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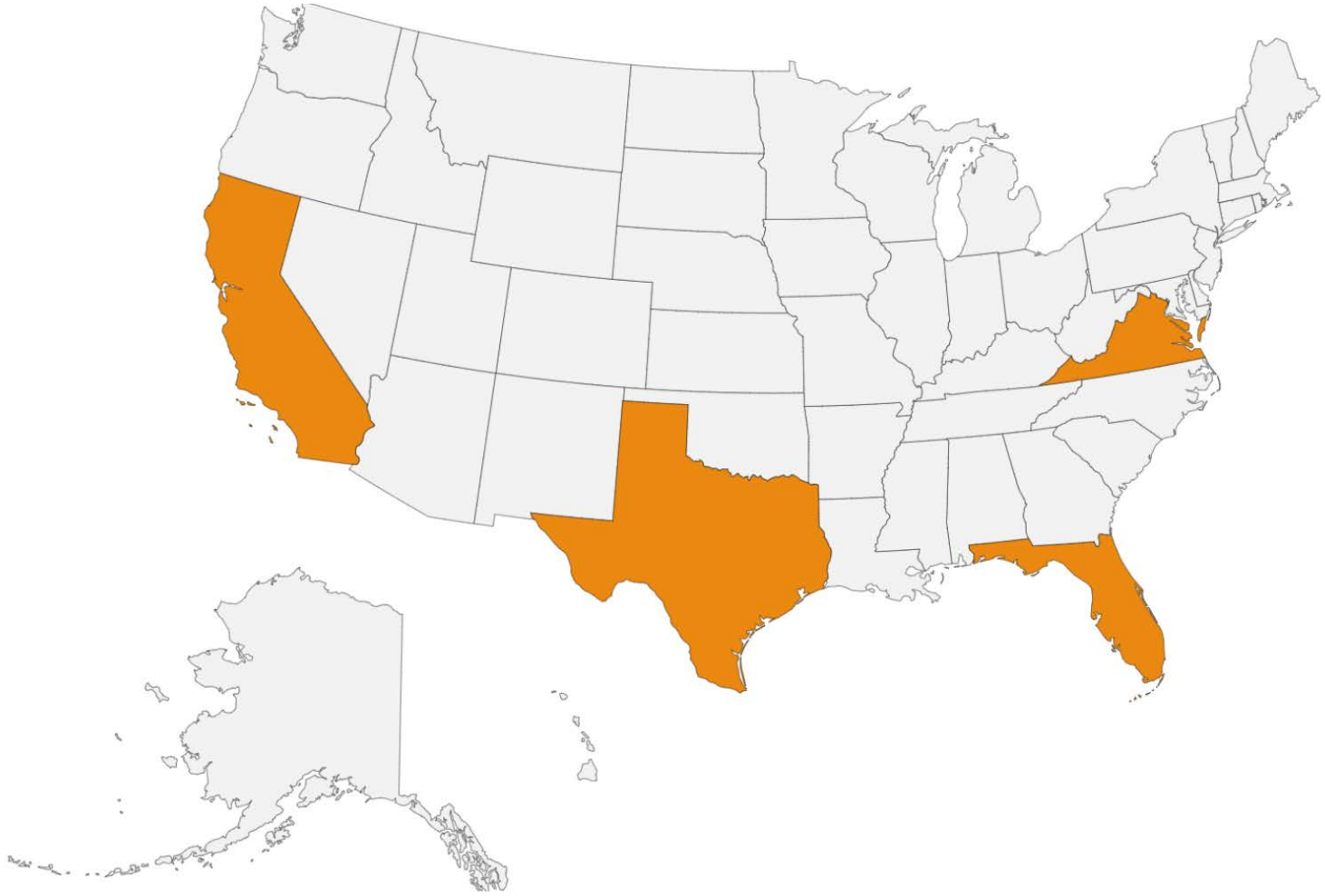
Review of State Projects

(California, Texas, Florida, Virginia)

Applied Technology and Traffic Analysis Program (ATTAP)

State Projects

- Virginia
- California
- Texas
- Florida



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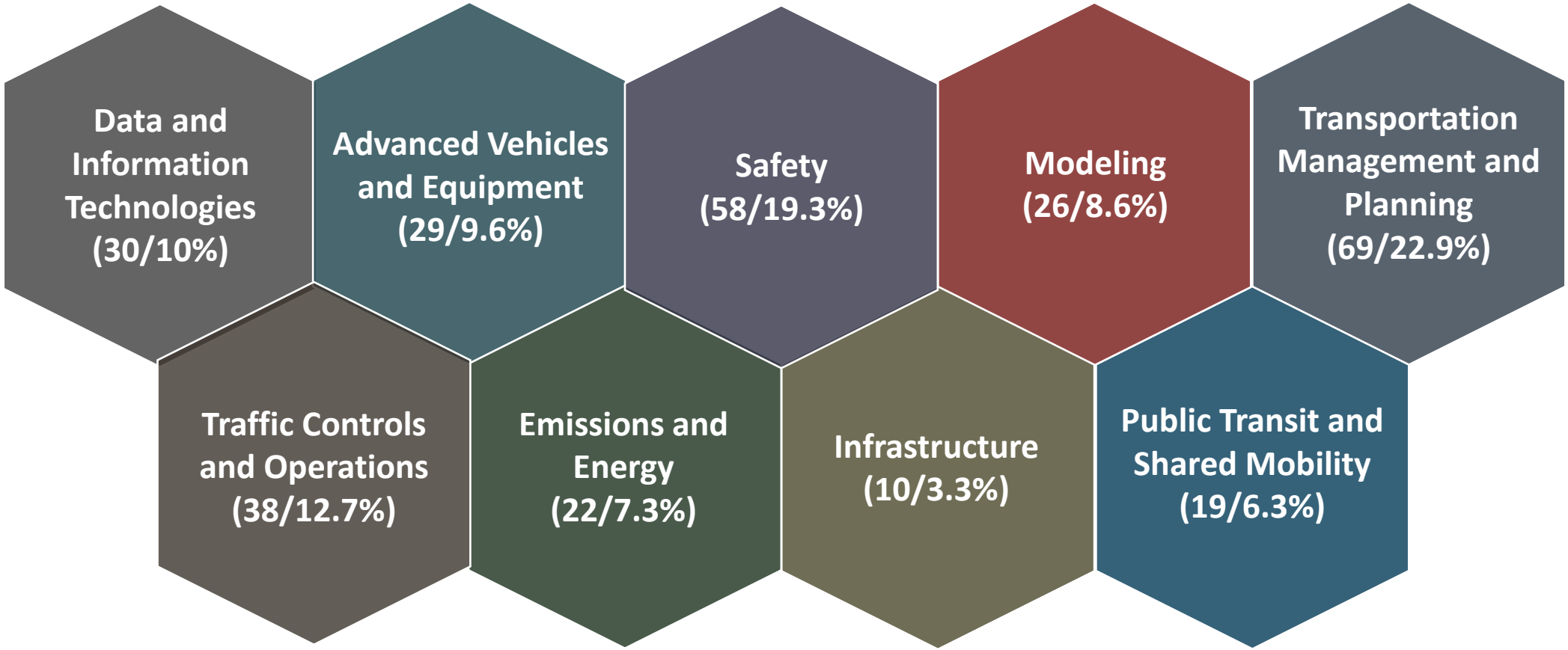
Classifications



