Highway Traffic Monitoring Committee (ACP-70)

Research Subcommittee: 2020/2021 Completed and Ongoing Research Projects

TRAFFIC DATA COLLECTION

Validation of Freight Volume Modeling on Major Highway Links

The objective of this research is to: (1) finalize our CCTV truck detection algorithms and validate the algorithms on actual video from the area of study for different times of day to understand the performance under varying lighting conditions, (2) validate our origin-destination estimation algorithms on synthetic data under different scenarios of increasing complexity, (3) validate our origin-destination estimation algorithms on real data from the area of study and understand if existing sensor layout is sufficient to achieve good performance, and (4) use our origin-destination estimation algorithms and simulation software to model different sensor layouts and adding new sensors (to understand optimal sensor deployment and to test performance when deploying new types of sensors). If successful, other studies can leverage these tools to assess how the system can be extended beyond the area of study. Ultimately, these tools developed as part of this project would allow Caltrans decision makers to obtain freight volume information not currently available and that is needed for transportation planning. These software products can be made available widely available, e.g., by integrating into the USC METRANS/IMSC Archived Data Management System (ADMS) for the larger Los Angeles area and/or in PeMS for California.

POC: Cort Brinkerhoff at 213-740-4297 or by email at mcbrinke@usc.edu
Sponsors: California Department of Transportation
Start Date: 01/01/2022
Expected Completion Date: 12/31/2022
Status: Active
URL: https://rip.trb.org/View/1861656

Investigation of LiDAR sensing technology to Improve Freeway Traffic Monitoring

This study will investigate the installation of LiDAR sensors at several locations along existing freeway corridors in both side-fire and overhead configurations. Models will be developed from the obtained data to derive conventional (volume, speed and occupancy) as well as novel traffic stream parameters used in Caltrans traffic operations and compared with existing traffic sensors such as inductive loop detectors. Concerns typically associated with side-fire sensors such as occlusions will be investigated and addressed by harnessing the wide field-of-view characteristics of LiDAR.

POC: Cort Brinkerhoff at 213-740-4297 or by email at mcbrinke@usc.edu
Sponsors: California Department of Transportation
Start Date: 09/01/2021
Expected Completion Date: 08/31/2022
Status: Active
URL: https://rip.trb.org/View/1862630

Cost-Effective System for Rural Roadway Traffic, Surface Conditions and Weather Conditions Monitoring

The main objective of this project is to develop and implement cost-effective monitoring system for rural roads. Specifically, this project aims to: (1) conduct applications of monitoring roads in rural areas with advanced sensing and communication technologies to monitor traffic and roadway surface and environmental conditions, analyze the collected data in real-time, communicate with traffic operations center as well as broadcast useful information to road users; and (2) establish the standards for transportation practitioners in Rural, Isolated, Tribal, or Indigenous (RITI) communities to implement such monitoring system to monitor traffic and roadway surface and environmental conditions, analyze the collected data in real-time, communicate with traffic operations center as well as broadcast useful information to road users.

POC: Yinhai Wang at (206) 616-2696 or by email at yinhai@uw.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 07/01/2021
Expected Completion Date: 07/31/2022
Status: Proposed
URL: https://rip.trb.org/View/1854576

Methods for Assigning Short-Duration Traffic Volume Counts to Adjustment Factor Groups for Estimating AADT

Commonly used methods for estimating AADT do not adequately address how short-duration counts should be assigned to adjustment factor groups. Also, there are concerns about the inherent errors in these methods, their applicability to roadways with insufficient traffic data, and the accuracy of the derived AADT estimates. There is a need to improve existing methods and develop new methods for functional classes of roadway where insufficient continuous counting exists to improve accuracy of AADT estimates. These methods will help transportation agencies improve the quality of traffic information and support the decisions regarding capital investment programs and budgets as well as design and maintenance programs. The objective of this research is to develop rational methods for assigning short-duration traffic volume counts to adjustment factor groups for estimating AADT. The research is concerned with all functional classes of roadways and traffic volumes. The project will be conducted in two Phases. Phase I: (1) Collect and review relevant literature; (2) Identify and prioritize the weaknesses and gaps in the methods; (3) prepare an updated, detailed work plan to be executed in Phase II; (4) Prepare an interim report that documents the research performed in Tasks 1 through 3. Phase II: (5) Execute the Phase II plan approved in Task 4. Propose improved and new methods for all functional classes of roadways and traffic volumes. Also, illustrate use of the proposed methods to obtain realistic estimates of AADT. (6) Prepare a final deliverable that documents the entire research effort.

