Highway Traffic Monitoring Committee (ACP-70)

Research Subcommittee: 2022/2023 Completed and Ongoing Research Projects

TRAFFIC DATA COLLECTION

AADT Estimation and Validation Tools for Local Off-System Public Roads

Per the Fixing America's Surface Transportation (FAST) Act of 2015, states are to have estimated Annual Average Daily Traffic (AADT) values on every paved road in the state by September 30, 2026. This will allow the Idaho Transportation Department (ITD) and local agencies the ability to better model safety. ITD has been tasked with coming up with an accurate and reliable mechanism to estimate traffic on every road in the state. ITD's existing traffic counting program covers all "federal aid" roads within Idaho but does not extend to local, rural, and other off-system routes. The need for expanded traffic counts (or volume estimates) is driven, in part, by the federal recommendations for roadway data collection described in the Model Inventory of Roadway Elements (MIRE). MIRE includes a set of roadway characteristics and traffic inventory elements that are considered critical to safety management. Currently, ITD maintains AADT estimates on approximately 12,000 centerline miles of roadway. This requirement extends that an additional 44,000 centerline miles on which ITD needs to establish an AADT estimate. In addition to federal recommendations, the expanded counts (or volume estimates) are requested for all public roads by ITD's traffic safety group to use for crash analytics. The objective of this project will be to develop comprehensive implementation and validation processing tools for estimating AADT values on every local non-federal aid public (off-system) road in Idaho using a geospatial interpolation methodology, ArcGIS, and Python.

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Exploring and Developing Innovative Methods for Estimating VMT on Local Roads in Texas

State agencies must report vehicle miles traveled (VMT) estimates for local roads compiled in the statewide summaries dataset of the Highway Performance Monitoring System (HPMS) database. While the VMTs for higher functional class roads are the product of annual average daily traffic (AADT) with the corresponding roadway segment length (L); the states produce the VMT estimates for local roads as an aggregate measure using a variety of methods. Currently, the local road network accounts for more than two-thirds (67%) of the total roadway mileage in Texas and is the largest in the United States. Conducting short-term counts (STCs) (e.g., for a few hours up to a few weeks) on an extensive local road network to develop VMT is financially challenging; hence, Texas Department of Transportation (TxDOT) uses statistical methods to obtain aggregated VMT. Although the current methods are statistically verified, they are yet to be revised and validated. The research team will investigate and develop data-driven methods for VMT estimation that can be implemented in Texas and provide significant savings to TxDOT. The developed methods will also reduce any bias in the estimation of VMTs on local roads that can lead to the overestimation or underestimation of travel demand.

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URL: https://library.ctr.utexas.edu/Presto/project=0-7187

A Guide to Navigating Existing and Emerging Sources of Local VMT and Travel Data

The research focuses on local governments' access and use of vehicle miles traveled (VMT) and transportation data for achieving VMT and greenhouse gas (GHG) reduction by land-use planning. The research also examines the role of MPOs in providing needed transportation data, training, and technical support to its local members to help them quantify VMT impacts of land-use plans and projects. Through surveys and interviews of 539 city and county governments and 18 MPOs in California, the research team analyzes current practices. Findings include that local governments utilize automobile data more frequently than alternative modes, and do not heavily rely on MPOs for obtaining transportation data. Local governments recognized the need for more transportation data and were particularly interested in publicly available sources. The MPOs reported that VMT/annual average daily traffic data and origin-destination matrix were most frequently requested. More sophisticated data such as travel-time matrix and mode-share scheme were considered useful by the MPOs, while requests were very low. Based on the results of the conducted surveys, interviews, and our analyses, we developed a transportation data guide for local governments that could help them access data for achieving VMT/GHG emission reduction via land-use planning.

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Low-Cost Sensing System for the Detection and Classification of Super Single Wheel Types and Distribution at the Network Level

This project will develop and test a low-cost novel sensing system to detect and classify wide-base tire (WBT) types and their distributions and demonstrate the usefulness of the system for data collection for pavement analysis and design applications. The work will be carried out in two stages. Stage 1 work will focus on developing and testing prototypes of a novel low-cost sensing system that can detect tire widths, wheel wander, and truck/axle configurations at highway speeds. A prototype of piezoelectric-based pressure transducers encapsulated in a special epoxy ready for embedment in pavement structures or temporary surface attachment will be developed. These transducers will constitute the basic components for the proposed sensing strip in the outer lane in one direction. The sensors can respond to very high-speed signals with a wake-up time in microseconds. The device will respond to applied pressure by the tires at highway speeds (>70 mph). After developing and testing the sensing system in the laboratory, verification tests will be conducted at a local parking lot and the university campus roads. Tests are also planned tests at Minnesota's MnROAD facility to verify the validity of the detection using the controlled truck traffic. Work in Stage 2 will involve field evaluation and validation of the developed prototype system. The system will be installed in the field adjacent to several WIM locations. The application of the system will be demonstrated by analyzing field data to identify (a) the type and frequency of various super single tires (WBT) on a particular route, (b) lateral distribution of wheels in the wheel-path (i.e., wheel wander), and (c) axle load spectra for WBT vs. conventional dual tires. Stage 2 will also involve field data collection in Michigan and Minnesota to demonstrate the sensor system's practicality and obtain feedback from state DOTs. At least 2-3 sites will be selected in these states, preferably adjacent to a WIM sensor, and the sensor system will be installed for data collection for at least 1-5 days in the outer lane. Data will be collected on the tire width, the exact number of

tires per axle, and their position along the cable (position along the lane). The information will be used to classify tire types (i.e., WBT vs. dual); it will also precisely measure the wheel wander. The obtained data will be synthesized to show the usefulness of the developed sensor system by summarizing (a) differences in axle load spectra (ALS) -- single and tandem axles for dual tires and WBTs; (b) wheel wander distributions; and (c) vehicle classes compared from the existing WIM system and the sensor for each site. A life cycle cost analysis (LCCA) of the sensing system will be performed. The final report will provide all relevant data, methods, models, and conclusions, along with guidance on using the system to collect WBT data by state DOTs.

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National Traffic Sensor System Evaluation Program

Traffic sensors are essential components of all highway traffic monitoring and traffic management systems and reporting. Traffic monitoring depends upon reliable detection and accurate measurement of flow rate, speed, classification, and other parameters for various modes of transportation. Active traffic management systems and other intelligent transportation systems applications require these parameters and more for varied uses like traffic control systems, wrong-way driving detection, near-miss crash analysis, and predictive analysis. Sensor systems based on new and emerging technologies—such as optics, electronics, communications, artificial intelligence, and connected and autonomous vehicle (CAV) applications—are rapidly supplanting traditional traffic sensor systems, but they typically lack independent evaluation of their accuracy and performance. State and local agencies must often rely on informal, inconclusive evaluations and pilot deployments to assess sensor systems' suitability for highway applications. The burden to test every sensor type and revision that comes to market creates massive duplication of effort and wastes time, effort, and funding. Although millions of traffic sensors are in use, manufacturers and distributers can rarely provide independent third-party test results demonstrating their real-world performance. Sensor errors can seriously affect safety, mobility, and public trust. The lack of information regarding system performance and reliability in different operational domains can lead to misapplication of sensor systems, unacceptable performance, or short service life. An authoritative method and a national testing program are needed to characterize the performance and identify the operational domains of current and emerging traffic sensor systems. The objective of this research is to develop evaluation criteria and testing methods for traffic monitoring sensors and systems, which could serve as the foundation for a national sensor system evaluation program.

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Strategies for Developing and Using Data Ontologies for Data-Driven Decision-Making

State departments of transportation (DOTs) have long collected and used data to inform decisions and to manage assets and programs. Much of the data are managed using legacy systems that lack interoperability and are difficult to access and update. These systems continue to be used because they are highly relevant for their intended use and well understood by those who have years of experience using them. However, they may be less useful for decisions that cut across functional areas, involve multiple modes, engage with external

partners, or require integration with modern data technologies. In many decision-making contexts, legacy systems can hamper cross-cutting analysis and require extensive investigation of metadata to ensure that the results of an analysis are meaningful for the decision at hand. A common approach to making legacy systems more amenable for cross-functional decisions is to develop a ‘data lake' or ‘data warehouse', moving all agency data to a single, enterprise-level platform. While this approach can provide agency-wide access, it does not address differences in data models or the need for a cross-functional, shared understanding of the meaning of the data. The shift to performance-based management and the need to respond quickly in emergent conditions has made data-driven decision-making imperative for state DOTs. This requires a data governance and management perspective that elevates data as an asset, with the same priority as traditional physical transportation assets. This perspective requires data representations that include data ontologies, glossaries, taxonomies, registries, catalogs, metadata, and models. Data ontologies are a key element in data representation. A data ontology describes the core information concepts represented in the data that, in turn, drive the business processes and the relationships among the concepts. An ontology ensures not only consistent naming across disparate disciplines, organizations, and information technology systems, but consistent meaning across users. For example, data about a highway bridge would not only include bridge components—superstructure, substructure, and deck—but also traffic volumes carried, noise propagation to nearby receptors, hydrologic conditions below the bridge, stormwater runoff, use of the bridge by birds or bats, maintenance history, construction and maintenance costs, and cultural or historic value of the bridge to a community. Taken together, these interrelated data provide a holistic view of the bridge and its context; a view that can better inform decision-making. A well-designed ontology allows these data to be discovered, integrated, analyzed, and understood by all users without resorting to ad hoc methods that may produce unreliable results and different interpretations. This common understanding of the meaning of the data also supports nimble, multidisciplinary teams that are prepared to collaborate to analyze the data and provide leadership with the best available information to formulate a response. Research is needed to identify effective practices for developing robust data ontologies and for building agency capacity to use them in transportation decision-making. The objective of this project is to develop a guide for state DOTs on strategies for implementing data ontologies that support nimble and efficient data-driven decision-making.

