Program Progress Performance Report
for University Transportation Center

Submitted to: U.S. Department of Transportation
Office of the Assistant Secretary for Research
and Technology (OST-R)

Grant Number: DTRT13-G-UTC60

Project Title: University Transportation Centers
Transportation Research Center for Livable
Communities (TRCLC)

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Submitting Official: Same as Program Director

Submission Date: April 30, 2018

DUNS and EIN: 622364479 / 386007327

Recipient Account Number: 25-7020240

Recipient Organization: Western Michigan University
1903 West Michigan Avenue
Kalamazoo, MI 49008

Project/Grant Period: September 30, 2013 – September 30, 2019

Reporting Period End Date: March 31, 2018

Report Term or Frequency: Semianual

Signature of Submitting Official: [Signature]
1 ACCOMPLISHMENTS

1.1 What are the major goals and objectives of the program?

The TRCLC addresses five USDOT strategic goals through the prism of Livable Communities. The Center’s primary focus is to help developing communities that provide people with access to affordable and environmentally sustainable transportation through coordination between transportation, housing, and commercial development. In particular, the Center will concentrate on “bringing technological advances to aid the development of livable communities” by coordinating efforts among faculty in associated fields at five universities to collectively enable livable communities through transportation research.

Research
Livable communities are where people can enjoy their daily lives without having to drive their car. Toward this end, the TRCLC focuses on three research objectives:
- improving public transit systems and alternative transportation modes,
- providing better and safer pedestrian and bicycle networks, and
- enhancing transportation accessibility for children, people with disabilities, older adults, and lower income populations.

Education and Workforce Development
The TRCLC consortium will create opportunities for learning and knowledge sharing through a comprehensive education and workforce development program based on a lifecycle of occupational development approach that emphasizes K-12 outreach, career-oriented higher education and professional development. Our program goals are to:
1) Develop activities for teachers, counselors, administrators and students in K-12 schools to enhance awareness of the forms and functions of transportation systems.
2) Develop career-oriented higher educational programs that combine multidisciplinary course work, experiential education, participative research and industry-university partnerships
3) Create programs for professional development on a broad range of transportation topics geared to the needs of decision-makers, transportation officials, community members and professional staff.

Technology Transfer
The Center’s technology transfer program will leverage and extend our existing activities as well as build new capacity to achieve the following inter-related goals:
1) to formalize a widely distributed and multi-format knowledge-sharing infrastructure, and
2) to create opportunities for context-sensitive problem identification and participatory research.
**Collaboration**
Our primary collaborative goal is: to develop capacities to identify, cultivate and sustain inter-disciplinary and inter-sectoral partnerships in order to meaningfully frame and address transportation problems that stifle the development of livable communities.

**Diversity**
Our goal for diversity is to outreach to underrepresented groups, low income communities, and diverse disciplines and partners.

### 1.1 What was accomplished under these goals?

**Research**

**Status of Research Projects**

- Four projects funded during the 2nd funding cycle were completed.

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Title</th>
<th>Institution</th>
<th>PI</th>
</tr>
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<tbody>
<tr>
<td>16-02</td>
<td>Enhancing Non-motorized Mobility within Construction Zones</td>
<td>WMU</td>
<td>Attanayake</td>
</tr>
<tr>
<td>16-07</td>
<td>Blame-the-Victim Policy Narratives and Local-Level Transportation Policy Decisions</td>
<td>UTA</td>
<td>Casey</td>
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<td>16-08</td>
<td>Does Location Matter? Performance Analysis of the Affordable Housing Programs in Dallas Fort Worth Metropolis</td>
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- Seven projects funded during the 2nd funding cycle are on-going

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<tr>
<td>16-01</td>
<td>Paths to ADA-Compliance: The Performance and Cost Efficiency of measurement Technologies that Support ADA-Mandated, Self-Evaluations of Pedestrian Rights of Way</td>
<td>WMU</td>
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<td>16-03</td>
<td>The Effects of High Visibility Enforcement on Driver compliance to the Drivers yielding to Pedestrians in Crosswalks: Changing the Driving culture on a Citywide Basis</td>
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<td>16-04</td>
<td>Effectiveness of Bicycle Signals for Improving Safety and Multimodal Mobility at Urban Intersections</td>
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<td>16-05</td>
<td>Travel Behavior of Blind Individuals before and after receiving Orientation and Mobility Training (Phase 2: Full-scale Study)</td>
<td>WMU</td>
<td>Kim</td>
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</tbody>
</table>
**Vehicle-to-Device (V2D) Communications: Readiness of the Technology and Potential Applications for People with Disability**

**WMU**  
**Al-Fuqaha**

**Transportation Mobility Among Low-Income, Transportation Disadvantaged Older Adults Living in a Low Density Urban Environment using Innovative Data Collection Methods**

**UTA**  
**Fields**

**A Constraint-Based Bicycle Origin-Destination Estimation Procedure**

**USU**  
**Song**

- Eleven research projects funded for the 4th funding cycle are on-going.

