



Program Progress Performance Report for University Transportation Centers

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From Concepts to Deployment

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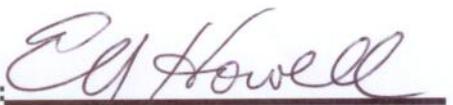
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Signed: 

Part 1: ACCOMPLISHMENTS

Major Goals

There have been no changes to program goals.

Major Activities

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure Maintenance Strategy

- Developed and completed case studies, which involved performing Data Envelopment Analysis (DEA) modeling of the historical data of bridge maintenance
- Analyzed the results from the DEA modeling to identify the characteristics of maintenance parameters
- Completing the final report

Developing Operational and Policy Insights into Next Generation Vehicle Needs Based on an Integrated Understanding of the Transportation and Energy System of Systems

- Integrated microscopic traffic simulation capabilities with existing agent-based modeling framework.
- Completed detailed Indianapolis network.
- Finalized the experiment setup.

Truck Activity and Wait Times at International Border Crossings

- Received and pre-processed additional geo-fence based time and location data for trucks using the Ambassador Bridge and Blue Water Bridge border crossing facilities
- Refined relations between queuing times for individual truck trips and truck volumes and individual inspection times at the Ambassador Bridge and Blue Water Bridge facilities estimated from disaggregate, geo-fence based queuing time and inspection time data and aggregate Public Border Operators Association volume data.

Integration of ground access to airports in measures of inter-urban accessibility

- Completed MA Thesis (Peng, 2013) is being expanded to find alternative data sources to map accessibility.
- Spatial interaction from origin (home) to access airports is identified as a key variable. It is difficult to measure, and the project is using innovative techniques to gather information from social media.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

- This Showcase project considers a transition from mobility-based evaluation of transportation to accessibility-based. Though accessibility is the purpose of transportation, evaluation remains based in metrics of mobility, and accessibility remains largely an academic concept.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

- We presented a selected paper at the 2014 summer meetings of the International Association of Energy Economics in New York. The title of the paper was "Analysis of Economic and Policy Options for Leveling the Playing Field between Natural Gas and Electric Vehicles in the US Transportation Sector," and the authors were Kemal Sarica and Wallace E. Tyner.

Standardized Metrics for Accessibility: Establishing a Federal Policy-Relevant Knowledge Base

- Continue writing final report: The final product will explain practices in data standardization that we discover through the historical analysis, document the current state of practice in data collection, and propose a means for achieving a standardized collection of data to support accessibility metrics at the national level.

Research, Education and Outreach from Campus Transit Laboratory

- Continued collection of CTL automatic passenger count (APC) and automatic vehicle location (AVL) data on a regular basis.
- Continued manually-assisted collection of CTL Wi-Fi data on a regular basis.

- Continued collection of directly observed CTL onboard bus route passenger origin-destination (OD) flows on a regular basis.

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- Two master theses were finished for the respective research tasks.
- The performance of the developed adaptive traffic signal logic (ATSC) is significantly influenced by the estimation accuracy of intersection turning proportions.
- Mixed traffic flow also has an effect on the developed ATSC.

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

- Tested the driving simulator system comprehensively.
- Upgraded experiment software packages to improve experiment reliability.
- Revised the experiment scenarios based on the observations from the pilot tests.
- Procured electroencephalography (EEG) devices.
- Recruited experiment participants.
- Started the driving simulator experiments in December 2014.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- Determined the network and types of data in the field case study. The network is located in India Institute of Technology (IIT) College and residential area in Madras, India.
- Developed traffic simulation models in AIMSUN and Dynasmart-P.
- Collected field data from multiple sources in the network.
- Refined the experimental design and planning.

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- Data analysis continued with two simultaneous approaches: 1) a Markov approach; 2) population spline fitting.
- The investigators decided to focus this initial analysis on the following types of distracted behavior: 1) texting only; 2) conversation only; and, 3) both texting and conversation.
- For use in both approaches, all 349 case events and 950 matched control events were categorized into two scenarios using video and kinematic data: 1) Following Events; 2) Lane Keeping/Lateral Events

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Evaluate LiDAR IMU integration for motion compensation
- Background detection in spherical coordinates
- Object association across frames /

Guaranteed LiDAR-aided Multi-object Tracking at Road Intersections

- Custom made IMUs holder for hardware integration.
- Started backward tracking objects with measuring their dimension.
- Started developing and data exchange and user interface concept.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development and Entrepreneurship Opportunities in Urban Region
- Assembled database of New Mobility industries within Southeast Michigan based on an expanded context of NAICS codes derived from regional case studies undertaken in previous phase of the project.
- Refined Cartographic and Visualization standards for Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Developed models for bus route-level transit passenger origin-destination (OD) flow estimation using automatic passenger count (APC) data capturing clusters of flow patterns across bus trips continue to be refined.
- Numerical investigations and assessments of the refined models continue to be carried out.

Specific Objectives

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure Maintenance Strategy

- Identify how maintenance parameters of bridges affect the efficiency of maintenance investment strategy, determine the type and extent of the effects these parameters have on maintenance efficiency, and how the effects may differ between different observation areas.

Developing Operational and Policy Insights into Next Generation Vehicle Needs Based on an Integrated Understanding of the Transportation and Energy System of Systems

- Study the electric vehicles' energy requirement under different traffic conditions.
- Study the impact of electric vehicles on energy grid.
- Make policy suggestions based on the daily energy demand.

Truck Activity and Wait Times at International Border Crossings

- Obtain geo-fence-based truck time and location data for trucks crossing the Ambassador and Blue Water bridges
- Process data into information on times truck incur at various activities at and near the Ambassador Bridge and Blue Water Bridge border crossing facilities
- Deliver targeted information to stakeholders

Integration of ground access to airports in measures of inter-urban accessibility

- The main objectives are to form a more complete account of the accessibility and catchment areas of US Airports.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

- The project is designed to answer four questions: 1. What impact has mobility based evaluation had in transportation? 2. What difference would accessibility-based evaluation make? 3. What are the obstacles to accessibility-based evaluation? 4. What are approaches to overcoming those obstacles?

