Program Progress Performance Report for University Transportation Centers

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From Concepts to Deployment

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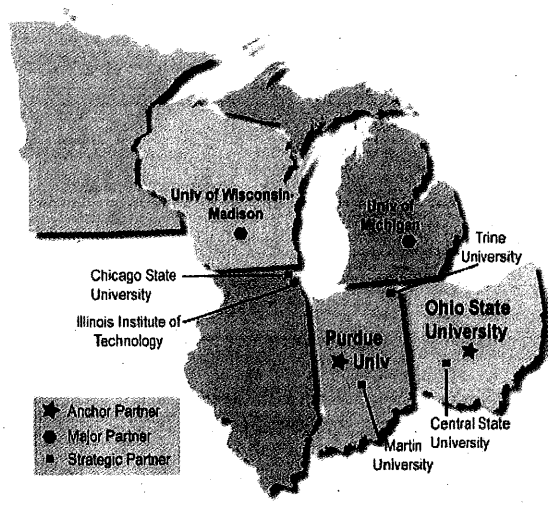

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Signed: _____
Rick D. Evans, Managing Director

PURDUE UNIVERSITY
Discovery Park

From January 1 to June 30, 2012, activities of the NEXTRANS Center focused on eleven projects at Purdue University, The Ohio State University, the University of Michigan, and the University of Wisconsin – Madison.

PART 1: ACCOMPLISHMENTS

Major Goals

There have been no changes to program goals.

Major Activities

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

- The analysis will be done using a model called MARKAL-Macro. MARKAL (short for market allocation) is a widely used bottom-up energy model originally from the International Energy Agency with thousands of technologies included for satisfying energy demands.
- We will do model modifications to implement the indicated natural gas policies and technologies.
- We will measure costs of each policy option in terms of GHG reduction and reduction in oil imports.
- We will be able to estimate how natural gas incentives for transportation compare with alternative policies both in terms of GHG reduction and increasing energy security through reduced oil imports.

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

- Review the literature on distracted driving.
- Select a sample of distracted driving events from UMTRI's naturalistic driving database.
- Develop an algorithm to identify distracted driving and estimate the level of distraction using kinematic indicators.
- Validate the algorithm using telematic data from instrumented vehicles.

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

- Hired a team of research assistants integrated between current project and Grengs' data standards project.
- Refined research questions.
- Refined methods for all four research questions (below).
- Researched possible case studies.

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

- Investigated the National Transit Database (NTD) and the Highway Performance Monitoring System (HPMS) as models for standardized data.
- Examined the requirements, mandates, and incentives that drive current travel demand modeling at regional agencies.
- Prepared for conducting interviews by doing background reading on federal requirements related to data collection and reporting, especially related to travel demand modeling. Identified contacts for conducting interviews.
- Conducted approximately five interviews.

Mapping New Mobility Business and Employment Opportunity in Michigan: Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development Opportunities in Urban Regions

- Project work initiated: May 1 2013.
- Team coordination meetings to refine scope.
- Establishment of Industry Sector Metrics (underway).
- Data Collection (underway).
- GIS based mappings (underway)

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure

- Prepared a proposed work plan and completed the Research Project Funding Agreement.
- Awaiting funds to be awarded via an established fund account at UW-Madison to begin work.

