

## ***A Description of Cross Border Trips and Crossing Times at the Cascade Gateway and Trade Corridor***

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We present a description of commercial vehicles crossing at the Cascade Gateway, the primary border crossing between Southwest British Columbia, Canada, and Northwestern Washington, United States. Using four data sources for comparison—a probe vehicle border delay data set, a detailed border operations survey data set, loop detector volume counts, and manifest sampling, we describe observed seasonal, daily, and time of day patterns including the average and variability of delay, that comprise crossing times at this border crossing, the fourth busiest commercial crossing on the U.S./Canada border. We add to this a description of the origins and destinations and primary commodities at this port, which are agricultural/food, wood, and paper products. These commodities are not viewed as particularly time critical as they do not move in a strictly scheduled environment, although a significant proportion of these goods are highly perishable. These factors are significantly different than at the eastern portion of the border, where manufactured goods are flowing across the border in a time sensitive business environment which requires more precise delivery time estimates.

It is approximately 150 miles between Vancouver, BC and Seattle, WA. We present a transportation profile of commercial vehicle origins and destinations, demonstrating the regional and bi-national nature of this port. About 35% of southbound trips are served by drivers based in the region who can reasonably make one round trip from their home, to origin, destination, and return, in one working day and not exceed hours of service regulations.

The Cascade Gateway (southbound) has three gates available for commercial vehicle crossings, including one FAST (Free and Secure Trade) lane. The FAST lane has limited hours of operation (M-F 8:00 AM to 8:00 PM) and until recently (January 2008) was only available for southbound crossings. It offers expedited customs and immigration processing for approved commercial vehicle drivers, carriers and importers, who all must be approved through a background and business process evaluation. Our datasets demonstrate that FAST provides significant benefit to carriers. Primary booths times are substantially reduced, and wait times are almost an hour shorter. The average FAST primary inspection time is approximately 30 seconds per vehicle faster than non-FAST booths, with a one hour

reduction in crossing time per vehicle when comparing FAST to non-FAST crossing times. Crossing times can be more variable southbound due to the more demand responsive Canadian staffing policy at northbound gates.

The arrival pattern peaks in the morning, with a leveling off of demand in the mid-day when the regional drivers are at their destination and more a spread peak in the afternoon, dropping off late in the afternoon when variances in travel times and wait times spread the demand across a greater period than in the morning. When the FAST lane is available to FAST approved vehicles the average crossing time is less than 19 minutes. Outside of FAST hours, crossing times are on average just over 22 minutes. The crossing time is larger outside of FAST hours due to the lack of an available FAST lane, although delay times are shorter than non-FAST crossing times in peak hours due to reduced volumes. The crossing times are variable, with a standard deviation of about 20 minutes in the FAST hours and 22 minutes outside of FAST hours. The arrival pattern is consistent across days of the week, with a stronger morning peak on Fridays and an earlier drop-off in traffic volumes in the afternoon. Monday morning has the smallest morning peak. Seasonal arrival patterns experience lower volumes in the winter and spring, with higher volumes in summer and fall, but the daily pattern remains consistent, with a peak in the morning, a leveling off at noon, and a gradual decline in volumes in the afternoon period. Although the delay patterns do not show any day of week or seasonal pattern, we do see day of week and seasonal patterns in the arrival volumes.

Unlike the Eastern portion of the Northern Border, the Cascade Gateway is not dominated by unfinished goods moving between factories on either side of the border. Early evidence suggests these crossings have problems similar to Southern Border concerning difficulties for FAST enrollment for certain commodities, where it is not easy to become FAST approved and C-TPAT certified due to the difficulty of securing the supply chain of wood products, fruits, and vegetables (especially for small and medium producers). Initial evidence suggests that empties and bulk commodities are more likely to use the FAST program than other types of commodities (wood, farm, and food products).

We see that FAST is very effective and does improve travel times for most carriers who become approved however, utilization is low at Blaine. Every region has a unique commodity and trade profile that affect that usage, operations, efficiency, and infrastructure—they are not just physical and geographic locations. This paper presents a context for understanding the impact of the border on regional supply

chains, and informing the discussion of strategies designed to reduce the cost of border crossings to regional trade.

### ***A Driver-Focused Truck Crash Prediction Model***

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Within the Federal Motor Carrier Safety Administration and among U.S. motor carriers, there is great interest in developing a model to understand the key factors contributing to an increased likelihood of a truck crash. This paper advances a driver focused truck crash prediction model. Its spotlight is on drivers: their individual characteristics, their employment history, and their roadside inspection record in terms of both driver and vehicle safety violations. The model investigates the contribution of each driver factor on the dependent variable—i.e., the number of state reportable crashes in which the driver was involved. The findings suggest that the following driver specific factors are significantly related to the increased likelihood of a crash occurrence: driver age, weight, height, and employment stability as well as their record of both driver and vehicle violations (based on past inspections) and past crashes. The results have significance regarding both motor carrier and Federal Motor Carrier Safety Administration imperatives to improve motor carrier safety.

## ***Adding Sustainability Performance Measures to a Transportation Data Archive***

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Transportation sustainability is of increasing concern to professionals and the public. This project describes the modeling and calculation of sustainability performance measures in a transportation data archive. The purpose of these measures is to assess the sustainability of Portland, Oregon's metropolitan freeway system. The measures were developed to be part of, and use the data from, the PORTAL regional transportation data archive at Portland State University. They estimate vehicle emissions (CO, VOC, NO<sub>x</sub>, and CO<sub>2</sub>), fuel consumption, cost of time delay, and person mobility (travel in person-hours and person-miles, and delay in person-hours). Methods for modeling and necessary data are described in the project paper. In the future, plans call for integrating these measures into the PORTAL web interface to expand the types of performance measures used for regional transportation planning and operations.

***Advantages and Characteristics of Public Transportation Stochastic Assignment Models Relating to Non-Stochastic Assignment Ones***

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Reaching least tolerance to actual behavior in the network, best assignment methods are used. In the recent years, stochastic methods are used frequently. These methods are based on stochastic and undetermined behaviors of passengers or application of statistical functions in current stochastic assignment demands. Advantages of these procedures to non- stochastic assignment ones are distinguishable. In this study, applications of stochastic assignment methods in modelling of current networks are considered.

## ***Airline Induced Regional Development***

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It is often considered a truism that transportation infrastructure is an important component in regional development. Considerable effort is devoted to encouraging various levels of government to support transportation infrastructure enhancement and expansion. Clearly, the benefits which attend this type of development stimulus have both private and public components. Hence, they are prone to agency costs which arise from the conflict of interests surrounding contracts in which the assignment of benefits and costs are not fully congruent.

Since 1998 a contract mechanism called the airline travel bank (ATB) has emerged as a means of encouraging additional air service to smaller municipalities by transferring risk from the airline to the community being served. Moreover, the ATB spreads the financial burden between public and private members of the community.\*

In this paper we examine the agency costs associated with expanding airline service as a means of regional development. A review of the history of ATB's in North America is used to identify the extent to which they address agency costs.

Finally, other approaches to the agency problem in transportation-led development are discussed and compared with the ATB experience.