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

- Gas in the Transportation System

Research, Education and Outreach from Campus Transit Laboratory

- Sustain, develop, and showcase the CTL as a living lab infrastructure supporting research, education, and outreach
- Archive and process data on passenger flows, vehicle locations, and community perceptions and travel patterns related to a technology-enhanced transit service

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- Formulate a mathematical model for the estimation of intersection turning proportions
- Develop an ATSC by incorporating the intersection turning proportion estimates
- Evaluate the effect of sensor deployment configuration on the performance of the developed intersection turning proportion estimation model and ATSC model

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

Establish and sustain the Driving Simulator Lab as infrastructure to conduct interactive experiments using travelers so as to perform research on driver behavior and safety as well as policy and market aspects of Advanced Traveler Information Systems.

- Develop a comprehensive methodology to better assess the potential value of real-time information to travelers.
- Exploit synthetic driver choice behavior data to construct reliable quantitative models for evaluating Advanced Traveler Information Systems using performance measures beyond travel time benefits.
- Use archived interactive experiment data and the analytical models developed as educational materials to help graduate and undergraduate students better understand the present state-of-the-art in human performance modeling and related safety aspects.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- Use field collected experiment data to develop the state-of-the-art methodology in origin-destination demand matrix estimation.
- Develop a statistical model to synthesize multiple sources of data.
- Use field collected experiment data to calibrate and validate the developed model.

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- There were two specific objectives during the current period: Continue data analysis, Prepare presentations and manuscripts to disseminate the results

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Calibrate the noise in LiDAR sensing
- Background detection and removal
- Forward tracking to solve the association of objects across frames

Guaranteed LiDAR-aided Multi-object Tracking at Road Intersections

- Backward tracking to get the best estimation of objects location and dimensions.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development and Entrepreneurship Opportunities in Urban Regions

- Expand understanding of relationship between underlying regional assets, extant regional infrastructures, and nascent new mobility opportunities (events) in producing emerging industry clusters.
- Test description of specific industry agents within the new mobility economy via existing industry classification structures (NAICS & Others) for the local area of Southeast Michigan
- Utilize standardized visualization techniques for industry cluster description (geospatialized and relational mappings) against newly assembled data for Southeast Michigan to assess process efficacy and database structure.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Quantify the magnitudes of the impacts that changes in certain variables have on CO2 emissions in select US urbanized areas.
- Identify the policy implications of the findings.
- Document findings based on US data in the form of papers.
- Continue to examine relationships among transportation supply and demand, urban form, policy, and CO2 emissions variables in non-US urban areas and compare results to those of US areas.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Improve transit passenger OD flow representation and estimation.
- Quantify the achieved improvements with respect to other state-of-the-practice and art methods.
- Demonstrate the feasibility of the new model and methods and their ability to produce interpretable results.

Significant Results

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure Maintenance Strategy

- Tables and charts of data results from the DEA modeling process and analysis
- Identification of the different effects that fluctuating maintenance parameters have on maintenance efficiencies in different observation areas
- Identification of certain observation areas that are performing at their peak efficiency levels on maintenance of certain asset types

Truck Activity and Wait Times at International Border Crossings

- Estimated results using disaggregate (truck trip level) geo-fence data with available aggregate (average) truck volume data show strong statistical and meaningful relations between queuing times and inspection times and volume data
- Estimated results using disaggregate (truck trip level) geo-fence data with available aggregate (average) truck volume data show strong and meaningful statistical relations between travel times on surface streets that exhibit heavy truck traffic and truck volumes
- Relations between inspection times and queuing times estimated from disaggregate (truck trip level) geo-fence data show the expected positive association at the Blue Water Bridge facility but an unexpected negative association (decreased inspection times with increased queuing times) at the Ambassador Bridge during the time period of large bridge redecking project

Integration of ground access to airports in measures of inter-urban accessibility

- A significant development is the use of social media check-ins to make pairings between origins and airports.
- The positive aspect of this idea is that the data provide insights that are difficult to obtain without exhaustive sample surveys.
- The weakness, which is currently being addressed, is the relatively low rate at which clearly identifiable airport-specific data is present in the data.
- The result is that a very large data set has to be filtered to yield reasonable rates.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

- The project developed case studies of the impact of mobility-based metrics in practice. Mobility thinking influences transportation outcomes both through formal evaluations and through informal processes of problem definition. The project is currently developing original case studies of accessibility-based evaluation of transportation and land-use projects to examine the difference in analytical outcomes implied by the mobility-to-accessibility shift. Through interviews and focus groups, the project identified principal obstacles as difficulty in communicating accessibility concepts and absence of readily applied metrics and techniques. The project developed a set of graphical techniques for conveying accessibility concepts and is currently working on applied methods and metrics.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

- In 2050 there are 36% more CNG internal combustion vehicles in the fleet if the CNG LDV subsidy is in effect compared with only the PHEV subsidy. On the other hand, if only the PHEV subsidy is in effect, there are 15% more of those vehicles compared to the case with the CNG LDV subsidy as well. Interestingly, the CNG subsidy also results in a reduction in GHG emissions relative to the case with only the PHEV subsidy. Oil imports also decrease with the CNG subsidy. Thus, we have documented that if a CNG subsidy were provided as is the case for PHEV, it would have important impacts on the transportation system.

Research, Education and Outreach from Campus Transit Laboratory

- Observed OD flow data were collected and summarized; results were also provided to researchers evaluating the performance of OD estimation models.