Research, Education and Outreach from Campus Transit Laboratory

- Continued collecting directly observed passenger origin-destination (OD) flows.
- Summarized directly observed OD flows for stakeholders and research efforts.
- Continued processing automatic vehicle location (AVL) data to determine bus cycle times, and stop-to-stop travel times.
- Summarized bus cycle times and stop-to-stop travel times for stakeholders and research efforts.
- Investigated bus cycle times and stop-to-stop travel times to evaluate impacts of infrastructure and class scheduling changes.
- Continued processing automatic passenger counter (APC) data.
- Summarized APC data for stakeholders and research efforts.
- Began empirically investigating feasibility of OD flow collection from Wi-Fi signal detection on CTL routes.
- Developed statistically significant results on community perceptions and attitudes related to a technology-enhanced bus transit service.
- Continued developing a website that describes Campus Transit Lab (CTL) related activities.
- Used CTL-based education modules and activities in three courses.
- Responded to multiple stakeholder requests for CTL data and information.
- Summarized boarding and alighting volumes at selected stops to allow an assessment of transfer potential between OSU Campus Area Bus Service (CABS) and Central Ohio Transit Authority (COTA) routes at request of Ohio State University (OSU) Transportation and Traffic Management (TTM).
- Summarized boarding and alighting volumes by time-of-day for a specific CABS route to allow an assessment of late-hour, weekend bus service needs at request of OSU TTM.
- Provided selected CABS APC and AVL data to allow an assessment of anticipated electric bus operating performance on campus routes traversing steep grades; at request of OSU Center for Automotive Research.

Truck Activity and Wait Times at International Border Crossings

- Received and processed additional CEVA Logistics truck time and location data.
- Processed data into times trucks incur at various locations at and approaching Ambassador Bridge and Blue Water Bridge border crossings in both US-bound and Canada-bound directions.
- Summarized processed truck times and investigated results for items of interest.
- Combined newly processed truck times with previously processed times to form longitudinal data sets of more than 50 months of queuing and inspection times (medians, 90th percentiles, 90th – 50th percentiles).

- Downloaded aggregate volume data of total and truck traffic using Ambassador Bridge and Blue Water bridges for same multi-year time period.
- Processed longitudinal data to determine long-term trends and monthly variations.

Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretations and Tracking

- Testing the TScan hardware components installed in the van (LiDAR, two surveillance cameras, data storage, PT mounts).
- Testing data acquisition and retrieval in laboratory conditions - Collecting data at a pilot intersection in West Lafayette and evaluating.
- Testing the LiDAR data acquisition and retrieval in controlled (indoor conditions).
- Acquisition of data at a pilot intersection and their visualization with the vendor software.
- Developing formulae for conversion of data points' spherical coordinates to orthogonal coordinates.

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

- Institutional Review Board approval for the participation of human subjects in the experiment.
- Graduate, undergraduate, and high school intern hiring.
- Experiment network building in SCANeR.
- Demand calibration in AIMSUN to create ambient traffic for the experiments.
- Online survey development to collect participants' socioeconomic information, daily travel behavior, and trip information usage.
- Computer program implementation for information provision and triggering incidents during the experiments.
- Reward system development to encourage realistic driving behavior.
- Navigation system development to provide location information to participants during experiments.
- Experiment participation scheduling system development.
- Development of driving simulator experiment website.

Specific Objectives

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

- The major objective of this research is to evaluate a series of natural gas for transportation policy options and to compare them with existing options for electric vehicles, biofuels, CAFE standards, etc.
- The policy incentives that will be considered are: 1)incentives to create natural gas fueling stations, 2)subsidies for natural gas vehicles comparable to the benefits provided to the country from their use, 3)incentives for retrofitting gasoline vehicles for conversion to CNG, and 5)incentives for fleet adoption of CNG.

Information and Transportation Choices, Long- and Short-Term, that Link Sustainability and Livability Project

- Assess the capacity of provision of transportation-relevant information to affect long and short run decisions, including (from long- to short-term) residential locational choice, auto ownership, mode choice and route choice.

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

- Review what is already known regarding driver distraction, its measurement, and association with vehicle kinematics.
- Collect data from a sample of drivers demonstrating distracted and undistracted driving.
- Develop an algorithm to identify distracted driving and estimate the level of distraction using kinematic indicators 4) validate the algorithm using telematic data from instrumented vehicles.

