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# Proceedings of the 54th Annual Transportation Research Forum



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## **DO OWNER-OPERATORS POSE A SAFETY RISK ON THE NATION'S HIGHWAYS?**

*Heidi Celebi, University of Maryland*

*Thomas M. Corsi, University of Maryland*

*Curtis M. Grimm, University of Maryland*

*David Cantor, Iowa State University*

### **ABSTRACT**

Despite persistent claims in the motor carrier industry of poorer safety performance of owner-operators, there is little empirical work directly comparing their safety and crash records to those of employee drivers. This study advances recent carrier-level work of Monaco and Redmon by using data from both the Motor Carrier Management Information System (MCMIS), and the Commercial Driver's License Information System (CDLIS) databases. The latter has never been used before and enables directly linking a driver with the safety performance variables of driver and vehicle out of service violations as well as crash occurrence. In this way, the results of this paper empirically establish whether or not owner-operators pose a higher safety risk than do company drivers.

*NOTE: Paper not available for publication in these Proceedings.*

## **ANTICIPATING AIRPORT CONGESTION: AN APPLICATION OF RELIABILITY ANALYSIS**

*Tony Diana, Federal Aviation Administration*

### **ABSTRACT**

When the demand for departure exceeds the airport departure capacity, the surface movement area that includes the ramp and taxiways gets congested and departure delays are likely to arise. At peak times or in the case of adverse weather conditions, aircraft are likely to move slower from the gates and takeoff queues are likely to grow. Since delay represents the trade-off between demand and available capacity, reliability analysis can help analysts identify the 'mean time to airport congestion' and the 'airport congestion rate' by focusing on taxi-out time. This is of great interest to airline and airport planners who seek to identify the trade-off point between demand and capacity and who need to schedule traffic accordingly.

# **COST OF SERVICE IN THE CONTAINER ON FLATCAR INDUSTRY: A FIRM SPECIFIC ANALYSIS**

*Ahren Johnston, Missouri State University*

## **ABSTRACT**

Shippers are very concerned with service quality and surveys consistently show some aspects, such as transit time and reliability, as being more important to shippers than cost in both mode and carrier selection. This implies that shippers are willing to pay more for higher quality service; however, many carriers may not have a clear understanding of how service quality impacts costs. There exist two competing views of the cost of quality. The traditional economic view states that there is a higher cost associated with higher quality. On the other hand, the manufacturing view is that quality is free. This view proposes that it is cheaper to avoid a mistake than to correct a mistake. To synthesize these two disparate views, the causes for service errors can be divided into those caused by a lack of physical capacity and those caused by a human error. The former would correspond to the economic view of quality and the latter to the manufacturing view of quality. The purpose of this paper is to investigate the impact these two dimensions of service quality have on operating costs to a carrier.

Specifically this paper will investigate the cost of changes to these two dimensions of service quality to container on flatcar (COFC) transportation for a single carrier. To identify the impact to costs of these two dimensions of quality, a typical translog cost function incorporating measures of the two dimensions of service as independent variables will be estimated. The benefit of only using a single carrier in the analysis is that very detailed information on costs and service quality has been obtained directly from the carrier on every order over a period of nine months. This data includes operating cost, cost of inputs, ton-miles, empty mile percentage, average load size, average length of haul, reason codes for every on-time service failure, and a record of over, short, and damaged and billing error service failures. These service failures have been classified as related to either the physical capacity or the human performance dimension of quality. Data collection has been completed, and data analysis is currently underway.

# **MODELING UNITED STATES RAILCAR FLOWS USING BAYESIAN METHODS WITH MARKOV RANDOM FIELDS**

*Steven Peterson, Oak Ridge National Laboratory*

## **ABSTRACT**

The U.S. rail system provides an interesting focal point for examining flow modeling and network structure. Little work has been done on rail flows and network relationships since the passage of the Staggers Act in 1980. Much of the geography literature on transportation has moved to the, perhaps, trendier topics of airlines, urban mass transit, or environmental issues. Recently, pedestrian transportation has received more attention from transportation geographers than railroads. While disconcerting that a major transportation backbone within the United States has received such little academic interest in recent times, this lack of inquiry allows this study to make a unique, and hopefully timely, contribution to the literature on modeling flows and on railroad dynamics.

This study proceeds from the belief that an examination of railroads and railcar flows provides important insights into economic geography and to the economics of transportation. These flows are examined using carload waybill survey data involving a relatively new modeling methodology. The waybill dataset provides an excellent historical reference of flows and flow patterns across the United States for the period after the Staggers Act.

The new modeling methodology, spatial Markov random fields applied to a network combined with a Bayesian auto-model framework, allows for a robust predictive estimation of railcar flows that is shown to be consistent over time. This method represents an improvement over standard gravity or spatial interaction models; models may be structured as simple spatial interactions or using more complex model forms.

# **DOES TRAFFIC CONGESTION REALLY HARM REGIONAL ECONOMIC EFFICIENCY? A STUDY BASED ON AMERICAN URBAN AREAS**

*Junyang Yuan, George Mason University*

## **ABSTRACT**

Properly evaluating traffic congestion's impacts on regional economy is valuable for governments to take appropriate measures to deal with this conundrum. The popular methodology that calculates congestion costs in terms of traffic delay and wasted fuel encounters critiques on debatable determination of both benchmark speed and time value. The Utopian free-flow condition is also regarded too optimistic to be achieved in reality. In addition, congestion's indirect impacts, especially its influence in business and people's long-term activities, are omitted in above method. Therefore, an econometric approach is applied in this study to comprehensively analyze traffic congestion's long-term impacts. Though the relationship between transportation infrastructure and regional economic performance has been investigated by plenty of scholars, only a few of them focus on traffic congestion that reflects the performance of transportation system, and their deficiencies in selecting research range and measuring congestion limit their reliability. To fill the gap, this paper is based on 31 urban areas in United States during the period from 1990 to 2009. Influenced by the conversion from SIC to NAICS in late 1990s, in order to keep variables' consistency, the research period is divided into two parts: 1990-2000 and 2001-2009, which provides an opportunity to make a comparison between these two periods. Besides, traffic congestion should be considered as a factor that may influence the efficiency of production procedure rather than an engagement in production. Hence, a two-step approach is used. Firstly, a translog production function with three inputs is applied to calculate the Total Factor Productivity growth. Secondly, a regression analysis is conducted to detect traffic congestion's impacts on TFP growth. To comprehensively investigate congestion's influence, a stochastic frontier analysis is further introduced to decompose the TFP growth to technical change, scale efficiency change and technical efficiency change. The relationship between traffic congestion and each component is then probed into. After considering most econometric problems, such as stationarity, spatiality, multi-collinearity, heteroscedasticity, autocorrelation, cross-sectional dependence, and endogeneity, and implement SYS-GMM correspondingly, we find that traffic congestion has significantly negative impacts on TFP growth during 1990 and 2000, while this impact becomes positive and still significant in the successive nine years. Moreover, congestion doesn't affect technical change significantly no matter in which period. Its impact on technical efficiency change became trivial after 2000, though it negatively influences this component in previous period. For scale efficiency change, traffic congestion seems like a positive contributor continually. Some results upset traditional understanding on congestion. However, these interesting results might be explained in three aspects: 1). people and firm's adaption to congestion in long run; 2). change in urban layout because of congestion; and 3). hidden-behind determinants of congestion. In sum, development of technologies and implementation of effective transportation policies have improved transportation system's efficiency as much as possible, which leads to a phenomenon of 'quasi-efficient' congestion. Briefly, traffic congestion may be not as bad as imagined to be in the new century. Thus, government should deal with this problem 'smartly', i.e. popularizing some cost-effective policies such as Intelligent Transportation System and congestion pricing.

# **EXPLORING THE AGGREGATE EFFECTS OF ROADWAY CAPACITY ON CONGESTION AND TRAVEL DEMAND USING PANEL DATA GRANGER AND CAUSALITY TESTS**

*Alexander Bigazzi, Portland State University*

## **ABSTRACT**

Debate continues about the relative merits of demand-side and supply-side roadway congestion mitigation strategies. This paper tests two central and competing tenets of congestion mitigation efforts: claims that roadway capacity expansions 1) reduce traffic congestion and 2) induce vehicle travel demand. Metropolitan-level panel data are used to test Granger causality between roadway capacity and congestion, and between roadway capacity and travel demand. Additionally, distributed lag models are estimated to calculate elasticities between these variables. While a relatively large literature exists that uses econometric models to investigate the effects of capacity on travel demand, this paper is unique in further testing the two-way relationship between roadway capacity and congestion level using a large aggregate data set (101 U.S. cities over 29 years). Model results indicate two-way heterogeneous Granger causality by city for lane-mile capacity and vehicle-miles traveled, one-way heterogeneous Granger causality of congestion on capacity, and homogenous Granger non-causality of capacity on congestion. Looking by city, the most prevalent significant effect is the induced demand effect (lane-mile capacity on vehicle-miles traveled), and the least prevalent is the capacity-based congestion mitigation effect (lane-mile capacity on congestion). Distributed lag models indicate elasticity of vehicle travel demand to roadway capacity of 0.55 (consistent with the literature), and short-run semi-elasticity of congestion (as the travel time index) to roadway capacity of -0.02. Overall, this research lends support to demand-side congestion mitigation efforts by highlighting the limitations of supply-side approaches. The importance of understanding the effects of congestion mitigation efforts is undiminished as the U.S. enters the era of a new federal surface transportation act that includes the Congestion Mitigation and Air Quality (CMAQ) Improvement Program as one of six core programs.



## **A FRAMEWORK FOR DETERMINING HIGHWAY TRUCK-FREIGHT BENEFITS AND ECONOMIC IMPACTS**

*Zun Wang, Washington State University*

*Anne Goodchild, University of Washington*

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*Rachel L. Knutson, Washington State Department of Transportation*

*Jeremy Sage, Washington State University*

*Eric Jessup, Washington State University*

### **ABSTRACT**

Effective truck-freight transportation is critical to both national and local economic competitiveness. Given limited institutional funding, a rational investment prioritization framework is needed to help decision makers identify effective projects when allocating funding. The most common transportation investment assessment method is benefit cost analysis in which the direct cost savings and travel time reductions to the general traffic stream are considered as benefits. However most existing benefit-cost analysis frameworks do not separately evaluate or account for the truck freight benefits of proposed highway infrastructure projects, and are therefore unable to evaluate and consider the economic impacts of highway projects that accrue to freight-dependent industries (those heavily reliant on goods movement) or non-freight-dependent firms (service sector) that are indirectly impacted by the productivity of the freight system. Given the fact that there is no framework for analyzing the full range and full impact of freight related projects, this paper proposes a method for not only calculating the direct freight benefits, but also the larger economic impacts of transportation projects.

Measurable and critical freight related benefits resulting from transportation investments are identified from a review of the literature, as well as technical input from collaborative meetings with stakeholder groups in Washington State. These technical teams were comprised of experts involved in the movement of freight throughout Washington's intermodal system, and identified by the Washington State Department of Transportation's Freight Systems Division. The identified direct transportation benefits included in the methodology are travel time savings, operating cost savings, and environmental impacts. These are estimated using regional transportation demand models and additional factors. Stemming from the transportation related benefits to system users, there are additional economic impacts as businesses, consumers and others respond to the infrastructure investments and improvements. These businesses may expand and grow as a result possibly increasing employment, earnings, and total state revenue, which then may result in further statewide investment and increased personal consumption. These economic impacts are estimated using a regional Computable General Equilibrium (CGE) model. Economic impact analysis outputs are composed of long-term and short-term employment and state/regional output by sector. The total project impacts are estimated combining the outputs of the transportation model and an economic model. The estimated project impact is one of the sets of factors considered when prioritizing transportation projects.

A widening project on a major interstate in Washington was selected as the case study to evaluate the capability of the proposed framework in determining the full project impacts. The projected 2035 regional travel demand model outputs of build and no-build scenarios were modeled using the relevant regional travel demand model. From the model we calculated the changes in system total truck vehicle hours traveled (VHT) and truck vehicle miles traveled (VMT) to estimate the travel time savings, truck operating cost savings, and environmental impact associated with the highway widening project. The results indicate that more than \$8.7 million in travel time savings and \$14.6 million in operating cost savings would accrue to the freight system from 2016 to 2035. Though the system truck performance was improved, the emission costs would increase by \$5.4 million due to the truck speed increasing. The total transportation related benefits consider the travel time savings, operating cost savings and emission impacts, and are equal to \$17.9 million for this case study.

Reductions in transportation costs influence the production costs of freight dependent and other related businesses and industries, and consequently influence the corresponding outputs. With respect to this, four regional CGE models are constructed to evaluate the case study project. The models consider two geographical scales (county and state levels), each with a short-run (SR) and long-run (LR) scenario. The estimated transportation related benefits were used as inputs to calculate the economic impacts using the Washington State CGE model. In the SR scenario, regional economy-wide employment increased in both the county and state models by nearly the same value; 25 and 22 jobs respectively. Additionally, output sales in the two regional economies also increased by rather similar values of \$9.8 million and \$10.5 million respectively. In the LR scenario, the county model showed a growth of 78 jobs, while the state model indicated an increase of 47 jobs. Similarly, the county model suggested output sales increases of \$28.7 million, and the state model indicated an increase of \$22.2 million. The economic analysis results show that \$4.5 million direct transportation benefits in 2035 may generate additional \$28 million county-level output, which may have significant impacts on project prioritization, and should not be neglected from the project cost efficiency assessment.

The proposed method is transparent, and can be used to identify total freight specific benefits and generated impacts. This framework will ultimately be used to enhance Washington State's infrastructure investment prioritization process.

