2015

2015 Annual Report Transportation Research Center for Livable Communities

Western Michigan University
University of Texas Arlington
Wayne State University
Utah State University
Tennessee State University

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Messages from the Director and Representatives

Jun-Seok Oh, Director of TRCLC, Western Michigan University

It has already been more than two years since the Transportation Research Center for Livable Communities (TRCLC) was born. During the years, TRCLC was able to support its members on 25 research projects. I am happy to present this annual report summarizing TRCLC research activities. TRCLC researchers in the five consortium universities have worked hard to bring technological advances to aid the development of livable communities. We have examined, tested and investigated various technologies to foster multimodal transportation systems and overcome barriers and obstacles delaying the onset of livable communities. I appreciate our members’ efforts and contribution, especially from TRCLC university representatives. Without their thoughtful collaboration, TRCLC could not have achieved such success in such a short timeframe. I would also like to thank center advisory board members, research advisory members, and collaborative partners for their continuous cooperation. Their support and encouragement have brought great motivation for us to develop new research agenda. Most importantly, I would like to thank the U.S. Department of Transportation for this opportunity. We will continue to strive to achieve U.S. DOT’s strategic goals by collaborating with TRCLC members.

Stephen Mattingly, TRCLC Representative, University of Texas at Arlington

The Transportation Research Center for Livable Communities has helped increase the recognition of the importance of transportation in creating and sustaining communities. On campus, the center has helped foster new research collaborations between civil engineering, urban planning, public affairs, computer science and social work. Within the community, we have connected with the local metropolitan planning organization, North Central Texas Council of Governments (NCTCOG), to extend some of the center’s research to address their needs. Furthermore, the collaboration with NCTCOG has connected our research activities with governmental agencies and advocacy organizations throughout the region. We look forward to continuing the work of the center for many years to come.

Anthony Chen, TRCLC Representative, Utah State University

Utah State University’s transportation research center is actively collaborating with the Transportation Research Center for Livable Communities in multi-modal transportation research, particularly focusing on modeling non-motorized and public transportation. Recent studies have examined the design of pedestrian environments for heterogeneous populations of individuals with and without disabilities, bicycle modeling and network analysis tool, and innovative park-and-ride facilities and transit services.

Joe Hummer, TRCLC Representative, Wayne State University

Wayne State University is pleased to be part of the TRCLC. We contribute in civil engineering in safety and pedestrian accommodation and in industrial engineering in systems for livable communities. We have two ongoing projects. Our industrial engineers are working on “Community-Aware EV Charging Station Network Design,” which is developing a decision support system (DSS) for city/community planning agencies to strategically design electric vehicle (EV) charging station networks for communities. Meanwhile, our civil engineers are working on “Prediction of Pedestrian and Bicyclist Crashes Using Behavioral Proxies,” investigating the relationship between pedestrian and bicyclist crashes and motorist behavior when encountering non-motorized users.

Deo Chimba, TRCLC Representative, Tennessee State University

The research at Tennessee State University (TSU) has been focused on pedestrian operations and safety. Our first research developed a framework to identify bicycle and pedestrian high crash locations for safety improvement prioritization focusing on population, demographic and socioeconomic spectra with the state of Tennessee as a case study. The second study focused on the impact of access management to pedestrian safety with the fact that poor access management has been linked to certain types of crashes. The study establishes the relationship between access management features and crash frequency, crash rates and injury severities through statistical modeling. Overall, the UTC funding has expanded transportation-related research here at TSU, has improved recruitment of graduate students especially those interested in the transportation engineering and planning field, and has given the participating faculties and students an avenue to publish from the research findings.
TRCLC Mission and Objectives

In retrospect, poorly balanced transportation systems in the United States have led to auto-dependent communities. Over the past several decades our communities have become less walkable, less bikeable and less accessible to public transit. Studies reveal that the percentage of students who walk or bicycle to school has dropped from 48 percent in 1969 to 15.7 percent in 2012. Recent estimates from the American Community Survey also show that nearly nine in 10 (86 percent) of Americans commute to work by car, more than three-quarters (76.1 percent) drive to work alone and only 5 percent use transit to get to work. And while 71 percent of older households want to live within walking distance of transit, only 53 percent of Americans have access to any form of public transportation.

The central mission of this Center is to engage in research that helps to achieve more balanced, affordable and environmental sustainable transportation systems for all. Such systems will foster the development of livable communities where people can enjoy their daily lives without having to drive a car. In particular, the Center concentrates on “bringing technological advances into livable communities” by coordinating efforts between researchers, practitioners and advocates. Toward this end, the TRCLC aims to achieve three objectives, including:

• Improve public transit systems and alternative transportation modes;
• Provide better and safer pedestrian and bicycle networks; and
• Enhance transportation accessibility for people with disabilities, older adults, and lower income populations.
Jun-Seok Oh, Ph.D., PE  
*Director*  
Western Michigan University

Research interests: Transportation systems modeling, non-motorized transportation, traffic safety, intelligent transportation systems, traffic simulation

Valerian Kwizigile, Ph.D., PE  
*Associate Director*  
Western Michigan University

Research interests: Traffic safety, non-motorized transportation, traffic enforcement, traffic data analysis

Osama Abudayyeh, Ph.D., PE  
*Center Advisory Council*  
Western Michigan University

Research interests: Bridge and infrastructure management, rapid bridge construction

Kay Mortellaro  
*Center Coordinator*  
Western Michigan University

Zhanbo Sun, Ph.D.  
*Assistant Professor, Civil and Construction Engineering*  
Western Michigan University

Research interests: urban traffic modeling using advanced sensing technologies, traffic control and operations, connected and autonomous vehicles, privacy in transportation, vehicular emissions modeling, livable communities
Research Investigators

Ala Al-Fuqaha, Ph.D.  
Professor, Computer Science  
Western Michigan University
Research interests: System simulation and modeling, wireless communications, mobile computing, VANETs

David Lemberg  
Professor, Department of Geography  
Western Michigan University
Research interests: Urban transportation planning, tourism, landscape and ecology

Upul Attanayake, Ph.D.  
Associate Professor  
Western Michigan University
Research interests: Bridge engineering, condition assessment and health monitoring of structures, finite element applications

Yang Li, Ph.D.  
Professor, Computer Science  
Western Michigan University
Research interests: Database management

Charles Emerson  
Professor, Department of Geography  
Western Michigan University
Research interests: Geographic Information Systems, remote sensing and spatial analysis

C. Scott Smith, Ph.D.  
Assistant Professor, Department of Geography  
Western Michigan University
Research interests: Long cane biomechanics, quiet vehicles, mobility of people who are blind

Robert Wall Emerson, Ph.D.  
Professor, Blindness & Low Vision Studies  
Western Michigan University
Research interests: Long cane biomechanics, quiet vehicles, mobility of people who are blind

Richard Long  
Professor Emeritus, College of Health and Human Services  
Western Michigan University
Research interests: Street crossing risk, roundabouts access for persons who are blind, perceptual cues for wayfinding at complex intersections

David Guth  
Professor Emeritus, Blindness & Low Vision Studies  
Western Michigan University
Research interests: Street crossing risk, roundabout access for persons who are blind, perceptual cues for wayfinding at complex intersections

Dr. Ron Van Houten  
Professor, Department of Psychology  
Western Michigan University
Research interests: Human factors, traffic safety analysis, pedestrian behavior analysis

Deo Chimba, Ph.D.  
Associate Professor, Civil and Architectural Engineering  
Tennessee State University
Research interests: Highway safety analysis, traffic operations and analysis, simulation, bicycle, and pedestrian studies, application of statistics in transportation, public/transit transportation, traffic demand forecasting and modeling, emerging technologies in transportation engineering, land use growth management

Paula D. Kohler  
Associate Vice President of Research, Special Education and Literacy Studies  
Western Michigan University
Research interests: Effectiveness of secondary education and evaluation of implementation strategies