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

- To Answer: What is effect of mobility standards on transportation and land use; what difference would accessibility standards make; what impediments exist to adoption of accessibility standards; what approaches can be developed to overcoming those impediments.
- On the assumption that one of the obstacles under #3 will be difficulties in applying existing methods, under #4: development of graphical tools for analyzing and displaying accessibility; development of easy-to-use quantitative tools for analyzing and describing accessibility.

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

- Assess the current state of standardized transportation data.
- Document the range of current practice with regard to the needed inputs to accessibility analysis.
- Develop a framework for standardizing the inputs to accessibility metrics.

Mapping New Mobility Business and Employment Opportunity in Michigan: Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development Opportunities in Urban Regions

- Develop a framework for data collection and indicators to identify the entities that comprise the new mobility 'industry'.
- Assemble GIS encoded data to map the geospatial relations between multiple 'sub-sectors' of this group of entities.
- Develop the logics for a tool that can map relational data between actors within this group of entities based on actor-network mapping practices.

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.
- Exploit CTL to develop seed research investigations, modules for coursework, training of students in data collection, and focused studies of immediate interest to service operators
- Develop collaborations with transit agencies and other investigators based on CTL-related activities.

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.
- Interpret processed information into results of general and targeted interest.
- Deliver targeted information to stakeholders.

Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretations and Tracking

- Finalize testing the integrated system.
- Deploy the TScan hardware at a pilot intersection, collect and visualize data clouds using the vendor software.
- Compare the visualized data with the video images.
- Test TScan hardware the installed components - Fix if needed malfunctioning hardware operations - Test the data acquisition and storage at a pilot road.

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.
- Use the Driving Simulator Lab platform to generate education modules to highlight various dimensions related to driver performance, behavior, and safety for middle and high school students.

Significant Results

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

- Relevant literature has been reviewed, though that applying specifically to vehicle kinematics was small.
- A sample of distracted driving behaviors has been identified and matched undistracted driving segments are being identified.

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

- Although we are only a few weeks into the project, we have learned that there is wide agreement among practitioners, scholars, and industry experts that efforts to standardize transportation data have been limited.

Research, Education and Outreach from Campus Transit Laboratory Showcase

- Observed OD flow data were collected and summarized. Results were also provided to researchers evaluating the performance of OD estimation models.
- Regression-based analysis using APC and AVL data was conducted to demonstrate the effect of roadway infrastructure changes, class scheduling changes, and passenger boarding and alighting volumes on bus cycle time and stop-to-stop travel times.
- Regression-based analysis using APC and AVL data was conducted to demonstrate the effect of temperature and precipitation on bus-vs.-walk choice.
- Binary logit-based analysis using APC and AVL data was conducted to quantify the impact of bus travel times on bus route choice and to demonstrate a difference in the choice

probabilities depending on the route alignment and the land-use traversed, after controlling for travel time differences.

- Binary logit-based analyses using responses to web-based surveys of the campus community were conducted to demonstrate that real-time passenger information system users value transit service more than nonusers and feel safer in using transit and that both transit users and nonusers value the environmental and traffic reduction contributions provided by transit service.
- CTL data and context were successfully used in three OSU courses: Five students (out of twelve) in a graduate-level transportation demand course used CTL data as the basis of their term projects. All 30 students in an undergraduate/graduate course in public transportation used CTL data and infrastructure for a major course project. CTL routes and data, as well as a formulation previously developed by CTL investigators, were used as an example of applied linear programming in a 137-student course on civil and environmental engineering economics and optimization.

Truck Activity and Wait Times at International Border Crossings

- A decrease in times associated with a targeted action was observed (release of more specific information awaiting company clearance).
- A change in the location of the Blue Water Bridge Canada-bound inspection location was seen not to have a noticeable effect on upstream truck times.
- Strong time-of-day effects on truck travel times on surface streets in Windsor, Canada were seen.
- Long term trends were observed for both US- and Canada-bound truck queuing times at both the Ambassador Bridge and Blue Water Bridge crossings.
- Stronger long term decreases were seen in U.S. inspection times than in Canadian inspection times.

Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretations and Tracking

- The TScan hardware operates correctly after fixing a minor server malfunction (incorrect settings).
- Positioning of the TScan is important for the quality of the collected data. Development of an algorithm to convert spherical data to orthogonal tied up with the intersection plane initiated
- The TScan data acquisition and storage work properly. Positioning of the LiDAR is important for the quality of collected data.

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

- A driving simulator experiment network that replicates the highway system of the city of Indianapolis was built to provide a more realistic driving experiment environment.
- A microscopic simulation model was established for the experiments. The simulation model was calibrated for different experiment scenarios base on real-world traffic volume and travel time data under different congestion levels.
- A driving simulator experiment website is available to help participants in understanding the experiment objectives, detailed experiment steps, and getting familiar with the driving simulator.
- Multiple information provision mechanisms were realized and will be available during the experiments, including: (i) Variable Message Signs, which provide generic travel information; (ii) Text messages through portable devices, which provide customized travel information; (iii) Voice messages, which provide detailed turn-by-turn route suggestion; (iv)

vehicle position in the experiment network, which provides location information to help participants drive to assigned destination.

- Familiarity with information technologies will be surveyed. Familiarity with technologies is one of the important aspects that impact traveler responses to real-time travel information. As in reality, more and more travel information provision mechanisms depend on the advanced information technologies. Portable devices such as smartphones and tablets are commonly used by travelers to access real-time travel information. Understanding the relationship between familiarity with technologies and responses to real-time travel information will help in researching driver behavior as well as improving the development of Advanced Traveler Information Systems.

Key Outcomes and Other Achievements

Research, Education and Outreach from Campus Transit Laboratory

- Dissemination of CTL-related research results further established CTL as a platform that supports the development of new research ideas.
- An externally funded project that was largely motivated by CTL activities was begun and a second was awarded.
- A CTL graduate research associate participated in the 2013 International Road Federation Scholar Program.
- CTL investigators held discussions with Jacksonville transit and Xerox about joint activities that take advantage of CTL infrastructure.
- During the reporting period two new undergraduate students inquired about participating in CTL activities as a result of exposure, during the previous reporting period, to the CTL in a large undergraduate transportation engineering class; one of these two students was incorporated into regular activities.
- Three students completed M.S. theses based on CTL activities; a fourth student completed an extended M.S. project based on CTL activities; a fifth student completed a PhD dissertation, where empirical analysis used CTL AVL data.

Truck Activity and Wait Times at International Border Crossings

- New data were successfully processed and merged with old data to form longitudinal data sets.
- Targeted results were produced for private stakeholder and general community.
- Canadian political official involved with trans-border trade expressed specific interest in trends of border crossing times.

Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretations and Tracking

- The TScan is hardware installed and integrated.
- Formulae for conversion from spherical data to orthogonal are tied up with the intersection plane initiated.
- The TScan hardware is tested and working.

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

- Driving simulator experiment network.
- Calibrated AIMSUM microscopic simulation model.
- Driving simulator experiment website.
- Experiment scheduling system.

- Online survey system.
- Route guidance system.
- Vehicle positioning system.
- Reward system.
- Information provision and incident triggering programs.

Efforts to Disseminate Results

Research, Education and Outreach from Campus Transit Laboratory

- Wrote and submitted journal and conference proceedings papers.
- Prepared and presented technical results at a national conference and developed abstracts and presentations for additional conferences to be held in future reporting periods.
- Prepared three M.S. theses and one PhD dissertation based on CTL activities and using CTL data.
- Communicated pertinent results to transit stakeholders through reports and meetings.
- Communicated overall activities and results to university administrators associated with university resource planning and data services.

Truck Activity and Wait Times at International Border Crossings

- Papers and presentations are being prepared. • Dissemination efforts are being developed.

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

- Presented results in conference.
- Invited partner institution (Martin University) group to visit Driving Simulator Laboratory.
- Communicated the novelty of experiments and possible implications with policy makers.