## **RELATING PUBLIC TRANSPORTATION TO THE MARCO ECONOMY**

*Elvis Ndembe, North Dakota State University*

### **ABSTRACT**

The security, availability and dependability of a transportation system play an essential role in the growth and development of a region or nation by channeling economic activity. The public transportation system involves common carriers of passengers using different modes including rail, buses, subways and boats. By providing convenient, reliable and reasonable services, the system has the capacity of moving large groups of people and services from one area or region to the other. Consequently, a robust public transportation system is likely to spur economic development. Public transportation is partially or extensively funded by the federal government. Continual request for funding and enhancement of existing infrastructure is partly based on ridership. The public's willingness to use the public transportation system where it is available and accessible is potentially impacted by the well-being of the economy in general. For example during prolonged high unemployment (recession), it is likely that fewer people have purchasing power to buy and bear the costs associated with operating a vehicle possibly becoming public transportation dependent. Similarly, fuel price increases can potentially lead people to switch from personal automobiles to public transportation. Although the effects from the aforementioned examples might be temporal in some instances, they provide impetus to evaluate the significance and potential existence of a relationship between public transportation ridership and macroeconomic factors (e.g., unemployment and fuel prices). Understanding such interactions would enable organizations involved with public transportation to make improved ridership forecast into the future. Such predictions have potential policy implications particularly those related to funding by reducing the likelihood of understating or overstating public transportation infrastructure needs. This study is aimed at evaluating linkages between the macro economy and observed changes in public transportation ridership using econometric time series analysis.

## **STRATEGIC PLANNING FOR TRANSPORTATION IN AFRICA**

*Peter Cook, Consultant*

### **ABSTRACT**

Weather has a major impact on the traveling public and the transportation agencies that operate and maintain the nation's roadways. In order to increase safety through effective winter road maintenance, accurate weather information in a timely manner is desirable. Road Weather Information System (RWIS) is recently applied to monitor and obtain weather information, which can support the decisions of winter maintenance operations, improve weather forecasts, and inform the public with the road condition.

RWIS network design starts from identifying locations for potential RWIS sites based on a set of criteria. This list would be shortened due to budget constraints and priority considerations. The major problem of the selection process is to control the distance between potential sites due to the goal of maximizing the coverage of the network in the region with limited number of sites.

To maximize the benefit of RWIS network through site selection, an optimization methodology is developed that combines traffic information, meteorological information, geographic data and existing station data into a Geographical Information System (GIS) model. The GIS model contains two phases. The first phase assigns scores and ranks the potential sites based on a set of criteria. The second phase of the model optimizes number and locations of sites while controlling the distance between each pair of sites, based on the ranking list resulted from the first phase. The proposed methodology is applied to a case study in New York State. The result shows the methodology is able to achieve the optimization goal and solve the problem effectively.

## **KEY TRANSPORTATION LINKAGES IN THE HEARTLAND: PAST AND FUTURE**

*Shannon S McDonald, Southern Illinois University*

### **ABSTRACT**

One of the oldest areas of our country for critical transportation linkages is at the confluence of the Ohio and Mississippi rivers, where the states of Illinois, Missouri, and Kentucky come together; known as the upper delta of the Mississippi – the confluence. This paper will discuss all the existing transportation systems that come together in Southern Illinois, in the very heart of the country, that are now unknown to most everyone except those moving coal or grain or part of the trucking industry; as well as the proposed and long term transportation ideas being explored. In the early years of our country this part of the country was considered the hub of all commerce. Once considered potentially as the location for the US capital and written about by Mark Twain, all matter of humanity and commerce passed through these water, road and rail connections.

Cairo, as the city in the southernmost point in Illinois and where one can stand at the rivers confluence, is now completely protected by floodwalls and levees, built in the mid nineteenth century. It was and still is directly connected to the Port of New Orleans where currently 6,000 vessels and 500 million tons of cargo travel, including over half of the countries grain exports. Cairo, IL was declared a port of delivery in 1854, by an act of Congress, due to all the steamboat traffic that flowed through the town. The town soon constructed a custom house, courthouse and many banks as it had first been a place of commerce. It was also known for its major ferry operations. It was a strategic location during the civil war becoming the civil war headquarters for General Grant and nearby Mound City became the headquarters for civil war admirals. The area was the changing point between northern and southern ways of living and all that this implied. However, as the railroads and eventually the highways along with bridges for these transportation options were constructed, Cairo and southern Illinois began its decline. In 1950, Cairo was still an active and thriving town but by 2005 over 80% of its 1950 population had moved away.

But, southern Illinois is still the path for barges, rail and highway to New Orleans, St. Louis, and Chicago; many east and west points, as well as connections to multiple southern and northern cities. Several small airports are found around the area serving passenger needs to and from the St. Louis and Chicago airports. So the area has become crisscrossed with many forms of transportation, although today, with little to no interconnection between them. A new highway has been under consideration for at least a decade, connecting east to west, the airports are ready for upgrading, high-speed rail is a vision, and, a new lock and dam – the Olmstead project is underway on the Ohio River. The Mississippi has been challenged in the last two years with first a flood (2011) and a drought (2012) affecting the movement of barges. However, the commodity industry is poised for growth due to the opening of the expanded Panama Canal and expanding world population and issues concerning sustainability are increasing.

This paper will present two maps that have been prepared locating all forms of existing transportation in Southern Illinois. The second map shows potential synergies due to the overlap of transportation modes measured in distance from a town center. These maps were created in order to identify areas for potential growth as transportation will expand in Southern Illinois to meet growing commerce and population needs. Synergy and overlaps will assist in creating a more sustainable Southern Illinois.

# **TRANSPORTATION SYSTEMS CONDITIONS AND SOLUTIONS IN CARBONDALE, ILLINOIS**

*Lucas E. Shubert, Southern Illinois University*

## **ABSTRACT**

This research proposes to study the creation of a new macro-system of multimodal transportation in and around Carbondale, Illinois, the home of Southern Illinois University. The areas that will be analyzed as part of the research are the local existing transit systems including train, bus, university campus shuttle, automobile, bicycle, and pedestrian traffic. Jackson County Mass Transit also provides a public transit service for any county resident. This project documents some of the more imminent problems with these existing systems such as travel time and cost. The research will explore how these problems could be alleviated by efficient planning combined with emerging technology including automated transit network (ATN) and car-shared automated vehicles; both are highly sustainable forms of transportation. This research will document how PRT has the potential to replace most of the above transportation systems, both public and private, as well as link to the last mile problem to create better mobility for all and a sustainable, cost-effective system. Carbondale is a small college-based city in Jackson County, south central Illinois (see Figure 1). It was founded in the 1850's at a location that made it the center of a cross formed by four nearby population centers connected by highway and rail: Murphysboro, Marion, De Soto, and Makanda (see Figure 2). A decade later it became the home of a state-funded school that has since become Southern Illinois University Carbondale (SIUC). Throughout the twentieth century, SIUC established itself as a research institute, now in the list of the top 100.

The economic condition of Jackson County is itself stable. However, it is the only county in southern Illinois that is not economically depressed. This fact has led to Carbondale becoming the 'capital' of southern Illinois in many ways. New development in and around Carbondale is on the rise. The SIUC Transportation Education Center has recently been completed and functions as a new home for the Aviation and Automotive Programs. Southern Illinois Airport recently won a federal grant for the development of a 900 acre area around the Jackson County airport and the Transportation Center with the intent of creating a new "high-tech zone."

Low cost public transportation modes in Carbondale are currently limited to university shuttle (Saluki Express) and bus routes. The Saluki Express has recently been upgraded both in number of routes and real-time tracking that can be accessed by anyone on the SIUC website ([siuc.transloc.com](http://siuc.transloc.com)). Saluki Express (all routes) is heavily used most of the year by as many as 264.7 riders per hour at peak times from data provided by Bill Bruns at Saluki Express office. Bicycle and pedestrian travel are viable and popular methods of connecting downtown Carbondale and SIUC campus, but these modes are inefficient around their less dense periphery.

Carbondale was originally a railroad city. The rail line is still used for freight movement daily and passenger trains, with the major routes to New Orleans and Chicago, although with priority given to freight. The portion of the 21.5% of Carbondale's non-family household population, according to the 2010 US Census, that is native to Chicago frequently takes advantage of the passenger line. However, St. Louis, Paducah and other large nearby populations are only accessible by driving. This rail line is in many ways the backbone of Carbondale and is positioned for city-funded development within the next few years.

Carbondale, like other small rural cities, has grown over the last century and a half in an outward, sporadic fashion based on highway usage. This has created a situation where automobile traffic is greatly dominant over public transit. It has also contributed to the typical high ratio of parking area. Currently, reliance on the automobile due to increasing gas costs and cost of vehicle ownership is causing mobility problems for many.

This research shows how automated transit networks (ATN) can alleviate the transportation problems in the Carbondale area by comparing the benefits and detriments of ATN and traditional transportation modes. Contrast has been depicted by simulating the ridership per hour potential and comparing resultant efficiency based on travel time. It will also show how ATN can move a person from point A to B much more effectively than car, bus or shuttle. On a large scale, ATN holds the potential to address an entire small rural community's transportation problems and even provide a viable option to private automobile use within its city limits. Planning for easier access to transportation providing a door to door service for many will allow SIUC and Carbondale to become fully sustainable while also addressing universal design. Providing mobility for all would be one of many steps in creating a model sustainable rural community.

## **DEVELOPMENT OF A METHODOLOGY TO INCORPORATE CO<sub>2</sub> EMISSION ESTIMATES INTO TTI'S URBAN MOBILITY REPORT**

*Tyler Alexander Fossett, Texas A&M University*

### **ABSTRACT**

The Urban Mobility Report is a heavily-cited resource that tracks and quantifies detailed congestion statistics in 101 urban areas in the United States. This paper describes the development of a methodology that TTI researchers will use to incorporate carbon dioxide (CO<sub>2</sub>) emission estimates into TTI's 2012 Urban Mobility Report. Due to the timing of the UMR release in early February 2013, results are not documented here, but they will be discussed in the presentation at the conference in March.

Interest in reducing greenhouse gas emissions (including CO<sub>2</sub>) has increased in recent years. Because transportation accounts for a large portion of these greenhouse gas emissions, policy and decision-makers desire a better understanding of how traffic congestion impacts greenhouse gas emissions. TTI researchers developed a relatively simple and consistent way to measure the impact of congestion on CO<sub>2</sub> emissions across many urban areas. By developing this methodology, TTI researchers can incorporate CO<sub>2</sub> emission estimates into the Urban Mobility Report (UMR) and provide new insight on the air quality impacts of congestion.

This paper will describe work performed at the Texas A&M Transportation Institute (TTI) in collaboration with researchers at the Wisconsin Energy Institute at the University of Wisconsin-Madison. This work was sponsored by the National Center for Freight & Infrastructure Research and Education (CFIRE), and matching funds were provided by a Federal Highway Administration (FHWA) pooled fund study.

To estimate and apply CO<sub>2</sub> emission rates from congestion in urban areas, this methodology uses CO<sub>2</sub> emission rates from the Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator (MOVES), average daily traffic counts (ADTs) from FHWA's Highway Performance Monitoring System (HPMS), and private-sector speed data from INRIX.

## **THE EMISSIONS BENEFITS OF TRUCK-ONLY LANE MANAGEMENT**

*Alexander Bigazzi, Portland State University*

*Miguel Figliozi, Portland State University*

### **ABSTRACT**

Traffic congestion mitigation has been proposed as a strategy to help attain air quality goals. A better understanding of the full impacts of congestion on heavy-duty (HD) vehicles is needed because HD vehicles contribute a large share of on-road emissions and are more sensitive to speed than light-duty (LD) vehicles. This research shows that estimated emissions effects of congestion mitigation vary greatly by pollutant and are sensitive to the assumed travel demand elasticity, initial congestion level, and lane management strategy. Analysis of four different managed lane scenarios shows that vehicle class-segregated facilities tend to out-perform general-purpose lane strategies in terms of emissions reductions. Although potentially controversial, from an emissions perspective, conversion of a general purpose lane to a truck-only lane may produce more emissions benefits than adding either a truck-only lane or a general purpose lane.

# **THE MEASUREMENT AND VALUATION OF TIME AND TIME RELIABILITY FOR FREIGHT FOR USE IN HIGHWAY PROJECT EVALUATION: CONCEPTUAL AND PRACTICAL ISSUES**

*B. Starr McMullen, Oregon State University*

*Daniel Holder, Oregon State University*

*Zun Wang, Washington State University*

*Ed McCormack, University of Washington*

*Anne Goodchild, University of Washington*

*Ken Casavant, Washington State University*

*Jeremy Sage, Washington State University*

## **ABSTRACT**

MAP-21 emphasizes improving the economic efficiency of the freight transportation system and also increasing the use of advanced technology to help in this endeavor.

A topic of particular importance in assessing system efficiency for freight is the impact of infrastructure improvements on the time and the reliability of freight movements. Once the impact of the investment on these dimensions of freight service quality is determined, a dollar value must be assigned for use in decision-making.

As far as measuring freight time and reliability of time improvements, there are a number of options that have been proposed and used that will be covered here. There are also alternative measures introduced here that have been developed as advanced technologies for data collection have become available.

Finally, we review the conceptual and practical issues involved in the valuation of time and time reliability for freight. We find that there are significant conceptual differences between the valuation of these measures for passenger and freight movements. A review of the empirical literature shows that there may also be significant differences in the valuation of reliability of time for different geographic areas and shippers of different commodities.

Thus, deciding how to value time savings and reliability of time improvements for a freight investment project is a complex issue --- and policymakers need to be aware of these challenges to make choices that will best attain improvements in freight system efficiency.