POC: Amir N. Hanna at 202-334-1432 or by email at ahanna@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 06/01/2021
Expected Completion Date: 11/30/2023
Status: Active
URL: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4945

Best Practices for Data Fusion of Probe and Point Detector Data

This study will investigate the installation of LiDAR sensors at several locations along existing freeway corridors in both side-fire and overhead configurations. Models will be developed from the obtained data to derive conventional (volume, speed and occupancy) as well as novel traffic stream parameters used in Caltrans traffic operations and compared with existing traffic sensors such as inductive loop detectors. Concerns typically associated with side-fire sensors such as occlusions will be investigated and addressed by harnessing the wide field-of-view characteristics of LiDAR.

POC: David Jared at 202-334-2358 or by email at djared@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 05/25/2021
Expected Completion Date: 0
Status: Proposed
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5135

Guidance on Improving Truck Traffic Estimates in Design Traffic Forecasts

This research is intended to explore the best practices of "design level" forecasting of truck volumes in the roadway project development process. The results should facilitate better project evaluation, prioritization and implementation, traffic estimation, and design of roadway improvements. Improvements in truck volume forecasts in "Design Traffic" Forecasting will enhance state and regional freight system planning, improve the project-level analysis on truck traffic management, and better accommodate the rapid growth in truck volumes due to a variety of reasons including online shopping. Traffic and design planners in state DOTs and MPOs will benefit from the outcome of the research and the resulting guidelines.

POC: Jennifer L. Weeks at jweeks@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 05/25/2021
Expected Completion Date: 0
Status: Proposed
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5131

Leveraging Existing Traffic Signal Assets to Obtain Quality Traffic Counts

The objectives of this research are to (1) gather the active support and participation of agencies across the nation that include city, county, state, federal, and private entity partners; (2) identify and summarize existing and in-development methods for obtaining traffic counts from existing traffic signal assets including, but not limited to, signalized intersections, cross walk signals, video, loops, magnetometers, radar, and traffic detection cameras; (3) identify good practices that can be adopted by the traffic monitoring community; (4) identify challenges associated with leveraging the data from these devices; (5) summarize improvements or solutions to these challenges including, but not limited to, standards, pooled fund studies, or additional research needs;

and (5) prepare a final report documenting the results of the research in a form to be used as a best practice guide for obtaining traffic counts from existing traffic devices and disseminate the results through webinars, training, and peer exchanges.

POC: Edward Harrigan at 202-334-3232 or by email at eharrigan@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 05/25/2021
Expected Completion Date: 0
Status: Proposed
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5131

Development of Congestion Factors for Adjusting Traffic Counts During Congested Periods: Phase 1 - Literature Review and Survey

The goal of this project is to develop congestion factors suitable for use by the Florida Department of Transportation to adjust traffic counts during congested periods on urbanized roadway sections experiencing both recurring and nonrecurring congestion. In Phase 1 of this project, the objective is to conduct a detailed literature search of both published and unpublished material as well as to conduct a survey of State DOTs to solicit information on the state-of-art and the state-of-practice in traffic data collection particularly during congested periods.

POC: Joey Gordon at (850) 414-4005 or by email at Joey.Gordon@dot.state.fl.us
Sponsors: Florida Department of Transportation
Start Date: 03/16/2021
Expected Completion Date: 09/30/2022
Status: Active
URL: https://rip.trb.org/View/1864557

Traffic Signal Detection Systems INDOT Evaluations

The Indiana Department of Transportation (INDOT) continues to evaluate new products for vehicle detection at traffic signals. Accurate and low-latency vehicle detections are central to ensuring efficient and safe operations at actuated traffic signals. New products in this field become available on a regular basis. Having additional detection technologies available aids INDOT in finding the most cost-effective system for given site constraints. This project will evaluate the performance of up to three new vehicle detection systems and compare their results to INDOT's established standards.

POC: Jay Grossman at 219.464.5203 or by email at jay.grossman@valpo.edu
Sponsors: Purdue University/Indiana Department of Transportation JHRP
Start Date: 02/01/2021
Expected Completion Date: 12/01/2022
Status: Active
URL: https://rip.trb.org/View/1758176

Refining Inductive Loop Signature Technology for Statewide Vehicle Classification Counts

The objective of this research is to to convert current loop detectors at signals, on freeways and at ATRs into classification sites using the existing loop detectors. The loop signature technology could be a huge innovation that can replace existing data collection methods and would save the state a lot of time and money. In addition, it would provide MnDOT more and better data on ramps and freeways in the metro area where it is difficult and time consuming to collect vehicle classification counts.