Plans for Next Reporting Period (July - December 2013)

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

- We will complete the project during this period and produce journal papers and other outputs.

Information and Transportation Choices, Long- and Short-Term, that Link Sustainability and Livability

- Project will begin. Michigan side will be providing Ann Arbor data for on-line accessibility, mapping tool, developing accessibility/livability indices, testing of on-line mapping tool, developing the Ann Arbor study population, and developing survey instrument.

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

- Continue on with steps two through four of the study protocol.

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

- Select case study locations Develop focus group protocols Run focus groups.
- Initiate case-study research.
- Initiate graphical side of research with case study and quantitative.

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

- Build a catalog of data requirements. Answer: which data are reported to other levels of government (esp. federal); which data come from which levels of government (local, regional, state); and how are they reported (format, mechanism, etc.)

- Write a summary that describes the range of issues involved with travel demand modeling data that we previously collected from MPOs, including (a) How do the data we received from each MPO line up with the data that we requested? (i.e., who provided what, and what's missing?); (b) Which softwares were used for each MPO?; (c) For the data that were provided, how do variables match up across MPOs?
- Develop a database of data items relevant to accessibility. Database will demonstrate range of use of each data item across MPOs, potential approaches to standardizing data item.
- Conduct interviews with public officials at various levels of government, including local, regional, and federal, and document viewpoints on current data requirements and on the possibility of modifying current data to advance accessibility-based evaluation. (e.g., What are the methods for defining, collecting, storing, and publishing data?)

Mapping New Mobility Business and Employment Opportunity in Michigan: Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development Opportunities in Urban Regions

- Scope defined in project submission will be undertaken between July - Dec 2013.

Use of Comparative Efficiency Analysis to Optimize Transportation Infrastructure

- Phase 1: July to September 2013. In this initial phase, the cycle of cost and condition in transportation infrastructure maintenance decision making will be defined and the parameters will be identified. The work in this phase involves the following:
    - Examining stages of progression in annual maintenance cycle at state transportation agencies.
    - Defining the cost-condition cycle as a generic model that encompasses common stages of annual maintenance cycle of transportation infrastructure.
    - Investigating the most common and relevant parameters in the cost-condition cycle. This includes determining data needs and availability.
    - Studying the interaction between input and output parameters of different types of transportation infrastructure while linked to the cost-condition cycle. Phase 2: October to December 2013. This phase includes defining case studies for different types of situations using cost-condition cycle model. Case studies will be divided according to the following:
        - Different types of transportation infrastructure.
        - Different performance measures.
        - Different input and output parameters.
        - Different levels of maintenance coverage area (county, district, region, state)
- This phase also introduces the usage of Data Envelopment Analysis (DEA) as a way to implement Comparative Efficiency Analysis. In this phase the selection procedure to find the most suitable DEA models for all of the types listed above will be described.

Research, Education and Outreach from Campus Transit Laboratory Showcase

- 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 two courses
- Outreach and communication: Discuss results and future efforts with transit, transportation, and other agencies, disseminate information through CTL website, and prepare and submit/deliver articles and presentations

Truck Activity and Wait Times at International Border Crossings

- Obtain, process, and analyze new data • Meet with data supplier and project partners to redefine geo-fences
- Investigate quantitative relations among queuing time, inspection time, and volume data
- Develop relations with expected stakeholders

Stationary LiDAR for Traffic and Safety Applications – Vehicles Interpretations and Tracking

- Finalize and implement formulae for conversion of data points spherical coordinates to orthogonal coordinates
- Develop an algorithm for separating vehicle data from background data - Develop vehicles tracking algorithm

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

- Pilot tests: Test and calibrate the driving simulator experiments and survey system.
- Participant recruitment: Recruit participants among the staff and students in Purdue University and people living in West Lafayette, Lafayette, and Indianapolis, IN.
- Experiment execution: Conduct the designed experiments using the driving simulator with interactive surveying system.
- Data analysis: Analyze the experiment data to identify factors in traveler decision-making process and the psychological effects of travel information provision.
- Model development: Develop analytical models to predict traveler responses and design more efficient information deployment strategies.