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Leveraging Existing Traffic Signal Assets to Obtain Quality Traffic Counts and Enhance Transportation Monitoring Programs

State departments of transportation (DOTs), metropolitan planning organizations (MPOs), counties, and other local agencies manage extensive traffic counting programs and have a need to ensure that traffic count data covers a variety of modes of travel, e.g., cycling and walking. These counts support decision-making with the aim of enhancing safety and mobility for the traveling public. There are thousands of existing traffic detection assets throughout the nation that serve traffic management operations. Moreover, other customers of traffic count data such as traffic engineers, traffic monitoring staff, transportation and active transportation planners, and data scientists, as well as non-transportation stakeholders (e.g., those responsible for realty, billboards, economic development, etc.), need to combine traffic count data sets in new ways to support various business processes. As sensor detection technologies mature in assisting traffic operations and intelligent traffic system (ITS) programs, the providers of traffic count programs recognize the potential benefits of using existing infrastructure and data to supplement their counts. However, the diverse efforts underway are generally not summarized, publicized, or leveraged. Key issues associated with using the data from traffic signal equipment for traditional traffic volume measurement include (a) inconsistency in data quality and format that varies across vendors and technologies; (b) inconsistency in availability of sensors at

all intersections as well as approaches to individual intersections; and (c) variable configuration of sensor equipment causing possible gaps in data availability, quality, and storage even though the equipment itself may be capable of counting vehicles, bikes, and pedestrians. Research is needed to examine whether the data provided by traffic signal assets can provide accurate traffic counts. The objectives of this research are to (a) determine the feasibility of using existing or enhanced traffic equipment to collect, store, and disseminate data for purposes other than traffic operations, particularly for traffic monitoring programs; (b) determine the suitability of traffic count data from already installed and existing traffic assets for this purpose; and (c) develop effective practices for obtaining and integrating traffic counts from existing traffic assets. The research will evaluate types of currently installed traffic monitoring assets and assess the suitability of traffic count data for non-operational traffic data usage. In this research, (a) the term "suitability" includes the quality, applicability, and type of the data obtained from the traffic equipment; (b) the term "traffic" includes motorized vehicles, micro-mobility devices, and non-motorized modes including bicycles, pedestrians, etc.; and (c) the term "traffic assets" includes, but is not limited to, signalized intersections, crosswalk signals, video, loops, magnetometers, radar, and traffic detection cameras.

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Anomaly Detection in Traffic Patterns Using INDOT Camera System

INDOT cameras at each highway location can provide lane-level traffic flow data from TASI's previous project. The primary goal for this project is to identify anomalies in traffic data patterns using a trained Neural Network, and store short video recordings of these anomalies as they are detected for review. The Neural Network can be trained using previously obtained week, month, or year traffic flow data and be used to distinguish in-distribution from out-of-distribution by comparing new data to the previous data.

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Development of Local AADT Estimates for Paved Roads in Idaho

At present time Idaho Transportation Department (ITD) has no rigorous or automated means other than very basic statewide generalizations to estimate Annual Average Daily Traffic (AADT) values for the local roads that comprise a majority of the statewide network. While the overall vehicles miles (VMT) traveled is calculated annually for the state, ITD is only capable of calculating general AADTs for broad categories: each large urban area, small urban roads combined, and rural roads combined. This means that some routes that may have a substantially higher AADT are not being well represented. This project will develop and define a methodology that may be implemented with geospatial tools that incorporate the characteristics of the local roads as well as the connecting roads that have an AADT calculated on them already. This project may use inputs such as the existing AADTs on the federal aid system, counts from local agencies, surface type, population, and other factors to develop the approach and method for distributing the annually published statewide VMT to generate annual AADTs on the local roads across the state. These values will then be validated using the Traffic Monitoring Guide (FHWA 2016) and other standards through sample collection

annually and across multiple counties, road types, etc. The objectives of this project are: (1) Conduct a literature review and State DOT survey to establish an understanding of current and emerging processes and methodologies used to collect, develop, and maintain local AADT estimates, including data needs and strengths/weaknesses for each method. (2) Create a thorough inventory of available data sources that are appropriate for use in AADT estimation. (3) Select and recommend a methodology for estimating AADT that can be integrated with ITD's existing data systems and is suitable given any data limitations. (4) Develop a plan and timeline for methodology implementation, including an approach to verify the accuracy and reliability of the identified methodology. (5) Summarize outcomes of objectives listed above in final presentation and final report submitted to ITD.

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Estimating Traffic Volume Using Ubiquitous Probe Vehicle Data

Annual Average Daily Traffic (AADT) is fundamental to a wide range of transportation applications. The recent Highway Safety Improvement Program (HSIP) Final Rule requires states to have access to AADT data for all public paved roadways, including local roads by 2026. KYTC's Traffic Count Reporting System plays a central role in collecting and providing this information through continuous count stations, short-term traffic counters, and classification data collection stations at selected locations on the state-maintained highways. However, AADT on many roads, especially local roads, is often unavailable due to limited resources. A methodology is needed to provide accurate estimates of traffic volumes on those unmonitored segments. Building on the findings of a previous KTC study on local roads ADT estimation, this study will employ more advanced machine learning methods and improved probe vehicle data to produce more accurate volume estimates.

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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.

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Use of Probe Data for Freight Planning and Operations

With the increased demand on supply chains, and factors such as resiliency and e-commerce, state departments of transportation (DOTs) rely more on probe data to understand the freight infrastructure needs, monitor freight infrastructure performance, and manage the demand. As the penetration of probe data has increased in the last decade, its usage in transportation planning and operations at state DOTs has become common. However, the application of probe data in freight is vastly different from traditional transportation planning usage. For instance, freight application tends to be specific to freight generators, freight attractors, and freight bottlenecks such as those near ports and borders, whereas the probe data may not be sufficient by itself. The objective of this synthesis is to document current state DOT practices regarding the use of probe data in freight planning and modeling, and operations management applications. Information to be gathered includes (but is not limited to): (1) Probe data providers for truck traffic that were utilized by DOTs and the range of applications for each and the observed limitations associated with the available probe data (e.g., applications near borders, ports, and other freight generators or attractors); (2) Use cases of probe data for freight planning/modeling, operations, and performance management (e.g., follow-up evaluations of infrastructure improvements); (3) Practices for fusing the probe data with other data sources (e.g., origins and destinations, commodity and load information, truck speeds and weather data, etc.). (4) Practices for conflating probe data network to DOT transportation networks (e.g., annual average daily traffic); (5) Practices on addressing biases in probe data; (6) Practices on probe data cleansing, analysis, maintenance, and stewardship; (7) Practices on funding the acquisition of, and navigating the procurement of, probe data and use restrictions; (9) Uses or plans for probe data from emerging technologies (e.g., truck parking information management systems, connected and/or automated vehicles); and (10) Practices on building and leveraging partnerships (e.g., freight stakeholder groups, coalitions, vendors, metropolitan planning organizations, etc.).

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Guide for Long-Term Automatic Traffic Signal Performance Measurement Systems Applications

Automated traffic signal performance measures (ATSPMs) could provide additional information to DOTs to help improve signal performance at intersections. ATSPM systems primarily present raw data in graphic representation to provide visual tools to assist signal operators in assessing signal performance on a regular basis, proactively identifying problems associated with signal timing, and to seek opportunities for improving traffic signal operation to improve traffic flow and system efficiency. However, ATSPMs user experiences have identified limitations of the current high-resolution data schema on which the ATSPMs are established including: (1) The unavailability of a universal schema or easy conversion from one data format to another for different types of systems, causing state DOTs and public agencies to duplicate their effort in creating and managing data and information. In addition, due to limited standardized guidelines about managing high-resolution signal data and associated metadata information, state DOTs and other public agencies may handle complex traffic signal system cases slightly different, which can lead to inconsistent methodologies between agencies. (2) Connected automated vehicles (CAV) and sensor technology, a new data source of short-term trajectory information as vehicles and pedestrians approach an intersection, are currently not included in the data schema for ATSPMs. (3) The unavailability of a well-documented standard available for recording geo-spatial metadata. Research is needed to define effective practices for state DOTs and public agencies for managing ATSPM data long-term and ensure these practices are scalable, transferable, and enable CAV integration. The objective of this research is develop a guide to assist state DOTs and public agencies with long-term management of ATSPM systems applications for scalability, transferability, and CAV integration.

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TDOT RDS Data Quality Assurance and High-Resolution Content Enhancement

The need to understand the state of traffic and its dynamics is only increasing on Tennessee's major roadways. Increasing passenger and freight demand is driving congestion and safety concerns. Tennessee Department of Transportation (TDOT) is taking major steps to address these concerns for the motoring public through capital projects, active traffic management strategies, and real time incident response. A major source of real-time roadway condition data in Tennessee is the RDS data system. Over 800 detectors across the state provide information on vehicle counts, classifications, and speeds. Crucially, they take high-fidelity measurements that are not available from many alternative sources, while being non-invasive for easy construction and maintenance. The challenge remains that powerful insights from the data can be hampered by suboptimal data quality and usability or availability limitations. Specific limitations that exist in the RDS data stream include degraded system uptime, short periodic data outages, a high degree of noise in data at some fidelity levels, and loss of sensor calibration over time.