<table>
<thead>
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<td>16-06</td>
<td>Vehicle-to-Device (V2D) Communications: Readiness of the Technology and Potential Applications for People with Disability</td>
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<td>Transportation Mobility Among Low-Income, Transportation Disadvantaged Older Adults Living in a Low Density Urban Environment using Innovative Data Collection Methods</td>
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<td>A Constraint-Based Bicycle Origin-Destination Estimation Procedure</td>
<td>USU</td>
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<tr>
<td>17-1</td>
<td>An Intersection Database Enhances Blind Pedestrians’ Access to Complex Signalized Intersections: Stage 2 Analysis &amp; Database Development</td>
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<td>17-2</td>
<td>Developing the Model and Environment for Evaluating Rid Quality of Cyclists</td>
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<td>Attanayake</td>
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<td>17-3</td>
<td>Integrating Crowdsourced Data with Traditionally Collected Data to Enhance Estimation of Bicycle Exposure Measure.</td>
<td>WMU</td>
<td>Kwigizile</td>
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<td>17-4</td>
<td>Monitoring Daily Activities and Linking Physical Activities Levels Attributed to Transportation Mobility Choices and Built Environment</td>
<td>WMU</td>
<td>Oh</td>
</tr>
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<td>17-5</td>
<td>Effects of Safe Bicycling Passing Laws on Diver’s Behavior and Bicyclists’ Safety</td>
<td>WMU</td>
<td>Van Houten</td>
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<td>17-6</td>
<td>Public vs Private Transportation Network Accessibility and Maternal-Infant Health Outcomes Across the Urban-Rural Boundary in Kalamazoo County, Michigan</td>
<td>WMU</td>
<td>Baker</td>
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<tr>
<td>17-7</td>
<td>Charging Station Network Designed for Electrified Vehicles in Urban Communities: Reducing Congestion, Emissions, Improving Accessibility, and Promoting Walking, Bicycling, and use of Public Transportation.</td>
<td>WSU</td>
<td>Venkatachalam</td>
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<tr>
<td>17-8</td>
<td>Transportation Access and Individuals with Disabilities' Community Integration</td>
<td>USU</td>
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<tr>
<td>17-9</td>
<td>Assessing the Impact of Air Pollution on Public Health Along Transit Routes</td>
<td>UTA</td>
<td>Mattingly</td>
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<tr>
<td>17-10</td>
<td>Simulating the Impact of Traffic Calming Strategies</td>
<td>TSU</td>
<td>Chimba</td>
</tr>
<tr>
<td>17-11</td>
<td>Evaluation of Transit Priority Treatments in Tennessee</td>
<td>TSU</td>
<td>Chimba</td>
</tr>
</tbody>
</table>

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Research Efforts at WMU

- Developed methodology processing LiDAR data (TRCLC 16-1)
- Submitted the final report and completed the project (TRCLC 16-2)
- Media campaign plan for behavioural modification is set for implementation (TRCLC 16-3)
- VISSIM simulation model analysis was done for bike signal scenarios (TRCLC 16-4)
- Data collection for the travel behavior of blind individuals study is currently in progress (TRCLC 16-5)
- Smart work zone simulations completed (TRCLC 16-6)
- Discussed how to restructure the database for analyses, what research questions to answer, and how to determine writing assignments (TRCLC 17-1)
- Successfully developed a bicycle model using ADAMS software and evaluated against fundamental principles and simulated bicycle movement at constant and variable speeds and evaluated stability (TRCLC 17-2)
- A survey of Michigan cities were completed and bike volume data was obtained from agencies (TRCLC 17-3)
- Developed an app to process daily activity and fitness activity and sample data were collected (TRCLC 17-4)
- A survey in four cities were completed and a data collection system on bike was developed (TRCLC 17-5)
- Multimodal accessibility metrics were developed in Kalamazoo County for hospital emergency room, urgent/prompt care, pediatric, obstetric/gynecological, and Family Health Center services. (TRCLC 17-6)