# **NETWORK BASED SIMULATION OF AIR POLLUTION EMISSIONS ASSOCIATED WITH TRUCK OPERATIONS**

*Joongkoo Cho, University of Southern California*

*Weihong Hu, University of Southern California*

## **ABSTRACT**

Estimating greenhouse gases (GHGs) and other emissions (especially diesel particulates) is an increasingly important basis for regional policy analysis. According to the EPA (2010b), the transportation sector contributed 27.2 percent of total GHG emissions in 2008, and 50 percent of these were from truck operations. This research focuses on estimating GHGs and other emissions (e.g. PM) from freight movements on roads in California (a prototypical example because of its leadership in air quality policy making) as well as the concurrent effects of various regulation scenarios. In this way, we address questions of sustainability and environmental policy as well as efficiency in freight transportation. We build on important data sources such as, ZIP code-level IMPLAN input-output data and the Freight Analysis Framework (FAF) which provides information on interregional freight movements throughout the U.S. for 2002-2035. We use these data to estimate interregional trade flows between ZIP code areas by applying a gravity model. We translate the estimated interregional trade flows into vehicle miles traveled (VMT) by applying a User Equilibrium model. The estimated VMT in turn are used as inputs to the emissions model to estimate GHGs and other emissions. We demonstrate that interregional freight flow data can be an important data source for emission models. The results are useful not only for estimating GHGs and other emissions based on estimated freight flows, but also for evaluating environmental impacts of policy alternatives. The results are useful not only for estimating GHGs and other emissions based on estimated freight flows, but also for evaluating area specific environmental impacts of policy alternatives. The analysis shows that emissions impacts vary by study area as well as by policy. A policy alternative that brings a significant impact in a specific area may show a trivial impact in a broader region or vice versa. Also an emissions reduction in one area may be because of emissions increase in another area. Therefore it is important to simulate possible emissions impacts by applying a spatially disaggregated model to help decision makers weigh alternatives.

# **HEAVY VEHICLE IMPACT ON RURAL TWO LANE HIGHWAY SEGMENTS OPERATING UNDER VARIOUS CONGESTED CONDITIONS**

*Zijian Zheng, North Dakota State University*

*Pan Lu, North Dakota State University*

*Denver Tolliver, North Dakota State University*

## **ABSTRACT**

Oil industry boom and continuous expansion in Western North Dakota State has resulted in an increase in traffic, especially heavy large oil truck traffic. The distinct characteristics of oil trucks: low speed, large size, and slow accelerate and decelerate result in significant impact on highway capacity. Lack of consideration of such impacts will result inaccurate traffic flow assignment, which in turn means inaccurate needs study and safety study results. In this research, the objective is to identify and quantify passenger car equivalent (PCE) factor considering oil trucks on two-lane rural highway. An improved method to calculate PCE based on headway and delay is introduced. It considers several elements that have effect on PCE factor: vehicle speed, safety passing time, headway distribution, level of service (LOS), and delay to downstream traffic. The new set of PCE factor value is classified into groups corresponding to different LOS. It was desired to use the products of this research as recommended inputs for future freight traffic assignment process which serves as input for North Dakota State/County Investment Need Study.

# **THE ECONOMICS OF CLOSING STRUCTURALLY DEFICIENT BRIDGES ON VERY LOW VOLUME RURAL ROADS**

*Eric Fitzsimmons, University of Kansas*  
*Thomas Mulinazzi, University of Kansas*

## **ABSTRACT**

The State of Kansas has over 4,400 local rural bridges that are rated structurally deficient or functionally obsolete. Maintaining these bridges puts a large burden on counties that bring in limit tax revenue or cannot that cannot easily receive federal assistance to repair or reconstruct the bridges. The current replacement rate with federal assistance is approximately 40 bridges per year in Kansas and at this rate it would take well over 100 years to replace all of the identified bridges in need of repair or replacement. Bridges are becoming increasing deficient every year and the bridge replacement costs are also increasing each year. The question this research project attempted to answer was: if a short enough detour exists around a structurally deficient or functionally obsolete bridge, would it be more economical to close the bridge and force vehicle traffic onto the detour.

The research project concentrated on very low volumes roads carrying between 0 and 25 vehicles per day on gravel or dirt surfaces. Using the National Bridge Inventory database, bridges were identified and detours were measured. It was found that over 90 percent of the structurally deficient or functionally obsolete bridges in rural Kansas had a detour or less than 2 miles. However, it was also found that some bridges had a detour as long as 14 miles, making them candidates for replacement or repair. Additionally, the research project used GIS to find trends among the counties in Kansas to identify bridge closure programs, and where many of the candidate bridges were located. The research project resulted in a chart in which detour length was plotted against average daily traffic along with the Kansas Department of Transportation's estimate on the cost to replace a bridge. A trend line was established which indicated the price to operate a vehicle for even a short detour was significantly higher than the cost of replacing a bridge over the estimated lifespan of a new bridge. The research team believes the results of this study will of interests to county engineers and commissioners across the country that area faced the growing number of aging rural bridges.

## **EFFECTS OF TRAFFIC AND GEOMETRIC DESIGN CHARACTERISTICS ON TRUCK CRASHES**

*Sunanda Dissanayake, Kansas State University*

*Niranga Amarasinghe, Kansas State University*

### **ABSTRACT**

Freight can be transported between most points in the country quite efficiently using trucks. However, involvement of large trucks in crashes can cause much damage and serious injuries, due to their large sizes and heavy weights. Large truck crashes occurring on limited-access highways may be more severe than crashes occurring on other roadways due to high speed limits, and traffic- and geometric-related characteristics. The purpose of this study is to describe the relationships between large truck crash probability, and traffic and geometric characteristics. Crash data from 2005 to 2010 were obtained from the Kansas Department of Transportation (KDOT), which included 5,378 large truck crashes that occurred on Kansas limited-access highway sections. The traffic- and geometric-related details of highways were obtained from the Control Section Analysis System (CANSYS) database, which is maintained by KDOT as a highway inventory system. Homogeneous road sections in terms of speed limit, AADT, percent of trucks, horizontal curvature, horizontal grade, lane width, shoulder width, median width, and existence of rumble strips were identified. The total number of crashes occurring within each segment from 2005 to 2010 was determined, resulting in 7,273 analysis segments used in the modeling. A Poisson regression model and a negative binomial regression model were developed for identifying the relationships between the occurrence of truck crashes, and traffic and geometric characteristics. According to the models, highway design features such as horizontal curvature, vertical grade, lane width, and shoulder width are factors which can be used to change the occurrence of large truck crashes. Identifying the effect of traffic and geometric characteristics is important to promote safety treatments through engineering improvements.

# **MANAGING PAVEMENT MAINTENANCE AND REHABILITATION PROJECTS UNDER BUDGET UNCERTAINTIES: A STOCHASTIC OPTIMIZATION APPROACH**

*Wei Fan, The University of Texas at Tyler*

## **ABSTRACT**

A well-developed and maintained pavement management system (PMS) empowers a decision maker to select the best maintenance program, i.e., which maintenance treatment to use and where and when to apply it, so that a maximum utilization of available resources can be achieved. This paper addresses a decision making problem for managing pavement maintenance and rehabilitation projects under budget uncertainty (MPMRPBU). A stochastic linear programming model is formulated and solved for the MPMRPBU so that a set of candidate projects can be optimally selected from the highway network over a planning horizon. Numerical results are discussed based upon a pilot case study. Different optimization solutions based on deterministic optimization and stochastic programming approaches are discussed and compared. The effect of the budget constraint on the optimized solutions is investigated. The computational result indicates a high quality MPMRPBU solution using stochastic programming approach, suggesting that there is a potential that the algorithm can be used for real world applications.

## **REGULATING AIR NAVIGATION SERVICE PROVIDERS: A SWOT ANALYSIS**

*Rui Neiva, George Mason University*

### **ABSTRACT**

This paper considers the effects of regulation of Air Navigation Service Providers (ANSPs). Unlike airlines and airports, not much analysis has been conducted on the regulatory environment in which ANSPs – the providers of air traffic control services – operate. For many decades they were treated as a government service with little variation across systems, and this still remains the situations for many systems today. Since the 1980's, however, several new ownership and institutional arrangements have been put in place embracing such things the emergence of government corporations, public-private partnerships, and non-profit private enterprises. We thus now have some experiences of a more diverse range of ANSP structures making possible to compare and evaluate the variety of institutional arrangements in place. Here we adopt SWOT analysis to examine the strengths, weaknesses, opportunities, and threats associated with the alternatives arrangements now in place in the industry looking at a range of international experiences. The SWOT methodology, while not as technically rigorous as some other approaches, allows both for the introduction of qualitative information and for a highly flexible way of assessing the various national systems of providing air traffic control services.

## **ASSESSING THE IMPACT OF AIRLINE CONSOLIDATION ON THE SUCCESS OF NEXTGEN PROGRAMS AND INITIATIVES: THE CASES OF FOUR AIRPORTS**

*Keatra Fuller, Federal Aviation Administration*

### **ABSTRACT**

Legacy airlines continue to adjust their business models as they respond to factors ranging from increased competition from Low Cost Carriers (LCC), the reduction of passenger traffic, to increased fuel costs. The latest economic recession has compounded the issues of diminishing passenger demand and rising fuel cost that have increased airlines' operating expenses by 35% on average. In addition, the number of legacy airline carriers has decreased from a total of twelve to only five. Consolidation and mergers have represented a means for ailing carriers to remain in existence and create some synergy through the integration of complementary networks. Legacy airline carriers are electing to move from a model of where it served as both the operator and seller on more than half of their scheduled domestic flights to one where they are increasingly using capacity purchase agreements to contract with commuter airlines. Furthermore, instead of operating a mixed fleet of aircraft, legacy airline carriers have found a way to service a greater number of passengers with fewer planes by filling larger planes with more people.

It is in this environment that the FAA is deploying NextGen programs and initiatives detailed in the NextGen Implementation Plan. This includes, among other portfolios, Improved Surface Operations and Performance Based Navigation. The ability of the FAA to transform the National Airspace System depends, not only upon the cooperation of the airline industry with the FAA, but also upon the operating models of airline carriers. Legacy airlines are moving towards a strategy where the ability to offer competitive fares depends heavily upon their capability to control operational costs. This is evident today as airlines become more discriminate in the types of aircraft within their fleet mix to boost revenue seat miles. The success of NextGen capabilities depends upon the type and capability of the aircraft being utilized at a specific airport or Metroplex. The purpose of this paper is to understand how airline strategic models and their resulting choices in fleet mix are likely to affect the success of specific NextGen initiatives measured by key performance areas and indices. The assumption is that the success of NextGen depends on environmental and market conditions that affect airlines' operations models.

# **CREDIT MULTIPLIERS AS A MECHANISM TO INCENTIVIZE LOW-CARBON FUEL POLICY ADOPTION**

*Jeff Kessler, University of California Davis*

## **ABSTRACT**

Low-carbon fuel policies such as the federal Renewable Fuel Standard (RFS) and California's Low Carbon Fuel Standard (LCFS) encourage the use of low-carbon fuels through different incentive mechanisms. One outcome of these market-based designs is that incentives for fuel shuffling exist for low carbon intensity fuels. Fuel shuffling reduces policy efficiency and potentially increases greenhouse gas (GHG) emissions due to transport. One way to address this inefficiency is to differentiate a commodity through the use of certification (e.g. GHG emissions or sustainability standards). We argue that decoupling certificates from physical quantities of fuel will mitigate shuffling concerns, improve the economic efficiency of fuel regulation, and better incentivize technology innovation for fuels. Use of decoupled certificates may also circumvent concerns associated with the General Agreement of Tariffs and Trade regulation by the World Trade Organization. While this analysis indicates that certificate decoupling adds substantial value to low-carbon fuel policy, the policy may also be inefficient if decoupling incentivizes paper shuffling. We propose using credit multipliers in addition to certificate decoupling to overcome this problem. This approach may provide economic benefits of over \$50 billion dollars for the trade of ethanol between the U.S. and Brazil alone.



# **THE ROLE OF TRANSPORTATION IN THE COMPETITIVE ADVANTAGE OF THE INDUSTRIAL SUGAR SECTOR**

*David Ripplinger, North Dakota State University*

## **ABSTRACT**

Development of new bioenergy and bio-product supply chains requires framing, quantifying, and exploring economic and environmental impacts and tradeoffs of decisions made by farmers, processors, and shippers. By identifying and capturing value, new supply chains can establish an advantage against competitors. Here, terms, concepts, and regulations relevant to bioenergy and bio-product business development are introduced. Energy-beet bio-product pathways involving the production of industrial sugar are used to model economic, environmental, and physical interrelationships. The role of transportation in facility siting, enterprise viability, and the competitive advantage of different regions of the United States are considered. The implications for transportation infrastructure investment is discussed as are the externalities associated with the pathway.

# **CONTRIBUTING CIRCUMSTANCES EFFECTS ON MISSOURI TEENAGE DRIVER FATALITIES**

*Jill Bernard, University of Missouri St. Louis*

## **ABSTRACT**

Motor vehicle accidents are the number-one cause of death for teenagers in the United States. Prior studies have indicated that teenagers lack adequate driving skills, display poor driving judgment, and are more likely than older drivers to exhibit reckless and risky behavior. Graduated drivers licensing (GDL) programs have been adopted nationwide in an attempt to better prepare teenage drivers and reduce fatalities. The purpose of this study is to provide information for future GDL legislation by identifying the major contributing circumstances that lead to fatal accidents of drivers 16 to 19-years-old. Missouri traffic, personal and vehicle accident data from 2002-2011 are used to analyze situations that increase the probability of a fatal accident for teenage drivers relative to older drivers. Cross-tabulation is used to compare the relative frequencies of contributing circumstances among different age groups, and a chi-square test is used to assess whether the differences among age groups are statistically significant. A multi-logistic regression model is used to predict the probability of accident severity levels for under different contributing circumstances for teenage drivers while controlling for road surfaces, road conditions, weather conditions and road type. We conclude that driving too fast for conditions, alcohol, inattention and speed exceeding the posted limit contribute to over 60% of teenage fatalities, while road surfaces, road conditions, weather conditions and road type have little marginal impact on teenage fatalities. Education of young drivers and regulations for GDL programs should focus especially on moderating the behavior of young drivers rather than on restricting privileges to specific driving conditions.