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URL: https://rip.trb.org/View/2006836

Development of Guidelines for Compatible Sensor Installation, Data Collection, and Database-based Visualization for INDOT

This project will develop comprehensive guidelines and example systems for sensor data collection, integration, and analysis to streamline implementation within INDOT's research division and MIS systems.

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Best Practices for Lidar Data Collection and Processing

The recent installation of Lidar sensors on roadway inventory vans lets the Kentucky Transportation Cabinet (KYTC) collect vast amounts of data along Kentucky's highway systems. Lidar has many transportation-related applications, however, not all Lidar data are created equally. Relative and geospatial accuracies, data densities, collection procedures, and other factors can limit the utility of post-processed Lidar deliverables. KTC will develop best practices for data collection, post-processing, and data extraction as well as train KYTC staff who will use Lidar sensors on roadway inventory vans.

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A Guide for the Development and Use of Truck Traffic Forecasts in Design

Transportation planning and design require different levels of detail with respect to forecasting travel behavior, demand, and use. Whereas many planning decisions can be supported by typical outputs of a four-step travel demand model, these same outputs are insufficiently precise to support many of the decisions being made during detailed project development and design. Truck traffic forecasting is often conducted as a post process of the data results from a travel demand model or is conducted using commodity flow or other economic and statistical models. Yet, a variety of specific decisions regarding the placement, quantity, length, and geometry of facilities to support a specific volume and type of truck traffic would benefit from more specific data, methods, and techniques for using truck traffic forecasts in project design. Among the limitations of typical travel forecasting models are the ability to predict the specific volumes, weights, and movements of trucks on highways. Truck traffic imposes specific design requirements to accommodate their unique weights and configurations. Transportation agencies and freight distributors need to assess truck travel in different contexts, including but not limited to long-haul goods transportation, local, and last-mile freight deliveries. State departments of transportation (DOTs) and modeling professionals are responding to these challenges by creating more accurate and responsive models and model applications, particularly as the research and development of modeling methods and techniques continue to advance. Nevertheless, the transportation industry is not uniform with respect to its technical knowledge, capabilities, budgets, or other resources needed to develop and apply sophisticated models and decision tools to support project design decision-making. While some state DOTs have the resources to supplement in-house staff or hire outside experts to conduct model runs and analyses, many others simply do not have that capacity. The objective of

this research is to develop a guide to assist state DOTs and other agencies in the selection and use of forecasting models, applications, procedures, tools, and techniques needed to support project design.

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BIG DATA ANALYTICS

Vehicle-Based Telemetric Data for State and Local Transportation Agencies

The collection and aggregation of data directly from vehicles has introduced a new set of tools for state and local transportation agencies to fill gaps in their existing understanding of roadway system performance. State and local departments of transportation (DOTs) are heterogeneous, and their needs and uses for telemetric data are nuanced. Telemetric data are defined here as data generated or collected by vehicles and in-vehicle devices. Private sector entities that provide telemetric data and related analytics are still relatively new and may be reluctant to share their data. Advancing technologies are changing the landscape relative to an agency's ability to improve safety, operations, and other DOT business practices. However, new technological capabilities uncover challenges related to telemetric data availability, accessibility, integration, privacy, and use. The research objectives are to (1) determine what telemetric data is available to state and local DOTs; (2) determine how telemetric data is being used by state and local DOTs; and (3) identify challenges and opportunities for the use of telemetric data.

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Guide to the Application of Spatial Segmentation on Travel Time Reliability Measures

Travel time reliability measures create a consistent means of comparing the performance of different highways in the network. Travel time reliability measures inform decisions regarding highway capital and operating investments and facilitate accurate public reporting of highway travel times and performance. Additionally, travel time reliability is a required federal performance measure for state departments of transportation (DOTs) and large metropolitan planning organizations (MPOs). Travel time reliability measures are affected by the way highway corridors are divided into segments for data collection, analysis, and reporting. Corridors with fewer segments may "average out" the impacts of congestion "hot spots" along a corridor, creating less reliability in practice. Shorter and more intentionally defined road segments may have the effect of creating more predictable and consistent reliability measures by isolating the impacts of places that experience more or less episodes of congestion. However, the travel time reliability measures calculated for longer corridors with many "hot spots" can be less certain and comparisons of reliability measures calculated for roads within a network cannot always be trusted. Typically agencies obtain travel time and speed data from third-party probe data suppliers who use predetermined segments. To improve travel time reliability measures, practices, and reporting, transportation practitioners need direction on the application of

methods for supplementing these data using segmentation and aggregation to produce the most consistently reliable measures, ones that can be compared across the network and used for public communication and investment decision-making. The objective of this research is to develop a guide for designing, modeling, and applying roadway segmentation in travel time reliability measurement to generate improved reliable predictions across similar roadway contexts.

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URL: https://rip.trb.org/View/1707208

Expanding Connected Vehicle Data Framework (CVDF) Data Sources to Increase Applications and Use on Texas Roadways

Connected vehicle (CV) technology is enabling transportation systems to become safer and smarter. Texas is assembling a robust CV ecosystem, with several CV deployments underway. At the heart is the Connected Vehicle Data Framework (CVDF), a data exchange that enables Texas Department of Transportation (TxDOT) to publish key information, such as work zone locations and travel times, as well as ingest data from other public agencies and third parties regarding traffic characteristics, road weather conditions, and safety events. Constraints in data access and format standardization, however, limit the CVDF from realizing its full potential. This project will leverage the existing CVDF that currently supports the Texas Connected Freight Corridors project to expand its efficacy through applications, data partners, and corridors. By expanding the CVDF, TxDOT will unlock new benefits—improved real-time traveler information; increased CV adoption in passenger and freight markets; and more strategic infrastructure investments. This project will deliver a CVDF Expansion Toolkit that includes: (1) New applications that improve safety and mobility (e.g., truck parking availability, road weather warning, border wait times); (2) Recommended data partners from local and regional agencies as well as third-party data providers to improve traffic operations; and (3) Corridor investment strategies that identify Texas roadways for CV operations and describe infrastructure readiness tactics.

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Start Date: 09/01/2022
Expected Completion Date: 08/31/2024
Status: Active
URL: https://library.ctr.utexas.edu/Presto/project=7164

Analysis and Assessment of the National Performance Management Data

Moving Ahead for Progress in the 21st Century Act (MAP-21) and Fixing America's Surface Transportation Act (FAST Act) laid the groundwork for a comprehensive national-level performance management framework. The first 4 year reporting period began January 1, 2018, and ended December 31, 2021, and is the first complete set of consistent national-level performance management data. The availability of this data is an opportunity to conduct the first comprehensive analysis and assessment of this unique data set. Research is necessary to: (1) understand the metrics and perform sensitivity analyses for the 17 transportation performance measures (TPM) for the three performance areas; (2) document processes being used to establish performance targets and how these influence performance outcomes; (3) assess the degree to which the performance analysis is influencing project planning and programming; (4) identify potential revisions to existing performance measures, identify gaps in measures, and develop mechanisms that could address these gaps that would help to set and achieve meaningful outcomes; and (5) explain the results of the national

performance data analysis in a way that can be used to effectively communicate the current performance of the highway transportation system. The objective of this research is to develop and implement a framework to analyze and assess the national performance management data from MAP 21 and the FAST Act to present a more complete performance story of the highway transportation system.

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Start Date: 07/02/2023
Expected Completion Date:
Status: Proposed
URL: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5321

A Deep Learning-based Network-wide Traffic Prediction Model for Integrated Corridor Management Systems

The objectives for this study are as follows: (1) Develop a deep learning-based modeling framework for high-fidelity traffic prediction utilizing traffic sensors, link capacity, socio-economic, and land use data; (2) Develop a predictive strategy evaluator to assess the impact of potential traffic management strategy given an incident and predicted traffic; (3) Develop a data pipeline that can feed a range of datasets and deliver prediction outputs to a visualization application; and (4) Create a data visualization dashboard providing traffic flow information (such as volume and travel time by link) to show future traffic forecast.

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Start Date: 06/06/2023
Expected Completion Date: 09/30/2025
Status: Active
URL: https://rip.trb.org/View/2194299

Cost-effective Traffic and Roadway Data Collection Using Edge-based Comprehensive Sensing System: A Machine Learning Based Approach

The primary goal of this research is to develop a robust and cost-effective traffic-sensing and data-processing system including software algorithms and a hardware unit to address the current unequal and insufficient collection of traffic data. The software system must be compatible with the Washington State Department of Transportation (WSDOT) system and connected with the existing TMC equipment seamlessly. Moreover, the hardware system should be easy to install and maintain as well as a competitive cost. To achieve this goal, the research objective includes the following aspects: (1) Propose a machine learning (ML)-based approach for realizing cost-effective traffic and roadway data collection. ML technology has the capability to effectively learn and extract knowledge from large amounts of data. Specifically, deep-learning-based object detection, localization, classification, tracking, and counting will be utilized in this project due to its outstanding capability to learn deep representative features with high accuracy and efficiency. (2) Incorporate the algorithm in an edge-based comprehensive sensing system MUST. This means the whole data process will be finished on edge devices without the need to transfer data back to a server. One existing problem here is deploying the model efficiently on edge devices while considering computational restrictions. Also, the system should function well in locations with poor communication infrastructure or safety concerns due to geometry and volume constraints. (3) Collect and categorize important traffic information accurately and automatically. This information includes classified vehicle volumes (FHWA 13-bin classification), road surface conditions, visibility, and other relevant data. It is important to note that this system only focuses on the data collection of vehicles, not including pedestrians or cyclists. To sum up, the expected outcomes of this project are a traffic data sensing and processing system deployed in a mobile unit. This system should be capable to

perform a 13-category vehicle classification and help researchers collect information where traditional methods cannot be used for safety or functional limitations. The collected traffic data will support data-driven decision making and more advanced technology development in related fields.

