter. Between METRANS News issues, we circulate bi-weekly email blasts for both METRANS and CITT with important updates on our research, education and community engagement programs.

METRANS on the Move is a weekly, e-newsletter written and produced by students under the guidance of the Associate Director, Deguzman. Over 2,000 subscribers receive this weekly publication containing transportation news, and notice of transportation events and opportunities, such as conferences, seminars, webinars, scholarships, internships, and job listings.

METRANS Website and Social Media: New content continues to be added to the website, and news articles (often written by transportation students) and opportunities are posted on a weekly basis. The Tier 1 UTC is at www.metrans.org/metrans-utc. METRANS.com is being updated as a portal for all five METRANS related centers including the newest center Pacific Southwest Region UTC (PSR).

METRANSInfo: The InfoShop, designed to be a queryable database, has been merged with the METRANS blog. Members of the METRANS media/outreach team are working with METRANS researchers to adapt their research briefs into informational "ask-the-expert" editorial products. We will incorporate new blog contributors from the PSR consortium into the series.

ContainerCasts: These are webcasts focused on topics of interest to the international trade community and feature discussions based on in part on O'Brien's *Long Beach Business Journal* articles. One ContainerCast was produced and posted during the reporting period. The episode is available at www.ccpe.csulb.edu/citt.

TransCasts: TransCasts are podcasts featuring interviews with METRANS researchers and other distinguished transportation experts. Three were recorded during the reporting period, and are scheduled to be posted in the spring of 2017. Episodes are at https://www.metrans.org/transcasts.

Student Podcasts: Student-generated podcasts are produced and posted bi-monthly under the guidance of Associate Director, Deguzman, highlighting news and events of particular interest to students. Episodes are available at https://soundcloud.com/metrans.

YouTube: METRANS Seminars are available on YouTube. The full METRANS Playlist URL is http://www.youtube.com/results?search_query=mtrans+transportation+center.

Trade and Transportation Perspective and Trade Talks: CSULB Associate Director O'Brien's monthly commentary for the Trade and Transportation Perspective column for the *Long Beach Business Journal* is ending due to changes in editorial policies for the paper. Instead, he will host a new quarterly television series called Trade Talks produced by CSULB's Advanced Media Production services and distributed through a regional cable network. The episodes are also available via YouTube. The first episode featuring trade economist Paul Bingham is at https://www.ccpe.csulb.edu/CITT/about.aspx?pID=143.

1.3.4 Dissemination

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

1.3.5 Plans for Next Reporting Period. Plans for the next reporting period include to: 1) continue to publish completed METRANS research reports and briefs to the website; 2) continue to publish news, webcasts, and podcasts; 3) enhance and expand the website; 4) continue social media programs and grow subscriber database for LinkedIn and followers of Twitter; 5) offer the series on Working and Living in a Port City; 6) continue to add to the InfoShop/Blog; and to 7) produce two new episodes of the *Trade Talks cable TV series.*

2. Products

2.1 PUBLICATIONS

In this reporting period, the Tier 1 projects resulted in six peer-reviewed publications (and 19 under review) and six presentations (and seven under consideration for presentation). See Section 1.1.3.

2.2 WEBSITES.
Our website is at http://www.metrans.org. It is described in section 1.3.3.

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 March 2017 and will meet again 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.

Other Relationships: We have extensive relationships with industry and government. SCAG provides regional planning and transportation modeling data. 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. O'Brien serves as a Board member for the Southern California Roundtable of the CSCMP, LATC, and Foreign Trade Association. During the reporting period, he was appointed Vice-Chair of the Southern CA Regional Transit Training Consortium and to the advisory board of the Nat'l Transit Institute.

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 Treasurer 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. We are concluding Year 5 of the 5-year contract with VREF although it has now been formally extended until December 31, 2018. Fifteen research projects are completed and 26 are in progress. Research briefs and final research reports

are posted on the METRANS website, along with the Urban Freight Curriculum Guide, periodically updated. Seven MF researchers from LA, New York, and Paris presented papers at the VREF Conference, "Urban Freight 2016: Plan for the Future – Sharing Urban Space," in Gothenburg, Sweden from October 17-19. Giuliano presented a paper at the Western Regional Science Association (WRSA) 56th Annual Meeting in Santa Fe, New Mexico in February. New York partners Alison Conway and Elliott Sclar were panel discussants with Giuliano in New York City on "Creating a More Livable City through Transportation" in March. Discussions are underway by the MF team about their participation in the upcoming October 2017 I-NUF Conference in Long Beach, using it as an opportunity to share the accomplishments of the past 5 years.

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): METRANS is home to SWTWC, one of five regional centers that form the National Network for the Transportation Workforce. FHWA funded the centers to build strategic partnerships and engage regional and national stakeholders to develop a skilled and career-ready transportation workforce. O'Brien serves as Director of SWTWC, which includes the following partner institutions: Sol Price School of Public Policy, Texas A&M University Transportation Institute (TTI), ICF International, and the National Occupational Competency Testing Institute. SWTWC facilitates results-driven partnerships with State DOTs, State Departments of Education, industry, and others throughout transportation, education, labor, and workforce communities.

Other Activities: With university partners, METRANS submitted several major proposals during this reporting period. We continue to work with a consortium led by U Antwerp on port innovation research.

4. Impact

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: At USC, active METRANS UTC research projects fund 60 student positions. Of those hired, three are undergraduates, 24 are masters, and 23 are PhD students. Ten positions were made possible by research projects started in March, and new students will be hired to fill these positions in the next reporting period. One undergraduate and sixteen master's level students work on outreach activities. At CSULB, METRANS UTC research funds three research assistants, one undergraduate student and two master's students. There are also 13 additional students that work at CITT on a variety of METRANS projects including social media, web management, conferences, non-credit training programs, and workforce development-related programs. We also provide financial and administrative support to allow students from both campuses to participate in transportation conferences and competitions.

Support for Underrepresented Groups: We are committed to promoting diversity. Of the 17 student administrative assistants at USC directly supported by METRANS funding, 15 are members of an underrepresented groups, 13 are both female and a member of an underrepresented group. Of the sixteen research and student assistants at CSULB directly supported by METRANS funding, four are female and

fourteen are members of an underrepresented group. Of the 14 student and professional groups supported by METRANS, three 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.

Opportunities for Research: Student support is an important component of research project selection. Thirty faculty and 60 student researchers participate in these projects.

New Educational Materials and Programs and Opportunities for Teaching: We began development for the second session of the LBUSD Teacher Training course to be offered June 2017. 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 O'Brien are members of the TRB Intermodal Freight Transport Committee. O'Brien is also a member of the Intermodal Freight Terminal Design Committee. CITT Director of Research Tyler Reeb serves on the TRB Education and Training Committee. 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.

6. Special Reporting Requirements.

No special reporting requirements.