## **CHARACTERISTICS OF CHILD SAFETY RESTRAINT USE AND MODELING THE INJURY SEVERITY OF CHILDREN IN CRASHES**

*Niranga Amarasingha, Kansas State University*

*Sunanda Dissanayake, Kansas State University*

### **ABSTRACT**

Motor vehicle crashes are the leading cause of death among children aged four to 13 in the United States. The objective of this study was to investigate crash severity risks and child safety restraint use characteristics in order to identify effective countermeasures to increase child safety. Characteristics and percentages of restraint use among child passengers age four to 13 years were examined using crash data from Kansas. The association between the restraint use, injury severity, and characteristics of children involved in crashes were investigated using Odds Ratios (OR) and a logistic regression model. The model was developed to estimate the coefficients in order to identify the injury risk factors. Results showed children not restrained, riding in front seats, riding with drunk drivers, riding on rural roads, and riding during nighttime were more vulnerable for crashes. The most frequent contributing causes related to children involved in crashes in Kansas were inattention in driving, failure to yield right of way, driving too fast, wet roads, and animals in the road. Based on the identified critical factors, countermeasures to improve child traffic safety were suggested which include age- and size- appropriate seat belt restraints, and the child being in the rear seat. It is important for parents and children to gain better education about these safety measures that are helpful to increase child safety on the road.

# **STATE-OF-THE-PRACTICE OF PREVENTING BACKING INJURIES AND FATALITIES IN CONSTRUCTION WORK ZONES**

*Wei Fan, University of Texas at Tyler*

## **ABSTRACT**

The purpose of this paper is to conduct a comprehensive survey of current state-of-the-practice and procedures on preventing backing injuries and fatalities in construction work zones. The engineering controls (i.e., the internal traffic control plan - ITCP), administrative controls (including signalers, drivers, and workers-on-foot training), and technology controls will be discussed in detail.

# **THE IDENTIFICATION OF NONSTATISTICAL FACTORS INFLUENCING PREDICTIONS OF FINANCIAL DISTRESS IN THE ALL-CARGO AIRLINE INDUSTRY USING GROUNDED THEORY METHODOLOGY**

Robert O. Walton, Embry-Riddle Aeronautical University

## **ABSTRACT**

All-cargo airlines carry over 50% of global airfreight, yet they are prone to bankruptcy. Many financial models are designed to predict a firms' financial health, but they do not assess many nonstatistical factors that influence the prediction capability of these models. In this study, qualitative grounded theory design was used to identify nonstatistical factors and explore how they influence bankruptcy prediction models in the all-cargo airline industry. In the first phase of the study, financial data from 2005 to 2009 for 17 all-cargo U.S. airlines were used to determine the bankruptcy prediction ability of the Kroeze financial bankruptcy model. A sample of six all-cargo airlines (ABX Air, Arrow Air, Atlas Air, Cargo 360, Gemini Air Cargo, and Kitty Hawk Air Cargo) were selected containing a mixture of airlines for which the Kroeze model correctly and incorrectly predicted bankruptcy. The sample was used as the starting point to explore the nonstatistical factors using grounded theory. Data were obtained on the six airlines from company annual reports, SEC 10K annual reports, reports from professional journals such as Air Transport Intelligence and Traffic World, news reports and company press releases. The data were coded and grouped into conceptual categories, which were used in theory generation to support the emerging theory. Six categories (management, risk, operations, competitive advantage, financial, and external factors) that relate to the financial stability of an all-cargo airline emerged during the research. Three themes emerged that may improve current quantitative bankruptcy prediction models. The three themes are airline fleet type, type of aircraft flown, and aircraft utilization. The three themes relate to the type, use, and make up of an airline's fleet. These themes may influence bankruptcy prediction models and should be incorporated into failure prediction models to improve their overall accuracy.

# **CHARACTERISTICS OF GENERAL AVIATION ACCIDENT DATA, WITH IMPLICATIONS FOR MODELING THIRD-PARTY RISK IN VICINITY OF PUBLIC-USE, NON-TOWERED AIRPORTS**

*Christian M Salmon, Western New England University*  
*Vahid Motevalli, Purdue University*

## **ABSTRACT**

This paper demonstrates that operations at non-towered airports should be considered as an independent population from general aviation operations in the aggregate. Of specific interest in this paper are the effects of this differentiation for modeling third-party airport risk exposure.

This paper demonstrates that airport accidents that are relevant to third-party risk occur in the non-towered airport environment at a significantly greater rate than those of a cohort group of aircraft operating at towered airports. A failure to differentiate these populations will artificially raise the expectation of an accident occurring in the towered airport environment, while simultaneously lowering expectation in the non-towered airport.

Further, it is demonstrated that the third-party relevant accident rate differs at non-towered airports as a function of the concentration of corporate and private Part 91 aircraft movements. This has ramifications for modeling third-party risk at non-towered airports near regional economic centers relative to rural airports.

The difficulty in differentiating the towered and non-towered populations is rooted in the quality and resolution of the underlying operations and accident data records. Therefore, this paper incorporates a discussion pertaining to characteristics of the underlying data.

In an era wherein the stated objective is to transfer travel demand from the towered airport infrastructure to the non-towered infrastructure by enabling High Volume Operations (HVO) in the non-towered environment, implications of these characteristics include the undervaluation of the inherent risk of existing third-party population. This, in turn, has the potential to undermined social acceptance of this risk, and thus implementation of HVO in the non-towered environment.

# **SOMETHING OLD IS NEW AGAIN: AIRLINE-AIRPORT CONSORTIA AND KEY STAKEHOLDER BENEFITS**

*Brian Sherman, Embry-Riddle Aeronautical University*

## **ABSTRACT**

Consortia have existed for many years, particularly in industries where advances in research and technology are critical for firm survival and industry profitability. While not new to the aviation sector, consortia, specifically those involving airlines and airports, have remained relatively unnoticed as a viable business solution for this challenging industry. This type of airline and airport consortia were in existence prior to industry deregulation, but were few and far between. However, there is growing evidence that the industry is turning its attention more and more to this form of inter-organizational relationship to combat costs and increase efficiency.

Airline consortia, formed in cooperation with the airports, are “a group of airlines that join together to hold responsibility in common for operation and maintenance of facilities, equipment, and/or services at an individual airport, as delegated by agreement with airport management” (ACRP Synthesis 31, 2011, p. 1) . These consortia have proven to be very flexible and adaptive, depending on the changing needs of participating airlines and the capabilities of the airport.

Due to the success of this type of inter-organizational relationship, the number of these arrangements appears to be growing (ACRP Synthesis 31). Yet despite the apparent success and increasing popularity, there is little empirical research that examines the attained benefits of airline consortia, particularly from multiple perspectives. As such, the inherent goal of this study is to fill this void and evaluate the cost-effectiveness and non-cost benefits. It is important for the industry, academia, and the government to understand and address the true impact of these arrangements on the key stakeholders involved: airports, passengers, and the airlines themselves. The questions to be asked include: What are the cost savings associated with the airline consortia? What other benefits may be realized by consortium members? What are the advantages for the airports and what cost benefits do they realize? Finally, do cost savings and increased efficiency for the airlines and airports ultimately transfer to the passenger? How do these consortia impact the passenger, if at all? This empirical study examines existing airline consortia, primarily in the United States, and their benefits via a survey-based data collection effort. First, a thorough review of the benefits of cooperative inter-organizational relationships, specifically consortia, has been conducted. Second, past applied research has been analyzed to determine key proposed benefits of airline consortia to its stakeholders that includes improvement in both efficiency and effectiveness of operations. Next, a survey instrument is under development and will be disseminated to a sample of airline-airport consortium operators, via a three-wave mailing with an online response option.

Expanding the body of knowledge about these organizations can only benefit communal understanding of these types of cooperative relationships which have pervaded. With multiple perspectives and influences taken into consideration, this study hopes to find support that these consortia are viable business alternatives for future airline-airport relationships and part of the business models for both.

## **MODELING POLICY IMPACTS ON WEST AFRICAN TRUCKING**

*Peter Cook, Consultant*

### **ABSTRACT**

The West African trucking industry has been noted for its inefficiencies, high prices and impact on road infrastructure, much of which can be attributed to the effects of three types of government policies. The net economic cost of these policy-related inefficiencies has been estimated at \$400-500 million per year. This paper examines the relationship between policies, trucking industry characteristics, inefficiencies, costs and prices. and describes a preliminary model which can be used to help predict the effects of policy changes on the trucking industry and its economic impacts, along with the necessary data and assumptions.



## **THE LIFE CYCLE COST ANALYSIS FOR A RURAL BRIDGE CONSTRUCTION**

*Nimish Dharmadhikari, North Dakota State University*

*Eunsu Lee, North Dakota State University*

*Poyraz Kayabas, North Dakota State University*

### **ABSTRACT**

The state of North Dakota has a high percentage (97.8%) of a total road length that is rural roads. These rural roads represent an important part of the state's economy. As there is an increase in the oil exploration in North Dakota the number of vehicles travelling on these roads is also increasing. This highlights the need of new construction in the road system to avoid congestion and safety hazards. The new construction projects include construction of the bridge. The life cycle cost analysis of the bridge construction is the overall objective of this research. Specific objectives can be summarized as: i) forecasting traffic, ii) traffic served by the bridge, and iii) comparison of the alternatives. The geospatial analysis with global optimization is used to generate the results. This research is expected to provide guidelines for the county or state government about feasibility of the bridge investment.

# **STUDY ON THE EXTERNAL COST OF URBAN EXPRESSWAYS IN BEIJING, CHINA**

*Huan Cheng, Beijing University of Technology,  
Xiaokuan Yang, Beijing University of Technology  
Steven Schrock, University of Kansas*

## **ABSTRACT**

Transportation system makes our daily life efficient as well as convenient. However, on the other side some negative effects can be imposed on the natural environment and society. Traffic demand is much larger than the supply due to the sharp increase in ownership of vehicles, resulting in traffic congestion, delay, traffic crashes, environmental damage, noise pollution, and extra fuel consumption.

The accurate estimation of the external costs of travel is the basis of conducting cost-benefit analyses for transportation investments. Besides, it can provide technical support for exercising congestion pricing and over-charge of parking in the CBD area. The congestion pricing that has already been implemented in London and Singapore, lies in the precise estimation of the external costs of travel in different modes. In the future, the government is likely to implement congestion pricing measures inside the central city of Beijing. As a result, it is necessary to conduct research on the external costs of the transportation system.

External cost refers to negative effects imposed on the social environment, and other road users and non-road users caused by a traveler's travel behavior. However, travelers do not fully recognize these types of cost and do not bear these costs. In this paper, the external costs of travel are analyzed from four aspects. They are: traffic congestion costs, traffic crash costs, air pollution costs and noise costs.

In this paper, congestion external costs are defined as additional economic loss and the value of extra time required by other road users because of the increase in traffic on the road. Congestion external costs are a generalized conception, which include delay as well as the concepts of the value of the users' time. Traffic crash external costs refer to casualty/injury of human beings and property damage caused by traffic crashes. This cost mainly covers medical and rehabilitation costs, property damage, emergency response costs of firefighting and ambulance, crash handling costs of police and legal costs as well as costs of loss of productivity. Air pollution costs refer to payment for the negative effects on people's health caused by vehicle exhaust. Air pollution cost can be estimated by multiplying the emission rate of exhaust by pollution cost per gram of exhaust. Noise costs refer to the negative effect on residential areas along the road caused by noise. In this paper, the effect of noise on other types of land use is not considered like commercial, industrial, and recreational areas. It is obvious that the closer to road, the more noise will be a detriment to the building occupants. It is found that the noise cost of transport is related to sound decibel as well as distance between the buildings and the road. Some reports show that if the decibel of sound is higher than 50db, it will impact people's normal daily life. Furthermore, this would lead to a decrease in the monetary value of surrounding real estate.

On the basis of all the above analysis, the estimation model for the external costs of traffic travel is established. The east 3rd ring road in Beijing starting from Huawei bridge to Sanyuan bridge is very congested during rush hour, is taken as an example to estimate the external cost of traffic travel. The estimated result of external costs on east 3rd ring road shows that congestion external cost takes up a large proportion of the full external cost. With an increase in traffic and a reduction in speed, congestion external cost, crash external cost and air pollution cost increase rapidly and they would each reach their daily peaks at roughly the same time.

These study results can provide technical support for developing a congestion charge criterion as well as conducting evaluation of the effects of congestion pricing.

## **LIGHTS, CAMERA, LEGAL ACTION! DID RED LIGHT CAMERAS REDUCE COLLISIONS IN LOS ANGELES?**

*Timothy Wong, University of California Irvine*

### **ABSTRACT**

Numerous cities across the United States have installed red light camera systems at street intersections in order to increase road safety and decrease collisions. However, the existing literature on the effect of red light cameras on safety is inconclusive due to estimation and design complexities associated with the policy. The selection of intersections that receive red light cameras is a non-random process, hence any study using simple differences suffers from selection bias. Furthermore, other factors that also affect safety at intersections need to be controlled for, many of which are unobservable to the researcher. Fortunately, careful selection of control groups can mitigate the concerns of both selection bias and unobservables.

This study estimates the impact of red light cameras on collisions under the Los Angeles Automated Photo Enforcement Program that ran from 2006 to 2011. Control groups consist of intersections adjacent to those with red light cameras and are matched on observable characteristics. A Poisson panel data model with random coefficients is applied to collision count data from the California Highway Patrol. Estimation proceeds using Bayesian inference in Markov Chain Monte Carlo (MCMC) algorithms. This study indicates that overall, red light cameras did not decrease collisions. However, fault may not lie entirely with the red light cameras but with the system's lack of support from the local courts.