- Value of using aggregated Wi-Fi data, either as direct estimates or in combination with APC data, was investigated
- CTL data and analytical techniques served as benchmarks for externally funded research conducted using Central Ohio Transit Authority data
- CTL physical and institutional infrastructure formed the basis of two proposals for external funding: one proposal for novel environmental sensing experiments and a second proposal for OD estimation with advanced technologies

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- The intersection turning proportion model provides satisfactory estimates given the entry/exit flow on the boundary of the target network.
- The developed ATSC is capable of calculating better timing plans based on the collected most update-to-date traffic flow information and the predicted gain-and-loss evaluation as opposed to an actuated or fixed timing plan. Mixed traffic flow conditions makes traffic flow prediction difficult, a mixed cell transmission model (MCTM) is applied to resolve this problem.

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

- The driving simulation system was tested through comprehensive pilot tests.
- The experiment reliability is improved significantly after upgrading the experiment software packages and redesigning the experiment scenarios.
- The traffic simulation software may crash under some circumstances. We reported this issue to the vendor for solutions.
- The driving simulator experiment data have been carefully archived. Team members in the Driving Simulator Lab start analyze the experiment data.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- The simulation model was integrated and tested through comprehensive tests. The simulation models in AIMSUN and Dynasmart-P were calibrated and validated; the link count data matches the traffic volume in simulation models.
- Cameras were setup at 16 intersections. In total there are 32 cameras. Those video cameras can provide link count data.
- Bluetooth is setup in 5-6 locations. The market penetration of Bluetooth is about 7%-8%. Bluetooth data can provide route travel time information.

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- Individual models produced stronger predictions of distracted behavior engagement than aggregated models, but the prediction of the aggregate models was acceptable (90% accuracy for individual models versus 50% accuracy for aggregate models)
- Texting affected driving performance more than conversation
- These preliminary results appear to replicate, naturalistically, what has been found using driving simulators

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Collected data to analyze sensor and characterize sensor noise
- Purchased IMUs after comparing offerings from various vendors.
- Integration of IMUs with existing TScan hardware framework.
- We have developed a preliminary algorithm to identify and remove background from LiDAR data in spherical coordinates

- We have used a Kalman filter based approach for detecting vehicles in each frame and also associate them with the detections in future frames

Guaranteed LiDAR-aided Multi-object Tracking at Road Intersections

- Custom made IMUs holder.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- Production of 350+ layered thematic industry geospatialization mappings, localized cluster analyses for presentation and discussion with project partners.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- The variable used as a proxy for the presence of policies aimed at addressing environmental concerns and travelers' attitudes and behaviors towards such concerns influences the impacts changes in transportation characteristics and population density have on CO2 emissions.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Results based on numerical investigations show that the developed cluster-based modeling approach and estimation methods determine overall flow patterns that are superior in accuracy to those determined by state-of-the-practice and art methods.

Key Outcomes and Other Achievements

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure Maintenance Strategy
Plan to implement the method as described in this study to:

- Evaluate prior maintenance efficiencies in different observation areas of different asset types
- Prepare for subsequent maintenance period
- Establish efficiency guideline to prepare for specific situation

Developing Operational and Policy Insights into Next Generation Vehicle Needs Based on an Integrated Understanding of the Transportation and Energy System of Systems

- Developed a flexible framework which integrates microscopic traffic simulation capability with agent-based modeling framework.

Truck Activity and Wait Times at International Border Crossings

- A productive meeting was held with Michigan DOT personnel interested with border wait times, including discussion on possible future collaboration
- Discussions with General Motors customs group has led to an upcoming meeting with potential project stakeholders

Integration of ground access to airports in measures of inter-urban accessibility

- A key achievement, in parallel to the work on ground access, is a novel exploration of air network accessibility based on the actual flown itineraries of US passengers (DB1B).
- Using a comprehensive data exploration, we have devised a time series of spatial interaction tables (from DB1B) that deal with the air passenger movement from origin to destination, on actual hub-routed itinerary.
- With the aid of a new sensitivity calculation, the PI and graduate student Yongha Park have a paper (under peer review) that classifies the changing air system access.

Research, Education and Outreach from Campus Transit Laboratory

- Value of using aggregated Wi-Fi data collections, either as direct estimates or in combination with APC data, was observed
- CTL data, infrastructure, and expertise were used in outreach and educational activities
- CTL infrastructure played key role in a successful external proposal
- Two papers and one abstract using CTL data context were accepted for presentations at two upcoming conferences

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- the key outcome and/or achievement is that we developed an integrated framework for the on-line adaptive signal control problem based on the time-dependent intersection turning proportion estimation results under a Mixed traffic flow condition.

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

- Comprehensive pilot tests were accomplished.
- The driving simulation system was updated.
- Participants registered and scheduled the driving simulator experiments through the experiment website.
- The driving simulator experiments are being carried out.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- The field network was selected in Indian Institute of Technology at Madras, India.
- Traffic simulation models were developed, calibrated and validated.
- Field data on the link count and travel time information was collected from multiple sources in the network.
- An analytical framework for dynamic origin-destination matrices estimation was developed.

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- The findings reported above have helped the investigators begin identifying variables that potentially predict distracted driving and the analyses completed to date have provided important input toward the creation of the algorithm to identify distracted driving and estimate the level of distraction using kinematic/driver performance indicators.

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Determined a possible method for removing background from LiDAR data
- Implemented forward tracking that can identify same vehicle across frames, thereby solving the association problem.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- Began production on film to composite all mapping produced to date in an animated sequence for presentation to project partners, governmental agencies, and publics.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Quantified the magnitudes of the impacts that changes in certain variables have on CO2 emissions in select US urbanized areas.
- Documented the results based on US data.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Continue to produce additional numerical results that provide clear validation of the estimates.