Kimberly L. Triplett, PhD, MPA  
Assistant Professor, Sociology, Social Work, and Urban Professions  
Tennessee State University
Research interests: Environmental Justice, transportation equity, public involvement, race and ethnicity, regionalism, social inequality, social justice, urban development, urban politics, historic development (metropolitan), and urban planning and policy
Anthony Chen  
**Professor, Transportation Division Head, Civil and Environmental Engineering**  
Utah State University  
Research Interests: Transportation systems modeling, transportation planning, sensor location, network reliability, non-motorized transportation, evacuation behavior, bicycle network analysis

Keith M Christensen  
**Landscape Architecture and Environmental Planning**  
Utah State University  
Research Interests: Social integration of individuals with disabilities, health and well-being disparities of individuals with disabilities, transportation access, equitable emergency evacuations, and socially inclusive environments

Ziqi Song  
**Assistant Professor, Civil and Environmental Engineering**  
Utah State University  
Research Interests: Transportation network modeling, sustainable transportation systems, travel demand management, traffic operations and safety, and transportation asset management

Ratna Babu Chinnam, Ph.D.  
**Professor & Graduate Chair, Industrial & Systems Engineering Department**  
Wayne State University  
Research Interests: Supply chain management, intelligent transportation, analytics, big data

Joseph E. Hummer, Ph.D., PE  
**Professor and Chair, Department of Civil and Environmental Engineering**  
Wayne State University  
Research Interests: Specialties in highway safety, highway design, and traffic operations. In particular, he is a leader in the area of alternative intersections and interchanges. He has also worked extensively in pedestrian and bicycle safety and operations and traffic control devices

Ekrem Alper Murat, Ph.D.  
**Associate Professor & Undergraduate Chair, Industrial & Systems Engineering Department**  
Wayne State University  
Research Interests: Supply chain management, logistics and transportation, healthcare analytics, big data

Stephen Remias, Ph.D.  
**Assistant Professor, Department of Civil and Environmental Engineering**  
Wayne State University  
Research Interests: Traffic operations, traffic signals, transportation mobility, performance measurement, connected infrastructure, and using large data sets to solve relevant transportation problems

Saravanan Venkatachalam, Ph.D.  
**Assistant Professor, Industrial & Systems Engineering Department**  
Wayne State University  
Research Interests: Supply chain management, transportation and logistics, energy, large scale optimization

Timothy Gates, Ph.D.  
**Associate Professor, Civil and Environmental Engineering**  
Michigan State University  
Research Interests: Traffic engineering, traffic operations, traffic safety, driver behavior, and transportation economics

Siamak (Sia) A. Ardekani, P.E.  
**Professor, Department of Civil Engineering**  
University of Texas at Arlington  
Research Interests: Traffic flow theory, traffic surveillance systems, intelligent transportation systems, managed lane operations, roadway pricing, emergency transportation management, and public transportation design and operations

Colleen Casey  
**Associate Professor, Department of Public Affairs**  
University of Texas at Arlington  
Research Interests: Community engagement, public participation, and cross-sector coordination and collaboration especially around the issues of health and transportation

Jianling Li  
**Professor, Department of Planning and Landscape Architecture**  
University of Texas at Arlington  
Research Interests: Organizational collaboration for transportation planning, economic returns from transportation investments, and the impacts of transportation planning and policies on travel behavior, health outcomes, and social equity

Stephen P. Mattingly  
**Associate Professor, Department of Civil Engineering**  
University of Texas at Arlington  
Research Interests: Decision and risk analysis, transportation and public health, institutional studies and analysis, transportation planning, connected autonomous vehicles, operations research/logistics, network optimization, intelligent transportation systems, aviation, public transit, bicycle and pedestrian behavior and safety and transportation safety

James C. Williams, P.E.  
**Professor, Department of Civil Engineering**  
University of Texas at Arlington  
Research Interests: Traffic engineering, traffic signals, traffic operations
Consortia

The TRCLC is composed of consortium universities and collaborative partners, including public agencies, interest groups and industry representatives. Collectively, the personnel involved in the Center represent multiple communities of practice. Together, Center participants form a community of interest defined by their collective concern with the resolution of transportation problems and the enhancement of transportation mobility and accessibility for socially- and economically-sensitive populations through multi-modal networks. By developing effective interdisciplinary, industry-university and inter-sectoral partnerships, the TRCLC will help facilitate the development of livable communities. The figures below graphically depict the five consortium member universities: Western Michigan University (WMU), University of Texas, Arlington (UTA), Utah State University (USU), Wayne State University (WSU) and Tennessee State University (TSU) and their participating departments.
Each of the five institutions in the TRCLC consortium has its own expertise within the theme of livable communities. Western Michigan University has expertise and strong research capabilities in the areas of mobility for those with disabilities and in non-motorized safety. The University of Texas, Arlington’s strengths are in analyzing environmental impact and multi-modal levels of service. Utah State University members have strengths in both network analysis and transportation services for individuals with disabilities. Wayne State University specializes in bus rapid transit and pedestrian safety. Tennessee State University members have strengths in safety and performance measures (see figure below).

The TRCLC is a collaboration that will be of benefit to all five institutions, their surrounding communities and for sustainable transportation research, more generally.

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**Public Agencies, Industry and Interest Groups**

Listed below are the public agencies, industry and interest groups that are actively supporting the Center by reviewing research proposals, identifying transportation problems and/or research opportunities, actively participating in the Center’s seminar series, providing research funding and/or other financial support, and/or engaging in collaborative research.

ASCE of Michigan  
City of Dallas, TX  
City of Kalamazoo, MI  
City of Portage, MI  
Complete Streets Coalition of Kalamazoo  
ITE of Michigan  
ITS of Michigan  
Kalamazoo Area Transportation Study (KATS), MI  
Kalamazoo County Road Commission (KCRC)  
Kalamazoo County Transportation Authority (KCTA), MI  
League of Michigan Bicyclists

Michigan Association of Planning  
Michigan Department of Transportation (MDOT)  
Michigan Office of Highway Safety Planning (OHSP)  
Nokia Americas  
Oshtemo Township, MI  
Scenaria  
Southeast Michigan Council of Governments (SEMCOG)  
Southwest Michigan Planning Commission (SWMPC)  
Tennessee DOT  
Texas DOT  
URS Corporation
Our Research

The TRCLC aims at not only promoting public transit and non-motorized transportation systems for commuters, but also for children, older adults, individuals with disabilities, and low income people. Our research includes planning, design, maintenance and technologies for public transit and non-motorized transportation. The TRCLC’s research falls into six categories of benefits: mobility, safety, environment, accessibility, health and performance. To help foster livable communities, TRCLC members deal with the following transportation-related needs:

- Technologies for communities’ safety and mobility;
- Performance measures for community walkability and bikeability;
- Transportation services and human health and safety;
- Safe routes to school and transportation education for the next generation;
- Multimodal level of services and complete streets;
- Bus rapid transit and transit information systems;
- Transit-oriented development;
- Technologies for individuals with disabilities;
- Rapid construction to minimize negative impacts for commuters; and
- Infrastructure monitoring and information services.