## **RISK FACTORS ASSOCIATED WITH CRASHES INVOLVING UNLICENSED YOUNG DRIVERS**

*Niranga Amarasingha, Kansas State University*

### **ABSTRACT**

Motor vehicle crashes are the leading cause of death among young drivers in the United States (U.S.) National statistics in 2008 showed teenage drivers accounted for 12% of all drivers involved in fatal crashes and 14% of drivers involved in all crashes. Unlicensed young drivers' involvement in crashes in the United States (U.S.) and the risk factors associated with crashes involving these drivers have not been fully explored. Few studies provide evidence of fatal crash involvement of young unlicensed drivers. The study investigates characteristics and contributory causes of unlicensed young driver crashes that occurred in Kansas using crash data obtained from the Kansas Department of Transportation (KDOT). In this study, the age range of drivers from 15 years to 24 years was investigated. There were 5,781 young unlicensed driver crashes representing 3.61% of all young drivers' crashes, during the five year period considered in this study. A total of 19 young unlicensed driver involved fatal crashes occurred during the period. A binary logistic regression model was developed to investigate unlicensed young driver injury severity. According to the coefficients of the logistic model, seat belt restrained unlicensed-young drivers were less likely to suffer severe injuries when involved in crashes. Failure to yield right way was a contributory cause which increased the unlicensed young driver injury severity. Based on the identified factors, crash mitigation strategies were presented.

# **ALTERNATIVE SOURCES OF FUNDING STATE SUPPORTED INTERCITY PASSENGER RAIL SERVICE**

*Anthony M. Pagano, University of Illinois at Chicago*

## **ABSTRACT**

The Passenger Rail Investment and Improvement Act of 2008 (PRIIA) has transferred to the states the obligation to subsidize intercity rail passenger services in their state, which are less than 750 miles in length. Many states currently fund rail services through the road fund or from general revenues. This paper develops a set of options for funding state supported intercity passenger rail service that does not rely on either general revenues or the road fund. The set of options include public-private partnerships, airline approaches, lessons learned from other industries, yield management and other ideas. The set of options are not mutually exclusive, in that several approaches can be implemented at the same time. The advantages and problems of implementing each approach are discussed.

# **ASSESSING TRANSPORTATION FOR SENIORS AGING IN PLACE IN URBAN AND SUBURBAN AREAS: A CASE STUDY OF HOUSTON, SUGAR LAND, AND PEARLAND, TEXAS**

*Gwendolyn C. Goodwin, Texas Southern University*

## **ABSTRACT**

Aging in place describes the ability of seniors to continue living in their homes instead of moving to a nursing home, assisted living or with family. As America prepares for the first wave of “Baby Boomers” to retire, scholars speculate that seniors will face transportation and mobility issues, housing affordability challenges, limited income, and declining health with increasing healthcare costs as they age in place. Of these issues, transportation (mobility) will remain at the forefront of the list and can directly impact the senior’s quality of life. In addition, these challenges are different for urban seniors compared to suburban seniors. This study examines the challenges seniors face while aging in place in Houston, Texas (urban) and Pearland and Sugar Land, Texas (suburban areas).

To determine how seniors will age in place in urban and suburban areas, this study examined each of the study areas’ mobility based on current transportation services and walkability. Results from the study conclude that while the urban area had access to transit, the suburban areas had limited access to transit. More urban seniors did not have a vehicle while suburban areas had high vehicle ownership. Despite these differences, all study areas scored below 4 for their walkability assessments proving that all areas were not walkable for different reasons.

This study shows that planners, transit agencies, families and seniors should also make wise housing decisions that support and compliment their continuum of life: young adulthood, parenthood, and senior years. This will ensure that seniors can age in place in urban and suburban areas and still maintain their mobility and quality of life.

# **A BAYESIAN APPROACH TO MODELING AND CALIBRATING DRIVERS' EN-ROUTE DIVERSION BEHAVIOR**

*Chenfeng Xiong, University of Maryland*

## **ABSTRACT**

This paper presents a Bayesian approach for modeling and calibrating drivers' en-route route changing decision with behavior data collected from laboratory driving simulators and field blue-tooth detectors. The behavior models are not based on assumptions of perfect rationality. Instead a novel descriptive approach based on naïve Bayes rules is proposed and demonstrated. The en-route diversion model is first estimated with behavior data from a driving simulator. Subsequently, the model is re-calibrated for Maryland based on blue-tooth detector data, and applied to analyze two dynamic message sign (DMS) scenarios on I-95 and I-895. This calibration method allows researchers and practitioners to transfer the en-route diversion model to other regions based on local observations. Future research can integrated this en-route diversion model with microscopic traffic simulators, dynamic traffic assignment models, and/or activity/agent-based travel demand models for various traffic operations and transportation planning applications.

# **INCORPORATION OF SUSTAINABLE TRANSPORTATION PRINCIPLES INTO INTELLIGENT TRANSPORTATION SYSTEMS (ITS) DECISION MAKING**

*Emmanuel Kofi Adanu, University of Alabama*

## **ABSTRACT**

Currently, the integration of ITS has taken center stage in improving the efficiency of the transportation network of many cities all over the world. The deployment of ITS technologies requires that the needs of system users, system providers as well as all other stakeholders are adequately met. Failure to meet the needs of stakeholders in ITS decision making and deployment can pose serious setbacks. Incorporating the principles of transportation sustainability into ITS development and deployment further increase the overall complexity of the decision making process. This paper describes a tool for selecting ITS technologies that best meet a set of sustainable transportation needs and priorities identified by a range of local stakeholders.

Various ITS stakeholders, both transportation system users and providers, are engaged to participate in a multi-criteria decision making (MCDM) process to develop long-term ITS deployment strategies that incorporates locally identified and prioritized sustainable transportation principles. Through the process, stakeholders identify and prioritize ITS technologies that best meet their sustainable transportation needs and priorities. The process is applied to a case study in Birmingham, Alabama.



## **NEW APPLICATIONS FOR REAL-TIME TRANSPORTATION SYSTEM DATA: ANALYZING IMPACTS OF RAIL TRANSIT INVESTMENTS**

*Genevieve Giuliano, University of Southern California*

*Sandip Chakrabarti, University of Southern California*

### **ABSTRACT**

The emergence of data storage and integration tools makes possible the use of very large data sources. Real-time transportation system data from road sensors, remote cameras, GPS devices, and other sources represents a potentially rich resource, not only for systems operations, management and planning, but also for analyzing impacts of system changes, from new infrastructure investments to exogenous shocks such as the recent Great Recession.

The Archived Data Management System (ADMS) archives real-time feeds by integrating multi-modal (freeways, arterials, ramps, incidents, and transit) transportation system data from various agencies in the Los Angeles region. We are developing a method of testing the impact of transport investments using large datasets such as ADMS. We are specifically focusing on analyzing the impacts of the Metro Exposition line, a 9-mile light rail line extending west from downtown Los Angeles. We explore whether the Expo Line has a significant impact on traffic flow, transit ridership, and vehicle and person throughput within the line's service area. We use a quasi-experimental design framework, comparing system performance within the service area for 6 month periods before and after opening of the rail line. The challenge is detecting what we expect to be small impacts given day-to-day variability of system performance. We estimate models of system performance (e.g. arterial traffic flow and delay; freeway traffic flow; transit boardings) by location and time of day to examine differences between the two time periods.

## **POST-PROCESSING TRAVEL DEMAND MODEL RESULTS FOR PLANNING LEVEL OPERATIONAL ANALYSIS TOOLS**

*Jiaqi Ma, University of Virginia*

*Michael Demetsky, University of Virginia*

### **ABSTRACT**

Continuing growth in urban travel demand inevitably leads to a need better using existing capacity of the transportation system through a wide range of operational improvement strategies in the short-term transportation planning. Effectively evaluating the available strategies is not a trivial matter, and this is particularly true when the performance of such strategies is compared to the construction of new lanes. The purpose of this study is to recommend methods to obtain input data for operational analysis tools that operate as post-processors to travel demand models. Among all operational planning tools compatible with the four step planning process, the Florida ITS Evaluation (FITSEval) tool is selected to be integrated with the primary planning software used by VDOT, Cube. The methods for estimating peak period flows from travel demand model outputs are investigated along with an examination of Hampton Roads area data where planning forecasts and 24 hour travel patterns are available. The modeling process is demonstrated by a HOT lane deployment case study in Hampton Roads area. This study can serve as a reference for users FITSEval or similar operational analysis tools for evaluating operational capacity enhancements and help states and MPOs arrive at planning decisions regarding operational capacity enhancements vs. physical capacity expansions.

# **SYSTEM-WIDE COST-BENEFIT ANALYSIS OF OPTIMAL INTEGRATED CORRIDOR MANAGEMENT (ICM) STRATEGIES**

*Xiaoyue Liu, University of Washington*

## **ABSTRACT**

Corridor performance analysis has been considered vital to effectively control and manage interrelated traffic facilities systematically in the recent years. A corridor generally consists of a set of parallel facilities designed to enhance traffic mobility covering both freeways and urban street arterials. The initiative of Integrated Corridor Management (ICM), affirmed by U.S. Department of Transportation (USDOT), thus aims at mitigating traffic congestion on the urban corridor networks by systematically leveraging and diverting traffic to available capacities within the corridor. Especially when traffic incidents occur along freeway that may cause significant delays, encouraging upcoming motorists to use the adjacent alternative arterials via real-time traveler information dissemination system, such as variable message signs, mobile device, and highway advisory radio, may be an effective solution to alleviate the negative impact of incidents. This study aims at understanding the mechanism and the effectiveness of ICM strategies, by performing a cost-benefit analysis from the overall corridor perspective. The cost of each facility within the corridor is quantified by the Measure of Effectiveness (MOE), Vehicle Time Traveled (VTT). With more vehicles diverted into urban arterials, intersection delays would increase, which directly add up to the cost of arterial utilization. In the meantime, freeway would benefit with less vehicles travelling. An optimal solution for an appropriate diversion rate thus can be computed to yield the minimum marginal cost of the transportation subsystems. A case study is further conducted in this paper using the Seattle South of Downtown (SoDo) area, which is selected by USDOT as one of the pioneer sites for ICM studies. This study can serve as the theoretical basis for evaluating ICM strategies to provide a solid foundation for both researchers and practitioners in optimizing corridor management strategies and assess their performance.

## **ACCOUNTING FOR SPECIAL COMMODITY MOVEMENTS IN STATEWIDE FREIGHT MODELING: COAL, OIL & GAS IN THE UTAH STATEWIDE FREIGHT FORECASTING MODEL**

*Kaveh Shabani, Resource Systems Group*

*Chad Worthen, Resource Systems Group*

*Maren Outwater, Resource Systems Group*

*Walt Steinvorth, Utah Department of Transportation*

### **ABSTRACT**

Freight traffic on the U.S. transportation system is growing fast, fueled by increasing international trade and lean industry logistics such as just-in-time delivery. The modeling of freight travel also has gained attention in the last two decades due to the importance of freight transportation to economic growth, interstate and international trade and its impacts on the transportation network. The commodity-based modeling approach which emphasizes commodity flow as the underlying determinant of freight traffic is a commonly used approach in statewide freight planning efforts. These models at times require special attention and caution for certain commodity movements, which may be highly dependent upon the region's infrastructure and socio-economic and geographical features. In the case of the Utah Statewide freight model, the primary source data (Transearch) did not give an acceptable degree of accuracy of the movement of coal and crude oil and refined petroleum products. For these commodities additional data sources (U.S. Energy Information Administration and Utah Geological Survey) were applied to determine the base and future-year totals and distribution internal and external to Utah.

This paper focuses on the reasons why additional data resources were needed in the Utah Statewide freight model and how these were used to overcome initial data deficiencies. The paper includes a description of the data and approaches used as well as a brief contextual overview of the Utah Statewide freight model, including an evaluation and discussion of the unique trends of coal movements in terms of value and tonnage shares compared to other states using Commodity Flow Survey data and the inter-modal considerations in the modeling process, its impacts on the accuracy of the model and the limitations of standard data sources in capturing inter-modal freight movements. Last, lessons learned are discussed to assist other regions seeking to develop similar freight modeling approaches.

## **VALIDATION OF DISAGGREGATE METHODOLOGIES FOR NATIONAL LEVEL FREIGHT DATA**

*Michael Anderson, University of Alabama Huntsville*

*Lisa Blanchard, University of Alabama Huntsville*

*Lauren Neppel, University of Alabama Huntsville*

*Tahmina Khan, University of Alabama Huntsville*

### **ABSTRACT**

As freight data is typically available in large, spatially aggregated databases, methodologies for the disaggregation of the data have been developed as a means to determine freight flow data for smaller geographic areas. This paper examines the validity of disaggregating freight data both using value of sales data and employment data by county as a disaggregation metric for specific commodities. The paper examines the use of disaggregation FTA for selected states within the Freight Analysis Framework Version 3 Database (FAF3). The paper concludes that specific commodities within the FAF3 database can be accurately disaggregated using value of sales data while other commodities perform better using employment data. Thus, a combination of disaggregation techniques might yield the best results when disaggregating large national freight data to the county level.

## **FREIGHT DEPENDENT BUSINESS RESPONSES TO INCREASED COSTS OF CONGESTION**

*Justin Taylor, 2L Data Solutions*

*Ken Casavant, Washington State University*

*Danna Moore, Washington State University*

*Jeremy Sage, Washington State University*

*Barbara Ivanovo, Washington State Department of Transportation*

### **ABSTRACT**

Congestion in the transportation system causes freight dependant businesses to alter their business model to satisfy consumer demands under uncertain operational conditions. Responses from freight dependant businesses indicate that consumers would likely pay 60 to 80% of the increased cost of congestion. Ultimately, this means that consumers will pay higher prices for freight dependant goods and freight dependant businesses will spend more to provide those goods.

From an economy wide perspective, the majority of the money disrupted by congestion for freight dependant businesses will continue to stay in the economy, it will just be redistributed. Consumers will spend less on all other products (services and non-freight dependant goods) and freight dependant businesses will spend more. Therefore, in a simplistic sense, the economic impact of increased congestion for freight dependant businesses is the difference between the decreased spending by consumers (consumer cost) and the increased expenditure by freight dependant businesses (societal benefit).