Efforts to Disseminate Results

Truck Activity and Wait Times at International Border Crossings

- An MS thesis was successfully completed based on aspects of this project
- A presentation was made

Integration of ground access to airports in measures of inter-urban accessibility

- Paper submitted for peer review (late 2014).
- Air transport data sets are publicized through the Center for Urban and Regional Analysis.
- For example: http://geog-cura-osgeo.asc.ohio-state.edu/airaccess/accessibility_map.html

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

- We are organizing an international conference in Ann Arbor in June 2015 under the topic "Accessibility-Based Evaluation from Laboratory to Practice." Research results will be reported there, and the conference will be structured to facilitate interchange between international decision makers, practitioners, and researchers on the topic.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

- Selected paper presentation at IAEE meetings in 2014

Research, Education and Outreach from Campus Transit Laboratory

- In conjunction with an externally funded project, CTL results and infrastructure were used as benchmarks in discussions with federal, state, regional, and private stakeholders
- Two articles and three abstracts were submitted for conference presentations
- Discussions about CTL capabilities with a private company who had previously heard about CTL led to collaboration on an external proposal

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- The preliminary research results have been presented at the IEEE International Conference on ITS Telecommunications (ITST 2012), Taipei, Taiwan.

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

- A research paper has been presented at the INFOMRS 2014 Annual Meeting.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- In preparation of technical paper writing for publication in a journal.

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- With data analysis and report preparation still ongoing, no results were disseminated during this period

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Podium presentation at the NATMEC: Improving Traffic Data Collection, Analysis, and Use. June 29– July 2, 2014

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- SMART has a database of over 16000 transportation professionals and leaders worldwide. We have announced the work through our website (see <http://um-smart.org/blog>), through our targeted news, and we have held a range of multi-sector meetings.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Revised two papers describing methods and results based on US data.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Continue writing and refining one paper aimed at describing the modeling framework, estimation methods, and numerical results.
- Outline another paper aimed at describing the new methodology and its numerical evaluation against other methods when only one cluster is assumed.

Plans for Next Reporting Period (January – June, 2015)

Developing Operational and Policy Insights into Next Generation Vehicle Needs Based on an Integrated Understanding of the Transportation and Energy System of Systems

- Run the experiment
- Analyze the results
- Write a paper
- Work towards real-time integration of the two frameworks.

Truck Activity and Wait Times at International Border Crossings

- Obtain, process, and analyze new data
- Complete transition from outgoing to incoming graduate student
- Investigate quantitative relations among queuing time, inspection time, and volume data
- Develop relations with expected stakeholders

Integration of ground access to airports in measures of inter-urban accessibility

- The PI and current MA student (Muzi Feng) are developing spatial data from novel sources and plan to reconcile these data into more conventional spatial interaction tables.
- Related methodological issues are being tackled to convert samples to a more useful format.
- Feng will write and defend an MA Thesis in 2015.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

- Demonstrate use of applied project-level accessibility tools in a number of case study situations. This involves solving methodological problems including adapting regional accessibility metrics for project-level evaluation; forecasting transportation impacts for land-use projects and land-use impacts for transportation projects.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

- We expect to publish a journal paper from this research.

Standardized Metrics for Accessibility: Establishing a Federal Policy-Relevant Knowledge Base

- Send draft for review and approval from interviewees.
- Submit final report.

Research, Education and Outreach from Campus Transit Laboratory

- Data collection: Collect automatic vehicle location (AVL), automatic passenger counter (APC), Wi-Fi based flow, and directly observed OD flow data
- Research: Exploit manual, web-based, and automatic data-driven investigations to generate and investigate research hypotheses
- Education: Use CTL-based modules in OSU courses, develop analytical and methodological skills of graduate students, offer data collection opportunities for graduate and undergraduate students
- Outreach and communication: Discuss results and future efforts with transit, transportation, planning, and other agencies, and prepare and submit/deliver articles and presentations

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- The research team will be consolidating the research outcomes to prepare the draft manuscripts to be submitted to the respective journals for further review.

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

- Continue participant recruitment. Recruit participants among the staff and students in Purdue University and people living in West Lafayette, Lafayette, and Indianapolis, IN.
- Conduct the designed experiments using the driving simulator with interactive surveying system.
- Analyze the experiment data to identify factors in traveler decision-making process and the psychological effects of travel information provision.
- Refine analytical models using the collected experiment data.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- Develop and refine the methodology to estimate the origin-destination demand matrices that synthesizes multiple sources of data.
- Use field collected data to calibrate and validate the developed model.
- Write a technical paper for publication in a journal.
- Present the results in outreach conferences.

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- Finish data analysis
- Present preliminary results to peers at meetings/conferences
- Finish manuscript preparation and submit to a peer-reviewed publication

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Finalizing the hardware integration and the custom made mount and connectors.
- Implement Backtracking to obtain the following results: Best possible dimensions of the vehicle from point cloud / Trajectory of Vehicle in the intersection / If possible, solve for specific cases of the occlusion problem

Guaranteed LiDAR-aided Multi-object Tracking at Road Intersections

- Finalizing the hardware integration and the custom made mount and connectors.
- Classifying the tracked objects
- Continue developing an implementation version of the codes for real-time processing

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- We will continue to complete the geospatialized maps for industry sectors not yet assembled.
- We will now being to present the cartographies to a range of partners / experts for feedback on content, and interpretation as well as efficacy of visualization techniques as specifically applied to the SE Michigan context.
- We will be developing customize scripts in Python to further automate the data to visualization process (originally done manually at the start of the project)

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Further investigate the policy implications of the findings.
- Investigate the differences found in some variables between the US and non-US urban areas.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Conduct empirical investigations to further validate the quality and interpretability of the flow estimates determined by developed model and estimation methods.
- Investigate the feasibility of the new model and methods.

PART 2: PRODUCTS

Truck Activity and Wait Times at International Border Crossings

Presentations: Sell, Nicole L., 2014. Empirical Investigations of Queuing and Surface Street Times using Truck Probe Data around International Border Crossings. M.S. Thesis, Graduate Program in Civil Engineering, The Ohio State University, Columbus, OH. Acknowledgement of federal support: Yes
Technologies or techniques: Vehicle location and timing technologies in use on operating trucks and virtual geo-fences are combined to produce unique datasets.