POC: Chen-Fu Liao at 612-626-1697 or by email at cliao@umn.edu
Sponsors: Minnesota Department of Transportation
Start Date: 07/14/2020
Expected Completion Date: 01/31/2022
Status: Active
URL:
https://mntransportationresearch.org/2020/08/27/new-project-refining-inductive-loop-signature-technology-for-statewide-vehicle-classification-counts/

Assignment of Short-Duration Traffic Volume Counts to Adjustment Factor Groups

This research is aimed at determining the most effective assignment methods that agencies can use to improve the accuracy of AADT estimates derived from short-term counts, and the need to conduct a comprehensive and in-depth study that will have wider scope and validate the performance of several assignment methods for different transportation networks nationwide. The need for this research study is described in a recent TRB e-Circular. The objective of this project is to determine the most effective methods of assigning traffic volume counts to adjustment factor groups. The project will be conducted in two Phases. Phase I, Research and Phase II, Implementation.

POC: Amir N. Hanna at 202-334-1432 or by email at ahanna@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 05/20/2020
Expected Completion Date: 0
Status: Proposed
URL: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4945

Investigation of Truck Data Collection using LiDAR sensing technology along Rural Highways

The purpose of this study is to investigate the use of LiDAR technology for accurate classification of trucks according to the established FHWA scheme along rural highway corridors as an alternative to in-pavement detector infrastructure – such as inductive loop sensors and piezo-based automatic vehicle classifiers which is not widely deployed along many rural highway corridors – and temporary sensors such as pneumatic road tubes, which expose workers to live traffic.
POC: Cort Brinkerhoff at 213-740-4297 or by email at mcbrinke@usc.edu
Sponsors: California Department of Transportation

Start Date: 05/01/2020
Expected Completion Date: 04/30/2021
Status: Active
URL: https://rip.trb.org/view/1709468

Estimating AADT on Non-Coverage Roads

The goal of this project is to develop models for SCDOT to predict AADT at non-coverage count locations. Currently, there are thousands of such locations on SCDOT-maintained roads and counts at these locations are preformed, at most, every ten years. The models to be developed in this project will provide SCDOT with more accurate AADT estimates at non-coverage count locations.

POC: Terry Swygert at 803-737-6691 or by email at swygerttl@scdot.org
Sponsors: South Carolina Department of Transportation & Federal Highway Administration
Start Date: 04/01/2020
Expected Completion Date: 09/30/2021
Status: Active
URL: https://www.scdot.scltap.org/projects/current/

BIG DATA ANALYTICS

Integration of the Lane-specific Traffic Data Generated from Real-time CCTV Videos into INDOT's Traffic Management System

This project aims to integrate TASI-generated real-time lane-level traffic status data into INDOT traffic management systems to enable INDOT to utilize this valuable information. TASI will collaborate with INDOT users to specify and satisfy dissemination and improvement requirements based on INDOT's needs.

POC: Stanley Chien at 317-274-2760 or by email at schien@iupui.edu
Sponsors: Purdue University/Indiana Department of Transportation JHRP
Start Date: 07/01/2021
Expected Completion Date: 08/31/2022
Status: Active
URL: https://rip.trb.org/View/1862594

An Innovative Internet of Things (IoT) Technology for Comprehensive Traffic Sensing and V2X Applications

This project proposes to install and implement the University of Washington (UW) StarLab developed MUST sensors along roadways for data collection, condition assessment, and vehicle-to-everything (V2X) applications. The goal is to deploy MUST sensors along roadways with high crash risks, such as segments with horizontal and/or vertical curves, locations with frequent snow or ice coverage, etc., so that MUST sensors can monitor traffic and roadway surface and environmental conditions, and communicate with traffic operations center as well as broadcast useful information to road users when needed. Specifically, this project

will utilize MUST sensors to collect traffic (volume, speed, vehicle types, etc.), roadway surface conditions (snow, ice, rain, etc.), and weather conditions (temperature, humidity, visibility, etc.) information. Additionally, the project will investigate the most cost effective way for data transmission and communication with operation center and road users.

POC: Doug Brodin at 360-705-7972 or by email at Doug.Brodin@wsdot.wa.gov
Sponsors: FHWA Washington State Division
Start Date: 03/16/2021
Expected Completion Date: 03/15/2022
Status: Active
URL: https://rip.trb.org/View/1862591

TITANv2 – Interactive, Web-Based Platform for Transportation Data Integration, Visualization and Predictive Analytics

The rate of transportation data collection is poised to increase exponentially with mobile computing, community-based sensing and vehicle-to-vehicle and vehicle-to-infrastructure communications. Under TR2018015 the research team designed a prototype interactive, web-based platform to assist decision makers at Missouri Department of Transportation (MoDOT) by seamlessly integrating and analyzing transportation datasets. This phase 2 project will create a robust web platform that pulls together data from TMS and other sources to provide dashboards which help make sense of various data sets. The platforms are interactive and can provide real time information or longer duration information. This platform will also help the TMCs with real time travel information and performance measures.