***An Examination of the FAST Commercial Clearance Border Crossing Program: A Policy for All Commodities and Shippers?***

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Efficient goods movement transport across the NAFTA borders are important for continued economic growth and stability in all three countries. By understanding the current trade and understanding potential growth and increases in commodity flows across border crossing locations, policy makers can better adapt border ports for continuing and increased efficiency at commercial vehicle crossings. Ports have commodity and trade profiles that affect usage, operations, efficiency, and infrastructure—they are not just physical barriers. Yet border operations are now subject to security programs such as FAST (Free and Secure Trade), a commercial clearance program expediting shipments and speeding clearance procedures for shipments that are known to be low risk. Yet all border crossings are not equal, and border delay has more impact, and higher costs, on certain types of commodities and shippers than others. This paper explores the FAST program, how the program is designed, its impact on border operations, and why it may not be a policy that can be efficiently targeted at all commodities and shippers, thereby affecting border operations along the northern and southern borders.



***An Exploratory Analysis of Collisions, Allisions, and Groundings in U.S. Navigable Waters***

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Marine accidents involving commercial ships in U.S. navigable waters are extremely rare occurrences. Although rare, these accidents pose significant safety, economic, and environmental risks to the United States. Two recent U.S. commercial vessel marine accidents aptly illustrate the nature of these risks. First, on November 7, 2007, the container ship COSCO BUSAN allided with the Golden Gate Bridge puncturing the ship's fuel tanks resulting in the spilling of approximately 50,000 gallons of fuel in San Francisco Bay damaging several fisheries and beaches. Then, on July 23, 2008, the tank ship TINTOMARA collided with a fuel barge resulting in the spill of 290,000 gallons of oil into the Mississippi River threatening New Orleans' water supply and closing more than 100 miles of the lower Mississippi River system at a total estimated cost of more than \$1B.

The United States takes a variety of actions to reduce the number of marine accidents, such as collisions, allisions, and groundings, of commercial ships and their associated risks. For example, regulations dictate the physical, training, and experience requirements necessary to become and remain a licensed U.S. commercial mariner. The implementation of vessel traffic management measures brings order and safety to congested waterways. The provision of visual and electronic aids to navigation, vessel traffic services, and marine information results in the availability of continuous information required to safely transit through U.S. waters. Finally, the U.S. not only regulates the construction and operation of marine vessels but it actively inspects these vessels to ensure compliance.

The purpose of this proposed paper is to analyze existing data on collisions, allisions, and groundings (CAGs) in U.S. navigable waters in order to develop better performance measures and identify future research approaches required to improve the effectiveness of the U.S. navigation safety efforts. The United States measures the effectiveness of its navigation safety initiatives by attempting to reduce the number of CAGs. There are several short-comings with this performance measurement approach, namely: (1) all CAGs have equal weighting, thereby ignoring geography, vessel type, vessel size, and consequence variances; (2) the myriad of environmental, geographical, and operational factors that lead to an individual CAG are not controlled for; and (3) the measure alone does not provide

the U.S. government with a casual understanding of the impact its various navigation safety efforts have on actually improving navigation safety.

***An Investigation of the Impacts of Economic Conditions on Vehicle Miles Traveled: A Vector Error-Correction Approach***

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Changes in vehicle-miles traveled (VMT) with respect to changes in gasoline prices and income i.e. price and income elasticities, have been studied extensively. Given the recent economic downturn and energy crisis, reckoning the potential impacts to travel behavior (and VMT) is not as clear-cut as it initially appears since responses to these changes have changed over time. In this paper, we estimate the long-run gasoline price and income elasticity to VMT for the period 2000-2008. Most of the previous studies use the very common classes of time series methods that are the autoregressive integrated moving average (ARIMA) models, developed by Box and Jenkins. We advance the analytical framework to include a vector error-correction (VEC) regression technique that overcomes several limitations of ARMA models. We find that long-run gasoline price elasticity to VMT ranges from -0.31 to -0.88, and income elasticity ranges from 0.18 to 0.49. The result suggests that consumer has become more sensitive to gas price than in previous period.

## ***Analysis of Hazardous Material Incidents Reported to the Aviation Safety Reporting System***

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Dangerous goods are often shipped by air on both passenger and cargo aircraft. These hazardous materials (HAZMAT) pose a danger to flight safety, passengers, and airline personnel. This research explored how effective the Aviation Safety Reporting System (ASRS) is at identifying aviation related hazardous material incidents. Early identification of HAZMAT trends using the ASRS data could lead to changes in aviation safety monitoring and reduce the likelihood of a HAZMAT event causing an incident. The study identified prevalent categories of hazardous material found in HAZMAT incidents. The study further identified that most of the HAZMAT incidents involved cargo being flown on passenger aircraft and that two-thirds of the incidents occurred after take-off. Missing or incorrect paperwork was identified in almost half the cases.

### ***Biodiesel Use in Fargo-Moorhead MAT Buses***

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The Fargo-Moorhead Metropolitan Area Transit (MAT) has been using biodiesel mixed fuels in its buses since 2005. The Small Urban & Rural Transit Center (SURTC) examined the direct effect on the bus fleet of switching to biodiesel. Attributes such as fuel economy, ridership, and service records were analyzed. MAT and city officials were also interviewed to identify changes they have seen since the switch to biodiesel from both a bus fleet and public relations perspective. A central element of this research was to determine whether or not biodiesel use at MAT had caused a significant decrease in fuel efficiency. Although overall fuel efficiency declined by four percent in 2007 compared to 2004, little of this decrease can be attributed to biodiesel use. Increased vehicle age almost always results in decreased fuel efficiency (Peterson and Molloy, 2006), and this was found to be the main factor responsible for the four percent decrease. The increase in fuel efficiency variability can be attributed to vehicle age as well. Because MAT does not use a high concentration of biodiesel (B2-B5) during cold weather months, temperature was not a factor. A main finding of this study was that heightened fuel costs have caused a massive increase in overall operating cost for MAT. Nearly \$300,000 in increased fuel costs between 2004 and 2007 are attributable to the 23 vehicles studied alone.

### ***Can Sensors Be Used to Provide Accurate Travel Time Information?***

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Travel time estimation is a critical ingredient for transportation management and traveler information—both infrastructure-based and in-vehicle. Infrastructure managers and operators are interested in estimating optimal freeway sensor density for new construction and retrofits. Focusing on freeway travel time estimation for display on roadside variable message signs, this paper describes a concept developed from first principles of traffic flow for establishing optimal sensor density. The method is based on computing the magnitude of under- and overprediction of travel time during shock passages when using the midpoint method. Two case studies are presented considering representative traffic dynamics situations. Along with other performance metrics, a suggested aggregate measure developed from vehicle hours traveled (VHT) is described for a reasonable range of detector densities. Extensions of the method to account for both recurrent and nonrecurrent.

### ***Capturing Hybrid Vehicles in HOV Lanes***

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Several High Occupancy Vehicle (HOV) facilities in California are suffering from degraded performances while there is no solid evidence that shows the degradation is due to single occupant hybrids. A long term empirical study of HOV lane performance impact by hybrid vehicles requires an automated approach to detecting hybrid vehicles in HOV lanes. In this paper we describe a system to automatically capture hybrid vehicles in HOV lanes. A small 10cm by 10cm distinctive sticker distinguishes hybrid vehicles from regular vehicles. The vehicles travel at speeds varying from 30mph to 70mph, making it hard to capture the sticker using existing solutions. Our solution uses a combination of technologies: embedded wireless sensing for vehicle detection, ruggedized smart camera for image acquisition and advanced computer vision algorithms for detection of the sticker. The system is able to operate at varying weather and lighting conditions and is compact and sturdy, so it can be readily deployed at HOV lane locations. We have tested the system in extensive field experiments and report the results.