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Data and Information Technologies

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Data and Information Technologies

- Study, design, development, implementation, support, or management or **computer-based information systems** for transportation applications
- Projects in this category are further divided into:

Data Processing and Management

Devices and Instruments

Emerging Technologies

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Data Processing & Management

- Planning and operating transportation systems involving the exchange of large volumes of data
- Critical issues associated with data processing and management :
  - **Assessing the reliability of** in the available data
  - **Reconciling data discrepancies** among different sources
  - Validating processes for converting the data into usable information
  - **Understanding the implications** of big data and machine learning approaches

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Project: Data Integration, Sharing, and Management for Transportation Planning and Traffic Operations

- ***Objectives***
  - **To develop tools for improving data integration, sharing, and management practices to enable transportation agencies to make better planning and operations decisions**
- ***Major Components***
  - **Pilot Integration of ITS Transit Data in an Integrated Corridor Management System**
  - **Assessment of Real-World Connected Vehicle Datasets**
  - **Guidance and Demonstration for Improved Conflation and Geodata Reference Process**
  - **Pilot Integration of Big Data for Freight Transportation Planning and Operations**
  - **Data Sharing Resources Guide for Shared Mobility Data**
  - **Pilot Integration of IoT Data with the WZDx**
  - **Demonstrated Use and Value of Crowdsourced Data Integration**

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Devices & Instruments

- Efficient operations of the traffic management rely heavily on the **quality of sensor data**
- The sensor data's quality and reliability issues may significantly degrade the quality of traffic estimation and effectiveness of management

- It is essential to **assess the performance** of the commonly-used traffic detection devices to ensure reliable management decisions

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Project: Traffic Sensor Data Error Estimation with Statistical Learning Techniques

- ***Objective***
  - **To develop a framework for sensor-error estimation, including quantifying and correcting the systematic errors.**
- ***Methodology***
  - Incorporating the spatial correlation of traffic counts from sensors in a roadway network
  - Developing a statistical learning-based error estimation framework

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Enabling Technologies

- "Enabling Technologies" is a new program area, identified by US DOT, focusing on identifying, developing, and assessing **next-generation technologies**
- Examples of enabling technologies for the applications in the transportation system include:
  - **Unmanned Aerial Vehicles** (UAVs), i.e., Drones
  - **LIDAR** (light detection and ranging – a remoting sensing method)
  - **Smart sensors**

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Feasibility Analysis of Real-time Intersection Data Collection and Processing Using Drones

- ***Objective***
  - **To test the feasibility and efficiency of drone-based real-time data collection and processing at intersections**
- ***Major Components***
  - **To extract the vast amount of knowledge from the drone implementations, including video image processing software and other related data collection equipment**
  - **To analyze the results of this search to identify the operational barriers, best implementations, practices and strategies**
  - **To conduct a field experiment through a pilot drone study at selected intersections**

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Lists of Projects

- ***Data Processing and Management***
  - Enhancement to the Intelligent Construction Data Management System (Veta) and Implementation
  - Knowledge Discovery and Data Mining for Shared Autonomous Mobility Applications
  - Moving Forward with the Next Generation Travel Behavior Data Collection and Processing
  - Data Integration, Sharing, and Management for Transportation Planning and Traffic Operations
  - Exploring Data Fusion Techniques to Derive Bicycle Volumes on a Network
  - Develop an Integrated Data Management System at the Microscopic, Mesoscopic, and Macroscopic Levels to Assess the Environmental Impacts of Transportation Systems
  - Examining Data Needs and Implementation Process of AV-based Microtransit Service: A Case Study in Lake Nona
  - A Synthesis on Data Mining Methods and Applications for Automated Fare Collection (AFC) Data
  - Bigdata Analytics and Artificial Intelligence for Smart Intersections
  - Data Fusion for Signalized Arterial Performance Measurement
  - Big Data for Safety Monitoring, Assessment, and Improvement
  - Traffic Accident Surveillance and Analysis System (TASAS) and Injury Data Base Development
  - Improving the Accuracy of Intersection Counts and Densities for Measuring Urban Street Network Compactness and Resilience
  - Standard Test Procedure for Travel Time Data Quality Assessment