PART 2: PRODUCTS

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

- Databases: We are developing a database containing the data on this sample, but it is not yet complete and will be used for analysis.

Research, Education and Outreach from Campus Transit Laboratory Showcase

- Publications, conference papers, and presentations
    - Chen, C., "Using Archived Bus Automatic Vehicle Location Data to Identify Indications of Recurrent Congestion," PhD. dissertation, The Ohio State University, April 2013 (acknowledgment of federal support: yes)
    - Ettefagh, M., "Effects of Real-time Passenger Information Systems on Perceptions of Transit Services: Investigations of The Ohio State University Community," M.S. thesis, The Ohio State University, April 2013 (acknowledgment of federal support: yes)
    - Hertler, G., "Effect of Service, Temporal, and Weather Variables on Short Bus Transit Passenger Trips: Investigations of OSU's Intra-campus Transit Demand," M.S. thesis, The Ohio State University, April 2013 (acknowledgment of federal support: yes)
    - Reinhold, H.E., "Combining Transit Route Origin-Destination Passenger Flow Matrices into Integrated Area or Corridor Matrices: Evaluating Flow Patterns on the OSU Campus and along a Columbus Corridor," M.S. thesis, The Ohio State University, April 2013 (acknowledgment of federal support: yes)

- Websites: A website was updated to include 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 provided data that were regularly downloaded and stored.
    - New investigations using Wi-Fi sensing technologies were begun.
- Databases: Databases that include bus location, position, and speed data, bus passenger boarding and alighting data, estimated and observed bus passenger origin-destination flows were updated.
- Physical Collections
    - Bus passenger origin-destination flows were manually collected.
    - Manually assisted, exploratory Wi-Fi based flow data collection was begun.
- Software or NetWare: Various codes for archiving, processing, and analyzing the rich and large datasets collected through the Campus Transit Lab were developed.
- Educational aides or curricula
    - Data obtained from the CTL, as well as the physical infrastructure, were again used in a variety of transportation and civil engineering courses.
    - Hands-on experience in transit data collection was provided to graduate and undergraduate students associated with the project.
    - Experience with practical transit planning and operations issues was provided to graduate students through the outreach activities.
- Data & Research Material: Data that include bus location, position, and speed data, bus passenger boarding and alighting data, estimated and observed bus passenger origin-destination flows were updated.
- Models
    - Models were estimated to investigate effects of infrastructure, class schedule, and boarding and alighting volumes on bus travel times.
    - Models were estimated to indicate the effects of temperature and precipitation, as well as agency specific factors, bus ridership.
    - Models were estimated to indicate the effect of transit real-time information systems on perceptions of transit service quality, safety, and external benefits.
- Other publications, conference papers and presentations
    - Ji, Y., R.G. Mishalani, and M.R. McCord, “Estimating Transit Route-level OD Flow Matrices from APC Data on Multiple Bus Trips Using the IPF Method with an Iteratively Improved Base,” presentation at the Meeting of the Transportation Research Board, Washington, DC, January 2013 (acknowledgment of federal support: yes)
    - McCord, M.R., and Mishalani, R.G., OSU Campus Transit Lab (CTL): Background, Data, Applications, and Outreach. Presentation to OSU Chief Data Officer, The Ohio State University, Columbus, OH, June 3, 2013 (acknowledgment of federal support: yes)

Truck Activity and Wait Times at International Border Crossings

- 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 aides or curricula: Project data and analysis related to the project formed the basis of an individual term project by a student in a graduate level transportation analysis course.
- Data and Research Material: Unique aggregated longitudinal and disaggregated, truck trip-level data are amassed.