### ***Does Weather Affect Traffic Flow on Freeways?***

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It is commonly thought that inclement weather can affect travel times, speed and may result in increased congestion. The research reported in this poster attempts to analyze and quantify the potential weather impacts on the fundamental traffic flow parameters such as flow, speed and occupancy. Using a rich data archive from the Portland metropolitan region, results show that there is a considerable decrease in flow and speed during peak hours on rainy days. Travel times during off-peak hours did not change substantially, while travel times during peak hours on rainy days increased. Some conclusions and suggestions for future research are also provided.



***Earnings and Expenses of Drayage Drivers at California's Port: Implications for Clean Air***

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Using data from surveys of drivers at the Ports of Long Beach, Los Angeles, and Oakland, we first examine the earnings of drayage drivers. Though possessing relatively low levels of education, drivers average \$40,000 per year, working, on average, 11 hours per day.

The percent of owner operators differs by port. In Oakland approximately two-thirds of drivers are owner operators, significantly lower than the 85% rate seen in Southern California ports. Not surprising, as drayage drivers provide their own capital, trucks at the ports tend to be older than average, exacerbating air quality problems at California's ports. All three major ports have implemented truck replacement and retrofitting programs. The second section of the paper provides detailed analysis of owner operator expenditures, with a focus on the likely costs of the truck replacement programs adopted by the three ports.

## ***Evacuations of Linear Systems***

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Conventional evacuation models are either based on mathematical programs or traffic simulation-generated outputs. None have analytically considered for the physics of a city. In this paper, the evacuation of a special case linear system – a freeway – is physically examined. Formulas for computing evacuation times and graphical solutions for queue evolution are developed. The key driver for the evacuation of linear systems is uncovered. As it turns out, the evacuation process of a linear city can be much improved by accounting for this key driver. The improvement is calculated exactly and is shown to be increased under more realistic circumstances.

A simple control strategy is found to minimize the total evacuation time. The strategy is robust and adaptive, and requires no knowledge of demand for implementation. Finally a second evacuation objective – maximizing throughput given an evacuation time constraint – is introduced. The same strategy can be shown to further optimize for the second objective. Issues surrounding the actual deployment of the strategy are discussed.

## ***Evaluating Emissions Reductions and Trade-offs in Urban Pickup and Delivery Systems***

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There is increasing pressure to decrease pollutant production from transportation systems due to their negative effects on society's health and quality of life. These pressures are felt in particular, in urban pickup and delivery systems (UPDS), which have a strong presence in urban regions and contribute significantly to vehicle miles travelled. UPDS have designed their operations using what are called the Vehicle Routing and Schedule models. These models do a very good job at minimizing financial costs (e.g. costs of fuel, ownership of vehicles, cost of inventory, etc.) but do not consider societal costs, such as air pollution. This is an important impediment to reducing UPDS's emissions contributions in a cost effective manner.

In this research we develop a novel mathematical formulation for routing and scheduling based on the minimization of the CO<sub>2</sub>, NO<sub>X</sub>, and PM emitted by a fleet of vehicles with different emission profiles and engine technologies. Two aspects of the operations/emissions relationship are exploited in this model: vehicles emit fewer emissions when their engines operate in a hot-state rather than a cold-state; and, reduced speed and stop-and-go traffic makes vehicles produce higher level of emissions than when they are in free flow. Emissions factors are calculated using Mobile 6 (by EPA). Traffic conditions are modeled by using different estimated travel speeds for a link during different periods of the day. During the peak travel period, we expect that travel speeds would be reduced.

This research presents a methodological contribution through the formulation and solution of the model, but more importantly an increased understanding of the relationship between vehicle operations, routing cost, urban design, geography, and air quality impacts. We present a comparison between the minimal emissions solution and the the minimal cost solution in terms of emissions and financial resources. We also evaluate the impact on service quality and, given a heterogeneous fleet of vehicles, what rules of thumb can be developed for assigning vehicles to routes in an emissions-efficient manner. Trade-offs between vehicle technology and fleet size, emissions and schedule, and the sensitivity to delivery time windows changes will be explored through numerical results and mathematical

analysis of the optimization model. These features are analyzed using data from the University of Washington Mailing Service.

## ***Evaluating Rail Access Policy in North America – The Case of Passenger Rail***

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As a by-product of both transportation deregulation and increased competition from both air and automobile, North America has been left with only two dedicated passenger rail operators. Amtrak was created in 1971 out of a concern to maintain passenger service at a time when railroads were losing money on passenger operations. For similar reasons, VIA rail in Canada was founded in 1977 and was designed and modeled after Amtrak. While the scale of passenger operations for both railways is very different, in many ways they are still remarkably similar. Both are publicly operated and heavily subsidized for both capital and operations, while neither owns very much of its own track infrastructure.

After many years of infrastructure abandonment in the North American rail sector, the past few years of unprecedented economic growth and increased overseas trade with Asia has driven much of the continental rail system to capacity. Furthermore, public policy considerations and calls for environmental sustainability have led to a push for increased funding for inter-city rail to compete with other modes. In order to achieve the latter under foreseeable economic conditions, rail system congestion will need to be addressed in some fashion. Like highways, congestion relief might be achieved through system expansion or possibly through policy instruments like congestion pricing.

Unlike much of the EU, the North American rail industry holds sacred the operational integration between rail track and rolling stock. In spite of this structure for freight rail, as passenger railways both VIA Rail and Amtrak instead must lease operating time and space (or access) from other (landlord) railways. While not much is publicly available about the contractual structure of this access, what is known is that in Canada track rights are purchased on a "cost plus" basis for the landlord railway (Soberman, 1995), while in the US there exists nominal enforcement through transportation legislation of priority scheduling/routing for passenger movements over freight movements. But given the congested state of current rail networks, it is clear that passenger rail service in both countries could be difficult to maintain or expand without structural changes.

After evaluating the nature of the contractual relationship between passenger operators and the freight rail track owners in both countries, in this research we will

assess how the current passenger access system interacts with freight rail movements, leading to identification of those places where actual or potential bottlenecks exist in the rail network. We will employ an extensive operational simulation of the North American rail system and develop a baseline model of passenger rail movement within the railway network. Once calibrated, we can establish whether or not the current routing and access structure for passenger rail is compatible with system efficiency. In addition, other potential access schemes can be tested in the simulation to see if they can help improve congestion on those identified portions of the rail network.

### ***Evaluating the Determinants of Container Dwell Time***

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Numerous options are being considered in practice, and have been captured in theoretical research, for increasing container terminal capacity. These include new equipment, improved vessel berth allocation, and expanded hours of operation to mention a few. Among these, reducing the amount of time a container spends at the terminal may prove to be one of the least costly solutions. Unfortunately, existing research has provided limited understanding of the determinants of container dwell time (CDT) and their relative importance. Using data typically available at container terminals, this paper attempts to develop a framework to identify determinants and evaluate their impact on CDT. These determinants range from stakeholders in the supply chain to seasonal demand for cargo. The framework employs a data-mining algorithm (Naive Bayes) that is suitable for data collected by terminal operators, and applies the methodology using a real data set obtained from a terminal. Additionally, this paper measures the how changes in the identified CDT determinants can impact yard capacity and terminal revenue. This research potentially provides members of the port, trade, and transportation community with a useful tool for establishing appropriate policies to improve container terminal capacity and revenue.