Data from a survey of freight dependant businesses and seven IMPLAN models were used to calculate the costs of congestion and estimate the annual economic impact of increased congestion for freight dependant businesses in the State of Washington and six sub-regions of the state. All of the annual estimates used the 2008 IMPLAN database and are reported in 2011 dollars. The primary areas of increased cost for freight dependant businesses were identified as additional trucking costs and inventory costs. It is estimated that the consumer cost for a 20% congestion increase (60% cost realization) in Washington State is \$8.7 billion. Due to waste and other losses, the state economy will only see \$8.5 billion of that money spent by freight dependant businesses. The economic impact of this redistribution of wealth and inefficiency is a loss of \$3.3 billion dollars (0.5%) in total output and over 27,000 jobs (0.7%).

The impacts might actually be higher when you look at the State in regions. It is estimated that the Puget Sound area alone would see output declines of \$3.6 billion (0.8%) and lose more than 21,000 jobs (0.9%).

## **DETERMINANTS OF VMT IN URBAN AREAS: A PANEL STUDY OF 87 US. URBAN AREAS 1982-2009**

*B. Starr McMullen, Oregon State University  
Nathan Eckstein, Oregon State University*

### **ABSTRACT**

This paper uses econometric techniques to examine the determinants of vehicle miles traveled (VMT) in a panel study using data from a cross section of 87 U.S. urban areas over the period 1982-2009. We use standard OLS regression as well as two-stage least squares techniques to examine the impact of factors such as urban density, population lane-miles, per capita income, real fuel cost, transit mileage, and various industry mix variables on VMT. We also use a distributed lag model to estimate the long run elasticity of various factors on VMT driven.

Preliminary empirical results show the demand for VMT in urban areas is positively and significantly impacted by lane miles, personal income, and the percent of employment in the construction. Fuel price, transit use and population density are all found to be negatively related to VMT per capita. Consistent with results from earlier studies, we find the long run price elasticity of demand for VMT per capita is approximately five times larger than the short run elasticity. Holding all factors constant, per capita VMT is found to be differ significantly by region with VMT being higher the more western and the larger the population size of an urban area.

# **INCORPORATING INCIDENTS IMPACTS INTO TRAVEL DEMAND MODELING FOR TRANSPORTATION PLANNING AND DECISION MAKING PROCESS**

*Jaesup Lee, University of Virginia*

## **ABSTRACT**

Traditional safety study has utilized various data such as historical crash data, roadway geometry, field traffic observation, environmental data, and driver/vehicle information to find hot spots or corridors to reduce number of crashes or severity and/or improve mobility, which usually developed (prepared) independently and/or separately. This approach is very useful and powerful in safety improvement programs especially in short term projects (e.g., 5 years) and microscopic or macroscopic spatial scope. However this approach may not be appropriate to consider safety in regional-based long range transportation planning process because each analysis data (e.g., crash, traffic, roadway geometry) is just simply used to generate descriptive results based on historical and existing observations. Accordingly, it cannot explain the consequential impact on network when incident occurred and caused non-recurring traffic congestion.

This study proposes a framework for incorporating incident component in travel demand forecasting modeling process. The most of studies focused on the estimation of delay from an incident in simple manner, which considers either simple network with complicated scenarios or large network with simplified conditions. This study modified volume delay function (VDF) used in traffic assignment step of four step travel demand forecasting model to consider incident impact properly because VDF determines how many trips will be loaded on links or paths based on the relationship between supply side (free flow speed and link capacity) and demand side (link volume). From the functional form of VDF, incident impact could be added as additional variables for incident frequency, duration, capacity reduction from incident. By using modified VDF, Travel Demand Forecasting Model incorporating Incident impact (referred as TDFMI) could not only predict travel demand that consider incident impact but also assess various performance measures of sustainability for the evaluation of safety-related goals and objectives related.

Incident impact was estimated in three different sizes of networks by assessing various performance measures under normal and incident conditions. Analyses results show that TDFMI could take into account well its spatial and temporal impact of the transportation system. TDFMI could give more reliable network simulation results for evaluating the impact of various scenarios in long range transportation planning and decision making process.



## **INFORMATION SHARING IN TRAFFIC INCIDENT MANAGEMENT**

*Qian Ouyang, University of Southern California*

### **ABSTRACT**

Traffic Incident Management is a good way to relief the largest threats of congestion. It is the cooperation of one or more agencies to replace traffic flow to normal situation after an incident has occurred. The key to manage traffic incident is the coordination between numerous stakeholders. Efficient information exchange is critical to reduce the responding time, and enhance the safety of both motorists and responders.

Incident Command System and Unified Code provide responders with standardized operating procedures, and directing command personnel better cooperate with one another. Communication method in TIM practice includes face-to-face, remote voice, electronic text and other media and advanced systems. There are ways to disseminate the information to the public. Also, several ITS technologies can be utilized to improve communication.

However, certain barriers exist to effective information exchange, including administrative, operational and technological ones. Lots of future work can be accomplished to promote the efficiency of traffic incident management, including interoperable system, mobile application, cross training and joint operations, and other technical integration.

## **PROGRESS OF MINORITIES IN AVIATION**

*David Ison, Embry-Riddle Aeronautical University*

### **ABSTRACT**

Diversity within the science, technology, engineering, and mathematics (STEM) fields has historically lagged that found in other vocational paths. Aviation has also suffered poor diversity with virtually little participation among the professional pilots. With both the literature specifying the benefits of diversity in the aviation workplace and potential shortages of pilots looming, it is in the interest of aerospace stakeholders to have access to the most comprehensively diverse employee pool possible. The purpose of this research was to evaluate the trends in participation by minorities who completed professional pilot education programs in the United States. Data concerning the number of students who completed degrees at the associate's, bachelor's, and master's levels were collected via the Integrated Postsecondary Education Data System (IPEDS). Participation rates were compared to those found within the aviation industry. In general, the participation rates by minorities in collegiate aviation (32.9%) exceeds that reported in the professional pilot vocation (9.2%). Detailed trends over the past 10 years were evaluated. General trends over the past 15 years were also quantified. Between 2002 and 2011, minority (including women) participation increased from 27.1% to 32.9% which was deemed to be statistically significant ( $z = -4.093$ ,  $p < 0.01$ ). The greatest gains were exhibited among Hispanics, specifically Hispanic men, with marginal gains by Asians and women. When extending the analysis back another five years, minority (including women) participation showed significant change from 1997 (22.7%) and 2011 (32.9%),  $z = -7.628$ ,  $p < 0.0001$ . Minority participation in professional pilot education has shown steady gains over the past 15 years, however it appears that this trend leveling. Further study is recommended with particular interest in promotion and recruitment of a diverse aviation student population.

# **ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE INCLUSION OF AIR TRANSPORT INTO THE EUROPEAN EMISSIONS TRADING SCHEME IN THE TIME PERIOD 2012 – 2020**

*Janina Scheelhaase, German Aerospace Centre*

*Martin Schaefer, German Aerospace Centre*

*Wolfgang Grimme, German Aerospace Centre*

*Sven Maertens, German Aerospace Centre*

## **ABSTRACT**

International aviation is a substantial emitter of CO<sub>2</sub> and other climate relevant gases. According to recent estimations, aviation contributed about 4.9% to the total anthropogenic radiative forcing, in 2005 (Lee et al, 2009). To cap CO<sub>2</sub> emissions of the aviation sector, international aviation has been included in the emissions trading scheme of the European Union (EU ETS), since January 2012 (EU Directive 2009/29 EC). From this year up to (at least) 2020, all flights starting from or landing at European airports are subject to the EU ETS, apart from a few exemptions. In 2012, the CO<sub>2</sub> emission target for aviation is 97 per cent of the historical emissions of the years 2004-2006. From 2013 onwards, this reduction target will be lowered by another 2 per cent. In September 2010, the ICAO (International Civil Aviation Organisation) Assembly agreed to an exemption clause for market-based measures which could be applied to the EU ETS. Whether this should be the case is a controversial issue on the international political level.

While most studies in literature tend to focus on short/medium-term impacts of the EU ETS, our paper investigates the effects of the EU ETS on the aviation sector as such up to the year 2020. Unlike most other studies, this will be conducted assuming the current legal framework in detail and by employing a newly-enhanced simulation model. In addition, the cost impacts of the possible introduction of the ICAO exemption clause to the EU ETS will be investigated for the first time in literature. Also, the effects on the CO<sub>2</sub> emissions will be analysed. The findings of this paper are an important input for European and international air transport politics.

The modelling results show that the impacts of the EU ETS on costs, fares and on competition within the airline sector will be substantial, especially in the longer term: in the year 2020, more than 50 per cent of the required allowances will have to be purchased by the airlines. Assuming an allowance price of 20 € per tonne of CO<sub>2</sub>, the resulting costs for the aviation sector will amount to about 20,502 million € in 2012-2020. In addition, competitive distortions can be expected if the ICAO exemption clause is introduced to the EU ETS. Finally, the CO<sub>2</sub> effects will be remarkable: if the European Commission politically succeeds in integrating European as well as non-European carriers into the EU ETS, roughly one third of aviation's global CO<sub>2</sub> emissions will be regulated.

# **THE IMPACT OF CORPORATE BOARD CHARACTERISTICS ON OPERATIONAL EFFICIENCY IN THE U.S. AIRLINE INDUSTRY**

*Carl Scheraga, Fairfield University*

*Catherine C. Giapponi, Fairfield University*

## **ABSTRACT**

This study investigates the relationship between the structure and strategic conduct of U.S. airline corporate boards and firm operational efficiency. The only similar work in this area is that by Wang, Lu and Tsai (2011). However, that study utilized data envelopment analysis to examine a single year, 2006, and utilized a data set that was comprised of both U.S. and non-U.S. airlines. This study utilizes the Malmquist framework which allows the researcher to examine the change in operational productivity over a period of time, which is particularly desirable given that the impact of operational choices is an inter-temporal phenomenon as opposed to one occurring at a discrete point in time. Furthermore, the Malmquist methodology allows for the decomposition of the change in operational productivity into the two components of operational efficiency change and technological change.

The results of the Malmquist analysis are then related to corporate board characteristics in a multivariate analysis. Board characteristics are obtained through the utilization of airline proxy statements. The use of proxy statements allows for the extraction of information on such key factors as board size and composition, the structure of board committees, independence of board directors, board compensation structures, and CEO duality.

The analysis is conducted over the time period 2005-2008. This period was used because the airline industry was severely disrupted in the aftermath of 9/11 and the industry did not return to pre-9/11 levels until July 2004 (Bureau of Transportation Statistics, 2005). Subsequent to this period, major U.S. carriers as Northwest and United are acquired by competitors.

The sample employed is comprised of 20 U.S. carriers and unlike the Wang, Lu and Tsai (2011) study does not include non-U.S. carriers so as not to conflate different operating regimes and different regulatory environments with regard to corporate board structure and conduct.

# **DEVELOPMENT OF AN EVALUATION CRITERION TO ASSESS PEDESTRIAN FACILITIES IN URBAN ENVIRONMENT USING WALKABILITY MEASURES**

*Ishani Dias, Kansas State University*

*Saman Bandara, University of Moratuwa Sri Lanka*

## **ABSTRACT**

Utility walking has now become a solution in sustainable transport systems. Facilities for pedestrians act a main role in it. This research proposes a scoring model to evaluate pedestrian facilities in urban environment using “walkability” measures. Walkability is an idea of quantifying the safety and desirability of walking routes. The model can be used to evaluate pedestrian facilities in road links to compare different road links or to identify deficiencies in a given road. At present, walkability is evaluated using qualitative measures that are very subjective. Existing methods of evaluating walkability was carefully studied and the limitations and weaknesses were identified. Methods to evaluate as many features were proposed and validated. Among these factors, several features of sidewalks such as width, paving type and continuity are assessed. Modal conflict; the conflict between pedestrians and bicycles/ motorized vehicles, presence of an elevated sidewalk and presence of buffer are measured using passing and meeting number of events. Availability of crosswalks and delay at un-signalized and signalized crosswalks are some of the parameters used to evaluate crossing facility. Availability of pedestrian facilities including, benches, shades, bus halts with seats, pedestrian information boards, proper street lighting add scores to a road link. Addressing differently able people; the blind, the disabled, push carts, children is also taken in to consideration while universal accessibility is believed to be at vital importance. Apart from the above quantitative measures, parameters such as, aesthetics is also assessed qualitatively. This tool can be presented to the relevant authorities to make them aware of the facilities that should exist. A score as a percentage is finally obtained from the evaluation where 100% means a perfect road to walk and 0 means the worst condition for walking. This could be used in detail to compare two or more roads.

## **DISTRACTED WALKING: A REVIEW OF POLICIES AND DATA NEEDS**

*Judith Mwakalonge, South Carolina State University*

*Jamario White, South Carolina State University*

### **ABSTRACT**

Pedestrians, much like drivers, have always engaged in multi-task like using hand-held devices, listening to music, snacking, or reading while walking. The effects are similar to those experienced in distraction behind the wheel of a moving vehicle. However, distracted walking has not received similar interventions and policies to reduce safety related issues. A study conducted by Ohio State University showed that more than 1,000 pedestrians visited emergency rooms in 2008 because they were distracted and tripped, fell, or ran into something while using a cell phone to talk or text. In addition, the market penetration of electronic devices among walkers and drivers is on the rise and so is safety issues related to distracted walking. In the United States, fewer laws ban texting while walking and several states including New York, Illinois, and North Carolina have attempted to restrict the use of electronic devices while walking but were unsuccessful due to public objection. Though the problem is eminent, few to no data is collected for research and quantification of distracted walking. Recognizing the data and research needs on distracted walking, this study will present a review of the state of practice on policies, signs, and data collection pertaining to distracted walking.