Databases: Aggregated longitudinal and disaggregated, truck trip-level databases are developed for truck times incurred in multiple activities. (Data are received from private trucking company, and truck trip-level data are not presently available for public dissemination.)

Software or NetWare: Various codes are developed to process raw data into times truck incur at various locations and to process truck trip-level times into summary measures

Educational aids or curricula: Data and research questions formed the basis of a successful MS thesis

Data and Research Material: Unique aggregated longitudinal and disaggregated, truck trip-level data are amassed

Models: Regression models between queuing times at primary inspection and inspection times and truck volumes were developed. Regression models between travel times on surface streets with heavy truck volumes and magnitude of truck volumes were developed.

Integration of ground access to airports in measures of inter-urban accessibility

- Kejing Peng (2013). Evaluating the Integrated Accessibility and Catchment Areas of US Airports / Presented in Partial Fulfillment of the Requirements for the Degree Master of Arts in the Graduate School of The Ohio State University. Graduate Program in Geography. The Ohio State University, M.E. O'Kelly and Yongha Park (2014).
- Computation and interpretation of accessibility changes from spatial interaction data. Submitted for Peer Review.
- Website: Accessibility Mapping System for US Air Passenger Traffic. See also: http://geog-cura-osgeo.asc.ohio-state.edu/airaccess/accessibility_map.html

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

Educational aides or curricula: A set of graphical techniques were developed to illustrate accessibility concepts; these will be included in the final report and submitted for publication in appropriate venues.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

- Sarica, Kemal, and Wallace E. Tyner. "Analysis of Economic and Policy Options for Leveling the Playing Field between Natural Gas and Electric Vehicles in the US Transportation Sector." Paper presented at the 2014 meetings of the International Association of Energy Economics, New York, NY.

Research, Education and Outreach from Campus Transit Laboratory

- McCord, M.R., R.G. Mishalani, M. Etefagh, 2014. The Effect of Real-time Passenger Information Systems on the Perceptions of Transit's Favorable Environmental and Traffic Reduction Roles. Under review for possible publication in Transportation Research Record (acknowledgement of federal support: yes)
- Mishalani, R.G., M.R. McCord, M.G. Colman, Y. Yuan (The Ohio State University Transit Lab), "OSU Progress Update on Transit Passenger Flow Estimation and Characteristics Expansions Project," Teleconference presentation to the Ohio Department of Transportation, Mid-Ohio Regional Planning Commission, Federal Transit Agency, and Other Project Team Members (AECOM, ETC), November 5 and 12, 2014 (acknowledgement of federal support: yes)

Websites: A website includes among other things, activities and results from this project:

<http://transitlab.osu.edu/campus-transit-lab>

Technologies or techniques: Commercial-grade state-of-the practice automatic vehicle location technologies, passenger information systems, and automatic passenger counter technologies implemented on an operational bus service provide data that are regularly downloaded and stored, Systematic data collection using mobile-based Wi-Fi sensing technologies is regularly conducted, and techniques are developed to produce OD flow estimates from the data

Databases: Databases that include bus location, position, and speed data, bus passenger boarding and alighting data, estimated and observed bus passenger origin-destination flows are developed and updated

Physical collections: Bus passenger origin-destination flows are manually collected, Manually assisted, Wi-Fi based flow data are collected

Software or NetWare: Various codes for archiving, processing, and analyzing the rich and large datasets collected through the Campus Transit Lab are used

Educational aides or curricula: Data obtained from the CTL, as well as the physical infrastructure, are used in classes. Data are provided to students conducting independent research of project activities not associated with the project. Hands-on experience in transit data collection is provided to graduate and undergraduate students associated with the project.

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls

- Hu, Shou-Ren and Liou, Han-Tsung, "Estimation of Time-dependent Turning Proportions for Urban Signal Controls," proceedings of the IEEE 12th International Conference on Intelligent Transportation Systems Telecommunications (IEEE ITST 2012)

Driving Simulator Laboratory: Traveler Behavior Modeling and Interactive Experiments to Address Mobility and Safety Needs

Websites: www.purdue.edu/drivingsimulator. The experiment website provides participants a brief description of the driving simulator experiment, an online survey, and an experiment registration and scheduling system

Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

- A PowerPoint presentation has been created and will be shared with peers at meetings/conferences TBD.
- A manuscript is in preparation and will be submitted to a peer-reviewed journal for publication *T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking*
- Podium presentation at the NATMEC: Improving Traffic Data Collection, Analysis, and Use. June 29– July 2, 2014

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Mishalani, R.G., Goel, P.K., Westra, A.M., Landgraf, A.J., 2014. Modeling the Relationships Among Urban Passenger Travel Carbon Dioxide Emissions, Transportation Demand and Supply, Population Density, and Proxy Policy Variables. *Transportation Research Part D: Transport and Environment*, 33, 146-154.
- Databases: Transportation supply and demand, population density, environmental policy, and passenger travel related CO2 emissions in urban areas.
- Various codes for summarizing and analyzing the various datasets. Data: Urban transportation supply and demand, population density, environmental policy, and CO2 emissions data
- Models relating urban passenger travel related CO2 emissions to transportation demand and supply, population density, and environmental policy variables.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Landgraf, A., Mishalani, R.G., Goel, P.K., McCord, M.R., 2014. Estimating Transit OD Flows using Boarding and Alighting Data: A Clustering-based Variational Bayes Method that Recognizes and Identifies Several Underlying Latent OD Matrices. Extended abstract submitted for possible presentation at and publication in the proceedings of the 13th International Conference on Advanced Systems for Public Transport to be held in Rotterdam, The Netherlands, 19-23 July 2015.
- Technologies, techniques: New techniques are developed that improve upon the estimation of transit passenger OD flows using APC data.
- Software: Various codes for applying the new estimation methods and for conducting the numerical and empirical investigations.
- Models: Model for better representing transit passenger OD flows considering clusters of flow patterns across bus trips.