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Expected Completion Date: 08/31/2025
Status: Active
URL: https://rip.trb.org/View/2310053

Generating Reliable Freight Disruption Measures with Freight Telematics Data

Disasters on the transportation network raise awareness of the need to plan for quick mobility and recovery whether they are due to human error, human intent, or nature. Therefore, understanding how resilient a network is to such events provides opportunities for transportation agencies to better prepare. Resilience measures then become a useful tool to evaluate and predict impacts of disruptions and recovery to guide investment decisions to protect against these events. When it comes to freight network system measurements there are two major challenges the states and other agencies face: (1) the absence of data and (2) the lack of methods of analysis. There are robust data for the movement of people and passenger vehicles but understanding the way freight moves presents different types of challenges to decision-makers especially under disruptions scenarios. These movements are based upon supply chain decisions made by individual corporations, which quite often change over time due to various economic conditions. Freight often moves across numerous jurisdictions and by multiple modes of transport (e.g., air, rail, water/marine, and truck). Data that captures origins and destinations, as well as methodologies of collecting and utilizing data across multiple jurisdictions and modes, are extremely limited for freight. Currently, decision-makers are only able to use a few data sources that help in identifying freight movements among States and regions, commodities, tonnage, and value. With this in mind, this research presents a framework based on telematics technology from EROAD, a regulatory telematics technology company from New Zealand who has provided telematics services to over 69,000 vehicles (and already collected data), to evaluate this data source for generating reliable freight network resiliency measures. EROAD is a company that develops and implements technology to modernize traditional paper-based systems within the trucking industry. As part of this modernization, EROAD collects the data used for generating reliable freight performance measures. Still, EROAD data has yet to be used for such an application. This research utilizes the Pacific Northwest as a case study which will allow the research team to evaluate freight movements over various jurisdictions (e.g., within state and state-to-state) and assess EROAD data in the development of reliable freight network resiliency measures. Given that EROAD data captures freight telematic data for truck movements, this study focuses on the trucking mode. The findings of this study have the potential to generate new and reliable freight network resiliency measures utilizing a new source of data for state transportation planners.

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Expected Completion Date: 09/30/2024
Status: Active
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Free Flow Speed Estimation Methodology for Performance Measures

Free flow speed (FFS) is used as an input for many key performance measures, such as travel time reliability and congestion measures for interstates and arterials. While traffic practitioners generally agree on the idea that FFS should be estimated under good weather conditions and without incidents, some studies suggest that

driver behavior is always in a compromised status under the influence of both internal and external conditions. FFS calculated using different methods can yield varied, inconsistent results. In response to VDOT operational needs, it is imperative to develop consistent free flow speed estimation methods for performance measures. In response, this project will develop a set of methodologies to (1) compare commonly available FFS estimation methods on interstates, (2) evaluate how FFS estimates affect performance measurements on the interstate network, and (3) explore the usage of probe data for arterial FFS estimation.

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Expected Completion Date: 11/30/2024
Status: Active
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Leveraging Probe Data for Improving Incident Management Practice in Rural Areas

This proposed study aims to (1) acquire applicable probe data from applicable providers, and (2) spatially match the probe data to the OTD traffic count locations in the rural areas of Georgia for data fusion, (3) conduct a case study for a high-risk rural area in Georgia to showcase the feasibility of using the pooled data for improved incident management through predictive incident modeling.

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Start Date: 11/29/2023
Expected Completion Date: 11/29/2024
Status: Active
URL: https://trid.trb.org/View/2304486

Exploring Cost-effective Computer Vision Solutions for Smart Transportation Systems

The project is focused on developing a deep learning based data acquisition and analytics tool using vision - based sensors (i.e., cameras) to understand cities with machine eyes . The team will assess the maturity of various smart city applications using computer vision and object detection (e.g., pedestrian detection, work zone identification , curb lane usage, connected and automated vehicles [CAVs]) as well as the needs of the local agencies. The goal is to demonstrate the c ost - effectiveness of the computer vision technology to generate new stream of mobility data and provide support for planning and operational strategies , utilizing both existing transportation infrastructure and emerging probe and CAVs . More specifically, t his project aims to establish an inventory of available traffic camera systems in the U.S. and deploy two computer vision smart city applications based on stakeholder feedback that are customized for New York City (NYC) . The team will also establish a formalized pipeline for running the computer vision algorithm enhanced for NYC conditions and prototype the applications for real - world implementation.

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Start Date: 03/01/2022
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Status: Completed
URL:
https://c2smart.engineering.nyu.edu/exploring-cost-effective-computer-vision-solutions-for-smart-transportation-systems/

Data and Methods to Estimate Connected and Automated Vehicle Penetration Rates

Automated driving systems are becoming increasingly prevalent on Virginia roadways. These vehicles rely on radar, lidar, and machine vision to operate, and may detect road markings, barriers, and other vehicles in ways that human drivers do not. Vehicles may also leverage wireless communication to assist in driving, path planning, and communicating with roadside infrastructure. Recent research has investigated the impact of an increasingly connected and automated vehicle fleet on safety and capacity, but these estimates rely on accurate measurements of the volumes or proportions of vehicles on the road equipped with and utilizing these technologies. VDOT does not currently have a way to estimate the volume of connected (CV), automated (AV), or connected and automated (CAV) vehicles operating on Virginia roadways. The purpose of this project is to identify data required for VDOT to accurately estimate the proportion of vehicles equipped with and utilizing vehicle automation technologies that may affect safety and operations. This project will also consider practical ways to collect this data using both available data sources as well as potential additions to the current vehicle registration system. Benefits to VDOT include more accurate data on the rate of CAVs in the vehicle fleet, allowing the development and calibration of empirical models of the effect of CAVs on traffic flow, capacity, safety, and infrastructure planning.

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Start Date: 07/25/2022
Expected Completion Date: 08/31/2023
Status: Completed
URL: https://rip.trb.org/View/1992649

Best Practices for Data Fusion of Probe and Point Detector Data

Data fusion is the process of integrating multiple data sources to produce more consistent, accurate, and comprehensive information than that provided by any individual data source. In a transportation context, transportation agencies are seeking to define the types and characteristics of data for entry into data fusion engines. Research is needed to identify the challenges, issues, and proven or potential practices for performing data fusion to measure or forecast travel time, speed, reliability, and other aspects of operational performance on roadway networks. Traffic datasets of interest include point sensors; Bluetooth; data from GPS devices embedded in smartphones, personal navigation devices, taxis, and fleets; third-party travel time data; and emerging connected vehicle (CV) data sets. Research that enables better knowledge of the network state could help improve traffic management and planning decisions to address impacts of recurrent and non-recurrent (e.g., incident-related) congestion. Improved network state estimates could also enhance safety outcomes by identifying locations with high crash rates and anomalous traffic flow conditions. The objectives of this research are to do as follows: (1) Develop a process to (a) identify specific objectives for data fusion; (b) identify data sources available for fusion; (c) select the most suitable data for fusion; and (d) facilitate the fusion itself. (2) Develop guidelines for transportation agencies to facilitate data fusion, improve data reporting, and ultimately improve traffic management.

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Start Date: 09/07/2022
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Status: Active
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5135

Development of an Intelligent Traffic Monitoring System Based on Artificial Intelligence

Tennessee Department of Transportation (TDOT) provides essential services to support transportation operations on Tennessee highways. Among these services is the critical incident management service, one of the Transportation Management and Operations (TSM&O) strategies that significantly impact traffic flow in Tennessee. Coordinated action between all four regions managed through the various TDOT Traffic Management Centers requires better insights and analysis of the performance and operational awareness of the interstate highways and the surrounding roadways. The major challenge with the lack of information and real-time insights is the delayed detection of incidents and the inability to manage the response successfully and on time. The question that faces the team and TDOT is the following: can we use advanced sensor fusion techniques to obtain reliable insights from a collection of heterogenous sensors and achieve similar insights that may be gathered through expensive but high-resolution camera arrays.

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Status: Active
URL: https://rip.trb.org/View/1861656

Using Vehicle Probe Data to Evaluate Speed Limits on Texas Highways

Texas Department of Transportation's (TxDOT's) current practice is to conduct numerous speed studies throughout the year to determine if the speed limits should be changed due to new traffic patterns, development, crash history, and other factors. These studies are driven by stakeholder requests or as part of routine annual reviews. The number of studies performed at any given time is limited by staff and consultant resources, resulting in a process that can take several months to complete. Can the increasing availability of vehicle probe data, along with other big datasets, be used to reduce the level of effort and time needed to collect speed data? If so, what data can be readily obtained from big data sources and what procedure would be needed to refine the use of probe speed information and produce speed limit recommendations that are consistent with the sound engineering practices currently used by TxDOT staff? This project will explore if there are more efficient methods for conducting Texas speed limit studies that would allow TxDOT districts to be more pro-active and responsive with their speed zone program. Such a program would also provide a much safer method of collecting speed data, especially on high-speed and controlled access highways.