POC: Jennifer Harper at (573) 526-3636 or by email at Jennifer.Harper@modot.mo.gov
Sponsors: Missouri Department of Transportation
Start Date: 01/01/2021
Expected Completion Date: 12/31/2024
Status: Active
URL: https://rip.trb.org/View/1846491

Embracing Emerging Internet-based Traffic Big Data in Smart City Applications to Improve Transportation Systems Efficiency, Safety, and Equity

While public agencies still rely on traditional traffic data sets to monitor transportation system performance, the Internet-connected traffic big data is expected to soon bring fundamental changes to transportation management and reshape many concepts. The costs of those Internet-based traffic data are also becoming affordable in comparing with the traditional approaches in traffic data collection. This project explores novel applications to transportation system management based on various emerging Internet-based traffic big data, especially those Internet-connected vehicle data, in enhancing system efficiency, safety, and equity. This work explores novel applications of Internet-based traffic big data to multiple areas, including facility design, congestion management, traffic performance monitoring, and transportation planning. It focuses on efficiency and equity issues by measuring the mobility and job accessibility of traditionally underserved populations.

POC: Pengfeng (Taylor) Li at taylor.li@uta.edu

Sponsors: Center for Transportation Equity, Decisions, & Dollars, University of Texas at Arlington, Office of the Assistant Secretary for Research and Technology
Start Date: 01/01/2021
Expected Completion Date: 05/31/2022
Status: Active
URL:
https://ctedd.uta.edu/research-projects/embracing-emerging-internet-based-traffic-big-data-in-smart-city-applications-to-improve-transportation-system-efficiency-safety-and-equity/

Real-Time Traffic Analytics at Intersections

Central to a smart transportation system is access to real-time data especially at points of planned conflict such as intersections. Unfortunately, visual data is too expensive in bandwidth for remote analysis. The proposed research focuses on performing analysis at the edge and only transmitting compact analysis results. Algorithms will be developed to detect and track vehicles, pedestrians, and bicyclists to summarize counts, travel direction, and notable events such as near collisions. Summary results will be submitted to a website for a real-time look of the road environment.

POC: Robin Kline at 202-366-2732 or by email at robin.kline@dot.gov
Sponsors Carnegie Mellon University and Office of the Assistant Secretary for Research and Technology
Start Date: 07/01/2020
Expected Completion Date: 06/30/2021
Status: Completed
URL: https://ppms.cit.cmu.edu/projects/detail/335

Utilizing Cooperative Automated Transportation (CAT) Data to Enhance Freeway Operational Strategies

The objective of this research is to assess operational scenarios and use cases where freeway operations strategies could be improved through the transmission of data between a traffic management system (TMS) and the larger cooperative automated transportation (CAT) system (either directly or through a third party). This assessment should (1) spur development of enhanced and new operational strategies and (2) help agencies justify gaining access to additional CAT data.

POC: B. Ray Derr at 202-334-3231 or by email at rderr@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 07/14/2021
Expected Completion Date: 07/14/2023
Status: Active
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4956

Public Perception of the Collection and Use of Connected Vehicle Data

The purpose of this proposed project is to evaluate the current public perception of the collection and potential uses of connected vehicle data by transportation agencies (federal, state, and local). The project will include an extensive literature review and informal discussions with transportation agencies to inform the development of a survey. This survey will be distributed to the public both electronically and in-person. The survey results will be used to develop recommendations for data management policies and public engagement.

POC: Denver Tolliver at 701-231-7190 or by email at denver.tolliver@ndsu.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 02/19/2020
Expected Completion Date: 07/31/2022
Status: Active
URL: https://www.mountain-plains.org/research/details.php?id=518

Proof-of-Concept Research of Roadside LiDAR Sensing Multimodal Traffic (NDOT 744-18-803)

This project is at the First Application Field Pilot Stage and will provide proof-of-concept results for NDOT to understand the accuracy, reliability, and possible applications of roadside LiDAR sensing systems in various real-world scenarios. If the performance of the proposed technology is approved and accepted, NDOT can start to consider its application in wider and more diverse regions of Nevada. The systems, experience, and guidance developed in this project will directly guide the implementation of roadside LiDAR sensing systems. The next stage will be actual field implementation at prioritized intersections/corridors.