Research Themes

The TRCLC has identified four research thrusts as suggested by the research advisory committee, including:

- Behavioral and cultural research that addresses all users of transportation systems, including drivers, bicyclists, pedestrian, elderly, blind and low vision individuals.
- System and network, planning, design, and simulation for improving transportation services.
- Decision making models/policies that address competing transportation priorities and needs.
- Education and training on all aspects of transportation.
## List of Center Research Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Title</th>
<th>Institute</th>
<th>PI</th>
</tr>
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<tbody>
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<td>14-1</td>
<td>Explorations into the Equity Dimensions of US Bicycle Sharing System</td>
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<td>14-2</td>
<td>Developing Performances Measures to Capture the Effects of Transportation Facilities On Multiple Public Health Outcomes</td>
<td>UTA</td>
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<tr>
<td>14-3</td>
<td>Developing Performances Measures to Capture the Effects of Transportation Facilities On Multiple Public Health Outcomes: A Case in Michigan</td>
<td>WMU</td>
<td>Jun-Seok Oh</td>
</tr>
<tr>
<td>14-4</td>
<td>Conditions that Influence Drivers’ Yielding Behavior at Uncontrolled Crossings and Intersections with Traffic Signal Controls</td>
<td>WMU</td>
<td>Robert Emerson</td>
</tr>
<tr>
<td>14-5</td>
<td>Development of Decision Support Tools to Assess Pedestrian and Bicycle Safety: Development of Safety Performance Functions</td>
<td>WMU</td>
<td>Valerian Kwigizile</td>
</tr>
<tr>
<td>14-7</td>
<td>Development of Decision Support Tools to Assess Pedestrian and Bicycle Safety: Focus on Population, Demographic and Socio-economic Spectra</td>
<td>TSU</td>
<td>Deo Chimba</td>
</tr>
<tr>
<td>14-8</td>
<td>Big Data Analytics to Aid Developing Livable Communities</td>
<td>WMU</td>
<td>Li Yang</td>
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<td>14-9</td>
<td>Alternatives for Providing a Safe Passage for Non-Motorized Traffic across an Existing Highway Bridge</td>
<td>WMU</td>
<td>Upul Attanayake</td>
</tr>
<tr>
<td>14-10</td>
<td>Innovative Park-and-Ride Management for Livable Communities</td>
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</tr>
<tr>
<td>14-11</td>
<td>Innovative Park-and-Ride Management for Livable Communities</td>
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<td>14-12</td>
<td>Capacity Analysis of Pedestrian Facilities Involving Individuals with Disabilities</td>
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<tr>
<td>15-1</td>
<td>Effect of Cycling Skills on Bicycle Safety and Comfort Associated with Bicycle Infrastructure and Environment</td>
<td>WMU</td>
<td>Jun-Seok Oh</td>
</tr>
<tr>
<td>15-2</td>
<td>Development and Assessment of Performance Measures for Evaluating and Improving Regional Transit Coordination Using GTFS Data</td>
<td>WMU</td>
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</tr>
<tr>
<td>15-3</td>
<td>Real Time Bicycle Simulation Study of Bicyclists’ Behaviors and their Implication on Safety</td>
<td>WMU</td>
<td>Valerian Kwigizile</td>
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<tr>
<td>15-4</td>
<td>Travel Behavior of Blind Individuals before and after Receiving Orientation and Mobility Training</td>
<td>WMU</td>
<td>Dae Kim</td>
</tr>
<tr>
<td>15-5</td>
<td>Infrastructure and Technology for Sustainable Livable Cities</td>
<td>WMU</td>
<td>Upul Attanayake</td>
</tr>
<tr>
<td>15-6</td>
<td>Integrated Crowdsourcing Platform to Investigate Non-Motorized Behavior and Risk Factors on Walking, Running, and Cycling Routes</td>
<td>WMU</td>
<td>Ala Al-Fuqaha</td>
</tr>
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<td>15-7</td>
<td>App-Based Crowdsourcing of Bicycle and Pedestrian Conflict Data</td>
<td>UTA</td>
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<td>15-9</td>
<td>Impact of Access Management Practices to Pedestrian and Bicycle Operations and Safety</td>
<td>TSU</td>
<td>Deo Chimba</td>
</tr>
<tr>
<td>15-10</td>
<td>Development of Multi-Class, Multi-Criteria Bicycle Traffic Assignment Models and Solution Algorithms</td>
<td>USU</td>
<td>Anthony Chen</td>
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<tr>
<td>15-11</td>
<td>Development of a New Combined Modal Split and Traffic Assignment Model for Evaluating Transit Oriented Development Strategies</td>
<td>USU</td>
<td>Anthony Chen</td>
</tr>
<tr>
<td>15-12</td>
<td>Analysis of Walking Facility Performance Guidelines for Individuals with Disabilities</td>
<td>USU</td>
<td>Keith Christensen</td>
</tr>
<tr>
<td>15-13</td>
<td>Exploring Bicycle Route Choice Behavior with Space Syntax Analysis</td>
<td>USU</td>
<td>Ziqi Song</td>
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</tbody>
</table>

*completed projects are highlighted in green.*
Highlighted Projects
TRCLC 14-1: Explorations into the Equity Dimensions of US Bicycle Sharing System

Pl: C. Scott Smith – Western Michigan University

The researchers found that the conventional factors used to site most bike sharing infrastructure—i.e., population density; job density; points of interest density; land use characteristics; transit connectivity; commute mode share; station visibility; and topography—have translated into radically inequitable distributions of BSS with respect to economic hardship.

Research over the past several decades has made it increasingly clear that livable communities are inextricably linked to the provision of opportunities for active (i.e., non-motorized) transportation. Coinciding with these realizations are technological and demographic trends in the US and elsewhere—e.g., toward shared use mobility and (re)urbanization—that are dramatically changing the way people and non-human objects cooperate and interact within urban environments. A compelling example of the above realizations and trends is the rapid adoption of public bicycle sharing systems (BSS) across the country. Such systems allow individuals to use bicycles on an as-needed basis without the costs and responsibilities of bicycle ownership.

Alongside celebrations of the early successes of US bicycle sharing systems, have been criticisms that these systems have not been adequately integrated into lower-income communities; a pattern that mirrors transportation injustices—both past and present—that have burdened lower-income while simultaneously advantaging middle to higher-income communities. This study examined 35 bicycle sharing systems across the US spanning 72 municipalities and consisting of 2,063 stations and 39,394 bicycle docks. The systems were evaluated with regard to their spatial arrangements and, more specifically, whether lower-income communities experienced differential access to bicycle sharing infrastructure (i.e., stations).

The researchers found that the conventional factors used to site most bike sharing infrastructure—i.e., population density; job density; points of interest density; land use characteristics; transit connectivity; commute mode share; station visibility; and topography—have translated into radically inequitable distributions of BSS with respect to economic hardship. Indeed, more than three quarters (75.4 percent) of bike-sharing stations across the US are located in communities with relatively low economic hardship while only 245 or 11.9 percent are located in communities with higher economic hardship.

Spatial regression results also showed that both race and economic hardship were significant predictors in explaining variations in access to bike sharing infrastructure, even when controlling for the more conventional factors considered in the siting process.
TRCLC 14-2: Developing Performances Measures to Capture the Effects of Transportation Facilities On Multiple Public Health Outcomes

**PI: Colleen Casey – University of Texas at Arlington**

The research team is working on developing tools and applications that can help inform critical decisions as to the transportation infrastructure investments necessary to create healthy, livable communities.

A collaborative team of researchers from the Civil Engineering department and the Department of Public Affairs at the University of Texas at Arlington (UTA) are working on research to foster the development of healthy and livable communities. Specifically, the research team is working on developing tools and applications that can help inform critical decisions as to the transportation infrastructure investments necessary to create healthy, livable communities.

**Green Means Go For Safety.** Safe Routes to Schools (SRTS) and other programs aim to encourage schools and communities to enhance the safety of the routes children travel to school, which can also lead to other public health benefits such as increased physical activity, reduced dependency on car trips, and an overall improvement in the public health of children. However, to be effective and maximize the impact of such programs, decision makers must be able to weigh the consequences of investing in different options—which can be a challenging task as priorities may conflict. For example, is it better to invest in widening a sidewalk, installing a midblock crossing, or are both necessary in order to actually realize an improvement in the safety of the route? Likewise, how is the location of the route impacted by air quality? To address this problem, the research team is producing a decision making tool that mimics a stoplight by signifying “red”, “yellow”, or “green” to indicate the best options for safe routes. The data that informed the development of the tool was collected from surveys of experts in the field, field observation and inventories. The indicators identify the types of transportation investment options that will be most likely to promote safety and public health, considering the goals of safety, physical activity and air quality. Red means potentially an unsafe decision, yellow means some concerns still remain and green means “go”-- it’s a safe choice.