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Start Date: 09/01/2022
Expected Completion Date: 08/31/2024
Status: Active
URL: https://library.ctr.utexas.edu/Presto/project=7156

Research on Artificial-Intelligence for Data Integration with State Highway

Active traffic management implies the dynamic management of recurrent and non-recurrent congestion based on current and predicted traffic conditions. The goal of this project is to improve mobility and safety

using data analytics and artificial intelligence applied in active traffic management for arterial freeway interactions. The project team will develop an integrated system that uses data collected from videos and loop detectors and other sensors for this purpose. Using machine learning and artificial intelligence, the team will develop techniques that will support real-time traffic management.

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Expected Completion Date: 03/30/2024
Status: Active
URL: https://rip.trb.org/View/1982055

Leveraging Artificial Intelligence (AI) Techniques to Detect, Forecast, and Manage Freeway Congestion

The purpose of this project is to improve the quality and effectiveness of the Texas surface transportation system, it is important to be able to predict where and when prolonged congestion will start and how it will spread, as well as to track atypical events and estimate their evolution. Artificial intelligence (AI) approaches provide a unique opportunity to estimate precise congestion measures by utilizing data from agency-owned sensors, third-party providers, and big enterprise data. This project envisions to mitigate the current research gap by conducting two major project phases. The first phase can confirm the validity of commercial data sources for planning and operations, while the second involves understanding which AI models/ algorithm are the most suitable for addressing TxDOT needs based on desirable use cases and data availability. Furthermore, it is important to analyze the required data models and workflows to determine whether it is sustainable to train, test, and validate the proposed AI techniques. The research teams understand that achieving the research goals requires a comprehensive analysis and documentation of commercial big data platforms and datasets, appropriate AI algorithms, and robust prototype tool to foster return on investment (ROI) and reduce freeway congestion.

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Start Date: 09/14/2021
Expected Completion Date: 08/31/2023
Status: Completed
URL: https://library.ctr.utexas.edu/Presto/project=0-7131

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.

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Start Date: 01/01/2021
Expected Completion Date: 12/31/2024
Status: Active
URL: https://rip.trb.org/View/1846491

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.

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Start Date: 07/14/2021
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Status: Completed
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4956

WEIGH-IN-MOTION

Advancing Multiple Sensor Weigh-In-Motion (WIM) Technology for Improving Weight Data Accuracy and Reliability

Weigh-in-motion (WIM) systems measure the axle weight of moving vehicles as they traverse WIM measurement sites. WIM data are essential for the design, assessment, and maintenance activities related to pavement and bridge infrastructure and may be used for monitoring and enforcing motor carrier truck weights and dimensions and collecting tolls. WIM sensors vary from instrumented metal plates to piezoelectric, quartz, and strain gauge strip sensors. Their accuracy is evaluated with reference to static loads referenced in the American Society for Testing and Materials, Standard Specification for Highway Weigh-In-Motion (WIM) Systems with User Requirements and Test Methods, ASTM E1318-09 (2017) and is affected by the interaction between roadway roughness, vehicle dynamics, and speed. The narrow strip-type WIM sensors that sample a smaller part of the dynamic axle loads applied to the road may be strategically spaced to capture more data points of the dynamic axle load waveforms by using multiple strip sensors (two or more). The use of multiple strip sensors will potentially result in increased data reliability and more accurate estimates of the corresponding static axle loads, reduce measurement error, improve data quality, and reduce maintenance costs. State departments of transportation (DOTs) require accurate and cost-effective WIM technology. Research is needed to assess and optimize multiple-sensor spacing and determine its benefits and feasibility. The objective of this project is to develop a model to determine the optimal number of WIM strip sensors and array layout, given specified levels of accuracy and reliability considering pavement, environmental, and traffic conditions.

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Start Date: 11/13/2023

Expected Completion Date:
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Investigation of Heavier-than-Expected Vehicle Weights Observed in the Vicinity of the Savannah Port Area and their Impact on Georgia's Pavements and Bridges and Rate of Statewide Asset Degradation

The primary objective of Part A of this project is to investigate the impact of heavy vehicle traffic on pavement and bridge structures in Georgia. The main objective of Part B of this project is to evaluate pavement and bridge structures using weigh in motion (WIM) data, conduct field investigations, and evaluate the reliability of existing pavement and bridge structures.

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Start Date: 09/30/2023
Expected Completion Date: 09/30/2026
Status: Active
URL: https://rip.trb.org/View/2265649

Impact of WIM-based Direct Enforcement on the Service Life of Bridges

The Brooklyn-Queens Expressway (BQE) in New York City is a crucial corridor connecting the two boroughs of Brooklyn and Queens with other counties. Given its substantial daily traffic for transporting goods and services, the longevity of BQE is crucial to enhance public safety and alleviate congestion. The team has collaborated with the New York City Department of Transportation (NYCDOT) to implement (1) an integrated weigh-in-motion (WIM) systems on the northern part of the BQE corridor for a direct enforcement of the high percentage of overweight (OW) trucks, and (2) a structural health monitoring (SHM) system to estimate the remaining service life of the BQE structures. This project synthesizes WIM and SHM data to study the impact of the reduction in OW percentage over time resulting from direct OW enforcement on extending the service life of the BQE. Furthermore, the team will conduct a life-cycle cost analysis (LCCA) of the network of bridges in NYC based on the established correlation. The output of this project will be a new framework to evaluate the effect of reduced OW percentage on the service life prediction. This framework will help introduce new legislation(s) for direct OW enforcement to mitigate the number of OW trucks and their OW tonnages; thus, improving bridge service life and preserving highway infrastructure. Another aspect of this proposal is to expand the potential uses of physical testbeds to investigate the feasibility of utilizing biometric sensors, including eye tracking glasses, galvanic skin response sensors, and heart rate trackers, to assess the perceived safety of micro-mobility users, encompassing both cyclists and e-scooter riders. The primary objective is to collect pilot data to develop well-structured semi-naturalistic experiment protocols, allowing for the acquisition of reliable psychological data concerning the safety perceptions of micromobility users. The acquired sensor data will be cross-referenced with qualitative survey responses to analyze the advantages and disadvantages of various methods for collecting safety perception data among micromobility users. The data collected from these experiments will play a crucial role in providing insights into the types of infrastructure designs that are well-received by micromobility users and identifying built environments considered unsafe for travel. These findings will be invaluable for informing infrastructure design improvements aimed at enhancing the travel experiences of micromobility users, supporting mode shifts, and mitigating congestion.

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Expected Completion Date: 09/30/2024
Status: Active
URL:
https://c2smarter.engineering.nyu.edu/impact-of-wimbased-direct-enforcement-on-the-service-life-of-bridges

Low-Cost Sensing System for the Detection and Classification of Super Single Wheel Types and Distribution at the Network Level

This project will develop and test a low-cost novel sensing system to detect and classify wide-base tire (WBT) types and their distributions and demonstrate the usefulness of the system for data collection for pavement analysis and design applications. The work will be carried out in two stages. Stage 1 work will focus on developing and testing prototypes of a novel low-cost sensing system that can detect tire widths, wheel wander, and truck/axle configurations at highway speeds. A prototype of piezoelectric-based pressure transducers encapsulated in a special epoxy ready for embedment in pavement structures or temporary surface attachment will be developed. These transducers will constitute the basic components for the proposed sensing strip in the outer lane in one direction. The sensors can respond to very high-speed signals with a wake-up time in microseconds. The device will respond to applied pressure by the tires at highway speeds (>70 mph). After developing and testing the sensing system in the laboratory, verification tests will be conducted at a local parking lot and the university campus roads. Tests are also planned tests at Minnesota's MnROAD facility to verify the validity of the detection using the controlled truck traffic. Work in Stage 2 will involve field evaluation and validation of the developed prototype system. The system will be installed in the field adjacent to several WIM locations. The application of the system will be demonstrated by analyzing field data to identify (a) the type and frequency of various super single tires (WBT) on a particular route, (b) lateral distribution of wheels in the wheel-path (i.e., wheel wander), and (c) axle load spectra for WBT vs. conventional dual tires. Stage 2 will also involve field data collection in Michigan and Minnesota to demonstrate the sensor system's practicality and obtain feedback from state DOTs. At least 2-3 sites will be selected in these states, preferably adjacent to a WIM sensor, and the sensor system will be installed for data collection for at least 1-5 days in the outer lane. Data will be collected on the tire width, the exact number of tires per axle, and their position along the cable (position along the lane). The information will be used to classify tire types (i.e., WBT vs. dual); it will also precisely measure the wheel wander. The obtained data will be synthesized to show the usefulness of the developed sensor system by summarizing (a) differences in axle load spectra (ALS) -- single and tandem axles for dual tires and WBTs; (b) wheel wander distributions; and (c) vehicle classes compared from the existing WIM system and the sensor for each site. A life cycle cost analysis (LCCA) of the sensing system will be performed. The final report will provide all relevant data, methods, models, and conclusions, along with guidance on using the system to collect WBT data by state DOTs.

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Start Date: 07/11/2022
Expected Completion Date:
Status: Active
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=5385

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..