## **THE EFFECTS OF COMPLETE STREETS ON MOBILITY AT THE ARTERIAL LEVEL**

*Sara Patterson, University of Delaware*

### **ABSTRACT**

With an increasing desire to design complete streets, it is crucial to determine what constitutes a complete street and how complete streets affect mobility. The general definition of a complete street is one that is safe for all users including drivers, pedestrians, cyclists, and transit riders. This definition is vague and allows the designer to make the decisions about what techniques should be used to create a complete street. To determine what techniques are best for a specific project, first transportation engineers must determine the effect each technique will have on the street, and the tradeoffs that a community may have to live with after construction. Specifically, when working with an existing street, there will be changes in LOS, capacity, delay, and emissions.

# **THE IMPACT OF ENERGY EFFICIENT VEHICLES ON GAS TAX (HIGHWAY TRUST FUND) AND ALTERNATIVE FUNDING FOR INFRASTRUCTURE CONSTRUCTION, UPGRADE AND MAINTENANCE**

*Utpal Dutta, University of Detroit Mercy*

*Nishita Patel, University of Detroit Mercy*

*Ronald F. Titus, University of Detroit Mercy*

## **ABSTRACT**

Road construction, upgrades, and maintenance have largely been financed by gas taxes since the first tax on fuel was instituted by the federal government in 1932. States also tax fuel. The average fuel tax paid by U.S. drivers is 48.8 cents per gallon. However, the taxes have failed to keep up with inflation and need. The country's crumbling transportation infrastructure is the result and the funding gap is likely to worsen significantly.

The Mileage Based User Fee (MBUF), an alternative to the gas tax, charges drivers for the actual amount of road use, not on fuel consumption. A MBUF system offers significant potential benefits including:

- Fairness- drivers pay for the actual benefits derived from the use of the highway system.
- Stability of revenue- as gas prices increase less fuel is used resulting in lower gas tax collection although the mileage travelled remains relatively constant. With an MBUF system revenue remains relatively constant.
- Flexibility- additional factors such as time of day, congestion, and vehicle weight can be built into the fees charged to road users.
- Higher revenue yield possible- value-added options, improved roads, and a direct correlation between benefit received and fee incurred will make the public more willing to accept higher user fees.

The implementation of an ideal MBUF is a very big challenge. The project team has come up with a feasible means called "Mileage Based Vehicle Registration (MBVR)" to implement MBUF at the state level without any further delay to improve infrastructure funding.



# **A NOVEL SOLUTION FOR TRANSPORTATION INFRASTRUCTURE INNOVATION AND ALTERNATIVE FUEL VEHICLE ADOPTION**

*Jeff Kessler, University of California Davis  
Noble Lilliestierna, Deerns*

## **ABSTRACT**

Current alternative fuel vehicle technologies have failed to substantially penetrate today's automotive market. Given pressing environmental concerns, a new transportation paradigm is needed. While existing research, development, and deployment efforts in transportation have failed to deliver disruptive new technologies to the market, wireless charging technology has the potential to overcome concerns with current alternative fuel vehicle deployment models. By unifying the national electric grid with transportation energy consumption, consumers gain access to inexpensive, abundant fuel that can be sourced 100 percent domestically and, eventually, through entirely sustainable means, resulting in dramatic reductions in greenhouse gas emissions.

We have identified a novel technological approach that appears to be competitive with existing technology while offering the potential for long-term GHG emission reductions. By shifting the vehicle adoption cost to an infrastructure adoption cost, it is possible for society to build up new, next generation infrastructure while allowing consumers to adopt cost-effective transportation technology with many benefits over current vehicles.

Recent technological developments have made it possible to wirelessly and continuously charge electric vehicles (EVs) with induction coils. By using induction, electricity can be transmitted wirelessly to a vehicle from an external power source at high efficiencies, even over distances of meters and through obstacles such as road materials (Yu et al. 2011; Biofuels in the U.S. Transportation Sector 2007). Unlike other alternative fuel technologies, the technological hurdles for wireless vehicle charging have already been overcome; this technology exists today and has been demonstrated to work in both public and personal transportation applications with pilot projects appearing in the United States (OLEV Technologies 2011).

# **EQUIPMENT REPLACEMENT DECISION MAKING: DYNAMIC PROGRAMMING APPROACH AND NUMERICAL RESULTS**

*Wei Fan, University of Texas at Tyler*

*Mason Gemar, University of Texas Austin*

*Randy Machemehl, University of Texas Austin*

*Leonard Brown, University of Texas Tyler*

## **ABSTRACT**

The primary function of equipment managers is to replace the right equipment at the right time and at the lowest overall cost. The purpose of this paper is to present the application of dynamic programming approaches to solving the equipment replacement decision making (ERDM) problem. The detailed solution implementation process and techniques used are described. Comprehensive ERO numerical results are also discussed.

## **ICM AMS ASSESSMENT PROCEDURE ANALYSIS WITH TRAFFIC SIMULATION AND ANALYSIS TOOLS**

*Gabriel Jiangbo Yu, University of Southern California*

*Kate Amissah, University of Southern California*

### **ABSTRACT**

Integrated Corridor Management (ICM) program which was initiated by the United States Department of Transportation (US DOT), and in partnership with related institutions, uses various ITS technologies to provide a more efficient operation and management of corridor networks as a multimodal system. It's characteristics of large scale system determines that Analysis, Modeling, and Simulation (AMS) plays an extremely important role for both implementation and operation. In this paper, the current ICM AMS method is discussed and summarized. A case study using microscopic supply system analysis tool, Synchro, is conducted for a better understanding and simplification of the assessment procedure for related institutions (especially local agencies that might not be able to immediately obtain high enough analysis tools. The objectives of this paper are two folds: 1. Demonstrate a relatively simple method (using a widely used existing simulation tool) to conduct analysis under information for the traffic operators (especially for local ones) in the transition period; 2. Propose some findings and suggestions for a more efficient and effective analysis process simplified.

## **LAND USE SCENARIOS LINKED WITH TRAFFIC SIMULATION MODELS**

*Zheng Zhu, University of Maryland*

*Chenfeng Xiong, University of Maryland*

### **ABSTRACT**

Aiming at multiple goals including higher density development, encouraging transit usage and minimizing emissions, the initiative of transit-oriented development (TOD) has drawn increasing attention during the past several decades. How do land use scenarios change the local and regional travel patterns remains as a hot research topic. The integration of land use models and microscopic traffic simulation models is not widely seen in literature.

This paper explores the linkage between land use models and traffic simulation models. Specifically, two TOD scenarios in Washington DC are studied. The proposed land use model predicts trip generation, mode share and destination changes. Then the results are plugged into traffic simulation models to generate local and regional performance measures. The results of this study provide a reasonable method for the evaluation of land use models, and also indicate the necessity of the proposed linkage for more effective local planning process. This prototype model has identified a potential research direction that focuses on the integration of land use models and traffic simulation models so that local traffic conditions can also directly affect land use strategies.

## **WHY PEOPLE RIDE: EXAMINING MOTIVATIONS FOR USING PUBLIC TRANSPORTATION**

*Matthew Dickens, American Public Transportation Association*

### **ABSTRACT**

APTA has collected a sample of onboard surveys from transit agencies over the past three years. A handful of these surveys ask about the motivations of transit riders. Many facets of research on the transit industry rely on assessing these motivations. Economic studies of transit point to the benefits transit customers receive from an increase in productive time compared to driving. Evaluations of potential new transit lines must balance the cost of comfort and access features with the number of riders that they will attract. Transit agencies are adding new amenities to stations, stops, and vehicles, and must target this spending to their customers' desires and needs.

The sample of transit agency customer surveys collected by APTA creates a unique opportunity to look into the motivations of transit customers. Many transit riders cite the lack of alternatives to transit, such as the lack of a car, but a growing number name avoiding traffic or gaining back productive time as reasons for riding. These results confirm the benefits of transit to users beyond just mobility, and legitimize transit agency efforts to attract choice riders. Examining the motivations of current transit riders can help transit agencies find ways to attract new riders to transit. Having this data is vital to increasing public transportation use across the country.

More in-depth research is needed to assess rider preferences at a wide variety of agencies. This paper provides a compilation of common responses as a set of best-practice response categories for agencies. By standardizing responses across agencies, it would be possible to create a larger dataset for use in future research.

# **INTEGRATED METHODOLOGY FOR EXAMINING ADVERSE WEATHER EFFECT ON SUBWAY FACILITIES**

*Jiaqi Ma, University of Virginia*

*Jianfeng Shen, Tongji University*

*Yan Bai, Beijing Jiaotong University*

*Fang Zhou, Beijing Jiaotong University*

## **ABSTRACT**

The increasingly frequent extreme weather disasters caused by global climate change have attracted more and more attention to adverse weather's effect on infrastructure systems. This paper aims to establish an integrated approach to assessing the adverse weather's effect on subway facilities and providing decision makers with a foundation for the formulation of responding measures. First, the Fault Tree Analysis (FTA) is used to understand the whole system on where the risks are and what factors have the most significant effects by analyzing all the possible related basic events. Construction leftover problems and design drawbacks, both being human factors, are found to be the most important two factors causing weather related risks and all wind, rain and snow related adverse weather can cause great risks. Then, an AHP-Fuzzy Synthetic evaluation model is established to assess the risk level based on an evaluation index system. AHP is used to calculate the weights between different weather factors and between the indices in each weather factor subsystem. A Fuzzy Synthetic evaluation process is then carried out to identify the risk level of the evaluation target. A case study on the Beijing Subway Line 8 Olympic Center Station is conducted to illustrate the whole process of evaluation. The result shows that the level risk is medium and it is only acceptable after measures are taken. The measures on design improvement, monitoring and maintenance are then formulated based on the understanding of the system risks.

# **AN ANALYSIS OF CALIFORNIA AGRICULTURAL TRANSPORTATION: ORIGINS, DESTINATIONS, MODAL COMPETITION AND INDUSTRY PERSPECTIVES**

*Mechel Paggi, California State University at Fresno*

*Fumiko Yamazaki, California State University at Fresno*

*Jay Noel, California Polytechnic State University at San Luis Obispo*

*Sean Hurley, California Polytechnic State University at San Luis Obispo*

*Micheal McCullough, California Polytechnic State University at San Luis Obispo*

## **ABSTRACT**

In this paper we provide an analysis of primary and secondary data on those transportation modes (truck, rail, air, ports) where the California specialty crop grower, shippers, and transportation industry firms are experiencing or may experience changes in their regional and international competitiveness. We examine the logistical and cost issues associated with current and projected changes in transportation technology, infrastructure, and agricultural transportation markets. The importance of these alternatives is addressed by specialty crop category and California region. We develop a measurement of regional market penetration and opportunities, carbon footprint and other metrics for evaluation of the current system. We interpret the results with a view toward the impact that changes in agricultural transport technology, infrastructure, and agricultural transportation markets will have on the future competitiveness of California specialty crop producers. This information provides policy makers and others involved with transportation policy background with which to make more informed decisions regarding changes and improvements in existing transportation mode services intended to benefit California specialty crop industries.

## **2040 FREIGHT INDUSTRY LEVEL FORECASTS FOR THE NJTPA REGION**

*Jakub Rowinski, North Jersey Transportation Planning Authority*

*Alan Meyers, Cambridge Systematics*

*Chris Lamm, Cambridge Systematics*

### **ABSTRACT**

The North Jersey Transportation Planning Authority's (NJTPA) 2040 Freight Industry Level Forecasts project developed a clear, accurate and comprehensive picture of regional freight activity, both current and future. The end product provides an accurate picture of where concentrations of goods movement activity can be expected to occur in the region in the future, the types of commodities that will be moving, and where strategic investments should be made. The study utilized many proprietary data sets including Transearch and Freight Locator from IHS Global Insight, Selectory from Dun & Bradstreet, and Torto Wheaton from CB Richard Ellis. The industry employment forecasts were developed using the Rutgers Economic Advisory Service Model (R/ECON) that uses the national drivers developed by IHS Global Insight. Additional comparisons were made to the Moody's Economy forecasts.

Freight issues are extremely important in the NJTPA planning region, which includes 13 counties in Northern New Jersey. The region hosts: the Port of New York and New Jersey, one of the nation's top three ports on the basis of tonnage and containers; heavily used local, regional, and interstate truck corridors and crossings; heavy concentrations of intermodal and non-intermodal rail activity; significant domestic and international air cargo facilities; and more than 800 million of square feet of warehouse/distribution space. These networks and facilities are essential to the economic and transportation well-being of 6.6 million residents in the NJTPA region and 20 million in the NY/NJ metropolitan statistical area, along with regional businesses. Understanding the effects and importance of freight is therefore critical – not only to ensure the accuracy of the regional transportation planning process, but also to effectively communicate the importance of freight to the region's freight stakeholders, businesses, communities, residents, and funding decision-makers. The study developed an interactive Excel-based forecasting tool that allows the NJTPA to test various economic scenarios as well as calculate the specific impacts of economic or transportation drivers. The outputs include regional and county level summaries of freight activity for the forecast years and scenarios selected by the user as well as a truck trip table ready to be input into the NJRTM-E (NJTPA's Travel Demand Model). The baseline forecast for 2040 is for a 32 percent growth in regional employment and a 41 percent growth in the tonnage of goods that move in, out and through the region.



## **USING THE PETROCHEMICAL INCIDENT LOCATION SYSTEM (PILS) TO TRACK UNINTENTIONALLY RELEASED CHEMICAL INCIDENTS: IS YOUR CITY SUSCEPTIBLE?**

*Latissha Clark, Texas Southern University*

*Vincent Hassell, Texas Southern University*

### **ABSTRACT**

Petrochemical Incident Location System (PILS) is a web based application that provides a historical snapshot of hazardous material incidents throughout the United States. This data base spans a 20 year time period. We will identify critical areas, such as incidents, incidents proximity to schools, bridges and etc. The research will identify 4 high incidents areas based on population. Research will identify the chemicals, and time of incident. This data will be aggregated over the course of a timeline using a regression model on years: 1993, 1999, 2003, 2008 and, 2010. Using this method, we will provide a snapshot as to how many chemicals are being unintentionally released near high density population.