***Find Critical Traffic Control Locations for Emergency Evacuation***

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Proper traffic control and guidance are imperative to reduce fatality and property damages during emergency evacuation. Due to limited traffic control devices and personnel under such unusual conditions, it is crucial to find the most critical traffic control locations or intersections to deploy control devices or arrange manual guidance for emergency evacuation so that the best system performance can be achieved. This paper presents a mixed integer nonlinear programming model (NLP) to identify the most crucial intersections and simultaneously the optimal traffic control strategies at those locations to minimize the total system costs for emergency evacuation. Numerical examples show that the model performs reasonably well with valid results.



***GreenSTEP: Greenhouse Gas State Transportation Emissions Planning Model***

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Oregon like several other states has adopted strong goals for reducing greenhouse gas (GHG) emissions in order to help avert the severe consequences that global warming poses to the environment and mankind. The state has established the Oregon Global Warming Commission to develop a plan for meeting those goals. One of the major challenges facing the state is how to reduce GHG emissions from the transportation sector which is a substantial and growing contributor to the problem. Developing a strategy to reduce GHG emissions requires attention to many transportation factors as well as land use. The GreenSTEP model was developed by the Oregon Department of Transportation to help the Global Warming Commission to evaluate these factors and their interrelationships, and to develop a strategy for reducing transportation sector GHG emissions. The GreenSTEP model includes models of household travel, vehicle ownership and vehicle characteristics operating at the household level along with simple truck, fuels and emissions models to estimate the effect of land use, transportation pricing, and other policies on GHG emissions.

### ***Hubs versus Airport Dominance***

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This paper offers a new test for what is observed as the airport dominance effect. We consider five airports (Atlanta, Denver, Dallas-Fort Worth, Chicago O'Hare and Phoenix), each of which serves as a hub for two major airlines; however, only three of the above five gateways have a clearly defined dominant carrier. We then claim that the premium for access to a network of non-stop flights should be observed for both carriers using an airport as a hub. Then any airport dominance premium will be defined as the difference between the hub premiums. We use a sample of actual itineraries collected quarterly by the US Department of Transportation (this dataset is known as DB1B). For our analysis, we select non-stop and one-stop roundtrip itineraries that originate, terminate or go through one of the five airports which serve (or served) as a hub for two carriers: Atlanta, Chicago O'Hare, Dallas-Ft. Worth, Phoenix, and Denver. Data analysis shows that while airport dominance premium exists, it manifests itself in regressions with average price/yield as the dependent variable rather than at the upper end of the price/yield distribution; across-airport differences are also observed. Our results effectively suggest that, unlike implied by Lee and Luengo-Prado (2005) and Berry et al. (2006), it is the average traveler who is paying the airport dominance premium; the price-insensitive business traveler pays equal premium for traveling to/from an airline's hub, whether the airline has a dominant position at its hub airport or not.

***Improving Transportation Safety and Security: A University-Based Seat Belt Safety Program***

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This 2008–2009 study implemented a program to increase seat belt use among university students at South Carolina State University, an 1890 land grant institution in Orangeburg, South Carolina. The program pro-actively influenced seat belt use over the term of the grant, and beyond, utilizing student involvement, motivational tactics and observational methodology to improve transportation safety and security statistics on- and off-campus.

As of December 9th, 2005, South Carolina's safety belt law changed to require that "every driver and every occupant of a motor vehicle, when it is being operated on the public streets and highways of this State, must wear a fastened safety belt that complies with all provisions of federal law for its use" (Buckle Up South Carolina, SC Department of Public Safety). Encouraging seat belt use, whether a primary enforcement law or not, requires education of the driving population, using creative, persuasive communications and safety-specific strategies. This program offers the tools to increase seat belt use through heightened awareness and behavioral change.

A guidebook to implementing this research-based program of student-based activities is available, providing an easily replicated model to pro-actively influence personal and social at-risk behaviors for university students.

The original research grant was supported by the James E. Clyburn University Transportation Center in Orangeburg, South Carolina. The JECUTC premise is based on Professional Capacity Building. The focus of JECUTC is to assist federal, state and local agencies in successfully attaining their goals to develop a highly skilled workforce to meet the future needs in transportation.

***Incorporating Freight into the Transportation Process***

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The paper presents an application of NCHRP Report 570, a Guidebook for Freight Policy, Planning, and Programming in Small- and Medium-sized Metropolitan Areas, to develop an MPO Freight Plan for Mobile, Alabama. The paper discusses the application of the guidebook steps and the issues encountered in the application of the guidebook in a medium-size MPO environment. The paper investigates the appropriateness of applying the Freight Planning Framework developed at the University of Alabama in Huntsville as a mechanism for implementing a freight plan at the MPO level in accordance with NCHRP 570 recommendations.

## ***Increasing Freight Transportation Efficiency through the Detroit-Windsor Border Crossing***

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The arrival pattern of US-bound trucks for primary customs processing at the Detroit-Windsor border crossing can affect efficiency in trans-border freight transport operations considerably. To increase efficiency, we propose approaches to help stabilize the arrival pattern at that crossing. Based on a simulation study of the crossing's operations, this report highlights the significant efficiency benefits of such approaches. The simulation confirms that such a system benefits both truckers and relevant border authorities (e.g., US Customs and Border Patrol). The experimental modeling study found the following benefits:

- Shorter wait times for truckers
- Less uncertainty about the wait time (which translates to more reliable planning of freight delivery activities that come after crossing the border)
- Less truck congestion at border crossings (this can lead to improved security since there is less temptation to rush through inspection procedures to clear the congestion, and can also reduce environmental impacts caused by idling trucks)
- Fewer resources (e.g., primary customs booths) required to process trucks

***Integration and Visualization Challenges and Opportunities for Online Freight Data Mapping***

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This paper presents the issues surrounding the integration and visualization of freight data using internet-based mapping applications. An internet-based mapping system is utilized to provide geographic context and user friendly information to transportation planning decision makers. In relation to Internet-based mapping technology in freight data collection and planning we: (a) address implementation issues associated with data integration, (b) present a system architecture to leverage existing publicly available interfaces and web applications to accelerate product development and reduce costs, (c) describe an existing web-based mapping prototype and its capabilities, and (d) state lessons learned and present suggestions to streamline the integration and visualization of freight data. We conclude that despite data integration challenges, Internet-based mapping provides a cost effective and appealing tool to store, access, and communicate freight data as well as enhance our understanding of freight issues. We argue that institutional barriers, not technology, are the most demanding hurdles to widely implementing a freight data web-based mapping application in the near future.

### ***Market Dominance and Competition***

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Railroads haul a wide array of commodities between a multitude of different origins and destination located over a geographic space. Both existing and potential demanders of railroad services at different points in space may, or may not, have transportation options including: service from other railroads, service from other transportation modes, other destinations (or origins), and/or other products that could be used instead of the products transported. In this paper, we examine railroad pricing across different service demanders for the transportation of corn. Such demanders tend to be located at different points in space, and they often have access to truck (and through truck to barge), and they also have different outlets (destinations).

We use a model of market dominance to develop an empirical model of railroad prices to characterize rates at a point in space. The railroad chooses whether to provide the service or not and the rate and output level. In this model, if the railroad provides the service, it must be the case that they dominate other the alternative options available to the shipper. Given this, the rate level charged by the railroad is either the monopoly price when other shipping options do not limit railroad rates, or a constrained price that represents the maximum rate the railroad can charge before losing the traffic to a next best alternative.