**Improving Student Awareness of Balanced Transportation Systems.** In fall of 2015, the research team engaged undergraduate, junior-level engineers in field research to study and analyze the features of the transportation environment that foster or impede safety for bicyclists and pedestrians. This is important because, historically, the transportation-engineering curriculum has emphasized motorized vehicles over nonmotorized vehicles, such as bicyclists and pedestrians, providing students with less exposure to the transportation infrastructure needs of a balanced system. The findings from the project indicate that project-based learning can increase the awareness of engineering students about the needs of a balanced transportation system. The team recently presented the research on the project-based learning initiative at the 2016 Transportation Research Board Annual Meeting in Washington, DC.

TRCLC 14-4: Conditions that Influence Drivers’ Yielding Behavior at Uncontrolled Crossings and Intersections with Traffic Signal Controls

**PI: Robert Emerson – Western Michigan University**

Pedestrians who are blind might positively influence driver yielding in different travel situations. The behaviors of holding up an outstretched hand and taking a single step into the street had the largest impact on yielding.

There is a dearth of studies on how pedestrians who are blind might positively influence drivers yielding in different travel situations. This project assessed common pedestrian behaviors (head turning, holding a cane, taking a step, holding up a hand, exaggerated cane movement, standing without a cane) on yielding rates for right turning traffic at lighted intersections as well as at entry and exit lanes at roundabouts. Each pedestrian behavior was exhibited in each travel situation to determine yielding rate. Data demonstrated how common head and gaze related behaviors compared to previous results on cane and larger body movements impact yielding. By collecting data at both lighted intersections and roundabouts, we were able to assess relative merits of pedestrian behaviors for free flowing and stopped traffic. In replication of previous work, the behaviors of holding up an outstretched hand and taking a single step into the street had the largest impact on yielding. Simply displaying a cane was not statistically different from simply standing at the corner (very low yielding). The variety of head turning and gaze behaviors did not appreciably increase yielding rates beyond displaying the cane. The outcomes have major implications for O&M instruction. Orientation and mobility instructors can train blind pedestrians to safely take a single step in situations where they are concerned about vehicles yielding in order to reduce risk. This is a huge potential benefit for pedestrians who are both deaf and blind. These pedestrians often cannot reliably see or hear traffic and so must rely on their behavior to consistently impact traffic in a set manner.
Highlighted Projects

**TRCLC 14-7: Development of Decision Support Tools to Assess Pedestrian and Bicycle Safety**

*PI: Deo Chimba and Kimberly Triplett – Tennessee State University*

The motivation of our research stems from the observations that, pedestrian and bicycle safety is falling for neighborhoods inhabited by groups more likely to be vulnerable such as low-income populations and racial minorities. These sociodemographic groups are also overrepresented among bicycle and pedestrian crash injuries and fatalities.

The goal of this research was to develop a framework to identify bicycle and pedestrian high crash locations for safety improvement prioritization focusing on population, demographic and socioeconomic spectra with the state of Tennessee as a case study. This research comprised of in-depth analysis using existing data, conducts Geographical Information Systems (GIS) cluster analysis and statistical modeling to examine and identify bicycle and pedestrian high crash locations. A combination of Geographical Information Systems (GIS) cluster analysis and statistical analysis methodology was used to identify pedestrian and bicycle high crash locations and associated factors using 2008-2012 state wide crash data collected in Tennessee. Crash analysis was conducted at neighborhood levels of census block group and county. Neighborhood sociodemographic characteristics constituted the study’s independent variables, while the dependent variable was the number of crashes. Cluster analysis identified high crash locations, and using statistics, the study identified the associated factors. From the identified factors, this research developed a criterion for identifying pedestrian and bicycle high crash locations and framework to prioritize allocation of safety improvement resources. The research concluded that sociodemographic and socioeconomic factors can assist to explain the variation of bicycle and pedestrian crashes. Population density, commuting to work by walking/bicycling, non-white populations and households without vehicles were positively correlated with pedestrian and bicycle crashes. Median household income, commuting to work by private cars and white population were negatively correlated with pedestrian and bicycle crashes. The overall milestone of this research was developing an access based decision support tool that predicts the number of bicycle and pedestrian crashes of a neighborhood. The tool allows input for the varying sociodemographic factors within a neighborhood and gives resulting number of crashes. This tool can act as a framework to allocate safety enforcement resources and assist in development of effective safety countermeasures to reduce crashes.


*PI: Timothy Gates – Wayne State University*

This research investigated the relationship between pedestrian and bicyclist crashes and motorist behavior when encountering non-motorized users, in addition to geometric and exposure related factors.

Safety performance functions (SPFs) provide a promising approach for quantifying the level for pedestrian crashes at midblock crossing facilities. The Highway Safety Manual currently provides an aggregate non-motorist SPF, which is based upon land use characteristics. Research is limited in terms of disaggregate-level studies considering the effects of motor vehicle/bicycle/pedestrian volumes, roadway geometry, and other factors on pedestrian and bicycle crashes, due in large part to the relative infrequency at which such crashes occur. To address these issues, research is currently being conducted investigating the relationship between pedestrian and bicyclist crashes and motorist behavior when encountering non-motorized users, in addition to geometric and exposure related factors.

Data were collected using covertly positioned high-definition video cameras at greater than 150 midblock, unsignalized, and signaled pedestrian crossing locations within Detroit, East Lansing, and Kalamazoo. The sites were selected to provide a broad range of road user volumes and geometric characteristics in order to identify the effects of the various behavioral, exposure, and geometric characteristics on traffic crashes.

The data are currently being extracted using a manual review of the videos. The characteristics that are extracted for each site include behavior of drivers when encountering a crossing pedestrian or bicyclist, evasive actions taken by the road users during such encounters, motor vehicle volume counts, pedestrian crossing counts, bicyclist counts, traffic control devices, and cross-sectional characteristics of the roadway. Upon completion of the data extraction, the data will be prepared for integration with the SPF development to examine how the effects of certain geometric, volume, behavior, and traffic control features affect safety performance.

Various interactions between pedestrian, bicyclists, and motorists are depicted in the screen captures in pictures to the left.
TRCLC 14-8: Big Data Analytics to Aid Developing Livable Communities

Pls: Li Yang, Hyunkeun Cho, and Jun-Seok Oh – Western Michigan University

*We proposed to aggregate transportation data at multiple resolutions and to explore the data at various resolutions to balance between accuracy and speed.*

In transportation, ubiquitous deployment of low-cost sensors combined with powerful computer hardware and high-speed network makes big data available. USDOT defines big data research in transportation as a number of advanced techniques applied to the capture, management and analysis of very large and diverse volumes of data. Data in transportation are usually well organized into tables and are characterized by relatively low dimensionality and yet huge numbers of records. Therefore, big data research in transportation has unique challenges on how to effectively process huge amounts of data records and data streams.

The purpose of this study is to conduct research on the problems caused by large data volume and data streams and to develop applications for data analysis in transportation. To process large number of records efficiently, we have proposed to aggregate the data at multiple resolutions and to explore the data at various resolutions to balance between accuracy and speed. Techniques and algorithms in statistical analysis and data visualization have been developed for efficient data analytics using multiresolution data aggregation. Results will be helpful in setting up a primitive stage towards a rigorous framework for general analytical processing of big data in transportation.