PART 3: PARTICIPANTS & COLLABORATING ORGANIZATIONS

Partnership Organization Information

Truck Activity and Wait Times at International Border Crossings

(1) Michigan Tech Research Institute (2) CEVA Logistics

(1) Ann Arbor, Michigan (2) Worldwide offices

(1) Financial support – No, In-kind support - Yes

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

Network on European Transport and Communications Activities Research, Netherlands, Support of conference.

Research, Education and Outreach from Campus Transit Laboratory

(1) The Ohio State University Department of Transportation and Traffic Management (2) Clever Devices (3) Ohio Department of Transportation (4) Mid-Ohio Regional Planning Commission (5) Central Ohio Transit Authority

(1) Columbus, Ohio (2) Woodbury, New York (3) Columbus, OH (4) Columbus, OH (5) Columbus, OH

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls
National Cheng Kung University, Tainan City, Taiwan, Partial support for the students and equipment for the collaborating organization

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

Department of Civil Engineering, Indian Institute of Technology, Madras, India. Collaborative research.
Using Naturalistic Driving Performance Data to Develop an Empirically Defined Model of Distracted Driving

University of Michigan Risk Science Center, University of Michigan, School of Public Health, Financial, collaboration

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:
NEXT Energy, 461 Burroughs St, Detroit, MI 48202

- SMART collaborates closely with NEXT Energy, Michigan's Clean Tech / Energy industry accelerator supported by MEDC. We have had ongoing discussions with NEXT Energy regarding this project and its value to Michigan. The nature of the collaboration has involved data sharing related to the Power Electronic Sector in Michigan, Clean Tech. Industry sector, and in-kind support related to staff time. We also collaborate with Michigan based NGO's including Michigan Environment Council and Trans4M, a coalition of Michigan based sustainable transport efforts.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data
The Ohio State University Department of Transportation and Traffic Management, Columbus, Ohio, Financial support, in-kind support, and facilities and equipment.

Other Collaborators and Contacts

Truck Activity and Wait Times at International Border Crossings

Civil Engineering and Geography researchers collaborate on project activities, Michigan Tech Research Institute is a subcontractor and provide valuable services because of their close proximity to the border crossing facilities

Integration of ground access to airports in measures of inter-urban accessibility

The PI is the Director of the Center for Urban and Regional Analysis (CURA), and our center is closely allied with the Center for Aviation Studies (CAS) here at OSU. The Director of the CAS (Seth Young) serves as an affiliated faculty member of CURA and was very helpful on this project at its starting stage. The PI has an active collaboration with a cluster of colleagues from The Federal University of Minas Gerais (UFMG) Belo Horizonte Brazil. These colleagues are primarily assisting on other related work, but the synergy between the two areas is important and may yield further developments. For example, some of the same data issues that arise in US air passenger transport are even more problematic in Brazil, and the need for comparative and expanded data sets is an interesting potential result of the collaboration.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice
University of Michigan Mobility Transformation Center (support of conference), Network on European Communications and Transport Activities Research

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

Kemal Sarica, Assistant Professor, Department of Industrial Engineering, Isik University, Istanbul, TURKEY, 90-216-528-7153, kemal.sarica@isikun.edu.tr

Research, Education and Outreach from Campus Transit Laboratory

Civil Engineering, City and Regional Planning, and Statistics researchers and students collaborate on various project activities. CTL researchers collaborated with environmental engineering researchers to develop a proposal, presently under review, to an external agency that would use CTL infrastructure. A faculty member at Tongji University uses CTL data for education and research purposes at his institution. NEXTRANS researchers are collaborating with same individual on activities of value to the project. CTL researchers collaborated with a company to develop and submit a successful proposal to a federal agency that will use CTL infrastructure. A faculty member at Tongji University (China) uses CTL data for education and research purposes at his institution. NEXTRANS researchers are collaborating with same individual on activities of value to the project.

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls
National Cheng Kung University, Tainan City, Taiwan

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

- Interdepartmental or interdisciplinary collaborations
- Collaboration with professor Kartik Ariyur from the School of Mechanical Engineering

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- SMART is supported by over 40 advisors representing the full range of departments, institutes, and initiatives related to sustainable transportation at the University of Michigan. This project is now also supported with an active URP project from Ford Motor Company. SMART collaborates on a regular basis with: * the International Transport Forum of the OECD (Organization for Economic Co-operation and Development) * the World Business Council on Sustainable Development * the Global Clean Tech Cluster Association * SLOCAT (A United Nations-affiliated network of sustainable transportation related initiatives worldwide). * SMART also has its own global network of city leaders involved in the SMART Systems network, consisting of over 50 city leaders from 5 continents. Work maturing through this project will be presented for feedback to partner organizations listed above.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Civil Engineering and Statistics researchers and students collaborate on various project activities.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Civil Engineering and Statistics researchers and students collaborate on various project activities.

Part 4: IMPACT

Impact on the Development of the Principal Discipline(s) of the Program

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure Maintenance Strategy

- Helping maintenance managers understand better how their systems work
- Allowing maintenance managers to review efficiencies of prior work
- Makes it easier for the maintenance managers to employ a more efficient resource allocation strategy in future maintenance periods
- Enables maintenance managers to establish efficiency guideline to estimate the outcome of a maintenance cycle

Truck Activity and Wait Times at International Border Crossings

Results from project activities provide unique information on times trucks incur when crossing two of the busiest and highest valued freight border crossings in North America

Integration of ground access to airports in measures of inter-urban accessibility

Continuing expansion of a very traditional core topic for transport geography -- namely, aviation access and service. The integration of maps and GIS is a useful development. Interactive web mapping is an even more important tool that was not available in the past.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice
Transportation and land-use planning: The project demonstrates approaches and implications of the mobility-to-accessibility shift.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System
expansion of the base MARKAL model to include the EV and compressed natural gas vehicle technologies and policy options

Research, Education and Outreach from Campus Transit Laboratory

- Results from project activities add to the body of knowledge on transit travel behavior and transit operations and also motivate additional studies by the project research team and others. In addition, the results can inspire improvements in decisions taken by transit planners and operators that allow better transit service to be provided at lower cost.
- Successful implementation of course modules based on CTL activities, context, and data help promote the pedagogical use of “living laboratories” in Civil Engineering instruction.