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Lists of Projects

- ***Devices and Instruments***
  - Where to? Origins and Destinations of TNC and Transit Trips Based on Mobile Devices
  - Traffic Sensor Data Error Estimation with Statistical Learning Techniques
  - Evaluating the Performance of Traffic Detection Devices - Continuation of Task 1559
  - Evaluate Sensys and Radar Detectors
- ***Enabling Technologies***
  - Approach to Real-Time Commercial Vehicle Monitoring
  - GPS for Travel Time and Speed Monitoring
  - Feasibility Analysis of Real-time Intersection Data Collection and Processing Using Drones
  - Development of an Integrated Unmanned Aerial Systems (UAS) Validation Center
  - Feasibility of Estimating Commodity Flows on Highways with Existing and Emerging Technologies
  - **Corridor-Wide Surveillance Using Unmanned Aircraft Systems**
  - Evaluation of Smart Video for Transit Event Detection
  - Evaluation of Electronic Data Recorder for Incident Investigation, Driver Performance, and Vehicle Maintenance
  - **Automated Video Incident Detection (AVID)** System
  - Demonstration of a Low-Cost Vehicle Monitoring System for Tractor-Trailers

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Lists of Projects

- ***Other Projects***
  - Scan International Technologies and Programs for Vehicle-Highway Cooperation
  - Cybersecurity Analysis to Prepare VDOT Operations for Connected and Autonomous Vehicle Applications

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Advanced Vehicles and Equipment

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Advanced Vehicles and Equipment

- Recent advances in those promising types of vehicles have created an opportunity for **improving traffic operations** and **mitigating environmental impacts** due to fuel emissions, engine idling, etc.
- Projects in this category are further divided into:

Electric Vehicles (EV)

Autonomous Vehicles (AV)

Connected Vehicles (CV) and Autonomous Vehicles (CAV)

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Electric Vehicles (EV)

- Electric Vehicles (EVs) have been considered as a holistic approach to achieving **sustainable transportation**
- Encompassing the three dimensions of sustainability, i.e., environment, society, and economy, **battery technologies**, **charging infrastructure**, and **implications on the environmental, social, and economic aspects** are of concern

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Project: Spatial-temporal Modeling of Electric Vehicles Charging Infrastructure and Management for a Sustainable Energy System

- ***Objective***
  - **To provide insights to policymakers and academics on how to properly allocate electric vehicle charging infrastructure and manage charging activities**
- ***Major Components***
  - Using California as a case study, the mobility and dwelling information of 10,913 residents for one day is collected
  - Exploration of the benefits of the proposed spatial-temporal optimization model for detecting the best strategy of BEV infrastructure placement and charging management with minimum system cost, GHG emissions, and renewable curtailment

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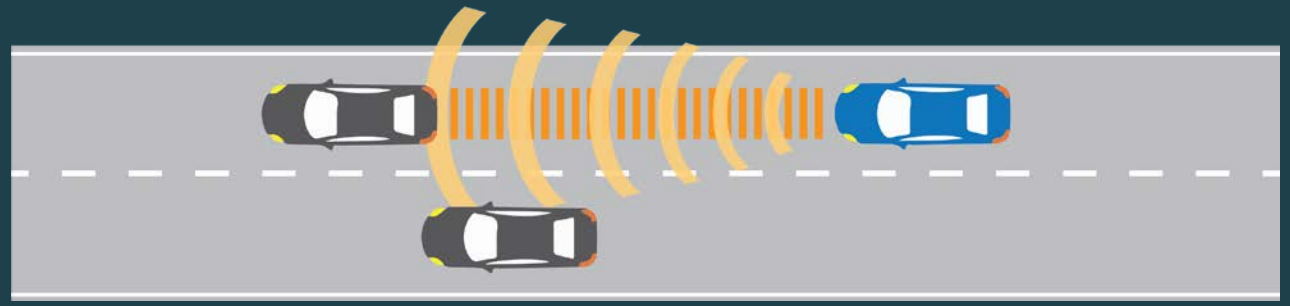
Autonomous Vehicles (AV)

- The Autonomous Vehicle (AV), by its definition, is a vehicle that is capable of **sensing its environment** and moving safety with little or no human input
- In the development of associated hardware and software, **Cooperative Adaptive Cruise Control (CACC)** embedded in vehicles is particularly of concern



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Partial Automation for Truck Platooning

- ***Objective***
  - To study the potential benefits of cooperative adaptive cruise control (CACC) by deploying the technology in a platoon of three trucks
- ***Major Components***
  - Building the CACC system and implemented it in three long-haul trucks
  - Testing it on closed tracks and open highways
  - Simulating its use in real traffic scenarios and demonstrating its use to stakeholders and interested parties

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Connected Vehicles (CV) and Connected and Autnomous Vehicles (CAV)

- A connected car is a car that can **communicate bidirectionally with other systems outside of the car**
- The common communication interfaces include
  - Vehicle-to-Vehicle (V2V)
  - Vehicle-to-Infrastructure (V2I)
  - Vehicle-to-Cloud (V2C)
  - Vehicle-to-Pedestrian (V2P)
  - Vehicle-to-Everything (V2X)
- Connected and Autonomous Vehicles (CAV) integrates technologies of **AV and CV**

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Development and Evaluation of Selected Mobility Applications for Vehicle-Infrastructure Integration

- ***Objective***
  - **To evaluate DSRC wireless communications among vehicles and between vehicles and the roadway infrastructure to improve mobility on limited-access highways**
- ***Major Components***
  - Evaluate DSRC wireless communications by combining ramp metering with variable speed limits to enhance control of traffic
  - Evaluate vehicle-to-vehicle (V2V) communication in improving the performance of adaptive cruise control systems

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Lists of Projects

- ***Electric Vehicles (EV)***
  - Innovative EV Deployment Strategies: Understanding Electric Vehicle Activity Patterns to Optimize Charging for LDV, MDV, and HDV
  - Developing an Integrated Platform for Electric Vehicle Chargers in a Microgrid Using a Universal Software and Interface
  - Spatial-temporal Modeling of Electric Vehicles Charging Infrastructure and Management for a Sustainable Energy System
  - Sustainable Management of Retired Electric Vehicle Batteries
  - Battery Technologies for Mass Deployment of Electric Vehicles
  - Electric Vehicle Grid Experiments and Analysis
  - Optimal Charging Scheduler for Electric Vehicles on the Florida Turnpike
  - Electric Vehicle Fleet Implications and Analysis
  - Socio-economic Implications of Large-scale Electric Vehicle Systems
  - Techno-Economic Analyses of Large-Scale Electric Vehicle Systems
  - Fuel Cell Vehicle Technologies and Infrastructure
  - A data driven approach to the development and evaluation of acoustic electric vehicle alerting systems for vision impaired pedestrians
  - Environmental and Safety Attributes of Electric Vehicle Ownership and Commuting Behavior: Public Policy and Equity Considerations