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TRCLC 14-9: Alternatives for Providing a Safe Passage for Non-Motorized Traffic across an Existing Highway Bridge

Pl: Upul Attanayake – Western Michigan University

*A decision-support tool was developed to evaluate possible alternatives for providing a Safe Passage for Non-Motorized Traffic across an Existing Highway Bridge.*

Non-motorized transportation increases mobility choices, relieves congestion, promotes local economy, reduces greenhouse gas emission, promotes a healthy lifestyle, and improves quality of life. Recently, there is an emphasis on developing integrated transportation systems with off-road shared use paths and on-road facilities. A majority of highway bridges that are located on the planned or existing non-motorized paths have become bottlenecks for non-motorized traffic. Therefore, there is a need to evaluate the bridges on non-motorized paths to identify safe passage alternatives to non-motorized traffic. The owner agencies need to have access to a methodological process to evaluate a site for the best possible alternatives and develop accurate cost estimates for funding proposals. As shown in the accompanying chart, five different alternatives for providing a safe passage within a bridge were identified. Also, a decision-support tool was developed using Excel/Visual Basic to evaluate possible alternatives for a given site. This tool is made available to highway agencies through the center website at http://www.wmich.edu/transportationcenter. The tool provides an opportunity for the user to customize the specification/guideline requirements and cost data to adapt them to the business practice of an agency.
Highlighted Projects

TRCLC 14-10: Innovative Park-and-Ride Management for Livable Communities

Pls: Ziqi Song and Kevin Heaslip – Utah State University

An integrated planning framework was developed to strategically locate P&R facilities and optimize transit service frequency.

Since its first introduction in Detroit in the 1930s, Park-and-Ride (P&R) has been recognized as an effective way to promote public transportation and reduce traffic externalities in urban areas. P&R describes an operation in which commuters, traveling by private vehicles, gather at a common site that enables them to transfer to public transportation. P&R management has become increasingly important because the country has been investing more than ever in high-quality transit services. Well-planned and managed P&R facilities are critical to the success of such high-quality transit services. Although the design and operations of P&R facilities have been extensively investigated, there is a lack of theoretically sound guidance for where to locate them, an important aspect of P&R planning.

Dr. Ziqi Song of the Department of Civil and Environmental Engineering at Utah State University (USU) proposed an integrated planning framework to strategically locate P&R facilities and optimize transit service frequency. P&R users’ route choice behavior is explicitly considered and a link-based multimodal user equilibrium model is established. The optimal P&R facility and transit service design problem is formulated as a mathematical program, and an effective solution algorithm is developed. Dr. Song employed a numerical example in a multimodal transportation network and demonstrated that the optimal design shifts commuters from the automobile mode to transit and P&R modes and, hence, improves the net social benefit dramatically.

This study is timely and much needed as many states are expanding their public transportation options dramatically. The proposed modeling framework provides practitioners with an effective tool to determine the optimal locations of P&R facilities as well as transit frequency.

TRCLC 14-11: Travel in Adverse Winter Weather Conditions by Blind Pedestrians

Pl: Dae Kim – Western Michigan University

The roller ball tip was ranked as the most preferred cane tip for visually impaired people to travel on a snow-covered surface.

Winter weather creates many orientation and mobility challenges for people who are visually impaired. Snow cover obscures familiar tactile clues, makes it more difficult to manipulate the long cane, and alters one’s cane-based perception of the surroundings. Getting the cane tip stuck is one of the noticeable challenges when traveling in snow, particularly when the walking surface is covered in deep snow. In this study, we found that cane users experienced significantly more sticking on a snow-covered surface when using the metal glide tip than when they used the roller ball, bundu basher, or marshmallow roller tip. The roller ball tip was ranked as the most preferred cane tip for travel on snow, while the metal glide tip was the least preferred. Cane users may want to consider these results when determining which cane tip to use on a snow-covered surface.
Highlighted Projects

TRCLC 14-12: Capacity Analysis of Pedestrian Facilities Involving Individuals with Disabilities

- PIs: Keith Christensen and Anthony Chen – Utah State University

A probability-based framework was developed to model time headway between different individuals, including people with disability.

Walking facilities must be designed to accommodate the behavior of pedestrians in order to be effective. The heterogeneity of pedestrians is one important factor generally overlooked in walking facility design guidelines. In particular, individuals with disabilities are often overlooked due to lack of available data on their pedestrian behaviors. A controlled, large-scaled walking experiment involving individuals with disabilities was conducted at Utah State University to observe individual pedestrian behaviors in various walking facilities. Using this data a framework was developed to model time headway between these different individuals using a mixed distribution model, and to estimate passageway and bottleneck capacities to identify individuals with disabilities’ influences on capacity estimations. The study’s findings are currently under review for publication and will improve walking facility level-of-service guidelines and best-practices for the design of walking facilities for heterogeneous populations.

TRCLC 15-2: Effect of Cycling Skills on Bicycle Safety and Comfort Associated with Bicycle Infrastructure and Environment

- PIs: Jun-Seok Oh, Kapseong Ro, and Valerian Kwigizile – Western Michigan University

An instrumented probe bicycle (IPB) is designed and constructed in this project to collect necessary motion critical data of a human-bicycle dynamic system.

The level of cycling skills will be determined based on physical characteristics and comprehensive surveys of participating riders, and the correlation between the level of cycling skills and bicycle safety and comfort will be investigated associated with bicycle infrastructure and environment. A tangible analytical model of bicycle dynamics will be developed based on necessary physical principles, and a numerical simulation model will be constructed using the bicycle data specific to the IPB. This research will also develop an instrumentation system for the IPB including a set of design guidelines for the future standalone unit for IPB applications. A structured survey based assessment method will be developed not only to differentiate the level of cycling skills but also the perceptions on bicycle safety and comfort based on trial rides on given bicycle infrastructure. The survey based data will then be compared to the system dynamic data from IPB, and the effect cycling skills on the perceptions on bicycle safety and comfort will be studied.
Highlighted Projects

TRCLC 15-3: Real Time Bicycle Simulation Study of Bicyclists’ Behaviors and their Implication on Safety

*PIs: Valerian Kwigizile, Pavel Ikonomov, and Jun-Seok Oh – Western Michigan University*

This research develops a special 3D space motion platform with attached bicycle, interfaced with virtual reality (VR) simulation and sensors to provide bicyclists with simulation experience closely resembling the real situations. There has been a measurable increase in bicycle use in the United States for both recreational and purposeful trips. As the popularity of bicycles has increased, so has the need to develop methods that can assist transportation engineers and planners in analyzing the performance of bicycle facilities. Understanding how bicyclists interact with other road users is among the imperative needs. This research develops a special 3D space motion platform with attached bicycle, interfaced with virtual reality (VR) simulation and sensors to provide bicyclist with simulation experience closely resembling the real situations. The main goal is to understand behavioral characteristics of bicyclists and pedestrians in different situations and their reaction to changing travel environment. The research will also discern bicyclists and pedestrian risk behaviors (such as not following traffic rules) to understand how they are likely to cause collisions. One of the methods used to collect bicyclist and pedestrian behavior information is with interview questionnaires completed by participants after completion of each simulation run. Another method to investigate the riders’ behavior is based on encephalogram reading using special Brain Computer Interface -Emotiv. The position coordinate in space, time, velocity, turns, force effort, applying breaks, riders’ field and direction of view will be collected and together with all input and output of the VR system, including (virtual) collisions and near miss, will be analyzed to understand riders’ behavior.