Research Efforts at UTA

- Completed two research projects during the period (TRCLC 16-7 and 16-8)
- App development completed and field test largely complete (TRCLC 16-9)
- Participated in the DFW Federal Statistical Research Data Center Workshop at the Federal Reserve Bank of Dallas and preparing methodology for performing the exposure level modeling. (TRCLC 17-9)

Research Efforts at USU

- Developed a constraint-based bicycle O-D estimation procedure and analyzed bicycle data collected to prepare for a case study (TRCLC 16-10)
- Initial development of an Index of Transportation Provision (IPTP) and preliminary development of an Index of Transportation Need (ITN) (TRCLC 17-8)

Research Efforts at TSU

- Final report was submitted and the project completed (TRCLC 16-11)
• Select Traffic Calming Study locations and set up VISSIM model along the study locations (TRCLC 17-10)
• Building Transit Priority VISSIM Model along the corridor (TRCLC 17-10)

Research Efforts at WSU
• Conducted a series of meetings with SEMCOG to provide details and obtain data and collected multiple data sets from SEMCOG (TRCLC 17-7)
• Design and integration of choice modelling for EV drivers to study their behavioral pattern

Education and Workforce Development
• Three graduate students completed their mini student research and submitted their final reports.
  o The Effects of Distance from Crosswalk and Offset Placement of a Gateway In-Street Sign Configuration on Yielding to Pedestrians on Multilane Roads at an Uncontrolled Crosswalk, Jonathan Hochmuth, Psychology, WMU
  o Drive-time versus Bike-time based Geospatial Model for Optimizing Healthcare Center Locations, Bandhan Dutta, Geography, WMU
  o Wayfinding for Visually Impaired People using Semi-supervised Deep Reinforcement Learning, Mehdi Mohammadi, Computer Science, WMU
• WMU conducts training sessions to prepare students to take the American Concrete Institute (ACI) – Field Technician Grade I Certification. So far, 88 students have been trained through this program. This is relevant to the research center theme since these students will work in the local communities to ensure quality of concrete walkways and trails built for non-motorized traffic.
• Training students in the use of Open Street Map to further the development of TRCLC-initiated methods for multi-modal accessibility and metrics applicable to healthcare
• Coordinated and funded student travel to TRB 2018 annual meeting and eight WMU graduate students attended this year’s TRB.
• UTA included 48 undergraduate students in App Field Test.
• WSU faculty and Student travel and participation in INFORMS annual conferences

Technology Transfer
• TRCLC researchers participated in the TRB annual meeting and other conferences and presented research outcomes.
• Research reports and outcomes were disseminated through e-mail, homepage, and social network media (Facebook).
• Conducted a workshop on Modeling of Highway Bridges with Carbon Fiber Composite Cable (CFCC) Prestressed Girders to train MDOT engineers on March 07, 2018
• A WMU faculty organized IABMAS 2018 Special Session: Recent Advances in Bridge Design and Construction, Melbourne, Australia, 2018.
• A WMU faculty organized the Special Session on Bridge Design and Maintenance, the ICSECM 2017, Kandy, Sri Lanka, December 07 – 09, 2017.
• TRCLC members presented at the Discovery Symposium on Mobility at the WMU Spring Convocation Discovery Symposia
• WSU provided data analysis tools for SEMCOG

Collaboration
• Collaborated with the City of Grand Rapids for a bicycle-related research. The city will install bike signals and bike boxes at two intersections for the research project.
• Collaborated with the City of Ann Arbor to study on pedestrian education and safety.
• Collaborations between WMU and Purdue University, University of Nebraska Lincoln the City University of New York on transportation-related data science research
• UTA members developed a collaborative research proposal between the UTA School of Social Work and Civil Engineering.
• Collaborated with DePaul University’s Chaddick Institute for Metropolitan Development.
• Ongoing collaboration with Kalamazoo County Health and Community Services with regard to Maternal and Infant Health project
• Ongoing collaboration with WMed (Homer Stryker Medical School of Medicine) with regard to pediatrician accessibility (Maternal and Infant Health project)
• Begin collaboration with Loaves and Fishes, a local ‘food bank plus’ regarding summer food service locations for children and teens in poverty (Maternal and Infant Health project)
• Begin collaboration discussions with local EMS regarding optimization of services
• Collaborated with Accessible Design for the Blind and Kittelson & Associate, Inc.
• WSU Collaboration with faculty at ‘School of social work’ to study the behavioral aspects of EV drivers with respect to EV network design

Diversity
• UTA is still a Hispanic-serving Institution, and TSU is one of Historically Black Colleges and Universities.
• Five female graduate students participated in WMU research projects; one of the students is Hispanic, and one of them is African American.
• Female faculty members are PIs of TRCLC projects: one project from WMU, two research projects from UTA
• Five African American graduate students and two female students are participating in TSU’s TRCLC projects.
1.2 What opportunities for training and professional development has the program provided?