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Lists of Projects

- ***Autonomous Vehicles (AV)***
  - Evaluating Deployability of Cooperative Adaptive Cruise Control (CACC) to Form High-Performance Vehicle Streams
  - Partial Automation for Truck Platooning
  - Developing and Testing an Advanced Hybrid Electric Vehicle Eco-Cooperative Adaptive Cruise Control System at Multiple Signalized Intersections
  - Automated Truck Mounted Attenuator
- ***Connected Vehicles (CV) and Connected and Autonomous Vehicles (CAV)***
  - Efficient Wireless Communication in Vehicular Environments
  - Expansion of the Vehicle-to-Vehicle and Vehicle-to-Infrastructure Technology Test Bed
  - Development and Evaluation of Selected Mobility Applications for Vehicle-Infrastructure Integration
  - End-to-End Performance in Vehicular Networks with an Emphasis on Safety and Security Applications
  - Efficient Routing for Safety Applications in Vehicular Networks
  - Drivers' Response to Scenarios When Driving Connected and Autonomous Vehicles Compared to Vehicles With and Without Driver Assist Technology
  - Automated and Connected Vehicle Implications and Analysis
  - Lane-Level Localization and Map Matching for Advanced Connected and Automated Vehicle (CAV) Applications

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Lists of Projects

- ***Other Projects***
  - Developing and Evaluating Intelligent Eco-Drive Applications
  - Evaluation of Advanced Vehicle & Communication Technologies through Traffic Microsimulation (Project I5)

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Traffic Controls and Operations



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Traffic Controls and Operations



- Traffic control plays a critical element in the **safe and efficient operation** of any transportation system, where elaborate operational procedures, rules and laws, and physical devices (e.g., signs, markings, etc.) are a few of the components
- Projects in this category are further divided into

Signal and Speed Control

Work Zone

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Signal and Speed Control

- Traffic signal control and speed control are two of the most widely used control strategies in transportation systems
- Based on different applications, projects are further divided into:
  - **Ramp metering** on the freeway
  - **Signalized intersections** on the arterial
  - **Corridor control** in the traffic network

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Evaluation of Midblock Pedestrian Signals

- ***Objective***
  - ***Understand the effectiveness of Midblock Pedestrian Signals, based on analysis at 27 study site.***
- ***Potential Application:***
  - ***Provide a large amount of field data for similar facilities***

Source: Google map

Pedestrian Activated Signal

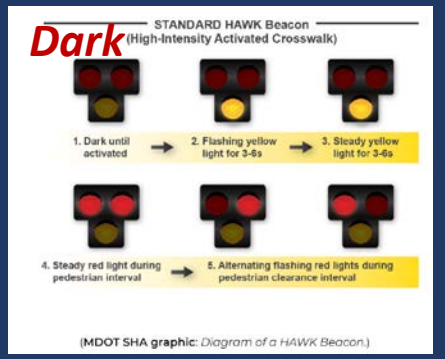
-Baltimore Ave, Hartwick, College Park, MD
-University Blvd, Four Corners, MD
-US 1 @ Doctor Patel, Elkridge, MD(proposed)

Source: https://www.youtube.com/watch?v=PAEt9I-g1JA;
Sabra & Associates, Inc. (2018) US 1 Safety Evaluation on Bicyclists and Pedestrian Safety

Midblock signal

-Campus Drive @ Paint Branch Trail

Pedestrian Hybrid Beacon (PHB)/ HAWK



Source: https://roads.maryland.gov/mdotsha/Pages/pressreleasedetails.aspx?PageId=818&newsId=2981

Rapid-Flashing Beacon

-Along Rhode Island Ave, College Park

Source: Google map

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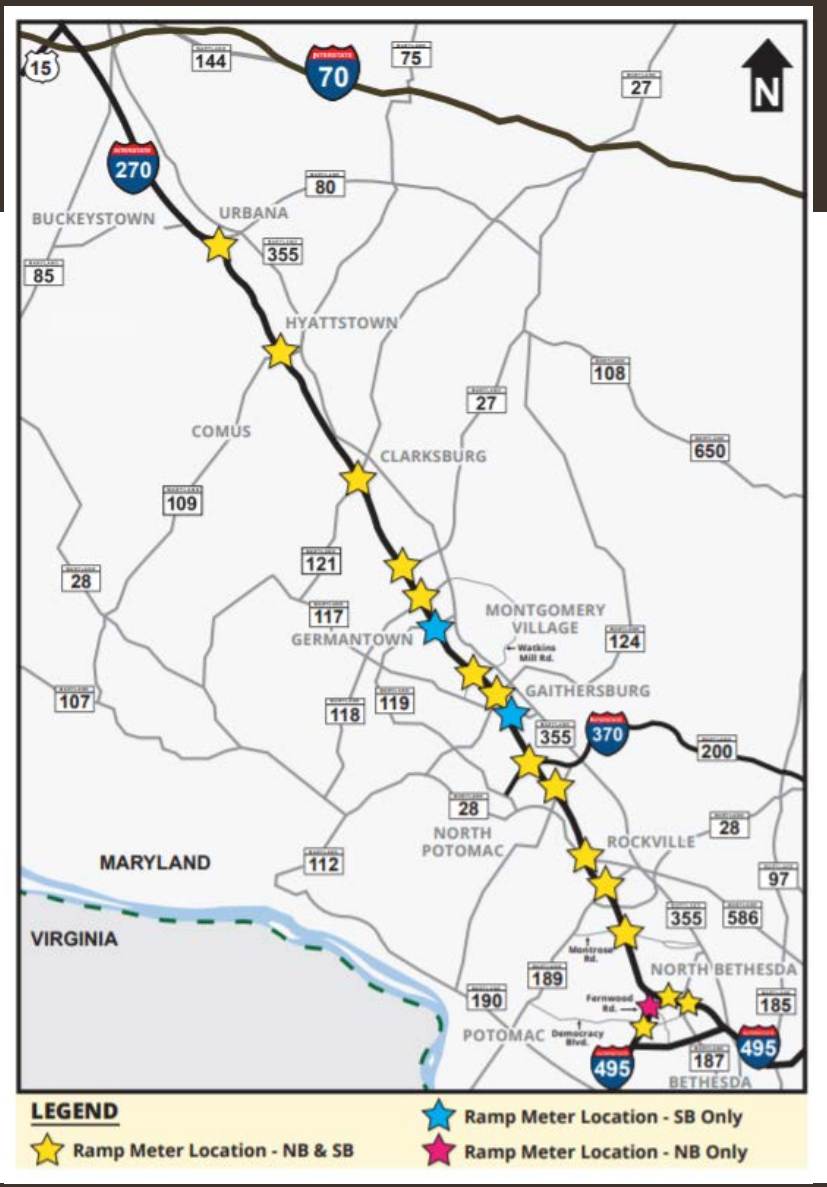
Performance Analysis and Control Design for On-ramp Metering of Active Merging Bottlenecks