An empirical version of the model is framed wherein rates for the transportation of corn are explained by cost and competition variables. This closely follows the existing literature. The model is then extended to include the presence of nearby ethanol markets, which theoretically reduce rates to other destinations. The other extension is to recognize that the effects of competition may vary dramatically over space. As such, the model is estimated for each point in space using locally weighted regression with parameters that vary across each observation. . The advantage of this technique is that it not only allows for differences across space, but it also allows for an identification of points where shippers face significant railroad market power. Results suggest that there are important differences in the geography of shippers.

***Maximizing Opportunity for Service Upon Arrival and Minimizing Delayed Departures: A Conceptual Berth Scheduling Policy, Model Formulations and Solution Approaches***

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Maritime transportation is a key facilitator of global trade, carrying about 71% of all international trade by share, 98% of global freight by volume and about 96% by weight, i.e. 6.4 billion tons of international trade. Seaborne trade is expected to continue to grow. Ports are trying to find efficient ways to accommodate the anticipated increase in traffic and to deal with various concerns, including maintaining service levels for the ocean carriers, improving terminal operations, reducing costs and port related emissions. To achieve these objectives, terminal operators seek optimal berth scheduling policies to minimize vessel waiting and delays at the port. At the same time, ocean carriers are concerned with the increases in fuel prices, which have been estimated to account for more than 60% of their operating costs. Shipping lines have slowed down their ships on several routes and singled out fuel as one of their single biggest challenges. In light of these issues this paper presents a conceptual framework for the berth scheduling problem where for the first time vessel arrival times are considered to be variable. The objective of this formulation is to determine the desirable vessel arrival time that will maximize berthing upon arrival and minimize delayed departures. Using this berth scheduling model and relevant information, ocean carriers will be able to reduce their vessels' speed to levels that will allow them to reach a port close to their scheduled berthing time, thus reducing fuel consumption on its way to the port and idle time at the port. Terminal operators, on the other hand, may improve efficiency and reduce costs, while significantly reducing vessel related emissions. A number of different berth scheduling policies, formulations and solution approaches are presented and critically discussed in terms of their applicability, versatility and ease of implementation.



***Modeling Impacts of Economic Forecasts and High Travel Costs in Oregon***

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The Oregon Department of Transportation (ODOT) has a long history of using integrated economic, land use, and transport models to support statewide policy and infrastructure decisions. Model results reflecting the statewide impact of higher travel costs and alternative economic forecasts will be presented, using output from the newest version of the Oregon Statewide Integrated Model (SWIM2). Scenario results will include predicted changes in statewide economic growth, urban growth patterns, and travel demand.

## ***Organizing Transit in Small Urban and Rural Communities***

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The efficient organization and operation of agencies providing transit in small urban and rural communities is a concern of policymakers, those with oversight responsibilities, taxpayers, riders, and transit agencies themselves. Despite the sizeable and increasing amounts of resources being dedicated to enhance personal mobility through public transportation in these areas and the practical benefits resulting from the incorporation of economic concepts and information into decision making, no rigorous study of the cost structure of transit firms serving small urban and rural communities in the United States has been conducted. Fortunately, the literature with respect to urban transit is quite mature and there has been recent work on regional and intercity public transportation in Europe. In this study, a short-run total cost function is fit to small urban and rural transit agency data using seemingly unrelated regression with the long-run function being derived using the optimal level of capital. In addition to estimating measures of scale, scope, density, and capacity utilization, the study takes the next step by investigating the implications of these findings on national and state transit policy, especially as it relates to organizing services including regionalization.

## ***Performance Differences Between Truck Transportation Providers Using Market-Oriented and Logistics Capabilities***

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A large percentage of manufacturers outsource their trucking activities to firms that are operating in a fragmented industry with several small and a few large players at the national, regional, and local levels. In addition, no single trucking company has a predominant market share in the for-hire carrier market. The key question for firms providing such trucking services becomes how to sustain a competitive advantage in such markets, especially where firms face similar uncertain environments such as gas price fluctuations, regulations, weak economy, and over capacity (Traffic World 2008). In such markets, price may not be a major method of differentiation since most transportation companies are still working off the base class rating, adjusted for discounts and fuel surcharge. Therefore, these firms may need to change their way of conducting business relations in order to survive such environment fluctuations, customer changes, and intense competition (Bowersox, Closs, & Cooper 2007; Cheng & Yeh 2007). The manufacturers are also looking for variables such as resource capability of these for-hire truck providers to establish business relations with them (e.g., Cheng & Yeh 2007).

In this article, the resource-based view and normative contract literature is used to suggest testable propositions based on major resource capability variables that aid trucking service providers to establish normative contracts with manufacturers to sustain a competitive advantage and enhance these providers' financial and non-financial performance. Resource-Based View proponents believe that sustainable competitive advantage of a firm is produced by using its internal resources capably. These resources may be any tangible or non-tangible assets in terms of strengths of a firm. These resources or capabilities are the fundamental core competencies of a firm for strategy formulations, building relationships, and obtaining superior performance. Normative contracts literature proponents claim that exchanges between parties may occur along a continuum from discrete, single transaction to on-going relational exchanges. These exchanges are enveloped by relational norms over and above the legal contracts and may be used to govern a business relationship (Macneil 2000). These relational exchanges have social norms such as degree of collaboration and information sharing between partners that guide the exchange between business partners (e.g., Poppo & Zenger 2002; Zsidisin, Voss, & Schlosser 2007). In this study propositions are developed based on the market-oriented and logistics capability of trucking service providers. It is proposed that the

logistics and customer service capability and formalization and information dissemination within the trucking firm's organization will result in superior normative contracts in the form of collaboration and information sharing with the manufacturer and ultimately superior performance and satisfaction for such providers. Completely returned surveys from transportation managers of a small sample of 15 trucking service providers from the 30 online surveys sent was used as a pilot study. These firms provided domestic-level services to a fortune 500 manufacturer selling commodity industrial products. Pearson correlations between the variables provide support for the need to test these propositions using a larger sample.

## ***Reliability Measures – Which Statistics Will Actually Help Manage Our Roadways?***

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Travel time reliability has become a key performance measure to allow agencies to track freeway congestion and analyze measures to improve freeway performance. Over the past decade, several measures of reliability have been proposed. All of these measures use one central tendency statistic to represent the "average" day and another deviation statistic to represent the unusually long travel times. This paper suggests that these statistics, while useful for many purposes, are not able to adequately describe the experiences of the traveling public, the changes in that travel experience over time, nor the benefits from the adoption of traffic management efforts.

This paper uses 2006 travel time data for four segments of SR 520 in Seattle to illustrate travel conditions under a variety of different congestion regimes. Evidence is provided to show that travel time distributions are not normally distributed and therefore median is a better central tendency statistic than mean. Furthermore, it is suggested that the best measures of travel time reliability should track a combination of median, 80th percentile, 90th percentile and 95th percentile travel times.

Using an entire year's data, this allows an agency to track the typical condition and the worst travel times per week, every two weeks and per month. The effects of specific types of traffic disruptions can then be clearly quantified, and the impacts of congestion mitigation measures that respond to large scale events on the extremes of the travel time distribution can be differentiated from measures responding to routine incident response.

***Riding Green: Environmentally Friendly Passenger Transportation in the Pacific Northwest***

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Speakers representing "environmentally friendly" transportation organizations in the Pacific Northwest will explain what their organizations are doing to enhance service quality and passenger convenience in an era of scarce and expensive fossil fuels.