Estimation of Time-Dependent Intersection Turning Proportions for Adaptive Traffic Signal Controls
The developed ATSC model for mixed traffic flow conditions has a significant impact on urban signal control discipline.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- Introduce a new methodology to estimate dynamic OD matrices.
- Introduce a new statistical model to synthesize multiple sources of data.
- The new methodology synthesizes multiple sources of data and thus provides better estimation than existing approaches

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking
Quantitative safety estimates and predictions will become possible because of the availability of real data to test various hypotheses and meet specifications.

Guaranteed LiDAR-aided Multi-object Tracking at Road Intersections

Quantitative safety estimates and predictions will become possible because of the availability of real data to test various hypotheses and meet specifications.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- The principle disciplinary groups participating in this project are urban and regional design and planning, and geospatial and relational data visualization. To this end, the techniques developed through this project to date include a number of novel methods not previously deployed in transportation economic planning as related to region system representation. We anticipate that this work will help to produce a context where the study of emerging industry sectors and related clean-tech clusters will be given greater attention in planning regional development, and specific policy development related to the promotion of regional industry clusters.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

- Anticipated project analysis and modeling results are expected to improve the understanding of the nature of the contributions of passenger urban travel to greenhouse gas (GHG) emissions, which in turn has the potential to inform transportation related policy-making aimed at possibly reducing such emissions.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

- Anticipated project model and methods are expected to improve the richness and quality of transit passenger OD flows representation and estimation using APC data, which in turn has the potential

to improve the planning for and design of transit services in urban areas carried out by metropolitan planning and transit agencies.

Impact on other Disciplines

Truck Activity and Wait Times at International Border Crossings

Collaboration among Civil Engineering and Geography researchers help the different disciplines better understand the use of geo-spatial and sensing technologies in addressing practical transportation issues
Integration of ground access to airports in measures of inter-urban accessibility

Collaboration with colleagues in Engineering is notable and has provided a very solid platform for continuing joint work and grant proposal writing.

Research, Education and Outreach from Campus Transit Laboratory

Collaboration among Civil Engineering, City and Regional Planning, and Statistics researchers help Civil Engineering and City and Regional Planning students better understand data analysis techniques and Statistics students work gain experience by working in an applied setting.

Guaranteed LiDAR-aided Multi-object Tracking at Road Intersections

The heuristic integration of data performed by computer scientists, such as in Google autonomous cars will be replaced by rigorous sensor integration with guarantees, likely using few and less expensive sensors.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- Key impact on other disciplines: we expect that the work produced through this grant project will be of particular significance to industry development and economic development (especially jobs / workforce development in a changing, urbanizing, technology-driven landscape). This type of visualization products produced through this effort has not been done before. Industry partners with whom the work has been shared have expressed interest and demand for application to other regional areas of study. We expect that this interest and demand will escalate relative to rates of urbanization and tipping points in the delivery of sustainable transportation.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

Collaboration among Civil Engineering and Statistics researchers help Civil Engineering researchers better understand data analysis techniques and Statistics researchers gain experience by working in an applied setting.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

Collaboration among Civil Engineering and Statistics researchers help Civil Engineering researchers better understand data analysis techniques and Statistics researchers gain experience by working in an applied setting.

Impact on Transportation Workforce Development

Truck Activity and Wait Times at International Border Crossings

- One graduate student used data to develop quantitative models
- One graduate student successfully completed an MS thesis based on the project data and research questions
- One graduate student with good geo-spatial background was introduced to a new application area

Integration of ground access to airports in measures of inter-urban accessibility

Training two MA level students. Collaboration and research writing with PhD advisee. MA student Kejing Peng now works for Microsoft and provides technical support to OSU on the site he developed.

Research, Education and Outreach from Campus Transit Laboratory

- Three graduate students and five undergraduate students regularly collected passenger flow information on CTL buses using manual methods and a Wi-Fi based sensing technology

- Three graduate students regularly processed and analyzed automatically collected CTL data.
- Over 130 students used CTL data and CTL infrastructure for course assignments
- An undergraduate student previously working with the CTL participated in a transportation-related summer internship with the German Academic Exchange Services (DAAD-RISE) program.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

Graduate students were provided the opportunity to work in the domain of mathematical modeling and traffic simulation, data fusion, statistical model, and route choice behavior.

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

Will facilitate data collection and several types of studies such as: pedestrian-vehicle interaction studies; traffic signals studies and intersection performance evaluation among others.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

Potential impacts of this research include identification of emerging industry sectors and opportunities for entrepreneurial initiatives, identification of gaps in industry cluster assembly that point to both corporate opportunities, and specific workforce development needs. This work may also ultimately inform policies supporting specific policy support to produce personnel in-state to staff emerging job production opportunities.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

One PhD student works directly with urban transportation supply and demand, population density, CO2 emissions, and policy data to identify patterns and relationships pertinent to transportation policy-making.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

One PhD student works directly with APC data and applies data to solve a pertinent transportation flow estimation problem.

Impact on physical, institutional, and information resources at the university or other partner institutions

Truck Activity and Wait Times at International Border Crossings

This project results in the amassing of a large and unique dataset on truck times when conducting multiple activities at two major border crossings

Integration of ground access to airports in measures of inter-urban accessibility

- The Center for Urban and Regional Analysis continues to provide a visible link for air passenger and aviation research. <http://cura.osu.edu>. The air access map is here: http://geog-cura-osgeo.asc.ohio-state.edu/airaccess/accessibility_map.html. The larger international / national visualization project for T-100 style data is here called "Sky Explorer:" <http://geog-cura-osgeo.asc.ohio-state.edu/t100/web/main.html>.