- ***Objective***
  - To analyze the performance and design the control parameters for both pretimed and ***traffic-responsive on-ramp metering*** of congested merging bottlenecks
- ***Major Components***
  - Quantify the congestion mitigation effects of different ramp metering algorithms at an active merging bottleneck
  - Design control parameters for efficient and robust traffic responsive ramp metering algorithms
  - Identify demand patterns when ramp metering algorithms are effective
  - Develop a set of simple decision-support tools for ramp metering with both kinematic wave models and microscopic simulations

- ***What can we learn***
  - Potential applications to I-270 ramp metering

Source: https://roads.maryland.gov/mdotsha/pages/pressreleasedetails.aspx?newsId=4006&PageId=818



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Design and Evaluation of Impact of Traffic Light Priority for Trucks on Traffic Flow

- ***Objective***
  - **To investigate the presence of trucks at intersections with traffic signal priority with the objectives of minimizing vehicle delay and reducing emissions**
- ***Two different proposed Controllers***
  - The first uses a neural network approach to model the vehicle delays by distinguishing different classes of vehicles and optimization to reduce the vehicle delays by properly controlling the traffic signals
  - The second uses a combined passive and active strategy in order to minimize delays which gives priority to truck in certain situations if such an action benefits the overall system

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Coordinated Traffic Flow Control in a Connected Environment

- ***Objective***
  - To investigate how **connectivity provided by communication technologies** can be used to develop **traffic flow control systems** that will enhance mobility and safety, reduce queues at ramps with positive benefits to transportation efficiency and environment
- ***Methodology***
  - Develop a COoRdinated traffic FLOw control system (CORFLO) that will involve
    - Variable speed limit, lane change, ramp metering control
    - Traffic light control in arterial intersections

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Work Zone

- Smart work zone management uses innovative strategies to **minimize work zone crashes** and to **increase the mobility** within work zone area
- These strategies include
  - The use of new and innovative technologies for Intelligent Transportation System (ITS) for **dynamic management** of work zone traffic impacts (e.g., queue)
  - The use of **crowdsourcing applications** to effectively alert and provide guidance to travelers

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Modern Solutions to Safe and Efficient Work Zone Travel

- ***Objective***
  - To identify **best practices** in leveraging technologies to assist the traveling public in **navigating roadway maintenance** or construction work zones
- ***Major Components***
  - To evaluate innovative and adaptive technologies that are attention-capturing and enhance work zone safety and mobility
  - To evaluate the use of crowdsourcing applications and data analytics for dynamic work zone devices and in-vehicle notifications for traffic management
  - To develop a guide for the application and management of innovative work zone technologies

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Lists of Projects

- ***Signal and Speed Control***
  - ***Ramp Metering***
    - **Connectivity-Based Cooperative Ramp Merging** in Multimodal and Mixed Traffic Environment
    - Leveraging Connected Vehicles to Enhance **Traffic Responsive Traffic Signal Control**
    - Investigation of Merge Strategies at Ramp Area in Connected Vehicle Environment based on Multi-Driver Simulator System
    - Performance Analysis and Control Design for **On-ramp Metering of Active Merging Bottlenecks**
    - Preparations for Field Testing of Combined **Variable Speed Limit** and Coordinated Ramp Metering for Freeway Traffic Control
    - Field Test Implementation of Queue Control Continuation of Ramp Metering Design Tools & Field Test Implementation of **Queue Control**
    - System-wide Ramp Metering as a Policy Tool to Induce Efficient Travel in a Freeway Corridor
    - Freeway Merge Assistance
    - Interchange Design to Accommodate Ramp Metering System

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Lists of Projects

- ***Signal and Speed Control***
  - ***Signalized Intersections***
    - Optimum Connected Vehicle Speed Control on Signalized Roadways in Mixed Flow
    - Eco-Speed Control for Hybrid Electric Buses in the Vicinity of Signalized Intersections
    - Signal Phase and Timing and Related Messages for Connected Vehicle Applications
    - Multimodal Intelligent Traffic Signal System Engineering
    - Extended Development and Testing of Optimized Signal Control with Autonomous and Connected Vehicles
    - Integrated Optimization of Vehicle Speed Control and Traffic Signal Timing: System Development and Testing
    - Eco-friendly Cooperative Traffic Optimization at Signalized Intersections
    - Comparing and Combining Existing and Emerging Data Collection and Modeling Strategies in Support of Signal Control Optimization and Management
    - Intelligent **Transit Signal Priority**