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

- Publications, conference papers, and presentations:
    - Srinivas Peeta (2013) "Understanding the Psychological Effects of Real-Time Information for the Travel Experience and Related Performance Measures"
    - Session 160: *Impact of Information on Decisions, Choices, and Behaviors of Travelers* (Workshop) sponsored by the TRB Use Information Systems committee (AND20) at 92nd Annual TRB Meeting, Washington DC, January, 2013
- Websites: Experiment website is available at: www.purdue.edu/drivingsimulator

PART 3: PARTICIPANTS & COLLABORATING ORGANIZATIONS

Partnership Organization Information

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 Matching funds collaborative brainstorming

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

- Rockefeller Foundation New York, NY Financial support

Mapping New Mobility Business and Employment Opportunity in Michigan: Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development Opportunities in Urban Regions

- NextEnergy, Detroit MI. In kind personnel/time contribution and network development.

Research, Education and Outreach from Campus Transit Laboratory

- The Ohio State University Department of Transportation and Traffic Management, Columbus, Ohio. Financial support, In-kind support, Facilities.
- Clever Devices in Woodbury, New York. In-kind support.

Truck Activity and Wait Times at International Border Crossings

- Michigan Tech Research Institute, Ann Arbor, Michigan. In-kind support, facilities, collaborative research.
- CEVA Logistics, worldwide offices. Support in the form of data.

Other Collaborators or Contacts

Mapping New Mobility Business and Employment Opportunity in Michigan: Developing a Data-Driven Graphic Platform for Assessing and Advancing Industry Cluster Development Opportunities in Urban Regions

- Brookings Institution, SMART, University of Michigan UMTRI, Peter Adriaens (U-M Ross/ CoE), Dr. Sven Stremke, Wageningen, University and Research Centre, Andy van den Dobbelsteen, Delft University of Technology.

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

- Co-PIs are from Urban and Regional Planning, Architecture, and University of Michigan Transportation Research Institute.

Research, Education and Outreach from Campus Transit Laboratory

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

Truck Activity and Wait Times at International Border Crossings

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

PART 4: IMPACT

Impact on the Development of the Principal Discipline the Program

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

- The new transportation data and analysis will be available to MARKAL modelers, and the results will be presented at conferences and published in disciplinary journals.

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

- None yet, though we anticipate that the results will contribute to the ability to measure and study driver distraction and may lead to the development of mitigation devices.

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

- Reform transportation and land-use planning practice around accessibility-based (rather than mobility-based evaluation)

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

- The project seeks to understand how a standardized set of data generated by regional planning agencies might be collected in a repository to facilitate consistent and dependable accessibility-based analysis among places and through time.

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.

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.

Impact on other Disciplines

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

- None yet, though this is anticipated to extend the ability of Risk Science to be applied to research on distracted driving by providing a means of measuring the occurrence and severity of driver distraction in large samples.

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

- Other transportation fields: engineering, economics would also be fundamentally transformed by the mobility-to-accessibility shift.

Research, Education and Outreach from Campus Transit Laboratory Showcase

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

Truck Activity and Wait Times at International Border Crossings

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

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

- Undergraduates from other disciplines are attracted to transportation. Undergraduates from Mechanical Engineering, Computer Science, Chemistry, and Environmental Engineering, were selected and working as summer interns in the Driving Simulator Lab.

Impact on Transportation Workforce Development

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

- Training around accessibility becomes a route for transformation of the field

Research, Education and Outreach from Campus Transit Laboratory

- Seven graduate and three undergraduate students regularly collected passenger flow information on CTL buses.
- Four graduate students experimented with Wi-Fi data collection on Central Ohio Transit Authority buses.
- One summer intern from the University of California – Berkeley was integrated into data collection activities on CTL buses and CTL research and outreach activities.
- Eight graduate students regularly processed and analyzed automatically collected CTL data.
- One hundred thirty-seven undergraduate students learned bus scheduling issues and applied linear programming based on CTL results and data in a classroom setting. Thirty undergraduate/graduate students developed transit data collection and analysis skills in a classroom setting. Five graduate students conducted in-depth analysis based on CTL activities and using CTL data and communicated results in end-of-term presentations.