POC: Hao Xu at 775-784-6909 or by email at haox@unr.edu
Sponsors: Nevada Department of Transportation (DOT) and Federal Highway Administration.
Start Date: 02/11/2019
Expected Completion Date: 02/11/2022
Status: Active
URL: https://www.nevadadot.com/home/showdocument?id=16259

WEIGH-IN-MOTION

Integration and Operation of an Advanced Weigh-in-Motion (A-WIM) System for Autonomous Enforcement of Overweight Trucks

The project will assist and support the New York City Department of Transportation (NYCDOT) in establishing the legislation to operate the automated enforcement system and extend the service life of the Brooklyn-Queens Expressway (BQE) corridor. The team will utilize two testbeds on both sides of the BQE corridor to develop the guidelines and specifications for the operation of the overweight enforcement system in an urban area. The deliverables will include, but not be limited to, an updated NYCDOT in-house calibration procedure and methodology to assure weight accuracy, the attainable accuracy target under current roadway conditions, and updates of service life predictions for BQE bridges.

POC: Hani Nassif at 848-445-4414 or by email at nassif@soe.rutgers.edu

Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 03/01/2021
Expected Completion Date: 02/28/2022
Status: Active
URL:
https://c2smart.engineering.nyu.edu/integration-and-operation-of-an-advanced-weigh-in-motion-a-wim-system-for-autonomous-enforcement-of-overweight-trucks/

Economic Benefits of Truck Weight and Safety Enforcement Improvements

The objective of this project is to identify the specific quantitative return on investment dollar for dollar of a weigh station, a weigh in motion system, a weigh scale, a virtual enforcement site, a pull off, and weight and safety enforcement operations in general that would definitely help MnDOT and the State Patrol to articulate the value of investing in these areas in the future.

POC: Lubinda Walubita at (979) 317-2301 x4230 or by email at L-Walubita@tti.tamu.edu
Sponsors: Minnesota Department of Transportation
Start Date: 08/20/2020
Expected Completion Date: 07/31/2022
Status: Active
URL: https://rip.trb.org/View/1678595

Sensitivity and Accuracy Assessment of Vehicle Weigh-in-Motion System Measurement Errors Using In-Pavement Strain-Based Sensors

The objective of this study is to provide scientific evidences of the systematic sensitivity analysis on the influences of external contributors on the measurement accuracy of a WIM system based on in-pavement strain sensors. The main external contributors to be investigated in this study include air temperature, vehicle wander behavior, air humidity, and wind speed on the measurement accuracy of a WIM system.

POC: Robin Kline at 202-366-2732 or by email at robin.kline@dot.gov
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 04/16/2019
Expected Completion Date: 07/31/2022
Status: Active
URL: https://www.mountain-plains.org/research/details.php?id=498

LTPP Data Analysis: Develop Practical Tools and Procedures to Improve WIM Data Quality

Weigh-in-motion (WIM) systems are a vital means for collecting traffic data—critical input for pavement and bridge designs—used for making transportation and freight planning decisions and in highway safety investigations. There are, however, many potential sources of error in WIM measurements which make it difficult for data collectors to evaluate data accuracy and consistency.

For over a decade, the Federal Highway Administration (FHWA) Long-Term Pavement Performance (LTPP) program collected a massive amount of WIM data, along with information about the performance of WIM equipment. This includes the WIM validation and calibration data from 24 LTPP Specific Pavement Studies (SPS) test sites across North America. This and other data sets provide an opportunity to develop more advanced WIM tools to help state highway practitioners perform WIM site selection, sensor selection, maintenance, development of calibration procedures including frequency, and data quality acceptance. These tools could help improve WIM data accuracy and consistency by considering factors such as temperature and seasonal effects, vehicle speed, pavement condition, changes in truck population and configurations, data sampling frequencies, system age, and other factors.

The objective of this research is to develop the next generation of tools and procedures to improve accuracy and increase reliability of WIM data through (1) more appropriate site selections; (2) WIM system selection, installation, calibration, and maintenance; (3) data analysis methods; and (4) quality control/quality assurance (QC/QA) procedures.

POC: Camille Crichton-Sumners at 202-334-1695 or by email at ccrichton-sumners@nas.edu
Sponsors: National Cooperative Highway Research Program, American Association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 10/01/2018
Expected Completion Date: 12/30/2022
Status: Active
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4412

Development of Low-Cost Weigh-In-Motion (WIM) and Response Spectra Techniques Phase I of "Development of a Cost-Effective Sensing System for Integrated Traffic and Pavement Response Monitoring in Support of Pavement Management"

This project proposes to develop a long-life weigh-in-motion (WIM) system with much lower costs using the piezoelectric sensors developed in a former EAR (Exploratory Advanced Research) project. The system will be named as P-WIM. The P-WIM will essentially consist of several piezoelectric disks sealed in a protective package made from engineering plastics. A wireless transmission module will be included in the package of the P-WIM to enable wireless data transmission. The P-WIM will be powered by solar panels and supplemented by the energy harvested from pavement deformations and vibrations.