TRCLC 15-5: Alternatives for Providing a Safe Passage for Non-Motorized Traffic across an Existing Highway Bridge

*PI: Upul Attanayake – Western Michigan University*

This research is proposed to synthesize infrastructure and technology that can be used to improve access to non-motorized traffic and mobility within cities while enhancing sustainability. Providing access and mobility for key installations and businesses located in cities has become a challenge. This is mainly due to limited public transport and non-motorized facilities. The challenges are significant in cities that are subjected to severe winter weather conditions. Sixty two percent (62%) of millennials indicated that they prefer to live in urban centers, while 74% prefer to live in small cities with improved mobility. Also, 49% prefer to live in walkable, technology-enabled cities where they have affordable and convenient transportation options regardless of the size of the city. Lack of mobility can significantly affect the small and medium size cities economically due to migration of millennials to larger cities around the country. Many cities around the world, ranging from large to small, have utilized infrastructure and technology to promote mobility and sustainability. Understanding the critical need, this research is proposed to synthesize infrastructure and technology that can be used to improve access to non-motorized traffic and mobility within cities while enhancing sustainability. Infrastructure and technology implementation policies, procedure, cost, associated risks, case studies, implementation challenges, and successes and lessons learned will be documented. Bike sharing plan and an implementation example for a small city will be presented. The ultimate goal is to develop a ‘catalog of infrastructure and technology’ that can be used by the city planners to select appropriate infrastructure and technology for a specific city. A few examples documented from various sources are shown in the above left figures.
TRCLC 15-7: App-Based Crowd Sourcing of Bicycle and Pedestrian Conflict Data

Pl: Stephen Mattingly – University of Texas at Arlington

The team is creating an app-based crowdsourcing tool to identify the safety issues encountered by pedestrians and bicyclists.

A collaborative team of researchers from the Department of Civil Engineering, Computer Science and the Department of Public Affairs is using technology to improve the quality of the bicyclist and pedestrian safety data available to local governments. The team is creating an app-based crowdsourcing tool to identify the safety issues encountered by pedestrians and bicyclists. The benefit of the app-based crowdsourcing tool is that it can capture localized and context-sensitive information, such as the nature and types of vehicle conflicts bicyclists and pedestrians encounter, about dangerous road segments. The app captures data on near-miss incidents that occur, i.e. those conflicts that happen but do not result in a collision, which is important because this type of data is not captured in the primary data sources available to local governments. The availability and quality of this data can help local governments better address road and safety conditions. The research team is working closely with bicyclist and pedestrian groups as well as local government officials to gather their input to make sure the app is both easy to use and provides data that can help local governments and agencies identify areas of high safety concern.

TRCLC 15-8: Community-Aware Charging Station Network Design for Electrified Vehicles in Urban Areas: Reducing Congestion, Emissions, Improving Accessibility, and Promoting Walking, Bicycling, and use of Public Transportation

Pl: Ratna Babu Chinnam – Wayne State University

We have developed a stochastic mathematical optimization model to perform network design for EV charging stations while considering various aspects of livability for a community.

The aim of the project is to develop methods, and eventually decision support tools, to aid planning agencies in promoting livability within communities through careful design of charging station networks for electrified vehicles (EVs). We have developed a stochastic mathematical optimization model to perform network design for EV charging stations while considering various aspects of livability for a community. The major components used for the stochastic model include: 1) origin - destination (OD) traffic volume within a community, and the destination information includes parking location, and final destination (office, shopping, restaurant, hospital, etc.) of the drivers, 2) walking behavior of the drivers based on the demographics of a community and final destination of the drivers, 3) arrival pattern of EVs to parking locations, state of charge (SOC) and estimated dwell time, and 4) impact on congestion, pollution, charging rates and other livability indices.

Modeling framework for improving community livability indices and adoption of EVs and charging stations

The project uses data from National Household Travel Survey (NHTS), and extant studies about general walking behaviors/preferences of people. Based on the inputs from major components and user specified parameters from an analyst in a planning agency, the stochastic mathematical model with an objective to maximize the livability indices and adoption of EVs proposes an optimal network for charging stations. Furthermore, pricing schemes are utilized to estimate the return on investments from the proposed network design in a post-optimization analysis. For any further details of the project, please contact Dr. Ratna Babu Chinnam (Ratna.Chinnam@wayne.edu), Wayne State University.
Highlighted Projects

TRCLC 15-10: Development of Multi-Class, Multi-Criteria Bicycle Traffic Assignment Model and Solution Algorithm

Pl: Anthony Chen - Utah State University

The surge in non-motorized mode share in recent years can be credited to municipal efforts to promote alternative transportation. Bicycles are especially popular because of their health, environmental, and economical benefits. However, current practices to model bicycle trips in a network are rudimentary. Existing bicycle network modeling tools are based only on the all-or-nothing (AON) assignment method using single attributes such as distance, safety, or a composite measure of safety multiplied by distance. This research addresses this problem by developing a more user-oriented bicycle traffic assignment model that explicitly considers multiple user classes and multiple criteria affecting cyclist route choice decisions for estimating bicycle volumes on a transportation network.

This research develops a multi-class, multi-criteria bicycle traffic assignment model that not only aims to model different types of cyclists, but also relevant factors that may affect each user class’s behavior in making route choice decisions. The overall procedure for developing the model follows a two-stage process. The first stage develops the multiple objective shortest path problem based on relevant key attributes by generating a set of non-dominated (or efficient) routes based on relevant criteria for each user class. The path-size logit (PSL) stochastic traffic assignment method is then adopted in the second stage to determine the flow allocations in a network. Numerical experiments will be conducted on real networks to demonstrate the two-stage approach for the multi-class, multi-criteria bicycle traffic assignment.

TRCLC 15-11 Development of a New Combined Modal Split and Traffic Assignment Model for Evaluating Transit Oriented Development Strategies

Pls: Anthony Chen and Ziqi Song – Utah State University

Transit oriented development (TOD) has emerged in recent years as a promising paradigm to promote public transportation, increase active transportation usage, mitigate congestion, and alleviate air pollution. Typical TODs share some core features: moderate- to high-density development, mixed land use, and high-quality transit services. Studies have shown that travelers’ mode choice behavior is heavily influenced by alternatives that are available to them. Failing to consider differences in feasible travel options available to different groups of travelers may lead to inaccurate representations of travelers’ mode choice behavior. For example, captive travelers have no choice but to rely on one specific travel mode due to limited mode accessibility/availability. In addition, route overlapping is one of the major concerns in the route choice models used in the traffic assignment problem for predicting traffic pattern in the transportation network. Therefore, it is critically important to develop a better behavioral model to predict the modes and routes that trips will take, resulting in traffic forecasts for the highway system and ridership forecast for the transit system.

Dr. Anthony Chen and Dr. Ziqi Song of the Department of Civil and Environmental Engineering at Utah State University (USU) are developing a new combined modal split and traffic assignment (CMSTA) problem that explicitly considers captive travelers in mode choice and route overlapping in route choice under congested networks. This new model has the potential to enhance the realism of modeling of captive travelers, and to assist in quantitatively evaluating the effectiveness of TOD strategies.

Results from this research are expected to help State Department of Transportation (DOTs), Metropolitan Planning Organizations (MPOs), and transit agencies in evaluating the effectiveness of TOD strategies for their communities, and prioritizing public resources to achieve the planning goals of a region to promote green transportation and livable communities.
TRCLC 15-12: Analysis of Walking Facility Performance Guidelines for Individuals with Disabilities

PI: Keith Christensen – Utah State University

Walking facilities are important infrastructure in a community's transportation systems. It is imperative to design and evaluate the effectiveness of these facilities to meet the walking needs of diverse pedestrian groups, including individuals with disabilities who represent a significant number of the population. The Highway Capacity Manual (HCM) defines walking facility performance using a qualitative measure describing operational conditions, or level of service (LOS). However, pedestrian LOS thresholds do not account for bi-directional flows, pedestrian/environment spacing, or heterogeneous pedestrian characteristics as there is little research on diverse pedestrians' walking behavior. As a result, how closely pedestrian LOS thresholds correspond to actual conditions have been shown to be inaccurate.

The purpose of this study is to compare individuals with disabilities' perceptions of quality of service and observed walking behavior with existing walking facility guidelines. The results will improve the guidelines used to assess walking facility performance, ultimately improving the design of walking facilities for heterogeneous populations which include individuals with disabilities.