- TRCLC researchers presented their work at the Mobility Symposium at the Convocation Symposia.
- Conducted a workshop on Modeling of Highway Bridges with Carbon Fiber Composite Cable (CFCC) Prestressed Girders to train MDOT engineers on March 07, 2018.
- Multiple CS and CCE students were trained on designing end-to-end solutions in support of smart transportation infrastructure.
- Made presentations, shared project details and results to date with SEMCOG.

1.3 How have the results been disseminated?

- TRCLC news and information continue to be disseminated through e-mails, center website, and Facebook (www.facebook.com/TRCLC).
- TRCLC reports and newsletters were electronically disseminated to related agencies.
- TRCLC researchers presented their work at various conferences and meetings with agencies.

1.4 What do you plan to do during the next period to accomplish the goals and objectives?

Research

- Select projects to fund multiple mini grants as a part of the 5th funding cycle.
- Complete the research aimed at changing the driving culture in the city of Ann Arbor to increase driver yielding to pedestrians in crosswalks.
- Complete the mobile app for travel and physical activity data and begin data collection.
- Collect data for drivers’ passing behavior for bicyclists.
- Complete bicycle simulation models.
- Analyze roadway infrastructure features to examine ADA compliance data using various sensors.
- Complete microscopic simulation analyses for traffic calming.
- Complete microscopic simulation analyses for bicycle signal analysis.
- Conduct simulation and experimental studies to study the performance of V2D technologies.
- Showcase scenarios that illustrate the need for interoperation between the DSRC and ISM frequency bands.
- Model development and analysis of results.
- Integrate choice model within EV network configuration framework.
- Meetings with SEMCOG to validate the approach.
- Validation of model results with planners and behavioral research consultant.
**Education and Workforce Development**
- Continue offering guest speaker series to provide education opportunities for graduate students and to provide skills and knowledge for local professionals.
- The 5th Annual Summer Conference scheduled on June 21 – 22 will provide an opportunity for students to present their research through poster presentations and to meet other professionals.
- Provide field trip and field training opportunities to undergraduate and graduate students in CCE Department and other departments at Western Michigan University.
- Try to explore mentorship programs which allow external professionals and experts take selected student mentees to have conversation on a regular basis.
- Incorporate the research results into educational resources for courses at WMU.
- Begin development of course materials for introducing transportation concepts into social work curriculum.
- Conduct a training session to prepare students to take the American Concrete Institute (ACI) – Field Technician Grade I Certification.
- Share project details with SEMCOG.
- Student participation and presentations at INFORMS, TRB, and TRCLC Conferences.

**Technology Transfer**
- Center research partners will present findings at its 5th Annual Summer Conference in June 21-22 in Kalamazoo.
- Participate in the Road Safety in Five Continent Conference and introduce TRCLC’s research efforts.
- Disseminate newsletters through e-mails, social network media and the center’s website.
- Organize technological expos during the summer conferences to showcase the different technologies developed and seek collaborations in applying them.
- Continue to provide news and information through the Utah Transportation Center website (http://transportation.usu.edu).

**Collaboration**
- Build international collaboration network with Korea Railroad Research Institute, Korea Transport Institute in Korea, and Southwest Jiaotong University in China.

**Diversity**
- Recruit more female and minority faculty and students to work on TRCLC projects.
- Encourage students affiliated with the center to apply to the Dwight David Eisenhower Transportation Fellowship Program (DDETFP) for the Hispanic Serving Institutions Fellowship.
- Collaborate with other disciplines including School of Social Work.
2 PRODUCTS

2.1 Publications, conference papers, and presentations

Publications.


Conference Papers
• [WMU] B. Qolomany, A. Al-Fuqaha, D. Benhaddou, A. Gupta , “Role of Deep LSTM Neural Networks And Wi-Fi Networks in Support of Occupancy Prediction in Smart Buildings," The 15th IEEE International Conference on Smart City (SmartCity 2017), Bangkok, Thailand, December 18-20, 2017
• [TSU] Sotonye Ikiriko and Deo Chimba. The role of Transit Signal Priority (TSP) to Community Travel Mode Choice Behavior. Presented at the Association of Social and Behavioral Scientists (ASBS), Nashville, TN on March 7-10, 2018.