POC: Eric Donnell at 814-863-7053 or by email at edonnell@engr.psu.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 03/01/2019
Expected Completion Date: 03/01/2021
Status: Active
URL: https://r3utc.psu.edu/research/current-research-projects/projects-year-1-2/ciam-utc-reg13/

Development of a self-powered weigh-in-motion system

This study deals with the development of a novel low power weigh-in-motion (WIM) system that uses cylindrical piezoelectric (PZT) elements for the dual purpose of sensing axle loads and harvesting mechanical

energy for its operation. It provides details on the characterization the PZT sensing elements, the conditioning of their signals and describes the algorithms developed for determining speed, axle load and vehicle classification. These algorithms were coded in MATLAB® and converted to C in a format suitable for installing in an low power microcontroller unit (MCU). The system has the capabilities of monitoring vehicle speed, number of axles, axle spacing, axle load and vehicle classification. It was tested in the laboratory by applying a range of loads and loading frequencies through a servo-hydraulic loading system. The results suggest sufficient accuracy and precision in measuring vehicle speeds, axle loads and determining vehicle class. Its low power requirements provide an inexpensive and sustainable method for obtaining roadway traffic data. Two journal papers describing this technology (DOIs listed below) and a third is in preparation. This technology was issued a provisional patent under the title *Self-powered weigh-in-motion system* (#63/219489) on 07/08/2021.

POC: A.T. Papagiannakis (at.papagiannakis@utsa.edu)
Sponsors: CPS Energy (9/2017 to 8/2019) and Tran-Set Regional UTC (08/2019 to 5/2021)
Start Date: 09/01/2017
Completion Date: 05/31/2021
Status: Completed
URL: https://doi.org/10.1016/j.ijtst.2021.06.004 and https://doi.org/10.1016/j.apenergy.2019.113585

PEDESTRIAN AND BICYCLES

Exploring the Use of Crowdsourced Data Sources for Pedestrian Count Estimations

The emergence of crowdsourced data such as Strava and StreetLight has allowed for the collection of large-scale datasets over broad areas of the network. While several research studies have evaluated and applied bicycle data from these datasets, no study has yet looked at pedestrian count estimates from these data sources or assessed how these compare to traditional pedestrian counts and other measures of pedestrian activity such as pedestrian actuations from traffic signals. The current study will evaluate pedestrian data estimates from the crowdsourced data sets and explore how these can be used along with traditional count data and sociodemographic data to derive count estimates.

POC: Sirisha Kothuri at (503) 725-4208 or by email at skothuri@pdx.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 10/01/2021
Expected Completion Date: 12/31/2022
Status: Active
URL: https://nitc.trec.pdx.edu/research/project/1489

Synthesis on Automated Pedestrian Data Collecting Techniques and Applications in Transportation Planning, Design and Management

In this project, the research team will undertake a comprehensive literature review on the state-of-the-art and the state-of-the-practice of automated pedestrian detection techniques. Additional insights shall be solicited from nationwide surveys and interviews. The outcome is an assessment of the different automated data collection methods, including well established and emerging artificial intelligence (AI)- and sensor-based

technologies, to evaluate their appropriateness and efficacy in different environments and for supporting data collection and usage efforts. In addition to generating a research report, the research team will provide TxDOT with a decision support system that compiles information gathered through the literature review, survey, interviews, and trainings while integrating economic analyses. The practical support tool shall be structured to directly and seamlessly feed into TxDOT's strategic planning and design efforts and enhance current operations.

POC: Tom Schwerdt at 512-506-5883 or by email at tschwer@dot.state.tx.us
Sponsors: Texas Department of Transportation
Start Date: 09/01/2021
Expected Completion Date: 08/31/2022
Status: Active
URL: https://rip.trb.org/View/1879860 or https://library.ctr.utexas.edu/Presto/project=0-7126

Recommendations on how to Capture and Prioritize Bicycle and Pedestrian Needs in Kentucky

More people rely on non-motorized means of travel as a primary means of transportation today than 20 years ago. Because this trend will likely persist, Kentucky needs to ensure it gives appropriate consideration to these transportation modes and develop methods for prioritizing limited funds in a data-driven way. As demand for non-motorized transportation projects continues to grow, KYTC and Kentucky's residents will benefit from data-driven solutions for addressing these needs.

POC: Reg Souleyrette at 859-257-5309 or by email at souleyrette@uky.edu
Sponsors: Kentucky Transportation Cabinet
Start Date: 07/01/2021
Expected Completion Date: 06/30/2023
Status: Active
URL: https://rip.trb.org/View/1877383

Investigating the Impact of COVID-19 Pandemic Outbreak on Bike Share Usage and Ridership: A Case Study in Houston

Project objectives include: (a) Identify potential attributes related to bike sharing demand, (b) Examine the trip distribution of bike share users throughout the four seasons of the year, and the different hour blocks of a day, (c) Model bike share station activity, (d) Examine and locate the dock stations in relation to potential demand, and (e) Investigate system users and impacts on the bike share.