TRCLC 15-13 Exploring Bicycle Route Choice Behavior with Space Syntax Analysis

PIs: Ziqi Song and Anthony Chen – Utah State University

Cycling provides an environmentally friendly alternative mode of transportation. It improves urban mobility, livability and public health, and it also helps with reducing traffic congestion and emissions. Although the mode share of bicycle accounts for a relatively small percentage of all trips taken in the United States, cycling is gaining popularity both as a recreational activity and a means of transportation. Therefore, to better serve and promote bicycle transportation, there is an acute need to understand the route choice behavior of cyclists.

Compared to the route choice model for private motorized vehicles, route choice behavior for bicycles is much more complex as there are many influential factors affecting cyclists’ route choice decisions. Empirical studies on bicycle route choice analysis indicate that cyclists choose routes based on a number of criteria that may include distance, number of intersections, road grade, bicycle facility, and safety. Nevertheless, existing studies tend to be based on observable quantities associated with the street segments themselves, but overlook a fundamental issue, travelers’ cognitive understanding of the street network topology. Space syntax theory is a spatial analysis technique that is based on human cognition and behavior. It focuses on the topological relationship of the network rather than physical distance. This theory has been used by architects and urban planners to model a wide range of traffic flow patterns, especially pedestrian flow.

Dr. Ziqi Song and Dr. Anthony Chen of the Department of Civil and Environmental Engineering at Utah State University (USU) are conducting an exploratory study with the goal of understanding cyclists’ route choice decisions and evaluating the applicability of the space syntax theory in the context of bicycle route choice.

Results from this research are expected to help state Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) in understanding and forecasting cyclists’ route choice behavior. It will also provide them a tool to evaluate the impact of different designs and planning scenarios of bicycle facilities, e.g., bicycle lane, on cyclists. Ultimately, the study will help transportation agencies better serve and promote bicycle transportation, and thus achieve more livable communities by encouraging the use of green transportation.
Technology Transfer and Outreach Activities

TRCLC Holds 2nd Summer Conference on Livable Communities

The Transportation Research Center for Livable Communities (TRCLC) held the 2nd Summer Conference on Livable Communities July 23-24, 2015, at Western Michigan University in Kalamazoo, Michigan. This conference brought together more than 80 transportation researchers, practitioners, and public agencies from around Michigan and the country to share current practices, ongoing research projects, and interesting ideas regarding transportation and livable communities.

During this event, 21 podium presentations and 13 poster presentations were made, which covered topics pertaining to non-motorized transportation, transportation services for people with disabilities, transportation and human health, transportation data crowdsourcing, visualization, and big data analytics. Dr. Jennifer Dill, director of the National Institute for Transportation and Communities at Portland State University gave a keynote speech that highlighted the findings that can increase bicycle usage for everyday transportation. Student best poster awards and PE credits were offered in this conference.

Mobile App Showcase

The Transportation Research Center for Livable Communities (TRCLC) at Western Michigan University invited high-school students to participate in the 1st Livable and Sustainable Community Mobile App Challenge, which aims to address the nation’s critical transportation challenges through the prism of livable communities. The participating high school teams designed and developed mobile applications that help to improve sustainable transportation options for communities in Michigan with special attention paid to non-motorized travel, public transit, traffic safety, energy saving, safe routes to school and “smart” transport technologies.

Two groups of students from Portage Central High School were awarded the Winners of the Mobile App Challenge. The winning teams received awarding certificates and cash prizes ($1000 for first place; $500 for second place).

- **First place team: Kzoo Biking Buddy**

- **Second place team: Plug and Go (Electric Car Charging Solution)**

The 2nd Livable and Sustainable Community Mobile App Challenge is under way and TRCLC is soliciting mobile app ideas from Michigan high school students.
The Transportation Research Center for Livable Communities (TRCLC) Seminar Series brings leading local, national, and international researchers to a public forum at TRCLC to speak about the latest advances in transportation planning. The Series helps advance TRCLC’s workforce development and technology transfer objectives by giving students, professionals and researchers an opportunity to hear from and interact with experts in their fields. It is free and open to the public.

R. Jayakrishnan, Ph.D., Professor, Department of Civil and Environmental Engineering & Institute of Transportation Studies, University of California at Irvine.

“Peer-to-Peer Sharing of Supply in Transportation: Possibilities and Algorithms.”

Newer technologies and high market penetration of personal communication systems bring up many new possibilities for different paradigms of operation in transportation systems. The users can consume transportation supply with more complete information and significantly more peer-to-peer (P2P) communication. Several possibilities exist in such a world of shared economy, with regard to using road and vehicle space in a temporally efficient manner. Car-sharing and ride-sharing are two of the more well-known systems in this regard. Autonomous vehicles bring up another dimension in terms of shared ownership as well. There are also possibilities in using P2P communication for collaborative, competitive or negotiated consumption of other elements of transportation supply such as signal timings and lane space availability. This presentation focuses on the possibilities, and discusses recent research into shared-ride systems for passenger transport and auction-based mechanisms for signal and lane usage. The presentation also lays out newer frameworks for supply, demand, and performance of transportation systems under these new paradigms and discusses algorithmic and mechanism-based details in solving real-world problems in ride-sharing and signal systems.

International Collaboration

TRCLC agreed with the Center for Medical Humanities and Convergent Contents at Ajou University, South Korea, to establish a formal linkage to foster international cooperation in education and research on February 26, 2016.

Technology Transfer and Outreach Activities

TRCLC - Great Lakes International Symposium

TRCLC sponsored the “Great Lakes International Symposium: Interdisciplinary Research in Data Science” together with the Department of Statistics. This event was held on February 26, 2016 at the Fetzer Center, Western Michigan University. Seven invited speakers from various areas presented their data needs and analysis techniques. The symposium sheds light on future research needs and multidisciplinary collaborations. Student research posters were exhibited during this event.

Seminar Series

The Transportation Research Center for Livable Communities (TRCLC) Seminar Series brings leading local, national, and international researchers to a public forum at TRCLC to speak about the latest advances in transportation planning. The Series helps advance TRCLC’s workforce development and technology transfer objectives by giving students, professionals and researchers an opportunity to hear from and interact with experts in their fields. It is free and open to the public.

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A bicycle is a promising human-powered and emission-free transportation mode to address growing transportation and environmental problems. Bike-friendly environments should be constructed to innovatively increase the use of bicycles as a significant transportation mode. From this perspective, the scientific and effective monitoring of bicycling environments is of keen interest. An important technical challenge for monitoring is to evaluate the performance of bicycling environments. This study proposes a novel monitoring method that can be used for evaluating bicycle performance in terms of safety and mobility. An instrumented probe bicycle (IPB), which is equipped with a set of sensors including a global positioning systems (GPS) receiver, accelerometer, and gyro sensor, was used to develop the proposed monitoring method. The IPB provides useful bicycle maneuvering data for identifying longitudinal, lateral, and vertical maneuverings of the bicycle, which are affected by environmental factors such as heavy vehicle volume, surface conditions, grade, crossings, humps and curbs. Regarding safety monitoring, an index to predict bicyclists’ perceived safety and comfort with the predictors derived from the measurements by the IPB was developed. A questionnaire survey was conducted to obtain actual responses from bicyclists for perceived safety and comfort during the field experiment. In addition, a method to evaluate the bicycle mobility using GPS speed data was devised. Then, a fault tree analysis (FTA) technique, which is a well-known technique for risk analysis, was adopted to integrate safety and mobility monitoring. As a result, the bicycling monitoring index (BMI) was proposed. Data obtained from the proposed method will be useful in developing various bicycle-related policies.
Keechoo Choi, Ph.D., Director of Transportation Research Center and Professor of Transportation Systems Engineering, Ajou University, Korea

“Transit-Oriented Development with High-Speed Urban Express Railway System.”