Presentations


2.2 Website or other Internet sites

• TRCLC disseminates information and relevant news via TRCLC website and the TRCLC Facebook page
  o Website – www.wmich.edu/transportationcenter
  o Facebook – www.facebook.com/TRCLC

2.3 Technologies and techniques

• Developed an assess to HERE data for mobile application through API
• Developed an automated data processing system for ADA compliance investigation
• Developed a bicycle data collection system to measure passing vehicles using LiDAR
Transportation Research Center for Livable Communities

TRCLC researchers are carrying out research via a range of novel technologies and techniques including mobile applications, cloud computing and IEEE 802.11p (WAVE)

Developed a mobile app to collect travel activity and physical activity integrating wearable devices

Two-stage stochastic model to integrate choice-models for EV network infrastructure

2.4 Inventions, patent applications, and/or licenses

An Intellectual Property (IP) disclosure has been submitted to the Office Of Vice President for Research (OVPR). The disclosure details a Smart White Cane (i-Cane) that helps the Blind and Visually Impaired (BVI) cross wide intersections. The OVPR office is considering filing a patent based on the disclosed technology.

2.5 Other products

Mobile application and associated infrastructure to report and monitor risk factors on public infrastructure.

Prototype and associated infrastructure to assess the efficacy of a Smart White Cane.

Prototype and associated infrastructure to assess the efficacy of a Smart construction cone.

Mobile application and associated infrastructure to track the association between transportation and physical activities.

3 PARTICIPANT & COLLABORATING ORGANIZATIONS

3.1 What organizations have been involved as partners?

<table>
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<th>Organization Name</th>
<th>Type / Location</th>
<th>Partner’s contribution</th>
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<td>Kalamazoo Area Transportation Study</td>
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List of Research Projects from Other Partners

- [WMU] “Bridge Structural Analyses for Staged Construction and Constructability Reviews”, Michigan Department of Transportation (MDOT), $271,683, October 2016–June 2018
- [UTA] “Dallas-Fort Worth Regional Assessment of Fair Housing,” City of Dallas, $914,231, January 2017- January 2018
- [UTA] “Transportation Mobility Among Low-Income, Transportation Disadvantaged Older Adults Living in a Low Density Urban Environment Using Innovative Data Collection Methods,” North Central Council of Governments (NCTCOG), $40,000, October 2016 – May 2018
- [USU] “Public Transportation System Accessibility for Individuals with Disabilities.” Utah Transit Authority. August 2017 – December 2018. $40,000
• [USU] Exploring Potential New Features for Rest Areas in Utah, Utah Department of Transportation (UDOT), 2017 – 2018, $40,000
• [USU] A Data Fusion Approach for Extracting Highway Maintenance Features, Utah Department of Transportation (UDOT), $50,000, May 2017 – April 2018

3.2 Have other collaborators or contacts been involved?
• Collaborated with DePaul University’s Chaddick Institute for Metropolitan Development to create an ideal route for highlighting Chicago’s innovative bicycle infrastructure.
• UTA researchers have been collaborating with bicycling and pedestrian groups and local governments to develop a crowdsourcing app for safety data.

4 IMPACT

4.1 What is the impact on the development of the principal discipline of the program?
• A better understanding of bicyclists’ safety behavior associated with bicycle environment and traffic operations
• A better knowledge of the abilities of blind pedestrians to positively influence their travel environment.
• Linkage between driver behavior when approaching pedestrians and crash occurrence
• The research findings will add to the knowledge base in the discipline of Orientation and Mobility and transportation engineering. In particular, the findings of the study may provide shed some light on the actual travel behaviors of blind pedestrians in their communities.
• Innovative and easy strategies for assessing pedestrian and bicycling infrastructure.
• Provide information on how to best implement a culture change in a city on the edge of a major city.
• Provide useful information on how to measure passing distance when a motorist passes a bicycle which could be useful for enforcement of bicycle passing laws.
• Development of new algorithms and communications protocols and solutions that are tailored for transportation applications.
• A novel way of measuring transportation-induced physical activity will be developed and validated from the current study. This method is expected to reliably quantify the physical activity.
• Improved recruitment of graduate students especially those interested in transportation engineering and planning field
• Planning tools for network design which can be easily integrated within state or national planning programs
• Quantitative framework considering qualitative factors for a charging station network design while considering the uncertainties in the inputs
• Integration of behavioral aspects for strategic decision making