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Start Date: 10/01/2018
Expected Completion Date: 04/30/2023
Status: Completed
URL: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4412

Evaluation of Integrated Overweight Enforcement System using High Accuracy WIM System and Non-Proprietary ALPR System

The main objective is to establish the second testbed for overweight enforcement along the BQE corridor in New York City. The team will develop the drawing for the site-specific sensor layout, install the Quartz sensors and automated-license-plate-recognition (ALPR) cameras to measure truck weight data and identify license plate and/or USDOT number, and evaluate the performance of the overweight enforcement system. The team will also estimate the impact of an extreme event using data collected for infrastructure resilience.

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Start Date: 03/01/2022
Expected Completion Date: 02/28/2023
Status: Completed
URL:
https://c2smart.engineering.nyu.edu/evaluation-of-integrated-overweight-enforcement-system-using-high-accuracy-wim-system-and-non-proprietary-alpr-system/

PEDESTRIAN AND BICYCLES

Statewide Non-Motorized Traffic Monitoring Study

The objectives of this research are to do the following: (1) Consolidate non-motorized traffic data collected by Louisiana Transportation Research Center/Louisiana Department of Transportation and Development

(LTRC/DOTD) to date onto a geographic information systems (GIS) platform (2) Explore the possibilities of consolidating non-motorized traffic data collected by other public agencies onto the same GIS platform. (3) Refine expansion factors for short-term counters with additional data. (4) Evaluate emerging data products by comparing them with counting data collected to date in Louisiana. (5) Evaluate opportunities for and needs pertaining to expanding counting locations to support DOTD's needs..

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Sponsors: Louisiana Transportation Research Center
Start Date: 07/01/2023
Expected Completion Date: 06/30/2025
Status: Active
URL: https://trid.trb.org/View/2194389

Measuring Pedestrian Psycho-Physiological Well-Being in the Built Environment

Current advancements in ubiquitous sensing technologies have the potential to increase transportation designers' understanding of pedestrian behavior and experience. It is now possible to collect human state and behavior data naturalistically and longitudinally. Currently, over 900 million wearable devices are being used worldwide on a daily basis (Tankovska 2020). The application of these devices spans over a variety of fields such as mental health (Coughlin and Stewart 2016), health and physical activity (Kos and Kramberger 2017, Hsu et al. 2018), and sleep monitoring and interventions (Jeon and Kang 2019). Similarly, these technologies can be utilized to identify how pedestrian states, behavior, and well-being vary in different contextual settings. Using mobile sensing technology such as gaze, heart rate, and stress trackers, this research attempts to characterize whether quantitative physiological data (as collected by these sensors) can be used to predict qualitative perception data (captured by stated preference surveys), to ultimately capture changes in the pedestrian urban experience as environmental and infrastructure design variables shift. These user-centric data on road environments are essential for establishing actionable standards linking roadway design to pedestrian well-being. By emphasizing multimodal urban streetscapes that serve as public spaces for people, transportation planners, engineers, designers, and policy makers can reach goals for more livable, safe, and economically vibrant environments.

POC: Joseph Niehaus at joseph.niehaus@morgan.edu
Sponsors: Sustainable Mobility and Accessibility Regional Transportation Equity Research Center
Start Date: 09/01/2023
Expected Completion Date: 09/01/2024
Status: Active
URL: https://rip.trb.org/View/2251037

Developing a data fusion framework to map active transportation usage patterns in Orange County

The proposed research aims to create a set of adjustment factors accounting for the built environment, socio-economic, and land-use characteristics which can be applied to crowdsourced data so that policymakers and transportation practitioners across the Southern California region can begin to incorporate exposure estimates more reliably and consistently into their safety, infrastructure planning, and decision-making analysis. The proposed solution will be relatively easy to use and will bring potentially substantial cost and resource savings to communities throughout the country. Public agencies using crowdsourced data can benefit from the proposed methodologies for validating exposure estimates and reproducing methodologies for working with similar datasets. By bridging the gap between crowdsourced data and the resources needed to reliably use that data, these factors will put exposure estimates at the fingertips of communities that urgently need data but have not prioritized it due to resource constraints. This research will also provide insights into bicycling patterns that may be more broadly applicable, such as geographic and

sociodemographic variables that consistently impact bicycling volumes in certain contexts or on certain street types regardless of context. These insights will be useful irrespective of whether a community has crowdsourced data or an established counting program. It will also highlight aspects of disparities in access to safe bicycling amenities that are often not well captured in count programs conducted by local authorities. The underrepresented communities which are often left out of planning decisions will be accounted for in the modeling framework by means of additional data acquired from US Census Bureaus' American Community Survey.

POC: Hong, Jennifer at jenc@usc.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 07/01/2023
Expected Completion Date: 06/30/2024
Status: Active
URL:
https://metrans.org/research/developing-a-data-fusion-framework-to-map-active-transportation-usage-patterns-in-orange-county

Integrating Non-Motorist Facility Data into Comprehensive Road Safety Assessment

This project aims to enhance pedestrian and bicyclist safety understanding, bolster educational and professional capacities, and facilitate the practical implementation of computer vision techniques in transportation planning and engineering, ultimately leading to safer transportation systems for pedestrians and cyclists. The project will address challenges in gathering pedestrian facilities data and assessing safety concerns for pedestrians and bicyclists, encompassing a comprehensive process involving literature review, case study design, data collection and preparation, model development and validation, result analysis, and recommendation formulation. Through innovative approaches utilizing satellite images and image processing techniques such as spatial analytics and deep learning models, the project intends to extract crucial information about pedestrian and bicyclist facilities and nighttime streetlight conditions. By leveraging deep neural networks and statistical analysis, the project aims to compare longitudinal datasets, predict injury risks, identify high-risk areas, and unravel potential risk factors and relationships contributing to pedestrian and bicycle accidents, thereby informing evidence-based decisions and interventions. The outcomes of this project will be disseminated through technical reports and academic discussion, contributing to the understanding of non-motorist safety, encouraging further research, and providing educational resources for transportation programs.

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Start Date: 06/01/2023
Expected Completion Date: 05/31/2024
Status: Active
URL: http://www.pedbikesafety.org/23uwm02

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

State DOT and tribal active transportation programs and their partners at other state, local, tribal, and territorial organizations are looking to answer questions on data standardization, sharing, and governance such as:

- What innovative, cost-effective data use cases could provide scalable examples among state DOT and tribal practitioners?
- What nontraditional or unusual sources or applications of data (that may be primarily for other purposes) could be adapted or integrated into active transportation analyses (e.g., police and hospital reports)?

- What practices do peer agencies recommend for identifying, collecting, cleaning, utilizing, analyzing, standardizing, storing, publishing, and funding data? How do they address privacy and legal concerns?
- How can tribes and state DOTS exchange data with other tribal, state, and local governments; public transportation; and rural and metropolitan planning organizations (MPOs)?
- What data are available on funding, facilities, public initiatives, multi-use trails, bicycle sharing, micromobility usage, standard practices, staffing, maintenance agreements, regional data-sharing partnerships, and regional and interstate connectivity?
- How many lane-miles of facilities exist or are planned per active transportation mode? How do they relate to funding and funding sources?
- Where, specifically, are resources flowing (geographically)? What also may be behind local agencies not matching project costs by state and federal programs which may prevent active transportation enhancements?
- What resources exist in state DOTs, tribes, MPOs, and local governments? What is the bicycle/pedestrian share of funding and staffing?
- How are tribes and state DOTs staffed to acquire and utilize new data?
- What are examples of effective state DOT and tribal practices in the acquisition, use, maintenance, and application of data? How are they structured? How are they funded?
- How do state DOTs and tribes handle cross-border data practices, including cross-state MPOs, urban/rural overlaps, and tribal/non-tribal jurisdictions?
- What injury data monitoring/surveillance systems are in place? Are there opportunities to further enhance the ability of existing systems to document health and safety outcomes, particularly for active travel modes? What barriers or safeguards are there when it comes to sharing this information with state DOTs and tribes?
- What methods and data sources, if any, are used to measure injuries that are not reported in police crash report systems, including falls and crashes not directly involving vehicles that occur in the right-of-way and could be attributable to the built environment or used for safety and health planning purposes?
- What data is currently not being shared among jurisdictions? Why not?
- What data is currently not being collected? Why not?
- How often are data sets re-collected? Are there best practices to draw on in recommending the frequency of data updates?

Research is needed to summarize existing literature on active transportation data, catalog relevant sources and data sets related to active transportation, identify data needs, and identify data gaps.

The objective of this project is to develop a playbook for state DOTs and tribes on the use of active transportation data. At a minimum, the research team shall: (1) determine how state DOTs and tribes are using data; (2) identify data sources, gaps, and recommendations on the next steps to integrate and develop the data and tools state DOTs and tribes need; (3) assess the state of the practice regarding pedestrian and bicycle injury and death reporting and integration systems; (4) critically examine existing methods; (5) demonstrate best practices; and (6) identify future data improvement needs.

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Sponsors: National Cooperative Highway Research Program
Start Date: 11/13/2023
Expected Completion Date:
Status: Proposed
URL: https://rip.trb.org/View/1707202

Leveraging Crowd-sourced Data in Planning, Design, Analysis, and Evaluation of Pedestrian and Bicycle Traffic

Collecting data on the number of people walking or bicycling along or across Michigan's vast transportation network is difficult to achieve, it can be time consuming and expensive. However, knowing the numbers of people walking or bicycling would be immensely useful in project planning, design, analysis, and evaluation of the transportation network for safety and accessibility among other measures. This research will help improve the assessment of the pedestrian and bicycle traffic exposure and help make informed decisions when planning, designing, and evaluating projects.