- Five graduate students completed theses, reports, or dissertations based on CTL activities and using CTL data. Of these, three accepted competitive positions in the transportation industry during this reporting period, a fourth accepted a position shortly after the end of this reporting period, and the fifth accepted a non-transportation position in the information technology industry.

Truck Activity and Wait Times at International Border Crossings

- Two graduate students and one undergraduate intern regularly processed and interpreted uniquely collected data.
- Using project data and context, one student conducted in-depth, quantitative analysis for term project in a graduate level transportation course and communicated results in a presentation.

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

- Internship opportunities are available for graduate, undergraduate, and high school students to work in the Driving Simulator Lab.
- Graduate students were provided the opportunity to work in the Driving Simulator Lab that can lead to multiple dimensions of possible research in the area of traveler behavior and safety.
- Minority and women students were provided the opportunities to improve professional skills in transportation through research and internships.

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

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

- None yet, but the results should contribute to the ability to identify, measure and understand the effects of driver distraction on safety and injury risk.

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

- Scholars and public policy analysts, through their research, will be better positioned, by tracking progress over time and across place, to discover new approaches to policy making.

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.

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.

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

- The Driving Simulator Lab setup is a state-of-the-art facility at the NEXTRANS Center, Purdue University. The advanced driving simulator has the unique capability of replicating/mapping a large city network and creating ambient traffic via integration to micro-simulation software (AIMSUN). This is one of the most advanced driving simulator

labs for understanding driver response to real-time information provision across many dimensions that have not been previously addressed in a research setting, but have key implications for safety and effectiveness of information in the real world. With its advanced features, the driving simulator provides a robust and realistic driving experience for drivers. The driving simulator is connected to three high-performance computers and other hardware components such as webcams, video capturing devices and high definition multi-media displays. The Driving Simulator Lab represents a unique physical and institutional resource.

Impact on Technology Transfer

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

- University of Michigan will likely host a conference on the topic in 2014 or 2015.

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 possibly broaden this communication will be explored.

Truck Activity and Wait Times at International Border Crossings

- Efforts will be made to communicate results to stakeholders.

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

- The results from this study will provide government and public sector transportation agencies an assurance that they are targeting their limited funds toward technologies that are most likely to improve the nation's highway system and deliver maximum benefit to travelers. This study will help traffic information service providers and investment decision-makers in understanding the value of real-time information and traveler behavioral response to it. Also, it will help in deciding the content and amount of information necessary for travelers to make informed and effective routing decisions.
- The ability to explicitly quantify the human behavior dimension provides a broader set of performance measures to public/private sector stakeholders relative to the evolution of the traveler information services market.

Impact on Society beyond Science and Technology

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

- Designed to improve the practice of transportation and land-use planning

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

- We expect that fostering more accessibility-based analysis will lead to more environmentally sound and socially equitable transportation investments.

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.

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.

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

- The study will help in developing a comprehensive understanding of the mechanism in which more benefits can be derived from real-time traffic information systems.
- This study can lead to direct benefits to the individual travelers, as it facilitates the design of personalized traffic information that can help commuters choose their routes based on their psychological benefits (which link to the quality of travel experience) in addition to travel time savings.
- The study can contribute to the development of better methods to provide information to travelers and enhance the quality and safety of the travel experience. The research accomplishments from this project can help in deciding the content and amount of information necessary for participants to make best route decisions.
- The research findings are expected to improve public access to and awareness of the positive and negative impacts of real-time travel information.
- The driving simulator lab can be used as a platform to educate middle and high school students in various dimensions related to driver performance, behavior, and safety.

PART 5: CHANGES/PROBLEMS

- Nothing to Report

PART 6: SPECIAL REPORTING REQUIREMENTS

- Nothing to Report