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Lists of Projects

- ***Signal and Speed Control***
  - ***Signalized Intersections***
    - Design and Evaluation of Impact of Traffic Light Priority for Trucks on Traffic Flow
    - Traffic Signal Systems Operations and Management
    - Improving Transportation Performance: The Case of Left Turns
    - Applicability of Adaptive Traffic Signal Control Systems to Arterials in the Inland Empire
    - Estimating switching times of Actuated Coordinated Traffic Signals: A deep learning approach
    - Balancing Safety and Capacity in an Adaptive Signal Control System, Phase II
    - Evaluation of **Midblock Pedestrian Signals (MPS)**
    - Optimal and Robust Control of Vehicle Platooning on Signalized Arterial with Significant Freight Traffic
    - An Investigation of Pedestrian Signals to **Reduce Intersection Crashes** and **Red Light Violations** for Elderly Drivers
    - Safety and Operational Evaluations of **Signalized Intersection Design and Control Treatments**

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Lists of Projects

- ***Signal and Speed Control***
  - ***Corridor Control***
    - Traffic Signal Control with Dynamic Traffic Routing in a VANET Environment
    - Coordinated Traffic Flow Control in a Connected Environment
    - Consumers and service providers to adopt behaviors that reduce the congestion caused by integrated Corridor Management: Cooperative Signal Control with Freeway Operations and Ramp Metering (Project B4)
- ***Work Zone***
  - California/Coordinated Speed Management in Work Zones
  - Evaluation of **Radar/CMS Trailer to Reduce Speeds in Work Zone**
  - Development of Guidance for Scheduling of Freeway Work Zones to Minimize Congestion Impacts
  - Evaluation of Work Zone Mobility by Utilizing Naturalistic Driving Study Data, Phase II
  - Modern Solutions to Safe and Efficient Work Zone Travel
  - Smart Work Zone System

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Emissions and Energy

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Emissions and Energy

- Motor vehicles are a major contributor to the greenhouse gas (GHG) emissions that are causing global climate change, with potentially catastrophic effects on the planet
- Projects in this category are divided into:

Assessment

Treatments

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Investigation of NOx and Tropospheric Ozone Transport around a Major Roadway

- ***Objective***
  - To model the ozone and **nitrogen dioxide** concentrations near **major roadways using CALINE4**
- ***Methodology***
  - Add an ozone analyzer to the mobile NOx analyzer-weather monitoring unit built during the project performed last year
  - Obtain coordinated measurements of NO, NO2 and ozone concentrations and meteorological conditions at varying distances from the roadway, together with the traffic volume and vehicle type data
  - Use CALINE4 to estimate the NO2 and ozone concentrations at receptors located at the measurement points
  - Analyze the data obtained to elucidate the adequacy of CALINE4 in predicting the local NO2 and ozone concentrations near roadways and perform a sensitivity analysis

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Reducing Energy Use and Emissions through Innovative Technologies and Community Designs: Methodology and Application in Virginia

- ***Objective***
  - To quantify the **impacts of growth and technology strategies** at the regional level by using modeling, simulation, and visualization tools, with the overall gall of enhancing **livability and sustainability**
  - To create a modeling and simulation system capable of addressing **interactions between land use, transportation, and emissions**
- ***Major Components***
  - Development of a modeling framework for evaluation of strategies that encourage alternative mode usage and provide eco-information to travelers
  - Demonstration of a test-case in Hampton Roads region in Virginia

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Lists of Projects

- ***Assessment***
  - Evaluating Policies and Incentives to Reduce Vehicle-Miles-Traveled and Air Pollutant Emissions through the Promotion of Telework and Remote Services
  - Develop a Performance Metric to Quantify the Inhalation of Traffic-Related Air Pollutants at both Mesoscale and Macroscale
  - Electric Vehicle Assessment and Leveraging of Unified Models toward Abatement of Emissions
  - Energy and Environmental Impacts of Atlanta's Reversible Express Toll Lanes: A Synthetic Control Analysis
  - Bridging Model Estimates of Vehicular Emissions with Near-Roadway Ambient Measurements
  - A Data-driven and Model-based Approach for Assessing the Potential of Electric Vehicle Adoption and Corresponding Reduction in Energy Use and Emissions: A Case Study in Georgia
  - Evaluating the Relative Carbon Emissions of Intercity Travel Choices
  - Modeling Framework of Population Exposure to Traffic-related PM2.5 and Environmental Equity Analysis: Case Study in Atlanta, Georgia
  - Hydrogen Fuel Cell Powered Lighting Trailer Evaluation
  - Develop Multi-Scale Energy and Emission Models
  - Investigation of NOx and Tropospheric Ozone Transport around a Major Roadway
  - Analysis of the Impact of Microsimulation Aggregation on Emission Estimates

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Lists of Projects

- ***Treatments***
  - ECO-Friendly Navigation System Research for Heavy-Duty Trucks Project
  - Smartphone-based Solution to Monitor and Reduce Fuel Consumption and CO2 Footprint
  - Reducing Energy Use and Emissions through Innovative Technologies and Community Designs: Methodology and Application in Virginia
  - Vehicle-based Sensing for Energy and Emission Reduction
  - Enhancing Traffic Control Systems to Reduce Emissions and Fuel Consumption
  - Costs and Effectiveness of Lower-Speed, Environmentally-Friendly Urban Highway Designs
  - Roles of Transportation in Achieving "Green City": Options, Measurement, Priorities, and Limits
  - Developing and Field Implementing a Dynamic Eco-Routing System
  - Strategic Research Initiative: Integration of Federal Lands Management Agency Transportation Data, Planning and Practices with Climate Change Scenarios to Develop a Transportation Management Tool
  - Biking in Fresh Air: Consideration of Exposure to Traffic-Related Air Pollution in Bicycle Route Planning

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Safety



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Safety

- Traffic safety is a measures to assess the **performance of the transportation system** and it is also the world's largest **public health problem**
- Projects in this category are further divided into:

Safety Assessment

Safety Improvement

Vulnerable Users

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Safety Assessment

- To well allocate the **limited resources**, it is essential to conduct safety assessments for the transportation systems
- The projects regarding safety assessment are further divided into:
  - **Human Factors** that involve the analysis of driving behavior
  - **Intersection Safety** that involves the intersection-level assessment
  - **Systemic Assessment** that involves the network-level assessment
  - **CV, AV, CAV Related**

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Driving Risk Assessment Based on High-Frequency, High-Resolution Telematics Data

- ***Objective and Major Components***
  - To characterize the high-frequency kinematic signatures for safety critical events as well as during normal operations
  - To develop models to **predict high risk** drivers based on the **kinematics signatures**
  - To develop models to distinguish and predict crashes from normal driving scenarios based on the high frequency data

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Evaluation of Signalized Intersection Safety Using Centracs System

- ***Objective***
  - To explore the possibility of using high-resolution data, such as sec-by-sec traffic signal data provided by the Centracs system or event-based data provided by **SMART-SIGNAL** system, to evaluate the **intersection safety**
- ***Major Components***
  - Estimating the drivers' decision to stop-or-run (SoR) by developing a simple method to identify first-to-stop (FSTP), yellow-light running (YLR), and red-light running (RLR) cases using high-resolution data
  - Applying a binary logistical regression model to quantify the safety level of an intersection

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An Enhanced Systemic Approach to Road Safety

- ***Objective***
  - To present an enhanced **systemic approach** which consists of **targeting blanket improvements** at sites across a road network based on specific roadway features that are associated with a particular crash type
- ***Systemic Approach***
  - Use **historical crash data** to identify the type of roadways that suffer from recurring safety concerns, designating it as reactive to data, but also provides a mechanism to make improvements to sites that have not experienced many—or any—crashes in a proactive manner
  - The systemic approach is a flexible**, data-driven methodology** that aims to identify recurring safety concerns by **identifying the crash profiles that are associated with certain roadway features**
  - The analysis takes the form of a transparent systemic crash matrix that shows **what types of crashes occur on what types of facilities,** with rows representing crash characteristics and columns corresponding to facility types.

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Safety Impact Evaluation of a Narrow Automated Vehicle-Exclusive Reversible lane on an Existing Smart Freeway

- ***Objective***
  - **To evaluate the safety impact of an innovative infrastructure solution for safe and efficient integration of the autonomous vehicle (AV) as an emerging technology into an existing transportation system**
- ***Methodology***
  - Investigate implications of adding a **narrow reversible AV exclusive lane** to the existing configuration of I-15 expressway in San Diego, resulting in a 9-feet AV reversible lane
  - Conduct AV manufacturers product review, expert interviews, and consumer questionnaire review
  - Conduct crash data analysis and traffic simulation analysis

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Safety Assessment

- Identification and prioritization of high crash areas by conducting the safety assessment and countermeasures to enhance the safety level of existing transportation systems
- Projects in this sub-category are further divided into:
  - Treatments involved **traffic infrastructure (e.g., signal)**
  - Treatments that integrate information from **CV, AV, and CAV**

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Human Factors Study on the Use and Effectiveness of Innovative Safety Messages on Dynamic Message Signs

- ***Objective and Major Components***
  - To design a driving simulator experiment to test driver's behavior in response to different safety messages and invite enough subjects across all age groups to validate results
  - To **identify several human factors** to be studied and evaluate the effectiveness of **innovative safety messages**
  - To develop a statistical model that will accurately analyze the impacts of the safety messages on driver behavior
  - To determine criteria to be incorporated into Florida Department of Transportation's (FDOT's) safety message approval process

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Preventing Crashes in Mixed Traffic with Automated and Human-Driven Vehicles

- ***Objective***
  - To identify **the factors** that contribute to **crashes in mixed traffic with automated and human-driven vehicles** through data analysis, simulation, and field tests
  - To develop measures and guidelines to minimize the risk of crashes in mixed traffic
- ***Major Components***
  - Identify a novel near-crash risk estimation technique to accurately predict the potential rear-end conflicts
  - Model potential conflicts and safe driving events using Random Forest classification algorithm
  - Estimate autonomous vehicle conflict risk with human-driven vehicles using popular forward-collision warning algorithms

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Safety Assessment

- Vulnerable users include **pedestrians**, **e-scooter motorists**, **cyclists**, and so on
- Projects in this sub-category focus on:
  - Interactions of vulnerable users with other road users
  - Identification of high crash area involved vulnerable users
  - Improvements of the safety level of vulnerable users in the transportation

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A Safe Systems Approach to Motorcycle Safety

- ***Objective***
  - To examine motorcycle safety from **a Safe System's perspective**, paying specific attention to how **"upstream" planning and policy decisions** influence safety outcomes
- ***Methodology***
  - Examine motorcycles from the four dimensions that comprise Safe Systems
  - Provide a synthetic review that interprets the existing literature in light of Safe Systems principles
  - Apply them to an empirical examination of the incidence of motorcycle crashes to the South Florida Metropolitan Area

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Lists of Projects

- ***Safety Assessment***
  - ***Human Factors***
    - Identifying Deviations from Normal Driving Behavior
    - Behavioral Indicators of Drowsy Driving: Active Search Mirror Checks
    - Driving Risk Assessment Based on High-frequency, High-resolution Telematics Data
    - Behavior-based Predictive Safety Analytics Phase II
    - Investigating Relationship Between Driving Patterns and Traffic Safety Using Smartphones Based Mobile Sensor Data
    - Eye Glance Analysis and Cognitive Distraction
    - Determining Sample Measures of Distracted Driving, Distracted Pedestrian Activities and Impacts of Such Behavior on Traffic Operations at Signalized Intersections
    - Improving Methods to Measure Attentiveness through Driver Monitoring