# **ECONOMIC EVALUATION OF A NEW VESSEL DESIGN FOR AMERICA MARINE HIGHWAY SYSTEM**

*Qing Liu, Rahall Transportation Institute*

*Eric Pennington, Rahall Transportation Institute*

*Justin Matthews, Rahall Transportation Institute*

## **ABSTRACT**

Established by the Energy Independence and Security Act of 2007, America's Marine Highway (AMH) system allows for the waterborne movement between origins and destinations otherwise served solely by roads and railways. It offers a cost-effective way to improve the economic efficiency, environmental sustainability, public safety and security and the resiliency of our transportation system. However, the waterway system is highly underutilized because it is hard to compete with prevailing trucking and rail transportation. New technology and operating approach need to be adapted in order to make AMH transportation appealing to shippers as a reliable, flexible and cost efficient transportation option.

In this study, a new vessel design is evaluated for the purpose of short sea container shipping in US. With a higher cruising speed and better fuel efficiency, this vessel will be able to offer a more frequent and reliable waterway service than current Container-on-Barge service, as well as obtaining lower operating cost. Based on market analysis and vessel characters, a specific short sea route is chosen to test its economic viability and competitiveness with other modes in the market. This new vessel will add to current vessel portfolio in US short sea shipping and offer a new technology option to utilize AMH system.

## **RAIL MARKET SHARE OF GRAIN AND OILSEED TRANSPORTATION**

*Marvin E. Prater, U.S. Department of Agriculture*

*John Adam Sparger, U.S. Department of Agriculture*

*Pierre Bahizi, U.S. Department of Agriculture*

*Daniel O'Neil, Jr., Oregon State University*

### **ABSTRACT**

The share of the grain and oilseed harvest moved by rail has been declining since 1980, when the Federal Motor Carrier Act and the Staggers Rail Act were passed. Large structural changes associated with these Acts affected the decline over the following two decades. Yet, even though the large structural changes had already taken place by 2000, the rail market share of grain and oilseed transportation continued to decline. A State-level statistical model for the top 27 grain-producing States (which produce 96.7 percent of all grain and oilseeds) investigated the major factors responsible for the decrease in the rail market share of grain and oilseed transportation since 2001. Although not every factor affecting the rail market share of grain and oilseed transportation could be captured, 14 statistically significant factors were identified. Of these, three were most important: increases in the concentration of animal feeding, the rise in rail rates, and the growth of ethanol production.

The increased geographic concentration of animal feeding has resulted in feed being hauled from State to State, increasing the rail market share for those States supplying the feed grains and decreasing it for the grain buyers. As more States are net buyers of feed grains than net sellers, rail market share has decreased overall. The average effect from the concentration of animal feedlots is a 3.34-percent decrease in a State's rail market share of grain and oilseed transportation.

As rail rates increase, rail market share decreases because shippers switch to competing transportation modes such as truck and barge. The increase in rail rates since 2001 is responsible for a 1.31-percent average market share decrease in each State.

The use of corn to produce ethanol has markedly reduced the rail market share in many States. Ethanol plants are usually located close to corn-producing areas, so trucks are used to haul corn to ethanol plants. Iowa, the leading ethanol-producing State, produced approximately 3.644 billion gallons of ethanol in 2010, reducing rail market share by approximately 34.2 percent. The average-rail-market-share reduction due to a State's ethanol production is 2.02 percent.

The decline in the rail market share of national grain and oilseed transportation was not uniform across States; some States had increases in rail market share. Factors responsible for an increase in market share include railroads shipping more grain in smaller shipments (under 50 carloads), shippers receiving higher prices for grains and oilseeds, increases in barge rates, longer distances to barge facilities, and increased grain exports. Crop production choices are also related to rail market share, with increased flaxseed, peanut, cottonseed, wheat, and soybean production causing an increase, and increased rice production related to a decrease.

At the national level, three factors have been responsible for most of the decrease in the rail market share of grain and oilseed transportation since 2001: the increased geographic concentration of animal feedlots, increased production of ethanol, and rising rail rates.

## **REGIONAL AGRICULTURAL RAILROAD DEMAND MODEL**

*Michael W. Babcock, Kansas State University*

*Philip Gayle, Kansas State University*

### **ABSTRACT**

In recent years there have been few railroad demand studies. Also no study has investigated the possibility of regional differences in railroad demand. The objective of the paper is to estimate railroad demand functions for wheat, corn, sorghum and soybeans for the U.S. as well as the east and west regions. A two region spatial equilibrium model is employed to specify the empirical model in which railroad tons originated is the dependent variable. The explanatory variables include railroad price per ton, crop production, grain exports, domestic(U.S.)demand for grain, barge price per ton,and barge market share for each crop. The theoretically expected sign is negative for rail price and barge market share. Alternatively, the expected sign is positive grain exports, crop production and barge rate. The theoretically expected relationship between rail demand and U.S. grain demand is indeterminate. Anticipated results include railroad own price elasticities and cross price elasticities relative to barge transport. Also information regarding regional differences in railroad grain demand will be obtained.

## **DEVELOPMENT OF AN ATTRIBUTED GIS RAIL NETWORK USING SATELLITE IMAGERY**

*Steven Peterson, Oak Ridge National Laboratory*

*Karreem Ali, Oak Ridge National Laboratory*

*Timothy Gouge, Oak Ridge National Laboratory*

### **ABSTRACT**

Oak Ridge National Laboratory (ORNL) has maintained a U.S. rail network for routing analyses of hazardous materials shipments for several decades. Recently, ORNL completed a three year project to validate the consistency, completeness, and quality of the network attributes and to improve the topological accuracy of the rail lines and node locations in the network. The network topology was improved using satellite imagery to place rail lines and nodes “on entity,” thereby creating a network with accuracy better than 1:100,000. The project also improved the accuracy of rail line attributes, including ownership, operating subdivision, trackage and haulage rights, signal systems, track class, and traffic density, using railroad timetable and track chart information. Further, the rail nodes associated with the network now reflect every station associated with a SPLC in the Official Railway Station Guide, as well as other named nodes associated with sidings, control points, and stations that are no longer in service. The improved network was installed in the new WebTRAGIS system at the end of 2012.

## **NETWORK ROUTING IMPLICATIONS FOR HAZARDOUS MATERIALS SUBJECT TO POLICY CONSTRAINTS**

*Steven Peterson, Oak Ridge National Laboratory*

### **ABSTRACT**

In late 2008, the Pipeline and Hazardous Materials Safety Administration issued new regulations regarding the transportation of hazardous materials by rail. Specifically, the rule requires “rail carriers to compile annual data on certain shipments of explosive, toxic by inhalation, and radioactive materials, use the data to analyze safety and security risks along rail routes where those materials are transported, assess alternative routing options, and make routing decisions based on those assessments.” The rules require that the rail companies complete their safety and security analyses and select the safest, most secure routes by April, 2010 using a minimum of 27 different risk factors in their route determination.

Several critics of the new rule-making have noted that the new regulations do not prohibit the shipment of hazardous materials through major population centers. In fact, several communities, most notably the District of Columbia, have attempted to ban or limit trains carrying hazardous materials from all or part of the city. With recurring calls for more regulatory oversight of hazardous materials and rail shipping, there are continuing calls for restrictions on the shipment of these goods.

This study seeks to examine the routing implications for hazardous materials should critics succeed in banning or limiting train routing through major urban areas. As many hazardous materials are important industrial and consumer inputs (ethanol, chlorine, anhydrous ammonia, and nuclear fuel rods, for example) the implications of such regulatory enforcement may be far reaching. Using recent rail routing data for specific hazardous materials, railroads and origin-destination pairs, coupled with a government-funded rail routing model, the potential routing decisions of the different railroads will be examined by comparing a shortest-route result with a set of alternative routes that are constrained by not passing through urban areas and clusters. Results are presented as deviations in time, distance, and a network impedance (friction) function.

### **STRATEGY FOR GREENFIELD OR ACQUISITION OF MILL UNDER SPATIAL COMPETITION AMONG BAKERIES IN MAINLAND UNITED STATES**

*Sumadhur Shakya, North Dakota State University*

#### **ABSTRACT**

This study will examine the strategy to decide on Greenfield (new location from scratch) location or acquisition (of existing mills) to increase market share among current bakeries under spatial competition. Beyond simple transportation problem of locating a plant such that it maximizes market share, this study will also look at spatial correlation of size and distribution of both population and bakeries with dependent variable like sales or flour consumption. The resulting location will not be the best to locate, but also give market share that can be compared with had the acquisition was done instead of Greenfield location. The study would also address hot spot analysis for verification of results subjectively.

### **USING THE PETROCHEMICAL INCIDENT LOCATION SYSTEM (PILS) TO TRACK UNINTENTIONALLY RELEASED CHEMICAL INCIDENTS: IS YOUR CITY SUSCEPTIBLE?**

*Latisha Clark, Texas Southern University*  
*Vincent Hassell, Texas Southern University*

#### **ABSTRACT**

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### **THE EFFECTS OF COMPLETE STREETS ON MOBILITY AT THE ARTERIAL LEVEL**

*Sara Patterson, University of Delaware*

#### **ABSTRACT**

With an increasing desire to design complete streets, it is crucial to determine what constitutes a complete street and how complete streets affect mobility. The general definition of a complete street is one that is safe for all users including drivers, pedestrians, cyclists, and transit riders. This definition is vague and allows the designer to make the decisions about what techniques should be used to create a complete street. To determine what techniques are best for a specific project, first transportation engineers must determine the effect each technique will have on the street, and the tradeoffs that a community may have to live with after construction. Specifically, when working with an existing street, there will be changes in LOS, capacity, delay, and emissions.

## **HIGHWAY MEDIAN LANDSCAPING DESIGN AND INTERSECTION SAFETY**

*Hongyun Chen, Embry-Riddle Aeronautical University*

*Aldo Fabregas, University of South Florida*

*Pei-Sung Lin, University of South Florida*

### **ABSTRACT**

This study validated these criteria in the current FDOT Index 546 for allowing the installation of trees in the median adjacent to left turn lanes. Twenty-nine states' policies regarding medians trees near the intersections were reviewed and FDOT Index 546 is the demanding standard to quantify the tree offset and detailed spacing requirements at highway medians near the intersections. Three groups of sites were selected and categorized as 1) those without median trees; 2) those with median trees compliant with the Index 546; and 3) those with median trees not compliant with the Index 546. The latest two years of crash data were used. The sites compliant with Index 546 showed the best safety performance in terms of the lowest crash counts and injury severity levels. The most dangerous sites were located at a speed limit of 40 mph with trees not compliant with Index 546. The results indicate that median trees near highway intersections can reduce the number of crashes and the injury severity levels of crashes.

## **PUBLIC INVOLVEMENT: ENGAGING COMMUNITIES FOR A BETTER TOMORROW**

*Peggy Adolph, Texas Southern University*

### **ABSTRACT**

Transportation, as we know it, is essentially designed to accommodate mobility. Offers humans access to and from various places; and facilitates the movement of goods and services, imports and exports. For this to happen, proper transportation planning remains a critical component for successful transport. Transportation planning involves a wide range of professional areas, subjects, and/or systems that are used to carry out this important process designed to foster involvement by all users of the system, such as the businesses, community groups, environmental organizations, and general public. Involvement is one of the core elements in which the strategic transportation planning must reflect the community needs. Public Involvement is an element that consults with interested or affected individuals and entities before making a decision; Two-way communication and collaborative problem solving with the goal of achieving better and more acceptable decisions prevents or minimizes disputes by creating a process for resolving issues. SAFETEA-LU emphasizes the responsibilities of the lead agencies under NEPA in determining the final purpose and need for the action and the range of alternatives, after considering input from the public and participating agencies. The opinions, comments, complaints, and or concerns must be heard and addressed in some form. This paper discusses the methods agencies use to involve the public, while exploring techniques to creatively engage the public participation using new ideas, performance measures, diversities, and technologies while being sensitive to a limited budget.



## **ASSESSING AIR FREIGHT FORWARDERS' DECISION-MAKING PROCESS IN CHOOSING AIRLINES**

*Hsing Chung Chu, National Chiayi University*

*Li-Yen Chang, National Chiayi University*

*Da-Jie Lin, Feng Chia University*

### **ABSTRACT**

Due to the accession to the World Trade Organization, many international freight forwarders have been permitted to set up a local company in overseas, which increases the competition in the air freight forwarding market. To survive in the highly competitive industry, air freight forwarders must enhance international freight forwarding operations and performance. This study aims to develop a prediction model for air cargo volume handled by forwards and also examine factors that affect the decision-making process in various transportation routes when assessing air freight forwarding. The operational strategies for airlines will also be proposed from the perspective of freight forwarders.

## **GEOSPATIAL AND STATISTICAL ANALYSIS OF PIPELINE SPILL INCIDENTS AND THEIR IMPACT ON LAND USE AND THE ENVIRONMENT**

*Robert O. Walton, Embry-Riddle Aeronautical University*

*P. M. Politano, The Citadel*

### **ABSTRACT**

Pipelines are key to the U.S. transportation system and transports 66% of domestic petroleum products. While pipelines are of strategic importance to the U.S. economy, the potential for a very large release of product to the environment is high. Using data from the U.S. Department of Transportation, Pipeline, and Hazardous Materials Safety Administration significant incidents database, this research geospatially plotted pipeline incidents to determine where clusters of spills occurred. In addition, statistical analysis was performed to determine any statistically significant relationships in pipeline operations. While reported incidents were found in almost every state in the U.S. the largest concentration of incidents were clustered in Texas, Oklahoma, and Louisiana (including onshore and offshore areas). This is not surprising since this area has a very large concentration of oil production and refining facilities. The most surprising findings from this examination of data was the relative ineffectiveness of SCADA. Sixty-five point three percent of sites had a SCADA detection system installed. However, only 12.8% of release detection was facilitated by the installation of this equipment. This research provides pipeline companies and regulatory agency's information on the most critical pipelines in relation to a spill or incident, and provides locations where expanded monitoring or protective action should be enacted to reduce the risk of spillage.