### ***Tehran ITS Strategic Plan***

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This paper will focus on Tehran ITS strategic plan and steps taken towards its completion. Tehran ITS strategic plan has been developed recently to reduce the problems in the field of ITS application as far as integrity of systems, institutional cooperation and long-term planning are concerned. This paper will also introduce appropriate strategies for enhancing ITS productivity with respect to existing potentials and threats involved in implementing intelligent transportation subsystems especially in Iran as a developing country.

***The Impact of On-Time Performance on Air Fare Prices in the U.S. Airlines***

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This study provides a time series evaluation of on-time performance in the U.S. airline industry. In the last two decades customer service, and in particular, on-time performance in the airline industry, has drawn the attention of the media, researchers, and even Congress. Recent incidents have raised concerns of how to improve customer service and on-time performance. This problem has been compounded by the growth in traffic, inadequate air traffic control, the use of small planes flying frequent schedules, high load factors, etc. However, not all airlines are equally at fault. Some carriers have higher on-time performance than others.

Given the increase in delays, this paper empirically assesses if better on-time performance contributes to increases in passenger demand and, in turn, higher yields. On-time performance data were gathered from the Bureau of Transportation Statistics. The final sample includes data from 14 carriers and encompasses 1,704 observations from 58 domestic city-pairs routes under 500 miles for 16 quarters from 2003 to 2006. The results indicate that on-time performance has a positive lagged impact on passenger traffic and has a positive indirect impact on air fares through passengers.



***The Spillover Effects of the Airfares among the Competing Airport Pairs in the US***

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Market definition is a crucial question in any study of the impact of competition on pricing. Market definition defines who the competitors are and which competitors provide effective substitute products. In the airline industry the impact of competition on fares has been studied extensively using a variety of market definitions. Some of these studies look at competition on individual airport to airport routes, while others use a broader market definition and look at competition among all airport to airport routes between a pair of cities. This paper will construct competition measures at both the airport to airport level and the city to city level. This will allow the comparison of the impact of different forms of competition on an individual airport to airport route. Is competition across alternative airport pairs as effective at reducing fares as competition on the airport pair itself? Does it matter if the competition is composed of low cost carriers or legacy carriers at the airport to airport level? At the city pair level? These are the sorts of questions that this paper will address.

***The Traffic Congestion Problem in Developing Countries Study of Lagos State, Nigeria: Causes, Consequences, Costs, and What Can Be Done?***

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While the largest cities are the most congested, congestion occurs—and has grown—in cities of every size. Congestion extends to more time of the day, more roads, affects more of the travel, and creates more extra travel time than in the past. It has become more volatile as well in cities of developing world. Rising population, rapid economic growth and increasing employment without a corresponding growth in the supply of public transport, responsible largely for major urban traffic issues in most cities of developing economy. Thus, this paper intends to examine in holistic contexts the traffic congestion problem in developing countries with case study of Lagos state, Nigeria: causes, consequences, costs, and what can be done to improve alarming rate of Traffic congestion.

For instance, Of the 15 largest mega-cities identified by United Nations, only four are located in highly industrialized countries: Tokyo, New York, Los Angeles, and Osaka-Kobe-Kyoto. The overwhelming majority of mega-cities is located in developing countries, and includes such gigantic conurbations as São Paulo (18.8 million inhabitants in 2007), Delhi (15.9 million), and Manila (11.1 million). Also, by 2015 Sao Paulo (20.2), Delhi (20.0), Manila (12.8 million), Cairo (13.5 million) and Lagos (12.8 million inhabitants ). However, by 2025 Delhi will have 22.5 million , Sao Paulo (21.4) Lagos 16.8 , Cairo 15.8 and manila 15.6 million inhabitant . (see Table 1.0). It however paradoxical that Vehicle ownership is growing geometrically without corresponding land use planning and sustainable transportation planning strategies whilst, something urgent measures must be done to redress the alarming rate of Traffic congestion.

## ***The Typology and Selection of Sustainable Transportation Indicators***

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The concept of sustainable transportation has gained worldwide attention. For transportation planning, this has placed greater emphasis on the use of "indicators" for evaluating policies, plans, programs, and project alternatives. Indicators allow transportation planners to evaluate choices with respect to the various goals of sustainable transportation. Despite the frequent use of indicators in practice, there is much to be learned about how and why certain indicators are used (or not used). This paper presents 23 case studies from 12 countries across Europe. The case studies represent a diverse cross-section of transportation planning situations. For each case study, different aspects of the indicators were identified in order to formulate a typology. For example, each indicator was classified as either quantitative or qualitative; as either involving a target or not involving a target; etc. The case studies were analyzed using descriptive statistics and cross tabulations (contingency tables). The analysis also investigated the reasons behind indicator selection. Previous research has suggested that indicators are selected based on three driving forces: data availability, theory, and political pressure. Our analysis sought to test the validity of this claim. For each case study, we asked one of the transportation planners involved why they felt certain indicators were used or not used in the decision process. Our results suggest that data availability is not as critical as one might expect, but that instead political pressure and theory are the primary driving forces behind indicator selection. Furthermore, our analysis highlights the relationship between indicator selection and the decision situation; a relationship that could prove useful for practitioners trying to decide with indicators should be used.

### ***Think Inside the Box***

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This paper looks at freight characteristics and proposes a new way of alleviating traffic congestion programs from inside the box, or the container most goods are shipped in. Most solutions to the nation's traffic congestion programs focus on the supply side of transportation systems. Few look at demand side and try to cut amount of traffic generated. In goods movement, the solution may lie inside the box. From redesigning packages to reducing packaging materials to packing tighter inside the container, shippers may save on transportation and warehousing costs while the general public enjoys lesser traffic on highways. This paper/presentation discusses ways to manage freight characteristics to reduce shipping weight and volume, compares and contrasts the conservation approach vs. building more capacity, and details a few best practices in the private sector. It concludes with a few practical steps for public agencies and private companies to take.

***Trade, Ports, Capacity and Investments***

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This session brings together leading experts in the analysis of ports from around the world. The theme is on the growth in trade, port capacity, port congestion and policy.

### ***Transit Ridership Models: Present Status and Future Needs***

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Transit authorities commonly use ridership models to help evaluate various capital project alternatives, but these models are also important for helping them anticipate the consequences of various events, both within and beyond their control. Currently, transit properties are making significant decisions about fare and service levels in a volatile economic climate without the benefit of robust predictive tools.

This paper begins by considering transit ridership models currently or historically in use. These include models maintained by metropolitan planning organizations for new start projects where ridership is starting from a zero base, and for service improvements of a more incremental nature. More relevant to ongoing operating decisions at most transit properties, however, are short-range models that measure demand elasticity (i.e., traveler response) to various changes in the outside environment or to transit agency decisions about fares and services.

Many properties have been grappling with ridership demands caused by fuel price increases, while at the same time dealing with hard budgetary constraints on the levels of service that can be provided, political constraints on obtaining increased subsidies from senior governments, and fuel prices and other operating costs that have been rising more rapidly than the revenue resulting from increased ridership. This has led many transit properties to seek immediate resolutions to their financial difficulties through higher fares and reduced service—measures which threaten transit's recent gains in public support. At this time of great opportunity and challenge for the transit industry, there is much need for models that link ridership changes to short-term shifts in the overall economic climate, such as fuel prices and unemployment trends.