POC: Wei Fan at 704-687-1222 or by email at wfan7@uncc.edu
Sponsors: Center for Advanced Multimodal Mobility Solutions and Education; Office of the Assistant Secretary for Research and Technology
Start Date: 10/01/2021
Expected Completion Date: 09/30/2022
Status: Active
URL: https://rip.trb.org/View/1881802

Investigating Walking and Biking Activities Among Low-Income African Americans

Different transportation organizations have collected various data related to walk and bike trips. However, few studies have investigated various aspects of walk and bike trips among different races and different household income groups. The main goal of this study is to explore the number of walk trips, number of walk trips for exercise, number of bike trips, number of bike trips for exercise, and bike share program usage among different household income groups and different races. To conduct the statistical analysis, the research team used the latest National Household Travel Survey (NHTS) dataset, which is the largest and the most valid national transportation-related dataset in the United States. The novelties of this study are to investigate the newly walk-related and bike-related attributes in the 2017 NHTS, and focus on different household income groups and different races. The primary contribution of this study is to provide a deeper insight into bike-travel and bike-travel behavior among different household income groups and different races in the U.S., which can assist the authorities and transportation planners in prioritizing investment in bike infrastructure.

POC: Eazaz Sadeghvaziri by email at eazaz.sadeghvaziri@morgan.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 10/01/2021
Expected Completion Date: 09/30/2022
Status: Active
URL: https://rip.trb.org/View/1873116

Pedestrians' and cyclists' perceptions of and behavioral responses to driverless cars

This research aims to investigate pedestrians' and cyclists' perceptions of and behavioral responses to driverless cars. The research team will conduct a survey that collects individuals demographic and socio-economic characteristics, their frequency of walking and biking, and their current perceptions of walking or biking safety. The team will then ask the individuals to answer a series of stated preference questions that are intended to gauge whether their perceptions of safety and walking and biking behavior will change in the presence of driverless cars. The team will design the online survey on Qualtrics' platform and purchase a sample from Qualtrics. Survey respondents will be de-identified so the survey study will qualify for IRB exemption. The team will analyze survey responses using multinomial logistic regression with respondents' preferences as the dependent variables and their socioeconomic characteristics, frequency of walking and biking, and current perceptions of walking and biking safety as the independent variables.

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Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 10/01/2021
Expected Completion Date: 07/31/2023
Status: Active
URL: https://rip.trb.org/View/1889096

Applying AI to data sources to improve driver-pedestrian interactions at intersections

This project aims to understand how we can link and harness new data sources along with machine-learning based optimization techniques to improve driver-pedestrian interactions at intersections. With a strong

emphasis on safe mobility, this study will address this critical issue in a real-life context with data links from and actuation feedback to 8 monitored intersections in the Chattanooga Shallowford road corridor between the Lee Highway and Gunbarrel Road intersections. The study reflects strong collaborations between UTK, UNC, ORNL, and the City of Chattanooga, TN.

This project will contribute by incorporating safety into optimization of traffic signals, collect and link data from traffic signals (cameras) and analyze behaviors of pedestrians and drivers at intersections, and provides an opportunity for students to engage in multiple aspects of safety analysis including data linking and new AI techniques. The impact of this project can be substantial in terms of enhancing safety and efficiency of intersections. Working closely with Chattanooga and ORNL, the project team will impact the safety as well as performance of traffic signals in a testbed corridor through: 1) data linking, 2) pedestrian detection and 3) optimization.

POC: Laura Sandt at 919-962-2358 or by email at sandt@hsrc.unc.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 05/01/2021
Expected Completion Date: 05/31/2022
Status: Active
URL: https://www.roadsafety.unc.edu/research/projects/2021r43/

Mobile-device data, non-motorized traffic monitoring, and estimation of annual average daily bicyclist and pedestrian flows

One option for obtaining travel data without expensive infrastructure is relying on mobile data collection. However, the accuracy of mobile data is unknown and may vary in different areas (e.g. urban vs. rural). This project will build trip distribution and network route choice models to predict road flows of pedestrians and bicyclists, and calibrate them to mobile data (e.g. StreetLight). A filtering approach that combines model predictions with erroneous data will be used to integrate mobile data (which captures only a fraction of trips) with the model of user trips and route choices (which does not perfectly capture user behavior). The ultimate deliverable of this project is a software tool that MnDOT can use to update pedestrian and bicyclist flows periodically (e.g. annually) as new data about trip frequency and mobile data becomes available. This project will provide a map-based visualization of current predicted non-motorist flows, as well as instructions to use the software tool for later updates.