Research, Education and Outreach from Campus Transit Laboratory

- The Ohio State University Campus Transit Lab is a unique living laboratory that is used for research, education, and outreach. This project makes a major contribution toward providing the physical and human resource infrastructure required to develop, sustain, and take advantage of the laboratory.
- CTL results in the amassing of large datasets relating to transit passenger flows, transit vehicle operations, passenger information systems, and transit user and non-user perceptions and attitudes towards transit services.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

Currently, the project has led to sharing of database information between Planning, engineering and business units at the University of Michigan, and several meetings to discuss methodological variations between disciplinary practices. Database organization, structure and access has been informed through

these exchanges. We anticipate that through this project, new database structures related to clean-tech industry clusters will be produced, and that gaps in data acquisition (specifically for non-traded private agents in these sectors) will be identified.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

A unique database that combines data from multiple sources spanning urban areas around the world is amassed and integrated in a consistent manner.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

Project activities rely on The Ohio State University Campus Transit Lab. The value of CTL to this project helps motivate and justify the provision of physical and human resources to develop, sustain, and continue to take advantage of this living lab. The estimation results arrived at could contribute to improved planning for and designing of transit services, both on campus and eventually more broadly in Columbus and other cities if the model and methods are adopted.

Impact on Technology Transfer

Truck Activity and Wait Times at International Border Crossings

- Efforts are ongoing to communicate results to prospective stakeholders

Research, Education and Outreach from Campus Transit Laboratory

- Amassed data are already leading to results of research and practical value that are communicated via presentations and publications. Ways to broaden this communication are being explored.

Field Data Based Data Fusion Methodologies to Estimate Dynamic Origin-Destination Demand Matrices from Multiple Sensing Technologies

- The results from this study will provide public sector transportation agencies a robust methodology that can synthesize multiple sources of data and thus provide more convincing results of dynamic origin-destination estimation. Provide an alternative to transportation planning agencies to obtain the dynamic OD information with relatively low cost. The technical method can contribute to a wide range of applications in transportation planning practice.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- Currently, we have not identified specific products that we will be pursuing through disclosure and patent protection; however, the project may lead to new software development. While this is a potential in the work, we have been focusing on methods and are not yet at the stage to develop specific code to automate actions related to the visualization process. The digital automation processes for visualization we are beginning to develop may have value for tech transfer, in particular, as a method, and possible plug-in for ESRI products. Once ready beyond the beta phase, we anticipate disclosing the process through U-M Tech Transfer, and meeting to discuss development options with ESRI.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

The estimation results arrived at are also expected to contribute to improved planning for and designing of transit services more broadly in Columbus and other cities if the model and methods are adopted.

Impact on Society beyond Science and Technology

Truck Activity and Wait Times at International Border Crossings

The overall project is focused on improving freight flow across international borders, which is essential to international competitiveness

Integration of ground access to airports in measures of inter-urban accessibility

The web data sets provide excellent teaching examples for course work in Transport Geography.

Accessibility-Based Evaluation of Transportation and Land Use Planning: From Laboratory to Practice

The goal is a transformation of the way transportation and land use planning are performed. These have been shaped by mobility frameworks that poorly represent transportation's fundamental purpose.

Analysis of Policies Aimed at Increasing Use of Natural Gas in the Transportation System

Evaluation of possible future vehicle policy options

Research, Education and Outreach from Campus Transit Laboratory

The overall project is focused on improving transit services, increasing transit utilization, and enhancing transit efficiency, all of which lead to more socially, economically, and environmentally sustainable transportation systems.

T-SCAN - Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretation and Tracking

This should make traffic modeling, estimation, prediction, and the meeting of safety specifications a matter of systematic scalable engineering rather than heuristics with large scale human intervention as it is today. This will enable policy makers to design roads and signals on a quantitative basis to meet societal expectations.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

In order to transform transportation at the order of magnitude required for the current challenges and to take advantage of the emerging opportunities – social, technical, and demographic, an economic conversion is needed, not just an urban policy or transportation policy approach. The private sector is already and needs to play an increasing role in the wicked problem of transportation in an urbanizing world. This project aims to produce data-based graphical analysis that enables this type of cross disciplinary / cross jurisdictional discourse.

Modeling CO2 Emissions as a Function of Transportation, Land-Use, and Regulation Variables

Supporting the motivation, development, and evaluation of passenger transportation, land-use, and environmental policies aimed at reducing greenhouse gas (GHG) emissions in urban areas.

Transit Origin-Destination (OD) Flow Estimation Considering Temporal Variations based on APC Data

The overall project is focused on improving transit services, increasing transit utilization, and enhancing transit efficiency, all of which lead to more socially, economically, and environmentally sustainable transportation systems.

PART 5: CHANGES/PROBLEMS

Integration of ground access to airports in measures of inter-urban accessibility

- The project took a little more time to get started than we anticipated. However, the advantage of the delay was having a completed Thesis (Peng, 2013) to provide a road map for the needed expanded data. One very positive aspect (that explains the time line) is that the student who completed that thesis has not only provided the basis for the new work, but has continued to maintain the web access sites (listed above) beyond the completion of his degree.

MAPPING NEW MOBILITY BUSINESS, INNOVATION, AND EMPLOYMENT / OPPORTUNITIES IN MICHIGAN:

- Original scope of work was to undertake general studies across Region V, we are now focusing on refining methods with specific highly detailed studies of SE Michigan. These, coupled with previous Case Studies undertaken in 2014 will inform project portability to other Region V location and other regions globally in future phases. No significant project changes beyond those previously reported.