4.2 What is the impact on other disciplines?
• Facilitate the collaboration of scholars between different disciplines on projects targeting at the common good, including engineering disciplines such as construction engineering and other disciplines such as psychology and education
• Provide test ground for scientific and technological development in other disciplines by adapting/adopting those developments to solve transportation problems
• The multidisciplinary nature of the project brings together faculty and students from the disciplines of Transportation, Construction, Mechanical Engineering, and Geography together to achieve common goals in infrastructure accessibility assessment, which in turn advances each of the discipline as well.
• This is a truly interdisciplinary collaborative efforts that bridges CCE and CS.
• Measuring transportation-induced physical activity can be used to examine associations between transportation and health.
• Social Work is able to collaborate with civil engineering and assess the impact that transportation gaps may have on their client populations.

4.3 What is the impact on the development of transportation workforce development
• Numerous undergraduate and graduate students are exposed to transportation-related project objectives and research methods.
• Many graduate students are being trained on the use of technology to develop transportation solutions.
• Provide access to state-of-the-art technologies for transportation engineers and future transportation engineers
• Many graduate students are being trained on the use of technology to develop transportation solutions.
• UTA Over 200 undergraduate students are introduced to active transportation modes through project-based learning.
• Students are receiving an opportunity to experience transportation research, which may increase their interest in pursuing additional education.
• Methodology for two-stage stochastic programming model considering choice modelling for strategic decision making
• Methodology for Risk-averse two-stage stochastic programming model with 0-1 variables in second stage

4.4 What is the impact on physical, institutional, and information resources at the university or other partner institutions?
• Through developing applications of advanced technologies in transportation engineering, it not only contributes to the domain of transportation engineering, but also provides opportunities to further develop, adapt, or customize the state-of-the-art technologies to better satisfy the need for real world engineering applications in the transportation sector
• It provides equipment, facilities, and financial resources to Western Michigan University and all partner institutions to allow the faculty there to conduct research using state-of-the-art knowledge and techniques, while at the same time allow students in these institutions to learn about state-of-the-art research and development first-hand
• TRCLC funds have improved recruitment of graduate students interested in transportation engineering and planning field and given participating faculties and students opportunities to pursue and publish transportation research
• Partner institutions have gained new appreciation for accessibility metrics and are considering the addition of travel information (such as ‘how did you arrive at this appointment’) to various forms to better understand the transportation behavior of at-risk patients
• It has improved recruitment of graduate students especially those interested in transportation engineering and planning field

4.5 What is the impact on technology transfer?
• The applications and hardware that we are currently working on can potentially lead to the generation of new IP (patent) and commercialization potential.
• Applied D2D technologies in developing applications for highway work zone traffic management and mobility for people with disabilities.
• Big data analysis framework and validation for the data sources provided by SEMCOG
• The model/tool will become an integrable solution to the existing toolkits at planning agency
• The tools are made in modular design so they can be seamlessly integrated within an organization’s technology infrastructure
4.6 What is the impact on society beyond science and technology?

- Promote a more sustainable transportation mode consisted of more frequent use of walking and cycling.
- Findings from current TRC study may help make walking safer which will have a positive impact on the likelihood that people choose walking as a mode choice.
- A smart construction cone that integrates with D2D technology is expected to better understand of spatial patterns in health infrastructure at a local level that impact use of health services and overall public health of the population.
- We are currently working on the development of a smart construction cone that integrates with collected traffic volume data and utilizes D2D technology to disseminate alerts to drivers.
- We are also developing an RFID based solution to help the blind and visually impaired to cross intersections without veering. This application also utilizes D2D to disseminate presence information to vehicular traffic.
- We are obtaining insights on the relationship between transportation and physical activities.

5 CHANGES/PROBLEMS

5.1 Changes in approach and reasons for change

- A no-cost extension was approved. The new termination date of the grant is September 30, 2019

5.2 Actual or anticipated problems or delays and actions or plans to resolve them

- Nothing to report

5.3 Changes that have a significant impact on expenditures

- Nothing to report

5.4 Significant changes in use or care of animals, human subjects, and/or biohazards

- Nothing to report.

6 SPECIAL REPORTING REQUIREMENTS

- Nothing to report.