The existing state of transit modeling, however, has not come up with predictive tools that provide reliable responses to pressing questions in a fast-paced environment with cost, revenue and ridership fluctuations. The remainder of the paper looks at what ridership models transit authorities need in order to make more properly informed decisions. The lack of ridership models relevant to today's fast-changing environment makes it difficult to formulate strategies other than immediate reactions to rapidly-evolving situations. In this setting, transit managers are forced to recommend actions to their boards that may be highly suboptimal,

favoring short-term resolutions that may make it harder to achieve longer range strategic goals.

As a first step toward the development of new analytical tools, this paper presents some preliminary analyses of changes in gasoline prices in major metropolitan areas during the 2006-2008 period, and the effects of these changes on ridership. Despite the widely-reported causal relationship between fuel prices and ridership, these factors do not appear to have been statistically correlated in a recent time frame. Also to be considered and analyzed are the contributing factors of fare and service changes to shifts in ridership during this same time period. A more complete understanding of the interrelationships of these factors and their overall impact on consumer behavior is critical to the ability to successfully model ridership in order to support decision making.

It is ironic that increased diesel fuel prices have adversely affected transit authority operating costs, resulting in budgetary issues with immediate negative fare and service impacts. Better ridership models may not enable transit agencies to avoid this dilemma, but they may make it possible to better identify and compare the impacts of alternative strategies, or combinations thereof. Although this paper proposes no specific model, the case for up-to-date, quick-response transit ridership models is made in the context of the complexities involved.

### ***Transportation Challenges/Opportunities Facing the Agricultural Industry***

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Mike Wong, Columbia Grain International, mwong@columbiagrain.com

This panel brings together five individuals with unique perspectives on emerging transportation issues, challenges and opportunities, especially as they relate to the movement of agricultural products to domestic and foreign markets. The panel includes:

- Scott Drumm – Manager, Economics and Research, Port of Portland, Oregon  
Scott will be able to provide a regional perspective of the importance of ports to the movement of freight and particularly the importance of agricultural freight to the port and region. He'll be depicting recent and projected freight movements through the port, by mode and a general overview of future port initiatives/plans, challenges and opportunities.
- April Taylor – Senior Research Associate, USDA AMS: Ocean Container Expert  
April brings extensive knowledge regarding national and international container movements and will discuss information on recent container movements, including the proportion related to agricultural commodities and high value agricultural shipments. This will broaden the discussion from regional, to national and global.

Then we have three individuals with unique experiences related to how they market agricultural products and have overcome transportation/logistical challenges. These include:

- Matt Harris – Director of Trade, Washington State Potato Commission  
The potato commission in Washington has been very innovative in how they identify and target international markets for high value potato products. Matt will discuss U.S./world potato movements and how they view the future for both container/bulk potato movements.
- Bob Sinner – President, Sinner Brothers and Bresnahan  
Bob has been very successful targeting niche markets, including utilizing



high-value, identity preserved transportation services for movement of specialty agricultural products.

- Mike Wong – Columbia Grain International  
Mike is very knowledgeable regarding international grain markets and will be able to discuss emerging issues/trends in addition to challenges/opportunities.

***Transportation Finance, Public Private Partnerships, Risk Allocation and Contingent Liabilities: Case Evidence from a Specific Type of PPP Venture from Texas***

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Transportation needs throughout the country are at levels that governments are unable to meet their capacity needs through traditional revenue collection methods. One innovative financing method that is a form of public private partnership (PPP) is value capture. These value capture initiatives are an inward-looking, non-commercial alternative form of PPP's that like typical PPP's, also involve contingent liabilities. This paper discusses the legislative background for such initiatives in the state of Texas via Senate Bill 1266 which is innovative from a municipal transportation financing standpoint and allows for the establishment of Transportation Reinvestment Zones (TRZ). The paper uses a case example from Texas to demonstrate that TRZ's are a way for cities to leverage their own funds for infrastructure construction and uses the case example to discuss various issues implicit in contractual arrangements of this type of PPP. How does this happen, and what are the implications? It is well known that although financial risk in PPP initiatives cannot be eliminated, it can be transferred to the party best able to manage it. Who bears the risk of financial non-performance of a TRZ? This paper also discusses other key issues inherent in such PPP ventures; how does one estimate financial flows and risk management implicit in the flow of funds in a TRZ, and argues that there is a need to better define the allocation of the contingent liabilities that are created as a result of this innovative financial mechanism.

## ***U.S.-Canada Land Border Crossings: A Review of Data and Framework for Collaboration***

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Along with the global economy, volumes of vehicles crossing US land border crossings have grown. The length and uncertainty of delay at land borders is often seen as a limit to economic vitality, yet minimal data is widely available to predict that delay or develop appropriate strategies to respond to demand. To further predictive efforts and appropriate infrastructure installation, this paper identifies available data, discusses its limitations, and suggests areas for additional needs.

In general, significant amounts of data are collected at border crossings but are not widely recorded or shared. Most US-Canada border stations collect vehicle volume information as well as electronic freight records or manifests. Some delay information is published in real time but the historical data is either not archived or not distributed. Border states and provinces provide the most detailed data but often these are regional, rather than comprehensive efforts and have different collection and reporting procedures. Local data efforts have focused on supplementing continuous information with detailed observations but are unrealistic to continue regular data collection efforts. To develop any national or international crossing data resources, the federal border agencies must be willing and able to share their information.

In this paper we discuss the current data sources and the obstacles to data sharing, we then suggest a framework, and existing data sources, that would supply the information required to meet transportation planning requirements and improve US-Canada cross-border transportation.

***Using Electronic "Town Hall" Meetings & High-Quality Survey Samples to Address Aviation Policy Issues: An Innovative Policy Research Method***

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This presentation will focus on the innovative uses of online research that we have conducted to inform public policy about aviation and air transportation. We will demonstrate a cost-effective and scientifically sound online solution for collecting public input using a combination of quantitative and qualitative methodologies. The methodology has been developed to augment traditional methods of public outreach, which tend to over-represent those who have the strongest opinions, and exclude people who do not live within proximity of locations for open houses or public meetings. This innovative online methodology can also be an alternative to more costly and less-accurate methodologies based on in-person focus groups for qualitative research and telephone surveys for quantitative research. The research itself was conducted by PRR, Inc. and Knowledge Networks as part of a broad public outreach effort for the Long-Term Air Transportation Study (LATS), Washington State's first effort to identify the long range, comprehensive future needs of Washington's multifaceted aviation system. Public policy issues related to aviation capacity and facilities are both complex and contentious. By using an electronic town hall format in combination with a representative population-based sample, our study was able to obtain a more thoughtful and representative cross section of public input, while allowing continuing involvement by stakeholders and the general public through other outreach tools. A significant advantage of the online discussion-group format is improved sample representation and the capability of including visual and graphic displays along with presenting complex policy alternatives. Participants are also encouraged to ask questions about the issues, which can be addressed in real-time during the meeting. The participants were recruited by Knowledge Networks from its nationally representative KnowledgePanel®, a probability-based panel used for public policy and market research. The technical findings from the LATS, based on the online research, is being considered by the Governor's Aviation Planning Council along with public and stakeholder input to develop recommendations for air transportation policy. We conducted two Electronic Town Hall meetings attended by more than 200 Washington State residents. The meetings were timed to support the deliberations of the Aviation Planning Council. The first meeting focused on the problem definition phase of the planning process, and the second meeting (which will be completed

before end of November, 2008) will focus on policy tradeoffs. The one hour meetings are conducted in an online discussion environment employed previously by Knowledge Networks for qualitative research involving Members of Congress who discussed issues with their constituents in selected Congressional Districts. To supplement the findings from the Electronic Town Hall meetings, there will be a survey of more than 1,000 Washington State residents using KnowledgePanel®, a scientifically selected and statistically accurate sample of U.S. households, including those without computers or access to the Internet. The 15 minute survey will assess public opinion on the issues discussed during the meetings. Because it is in a visual format, the questionnaire includes graphics related to the aviation policy deliberations. In our paper and presentation, we will provide details on the Electronic Town Hall meeting methodology and recommendations for its use for other transportation studies.