POC: Amit Misra at (734) 764-7799 or by email at amitmis@umich.edu
Sponsors: Michigan Department of Transportation
Start Date: 10/01/2021
Expected Completion Date: 03/01/2023
Status: Active
URL: https://nitc.trec.pdx.edu/research/project/1489

Evaluation of Gainesville Pedestrian-Bicyclists Connected Vehicle Pilot

This research project will support the University of Florida (UF) AID project through a multifaceted evaluation of the installed hardware and software, as well as pedestrian, bicycle, and skateboarder perceptions, and corridor-level operations.

POC: Edith Wong at Edith.Wong@dot.state.fl.us
Sponsors: Florida Department of Transportation
Start Date: 08/22/2023
Expected Completion Date: 04/30/2025
Status: Active
URL: https://rip.trb.org/View/2232146

Development of Pedestrian and Bicyclist Flow Volumes and Risk Factors

Pedestrian and Bicyclist safety is a growing concern and priority for the U.S. Department of Transportation. Fatalities for non-motorists have increased nationwide since 2009, and this increase has also been observed in Arkansas. The first objective of this project will be to collect data on non-motorized transportation users across the state using count stations and crowdsourced data. Traffic volume data will be overlaid with historical crash data to determine crash risks. Recommended countermeasures will be determined to address high-risk areas and provide resources for future project planning to make Arkansas roads safer for all users.

POC: Bethany Stovall at 501-569-2279 or by email at bethany.stovall@ardot.gov
Sponsors: Arkansas Department of Transportation
Start Date: 07/01/2023
Expected Completion Date: 06/30/2025
Status: Active
URL: https://rip.trb.org/View/2215433

Bike Lending in North America: Understanding Business Models, User Acceptance, Social Equity, and Public Safety

Bicycle lending is a growing phenomenon within cities and towns across the country. Bike lending libraries allow people to check out bicycles, much like checking out a library book, for a set period of time and return it after the term is up or they have finished with it. Bike lending is different from bike rental or bike sharing in that most lending arrangements do not involve an exchange of money. Bike lending libraries exist to serve several different use cases and purposes. One of the main purposes of bike lending libraries is to allow people to use certain types of bicycles that they do not need all the time. To better understand the role and potential

that bike lending libraries may have on the growth of bicycling as well as on the safety and social equity of access to riders, the research team first need an understanding of the scope and scale of bike lending initiatives across North America. This study will explore the topic by (1) conducting a literature review, (2) building an online census of bike lending operations in North America, (3) conducting expert interviews with operators, (4) conducting a survey of operators, and (5) conducting a focus group of users/lendees. The results will be synthesized in a final report.

POC: Nicholas Ferenchak at ferenchak@unm.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 06/01/2023
Expected Completion Date: 05/31/2024
Status: Active
URL: https://www.pedbikesafety.org/23ucb04

Pedestrian Level of Traffic Stress

Many of the existing methods to evaluate the suitability of pedestrian or bicyclist travel along roadway segments or crossing roadways require a large number of inputs, some of which are not available in typical roadway inventory data (e.g., on-street parking coverage, heavy vehicle proportion), making them impractical for most agencies to apply. Some of these methods also require statistical modeling expertise or specialized software to run. Occasionally, their outputs do not make intuitive sense. For these and other reasons, Bicycle Level of Traffic Stress (BLTS), a table-based framework from the Mineta Transportation Institute, has become a popular tool to assess roadway suitability for bicycling in the last decade. However, a similar Pedestrian Level of Service (PLTS) tool has not been established. The few table-based PLTS methods available today have been applied by separate agencies and use different inputs. This project will create a well-researched, standardized version of a table-based, Pedestrian Level of Traffic Stress (PLTS) tool. It will incorporate many of the most important and easy-to-collect roadway factors associated with pedestrian suitability from a) existing pedestrian suitability methods and b) the pedestrian safety literature.

POC: Carman Melendrez at carmanmelendrez@unm.edu
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Start Date: 06/01/2023
Expected Completion Date: 05/31/2024
Status: Active
URL: http://www.pedbikesafety.org/23uwm05

Evaluation of Innovative Pedestrian Detection Systems to Increase Safety

The project's objectives are described below: (1) Research the latest advancements in Dynamic Passive Pedestrian Detection (DPPD) or Automated Pedestrian Detector (APD) systems currently available and identify vendors with available products. This will build on the previous project where several products were identified and tested. (2) Develop evaluation, implementation, and data collection plans for investigating effectiveness of DPPD or APD systems to reduce pedestrians crossing without physically pressing a button to place a pedestrian call. This will include investigation of a system where a pedestrian call can be placed via a smartphone or motion sensor so there is no need for the pedestrian to physically press the push button. (3) Complete a detailed evaluation on the effectiveness and benefits for using DPPD or APD systems in Florida via before-after studies of the behavior of pedestrians where such pedestrian detection technologies are deployed including investigation of extending or shortening the pedestrian crossing time at midblock crossings and canceling the pedestrian call depending on pedestrian presence at signalized intersections. (4) Develop implementation guidelines on when, where, and how to deploy these systems and document analysis results and research findings from the evaluation and provide recommendations.

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Sponsors: University of South Florida, Tampa
Start Date: 03/29/2023
Expected Completion Date: 11/30/2024
Status: Active
URL: https://rip.trb.org/View/2144023

Leveraging Crowd-sourced Data in Planning, Design, Analysis, and Evaluation of Pedestrian and Bicycle Traffic

Collecting data on the number of people walking or bicycling along or across Michigan's vast transportation network is difficult to achieve, it can be time consuming and expensive. However, knowing the numbers of people walking or bicycling would be immensely useful in project planning, design, analysis, and evaluation of the transportation network for safety and accessibility among other measures. This research will help improve the assessment of the pedestrian and bicycle traffic exposure and help make informed decisions when planning, designing, and evaluating projects.

POC: Amit Misra at (734) 764-7799 or by email at amitmis@umich.edu
Sponsors: Michigan Department of Transportation
Start Date: 10/01/2021
Expected Completion Date: 03/01/2023
Status: Completed
URL: https://nitc.trec.pdx.edu/research/project/1489

Optimization of Signal Timing Based on Pedestrian Intervals Using Computer Vision and Deep Learning Technology

This project is to conduct extensive use of computer vision based deep learning methodologies for detection, tracking and prediction of pedestrian movements. This will in turn aid in achieving the following objectives: (1) Increase pedestrian compliance with crossing phases by (a) Reduced wait times with skipped phases (b) Reduced false calls (2) Increase signal efficiency by (a) Reduced cycle length and split times to accommodate pedestrians (b) Reduced false calls (3) Identify a methodology and display to provide feedback to pedestrians that a call has been placed and the approximate wait time.

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Sponsors: Florida Department of Transportation
Start Date: 01/03/2023
Expected Completion Date: 04/30/2024
Status: Active
URL: https://rip.trb.org/View/2093291

Estimating Latent Bicyclist and Pedestrian Demand for Shared Use Path Design

Texas Department of Transportation's (TxDOT's) Roadway Design Manual was updated in July 2020 and incorporates considerations for and accommodations of bicyclists and pedestrians, including preferred design order toward Shared Use Paths (SUPs) compared to bicycle lanes and shared lanes. However, the Guidance does not include specific procedures to estimate the anticipated volumes of non-motorized path users.

TxDOT's Bicycle Accommodation Design Guidance makes it clear that anticipated user volumes should be considered when designing facilities. The research team will develop a simple sketch planning-level demand estimation tool that provides anticipated user volumes for SUPs. The project shall also incorporate the results into the future editions of TxDOT's design guidance/manuals. Given the uncertainty in resources, the research team will not use an overly complicated method or a method that requires complex data or data architecture. The project shall benefit from existing data sources, including TxDOT's Texas Bicycle and Pedestrian Count Exchange and other count data resources in the State as well as other secondary and spatial data sources. The research team will develop an easy-to-use tool responding to the needs and requirements of the intended audience while incorporating advancements to improve the accuracy of the demand estimation.

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Sponsors: Texas Department of Transportation
Start Date: 09/01/2022
Expected Completion Date: 02/29/2024
Status: Active
URL: https://rip.trb.org/View/2056298

Modeling Pedestrian and Bicyclist Crash Exposure with Location-Based Service Data

Actual counts observed at selected locations in short periods of time are extrapolated to generate annual average daily pedestrian and bicyclist traffic estimates. This approach will not adequately display the difference in travel time (e.g., morning, afternoon, or evening), seasonal effects, days of the week, and will not cover the entire street network in a region. One of the main challenges in developing exposure measures is the lack of walking and biking activity data available at a finer spatial resolution, such as street segments, covering the entire road network of a city. The main source of information about area-based exposure measures is survey data (such as ACS or NHTS). The units used in area-based exposure measures vary widely and the geographic scale of available travel data is limiting (only 59 records for Lincoln MSA in the 2017 NHTS). This type of data does not have facility-specific trip information. Some local entities are directly collecting pedestrian and bicyclist count data, but these counts are collected at a very limited number of locations. Therefore, there is a critical need to develop a reliable methodology to analyze pedestrian and bicyclist exposure to risk with emerging data sources.