This study presents the recent development of a high-speed urban railway system in conjunction with the transit-oriented development (TOD) in Korea. The system, called GTX (Gyeonggi Train Express), will run between a new town and Seoul downtown at a commercial speed of 100 km per hour. Three parameters of TOD, such as density, diversity and design, are dependent on the speed of the GTX system. This study not only addresses design issues associated with the transit-oriented development, but also compares and contrasts the TOD system with those of foreign countries. Some limitations and future agenda will be addressed in this presentation.

Byungkyu Brian Park, Ph.D., Professor, Department of Civil and Environmental Engineering, University of Virginia

“Algorithms and Assessment Tools for Connected and Automated Vehicles.”

Connected Vehicle (CV) technology and automated vehicles have emerged and are expected to provide unprecedented improvements in mobility. This talk will present two algorithms developed for connected and/or automated vehicle applications. The first algorithm focuses on cooperative vehicle intersection control (CVIC) and its implementation at a corridor with multiple intersections. It evaluates sustainability aspects of the Cooperative Vehicle Intersection Control (CVIC) system by applying surrogate safety assessment model (SSAM) and VT-Micro model to measure safety and environmental impacts, respectively. A simulation-based case study is performed on a hypothetical arterial consisting of four intersections with eight traffic congestion cases covering low to high volume conditions. When compared to the coordinated actuated control, the CVIC system outperforms the existing actuated control. The second algorithm deals with speed harmonization for automated vehicles. The objective function is to minimize changes in accelerations while maintaining safe distance. An example case study on a freeway basic segment with a speed reduction zone indicated that the proposed algorithm outperforms the base case. Additional discussion on the use of connected and automated vehicles evaluation tools assessing (i) latencies in connected vehicle communications and (ii) surrogate safety under connected and automated vehicle applications, are to be made if time permits.
**Student Awards**

**WMU graduate student Lusanni Acosta received a 2015 Institute of Transportation Engineers (ITE) Scholarship.**

Lusanni Acosta, a graduate student in transportation engineering, was one of four winners of a $3,000 scholarship from the Michigan section of the Institute of Transportation Engineers. Scholarships were for both undergraduate and graduate students. Applicants had to submit a paper titled “My Future in Transportation,” describing their goals in the transportation field as well as their potential contributions to the area.

When asked what winning the scholarship meant to her Acosta said, “I am very proud of the academic institution I attend, Western Michigan University, and it is an honor to represent it with this award. For me this scholarship not only helps in alleviating my academic expenses but in confirming, strengthening and building more confidently my path in transportation engineering.”

**WMU graduate student Richard Boateng took first place in the ITE Great Lakes District Student Paper Competition for the paper titled “Evaluating the effectiveness of countdown pedestrian signals on the safety of the older drivers in the state of Michigan.”**

For this achievement, Richard was awarded $1,000 and a certificate of achievement. His paper was also forwarded to International ITE for consideration in the 2015 Daniel B. Fambro Student Paper Award. Richard is currently working on the association of Michigan’s older adult crashes with roadway features, which is sponsored by Michigan DOT.

Richard is expected to complete his master’s studies in April 2016 with his master thesis titled “Comprehensive Evaluation of the Effectiveness of Pedestrian Countdown Signals on Drivers and Pedestrians.”

**Matthew L. Clark received the “24th Annual Outstanding Student of the Year Awards” sponsored by USDOT.**

Matt has shown outstanding performance in his research. He led a research project on the cost and benefit of intelligent transportation systems. In this research, Matthew successfully constructed a spatial database in ArcGIS relating freeway segments with ITS device locations and operation dates, traffic data, NAVTEQ’s minute-by-minute travel time data, police-reported accident frequency, and incidents reported by traffic operation centers. The database was utilized to perform statistical modeling and analysis on the benefits of ITS regarding freeway incident management, as well as other ongoing research projects at the TRCLC. Additionally, through traffic microsimulation models, Matthew depicted the impact of ITS devices on freeway incident management and presented his work at the 2014 Michigan ITE Technical Session in October. Matthew presented his research paper, “Perception of Advanced Traveler Information by Active Users,” at the 2015 TRB annual meeting.

**Brenda C. Burdick received the “25th Annual Outstanding Student of the Year Awards” sponsored by USDOT.**

Brenda Burdick is a graduate student at Western Michigan University and will graduate in December 2016 with a master's degree in civil engineering, majoring in transportation engineering. Brenda is currently working as a graduate research assistant in WMU’s Transportation Research Center for Livable Communities (TRCLC) as well as a graduate teaching assistant in the Department of Civil and Construction Engineering. As an undergraduate student, Brenda was accepted into the accelerated degree program to pursue her master’s at WMU. Brenda’s academic achievements also have been recognized by various organizations. This past year, Brenda was awarded a scholarship from the ITE Michigan section as well as the Sharon D. Banks Memorial Undergraduate Scholarship from the Women in Transportation Foundation. As a master's student, she has shown outstanding performance in her research. Last year, Brenda assisted in a research project pertaining to engineering improvements and their effect on older drivers. The research was funded by the Michigan Department of Transportation. Also, she has been working on another research project funded by the Michigan Office of Highway Safety Planning to analyze overtime traffic enforcement performance of law enforcement agencies. Currently, she is leading a research project focusing on analyzing pedestrian and bicycle crashes in Michigan to determine potential countermeasures.
TRCLC hosts the Summer Conference on Livable Communities, June 21-22, 2016

The TRCLC is hosting its 3rd Annual Summer Conference on Livable Communities June 21-22, 2016 at Western Michigan University in Kalamazoo, Michigan. Transportation researchers, practitioners, and public agencies are invited to attend this event to share their ideas and thoughts by presenting research findings related to transportation and livable communities. This year’s theme is “Multi-modal and Non-Motorized Transportation for Various Users.” Please refer to our center website (http://www.wmich.edu/transportationcenter) for updates on this event. Topics in the conference include:

- Non-motorized transportation promotion and safety
- Transportation services for elderly and people with disabilities
- Impact of transportation on human health
- Enhancing public transit services
- Transportation services for livable communities

TRCLC hosts the International Workshop on Sustainable Transportation Systems together with Tongji University, Hong Kong Polytechnic University and Ajou University, July 5, 2016

International Workshop on Sustainable Transportation Systems will be held on July 5, 2016, Lecture Hall 103, School of Transportation Engineering Building, Tongji University (Jiading Campus). This workshop will provide a platform for communication among experts and scholars in transportation science and technology from China, Korea and the U.S. It will be a unique opportunity for the participants to keep up-to-date with research on sustainable transportation systems and the latest progress in the world.

- Non-motorized transportation (walk and/or bicycle)
- Public transportation systems
- Travel demand forecasting modeling
- Transit-oriented development (TOD) research
- Other topics on sustainable transportation systems

TRCLC sponsors the Symposium: Meeting the Challenges of Safe Transportation in an Aging Society together with ATLAS and ASAP, September 14-15, 2016

The call for presentations is now open for the Conference on Meeting the Challenges of Safe Transportation in an Aging Society, to be held in Ann Arbor, Michigan on September 14-15, 2016. The conference is sponsored by: Center for Advancing Transportation Leadership and Safety (ATLAS Center), University of Michigan Transportation Research Institute (UMTRI), Elsevier Ltd, Center for Accessibility and Safety for an Aging Population (ASAP), and Transportation Research Center for Livable Communities (TRCLC). Topics of special interest include but are not limited to: advanced technologies including autonomous and connected vehicles; infrastructure and engineering countermeasures; licensing and other policy issues; health-related challenges; training; and driver assessment. Research should focus on older adults themselves, the modes of transportation they use, or the roadway environment within which they function. Students are encouraged to submit for a student poster session and awards will be given. See the following URL for more information: http://www.atlas-center.org/symposium-call-for-presentation-abstracts/.
Visit The Transportation Research Center on Livable Communities website at wmich.edu/transportationcenter, for more information including the center’s objectives, purposes, and functions.

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