## ***We Built It, Who Came? New Service and New Demanders in Transit Systems***

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In economics, new products and/or the introduction of higher quality products often draw new consumers into the marketplace. In this analysis, we consider the effects of a new service in the bus market on ridership. Rapid Transit Lines (RTL) provide an express service between two or more locations in a transit system. The introduction of an RTL to an existing system provides for faster transit times, and by so doing increases the likelihood an individual chooses to ride the bus. In this analysis, we use an on-board survey of bus riders to examine the transit choice made before the RTL service was introduced to examine the characteristics of new bus riders. Before introduction, riders used many different options. These included car, bike, walk, or even not to make the trip. After introduction, they selected into the bus system.

The mode choice of individuals depends not only on the attributes of alternative modes e.g., transit time, but also on the attributes of the individual making the choice. We use a survey of bus riders in the Lane Transit District (LTD) to examine the characteristics of new bus riders vis a vis existing bus riders. Observed in the data is the mode choice made before the RTL service was introduced. We use a multinomial logit model to examine the effects of various socio-demographic characteristics on mode choice. Given that all of the sampled riders ride the bus after introduction, the data give an excellent opportunity to examine the sources of new demands when a service is improved.

The data used represents riders in the Lane Transit District in 2007. Lane Transit District is located in Lane County in the State of Oregon, and serves primarily the cities of Eugene and Springfield. A total of 1834 surveys were filled out and returned. In the survey, there is information not only on mode choice, but also the characteristics of individuals. These individuals made choices inclusive of bus, bike, car, walk, and no-trip taken. Those that rode the bus tended to be of relatively lower income, women and not own a car. Numerical estimates of the effects of these (amongst other variables) were estimated with a multinomial logit model. The results indicate that whether the individual owns a car has a significant influence on whether they ride the bus or not, income has a positive influence to a threshold and then a negative influence e.g., individuals do not make a trip until a threshold is reached then they ride the bus and then they own and drive a car. Females are

much more likely to ride the bus than males and are more responsive to income than are men. Finally, as the age of the individual increases so too does the probability of riding the bus. Further, for all ages, the probability of a woman riding the bus is larger than the probability of males

## ***Weigh-in-Motion / Permanent Traffic Recording Site Evaluation***

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This paper focuses on the methodology for evaluating Weigh-in-Motion, data collection sites for Washington State, as to data redundancy and potential gaps. The WSDOT Transportation Data Office currently collects, organizes and compiles information from these and other permanent traffic recorder locations throughout the state, to be used for a variety of applications and for various clientele. These data collection sites are evaluated by utilizing information collected at Washington State University, under the Strategic Freight Transportation Analysis (SFTA) study which produced a statewide origin-destination freight survey (2003). By merging that origin-destination data with WIM sites throughout the state highway network we can identify how traffic at one particular point on the highway network (WIM site) is related to any other site on the network via the freight flows that are common to those sites. This approach serves as a reference and tool for identification of specific traffic relationships that may be encountered in a wide variety of uses/applications in the future.

Overall system redundancy may be evaluated by summing the individual contribution of freight traffic at each site to all other sites and conversely, resulting in two aggregate system-wide measures for ranking the degree of redundancy for individual sites. This information is presented and helps identify candidate sites for elimination due to data redundancy and also identification of locations on the highway network where data gaps may exist.



## ***Why Large Trucks and Passenger Vehicles Collide***

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Large Trucks are involved in about 4,000 fatal, 80,000 injury, and 300,000 property-damage-only crashes every year in the United States. Sixty percent of these crashes involve a collision with a passenger vehicle – passenger car, pickup truck, van, sport utility vehicle, or motorcycle.

The Large Truck Crash Causation Study (LTCCS) examined 963 large truck fatal and injury crashes selected to be a representative sample of all truck crashes over a three year period from 2001 to 2003. The 963 crashes included 1,123 trucks and 959 other motor vehicles, and resulted in 249 fatalities and 1,654 injuries. In over half of the LTCCS crashes the first harmful event was a collision between a single truck and a single passenger vehicle.

Fatigue, drinking alcohol, and speeding are major factors in motor vehicle crashes. Although their presences does not always result in a crash, these factors, as well as other driver, vehicle, and environmental factors, can increase the risk that a crash will occur. The LTCCS defines "causation" as factors that increase the risk of crash involvement.

Data on over 1,000 elements were collected on LTCCS crashes. From this data three major variables were coded on each crash:

1. Critical Event – event assigned to one vehicle that made the crash inevitable
2. Critical Reason for the Critical Event – The immediate reason for the critical event which can be assigned to the driver, the vehicle, or the environment, and
3. Associated Factors – All factors that were present at the time of the crash.

For all large truck-passenger vehicle crashes the passenger vehicle was coded with the critical event and critical reason in 56 percent of the crashes, and the large truck in 44 percent of the cases. In these crashes sixty percent of the critical events assigned to trucks were running out of the travel lane, failure to stop for a passenger vehicle in the truck's lane, and crossing through an intersection. Fifty percent of the critical events assigned to passenger vehicles were running out of the travel lane, failure to stop for a truck in the passenger vehicles lane, and turning left at an intersection.

When trucks were coded with the critical reason, 77 percent of the reasons were failure of the driver to recognize the pre-crash situation (inattention, distraction, etc.) or making a bad driving decision (speeding, following too close, etc.). These same two reason categories accounted for 54 percent of the reasons assigned to passenger vehicles. By contrast only 10 percent of the reasons assigned to the truck driver, but 35 percent of the reasons assigned to the passenger vehicle driver were driver non-performance (asleep, sick) or performance (overcompensation, loss of vehicle control) errors. Vehicle reasons were secondary for both classes of vehicles, but more prevalent for the large trucks.

The list of associated factors for trucks and passenger cars was similar in most cases, but trucks were coded with brake problems, unfamiliarity with the roadway, and driving under work pressure much more often than the passenger vehicles. Passenger vehicles were coded more often for making an illegal maneuver, driver fatigue, and alcohol or illegal drug use.

A critical risk analysis was undertaken to discover which factors were most likely to raise the risk of crashes for both types of vehicles. The analysis examined the relationship between the assignment of the critical reason for a crash and associated factors.

For large trucks the top 10 factors that were most likely to raise the risk of being involved in a crash included seven driver error factors (making an illegal maneuver, inadequate surveillance, traveling too fast, etc.), two vehicle factors (overweight and brake problems), and one environmental issue (stop required before the crash). For passenger vehicles the top 10 most dangerous factors in terms of assignment of the crash critical reason included six driver error factors (making an illegal maneuver, misjudgment of a gap or another vehicle's speed, inattention, etc.), and four driver condition factors (alcohol use, fatigue, illness, and illegal drug use).