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Sponsors: Nebraska Department of Transportation
Start Date: 07/01/2022
Expected Completion Date: 05/31/2024
Status: Active
URL: https://rip.trb.org/View/1942732

Assessing Cyclists' Stress on A Large-Scale: A Practical Smartphone-Based Data-Driven Approach

The primary motivation for this project is to improve street design and planning through a better understanding of cyclists' perceived stress when they bike in city streets. The project team aims to create an "affective map", called StressMap, by integrating cyclists' stress levels in tempo-spatial domains. The team begins by narrowing the large field of potential stressors and measures of stress using traditional methods, such as instrumented bicycles and physiological sensors. However, such methods necessarily limit the scope of data that can be collected over time. Therefore, the project team's idea makes use of various onboard sensors of smartphones carried by cyclists to measure environmental and traffic surroundings over a larger area and time frame, enabling a large-scale stress assessment. The sensory data is then automatically collected

and uploaded to the cloud server, where our deep learning model is deployed, to derive cyclists' stress distribution over a large geographic area. This project consists of four components. First, the project team plans to measure environmental conditions when interacting with different types of infrastructure and traffic situations to quantify the perceived safety of cycling infrastructure. Using this data, the project team will identify critical environmental stressors. Second, the team will develop a smartphone app to measure those stressors, as informed by the first component, via onboard sensors. AI models will be constructed to map the sensory readings to cyclists' stress. Third, the team will conduct a controlled-environment bike simulator study to produce a labeled dataset essential for the AI model training and validate the assessment accuracy of the proposed AI model. Finally, the team will use crowdsourcing to generate the StressMap that characterizes stressful road environments and traffic encounters for bicyclists. The derived tempo-spatial distribution of cyclists' stress will be visualized and made publicly accessible for the stakeholders.

POC: Ming Li at ming.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: 06/01/2022
Expected Completion Date: 05/31/2023
Status: Completed
URL: https://rip.trb.org/View/2008002

Sidewalk Condition Assessment Leveraging Machine Learning/AI and Mobile LiDAR

This research project seeks to demonstrate the feasibility of mobile LiDAR data as a cost-effective means to support efficient inventory and condition assessment of sidewalks at DDOT. The objective of this research project is twofold: 1) to develop and validate an improved point cloud data processing method that can automatically map pedestrian infrastructures (e.g., sidewalk, curb ramp, etc.) using point cloud data, which will demonstrate its feasibility for network-level analysis (e.g., using Ward 7 as the pilot testing field; 2) if it proves feasible, to apply the developed, automated method to the city-wide mobile LiDAR dataset collected by CycloMedia and generate a complete pedestrian infrastructure map in the entire District. If successful, the outcome of the proposed method in this research project will layout a solid framework toward a sidewalk assessment management program that routinely and cost-effectively inspects, evaluates, and maintains pedestrian infrastructure in the entire District.

POC: Chengbo Ai at chengbo.ai@umass.edu
Sponsors: District Department of Transportation
Start Date: 07/01/2022
Expected Completion Date: 12/31/2023
Status: Completed
URL: https://rip.trb.org/View/1952005

Non-Motorized Count Program and Risk Factors Assessment

The objective of this research is to create activity estimates of non-motorized travel and use existing Georgia Department of Transportation (GDOT) datasets to assess the risk factors associated with bicycle and pedestrian crashes with the intent to give GDOT more tools for assessing safe design practices.

POC: William Bilsback at 4043470617 or by email at wbilsback@dot.ga.gov
Sponsors: Georgia Department of Transportation
Start Date: 03/15/2022
Expected Completion Date: 03/15/2025

Status: Active
URL: https://rip.trb.org/View/1926899

Effective Pedestrian/Non-Motorized Crossing Enhancements along Higher Speed Corridors

MDOT desires solutions for enhanced pedestrian/non-motorized crossings along highway corridors with speeds 45 mph or greater at both signalized and unsignalized intersections. Specific treatments are desired (rapid flashing beacon, HAWK signal, etc.) but do not meet minimum warrants per various guidance documents. In response, MDOT must rely on its judgment as to what the study team believes will work for additional enhancement features. MDOT would like research on effective treatments where pedestrian/non-motorized crossing warrants are not met for the bigger enhancements on corridors with speeds 45 mph or greater.

POC: Ron Van Houten at (269) 387-4471 or by email at ron.vanhouten@wmich.edu
Sponsors: Michigan Department of Transportation
Start Date: 10/01/2021
Expected Completion Date: 09/30/2023
Status: Completed
URL: https://rip.trb.org/View/1993828

Developing a Framework for Prioritizing Bicycle Safety Improvement Projects Using Crowdsourced and Image-based Data

During the last decade, non-motorized modes of transportation, including cycling and walking, have been spreading as they are considered economical, eco-friendly, and energy-efficient. In this project, we propose to develop a crash-risk scoring method for prioritizing Bicycle safety improvement projects in the county of San Diego. Caltrans has a great interest in this topic as many bicycle bridges need to be improved to meet new standards. The prioritization methodology will have a widespread applicability and can be adopted by Caltrans for similar projects. The majority of the studies on pedestrian and bicycle safety suffered from the limitation of the exposure data as they relied on traditional data collection methods. In this project, we will use a combination of traditional data (e.g., historical crash data, environment characteristics) as well as crowdsourced (e.g., STRAVA, StreetLight data) and image-based data in order to develop a robust model to identify high-risk locations. Since crowdsourced data could be biased towards males and more athletic people, we will investigate and utilize calibration methods to address this issue. Moreover, previous studies show a disproportionate bicycle crash distribution among people with different socio-demographic characteristics. We will investigate transportation equity factors to include in the proposed risk scoring method to account for social justice across all communities.

POC: Eric Glenn at 5408508489 or by email at eglenn@vtti.vt.edu
Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 01/15/2022
Expected Completion Date: 07/15/2023
Status: Completed
URL:
https://safed.vtti.vt.edu/projects/developing-a-framework-for-prioritizing-bicycle-safety-improvement-projects-using-crowdsourced-and-image-based-data/

Pedestrian Infrastructure and ADA Compliance: Leveraging Advances in Spatial Technologies

Cities are increasingly facing costly litigation because of their inability to build and maintain sidewalks and curb ramps that comply with the Americans with Disabilities Act (ADA) of 1990. The underlying problem is often less about willingness and more about a lack of good data. This research project will examine the use of mobile LiDAR (Light Detection and Ranging) technology to measure the ADA compliance of sidewalks and curb ramps. While historically expensive and somewhat difficult to employ at scale, high-density LiDAR has become much more commonplace and is standard on higher-end iPhones and iPads. The proposed project seeks to create a map of ADA sidewalk and sidewalk ramp compliance issues using iPhone LiDAR. This will include a comparison of sidewalk metrics from planimetric data to on-the-ground LiDAR sidewalk infrastructure data collection. We will compare the results of the iPhone LiDAR to manual methods, planimetric data, as well as data derived from a much higher-end LiDAR data collection device. We will also compare our ability to measure sidewalk issues from the sidewalk versus the street and consider how this differs by different possible occlusion issues (such as on-street parking). Lastly, we will explore built environment data against sidewalk infrastructure data to identify what factors are significantly associated with ADA compliance issues. The resulting ADA compliance maps will be integrated into a GIS platform for deployment into web-mapping and mobile-mapping applications. Given that 1 in 7 Americans has a mobility-related disability, this is about more than asset management and protecting cities from liability; it will help put cities on a data-driven path towards fulfilling the promise of the ADA.

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: 11/12/2021
Expected Completion Date: 07/31/2023
Status: Completed
URL: https://www.mountain-plains.org/research/details.php?id=574

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: Oregon DOT, University of Texas at Arlington
Start Date: 10/01/2021
Expected Completion Date: 06/30/2023
Status: Completed
URL: https://nitc.trec.pdx.edu/research/project/1489

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: Completed
URL: https://rip.trb.org/View/1877383

Toward Automating the Measurement of Urban Design Qualities Related to Walkability

Streets are one of the most significant elements of urban spaces to accommodate public activity and provide access to numerous locations and services. Today, our cities face various challenges, including urban sprawl, air pollution, and obesity. To address some of these problems, cities and local governments consider land use planning and urban design to lower car dependency and promote walking and biking. Many studies have characterized the built environment in terms of D variables density, diversity, design, destination accessibility, and distance to transit. Measurement of four D variables is relatively straightforward, while the D variable, design, is more nuanced. Urban designers believe that micro features are essential for active street life but have little empirical evidence to back the claim. The conventional research approaches to objectively measure the subjective qualities of the street environment require resource-intensive street-level field observation believed to be one of the main constraints of the widespread application of such methods. This dissertation will be consist of two studies that will collectively explore the applications of advanced technologies and methods such as Google Street View, computer vision, and deep learning toward automating the measuring of micro-scale characteristics of the built environment related to pedestrian activity and overall walkability.

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Sponsors: Office of the Assistant Secretary for Research and Technology
Start Date: 09/15/2021
Expected Completion Date: 08/31/2023
Status: Completed
URL: https://nitc.trec.pdx.edu/research/project/1527

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.

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Sponsors: Minnesota Department of Transportation
Start Date: 06/11/2021
Expected Completion Date: 07/31/2023
Status: Completed
URL: https://rip.trb.org/View/1764336