POC: Michael Levin at 612-301-7137 or by email at mlevin@umn.edu
Sponsors: Minnesota Department of Transportation
Start Date: 06/11/2021
Expected Completion Date: 07/31/2023
Status: Active
URL: https://rip.trb.org/View/1764336

The (In)Equitable Distribution of Quality Bicycling Infrastructure

This project seeks to investigate the development of bicycling infrastructure through a transportation justice lens. More specifically, how equitable has the distribution of this infrastructure been across the socioeconomic/sociodemographic spectrum? The project team will also seek to investigate whether the

installation of bicycling facilities leads to socioeconomic/sociodemographic changes in a neighborhood or vice versa. The results will assist cities and DOTs in managing and monitoring their bicycling infrastructure, assessing its equality, as well as understanding the potential implications for those that live and work in these neighborhoods.

POC: Robin Kline at (202)366.2732 or by email at Robin.kline@dot.gov
Sponsors: Transportation Infrastructure Durability & Life Extension; Office of the Assistant Secretary for Research and Technology
Start Date: 05/01/2021
Expected Completion Date: 06/30/2022
Status: Active
URL: https://tridurle.wsu.edu/the-inequitable-distribution-of-quality-bicycling-infrastructure/

State DOT Usage of Bicycle and Pedestrian Data: Practices, Sources, Needs, and Gaps

The research should also capture any untraditional or unusual sources or applications of data that may be primarily for other purposes but could be adapted or integrated into active transportation analysis. This research would inform practitioners on the expanse of available data, which may be unconventional, such as police and hospital reports; capture information on how peer agencies are identifying and using data, identify gaps for future research, and provide recommendations (identification, collection, cleaning, utilizing, analyzing, standardizing, storing, funding, privacy and legal concerns, etc.)

The objectives of this research are to determine how state DOTs are using data and to identify data sources, gaps, and recommendations on the next steps to develop the data and tools state DOTS need. To fulfill these objectives, the research contractor will need to complete the following:
1. Summarize/synthesize existing research on active transportation data.
2. Survey state DOTs to understand the current state of data sources and uses, as well as unmet needs.
3. Catalog active transportation data sets, common attributes, uses, including both well-known sources (e.g., Strava Metro) and less utilized sources (e.g., police reports, hospital reports, etc.).
4. Conduct a gap analysis between the data that state DOTs need/want versus what is currently available/being used.
5. Develop recommendations on next steps for developing, standardizing, maintaining, and storing the identified data, information, models, and/or tools.

POC: Stephan Parker at 202-334-2554 or by email at saparker@nas.edu
Sponsors: National Cooperative Highway Research Program, American association of State Highway and Transportation Officials (AASHTO), and Federal Highway Administration
Start Date: 10/12/2021
Expected Completion Date: 0
Status: Proposed
URL: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4946

Estimation of Pedestrian Volume Using Geospatial and Traffic Conflict Data

The objective of this project is to estimate models to predict pedestrian volumes at a variety of road crossing locations as a function of observed vehicle-pedestrian traffic conflicts while also considering geospatial and

road design factors. Specifically, the research team will seek to associate observed pedestrian crossing counts with census-reported population data, data describing the nearby land development pattern and data describing crosswalk site and roadway characteristics, along with observations of pedestrian and vehicle conflicts.

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Sponsors: Center for Advanced Multimodal Mobility Solutions and Education & Office of the Assistant Secretary for Research and Technology.
Start Date: 10/01/2019
Expected Completion Date: 09/30/2021
Status: Active
URL: https://rip.trb.org/view/1669771

Bicycle Volume: Counting Machine Validation & Correction, Estimating & Forecasting, and Analysis of Injury Risk

This project is aimed at; (1) determining how frequently routine validation should be performed to account for potential machine drift at continuous count stations (CCS) over time and at what level the correction factor should be applied; (2) determining the programmatic cost associated with calibrating systems at varying frequencies over time; (3) developing bicycle volume prediction model; and (4) developing injury risk model to analyze the factors that affect the cyclist injury frequency. This project will utilize both manual and automated bicycle count collected at continuous count stations (CCS) and the data collected by using a smartphone application (i.e., Strava).

POC: Wei Fan at 704-687-1222 or by email at wfan7@uncc.edu
Sponsors: North Carolina Department of Transportation
Start Date: 08/01/2019
Expected Completion Date: 07/31/2021
Status: Active
URL: https://connect.ncdot.gov/projects/research/Pages/ProjDetails.aspx?ProjectID=2020-43