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Lists of Projects

- ***Safety Assessment***
  - ***Intersection Safety***
    - An Evaluation of Signalized Intersection Safety Using Centracs System
    - Measuring Intersection Safety
    - Modeling and Predicting Traffic Accidents at Signalized Intersections in the City of Norfolk, VA
    - Operational Performance and Safety Effects of Arterial Weaving Sections
  - ***Systemic Assessment***
    - Partnership for the Transformation of Traffic Safety Culture: Phase 1, FFY 2015-2019
    - An enhanced systemic approach to safety
    - Evaluation of High Potential Areas for Truck Overweights and Accidents
    - Automated Assessment of Safety-critical Dynamics in Multi-modal Transportation Systems
    - Study of Operational and Safety Impacts of Disabled and Abandoned Vehicles on FDOT Roadways
    - Identify the Data Requirements for Safety Screening to Identify High Collision Concentration Locations
    - Accident Rates and Safety Policies for Trucks Serving the San Pedro Bay Ports

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Lists of Projects

- ***Safety Assessment***
  - ***CV, AV, CAV Related***
    - Highway Safety and Traffic Flow Analysis of Mixed traffic with Connected and Non-Connected Vehicles
    - Real-world Use of Automated Driving Systems and their Safety Consequences
    - Assessing the Impacts of Connected, Automated, and Autonomous Vehicles on the Future of Transportation Safety
    - Forecasting Impact of Connected, Automated, Shared and Electric Vehicles on Florida's Highway Network's Safety between 2020 & 2045 using Simulation & Artificial Intelligence
    - Safety Impact Evaluation of a Narrow Automated Vehicle-Exclusive Reversible Lane on an Existing Smart Freeway
  - ***Systemic Assessment***
    - Assessment of Work Zone Pre-crash Scenarios Using Crowdsourced Data
    - Examining potential safety risks associated with the introduction of light rail transit
    - Development of a Real Time Crash Risk Model based on Microscopic Traffic Data
    - Development of Crash Prediction Models for Short-Term Durations
    - Application of Dynamic Crash Prediction Methodologies to FDOT Safety and Transportation System Management and Operational (TSM&O) Programs
    - Developing Safety Performance Function (SPF) and Crash Modification Factor (CMF) for Managed Lanes Separation Treatments

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Lists of Projects

- ***Safety Improvement***
  - ***Infrastructure***
    - Automated Safety Warning System Controller Phase II: Enhancements and Field Tests
    - A Holistic Work Zone Safety Alert System through Automated Video and Smartphone Sensor Data Analysis
    - Signal Awareness Applications
    - Cooperative Intersection Collision Avoidance Demonstration to the FCC
    - Human Factors Study on the Use and Effectiveness of Innovative Safety Messages on Dynamic Message Signs
    - Improving Safety at Highway-Rail Grade Crossings in Florida while Maintaining Continuity of Passenger and Freight Flows: A Multi-Objective Approach
    - Development of Automated Roadway Lighting Diagnosis Tools for Nighttime Traffic Safety Improvement, Phase II
    - Development of Crash Modification Factors for Speed Management of Traffic Signal Progression

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Lists of Projects

- ***Safety Improvement***
  - ***CV, AV, and CAV related***
    - Intersection Collision Avoidance Concepts
    - Connected Vehicle Information for Improving Safety Related to Unknown or Inadequate Truck Parking
    - Preventing Crashes in Mixed Traffic with Automated and Human-Driven Vehicles
    - Countermeasures to Detect and Combat Inattention While Driving Partially Automated Systems
    - Drowsy Driver Mitigation System
    - Cooperative Intersection Collision Avoidance Systems Signalized Left-Turn Assistance
  - ***Other Projects***
    - Highway Safety Manual Implementation
    - Evaluation of Low Cost Safety Improvements
    - Strategies to Reduce Truck Mounted Attenuator Crashes
    - Algorithms to Convert Basic Safety Messages into Traffic Measures
    - Developing a framework to combine the different protective features of a safe system
    - Augmented Speed Enforcement (aSE) Part 1 of 2 WTI (RID 2146)

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Lists of Projects

- ***Vulnerable Users***
  - Phase 2: Pedestrian Safety Improvement Program Development
  - The Improvement of Bicyclists and Pedestrians Safety in Riverside County: Focusing on Environmental Contributing Factors to Bicyclists and Pedestrian Crashes
  - Data Mining to Improve Planning for Pedestrian and Bicyclist Safety
  - Identification and Prioritization of High Pedestrian Crash Locations/Areas
  - Evaluating the Effects of Cooperative Perception on Avoiding Pedestrian Crashes for Connected and Automated Vehicles
  - Simulation-based approach to investigate the electric scooter rider protection during traffic accidents. A step forward for safer e-scooters and for standardized national safety policies
  - A Safe Systems Approach to Motorcycle Safety
  - Understanding Florida Motorcycle Crashes and Injury Outcomes Using the Motorcycle Crash Causation Study (MCCS) Dataset

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Infrastructure



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Infrastructure

- Along with the developments of new technologies in the transportation system, particularly for EV, CV, AV, and CAV, assessments and developments of the physical infrastructure to accommodate these technologies are of concerns
- Traditional transportation infrastructure include
  - loop detector, traffic signs, curb, roadway design, etc.
- Advanced transportation infrastructure include
  - EV charging station, connected vehicle communication devices/systems, etc.

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Assessment of Requirements, Costs, and Benefits of Providing Battery Charging for Battery Electric Heavy-duty Trucks at Safety Roadside Rest Areas Facilities

- ***Objective***
  - **To better define possible barriers to the provision of battery charging infrastructure for heavy-duty electric trucks at roadside rest area**
- ***Major Components***
  - Determine whether providing the charging at the rest stops is practical for Caltrans to consider
  - Assess whether it is likely that the truck companies and drivers having multiple options for recharging their batteries will utilize charging stations at rest stops

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Lists of Projects

- Real-Time Data-Driven Simulation Development to Test Connected Infrastructure Environmental Applications: A Case Study of North Avenue Smart Corridor
- Identify Sources and Risks on Cybersecurity for Connected Vehicle Infrastructures
- V2I Infrastructure Placement and Safety Implications of CAVs in an Interconnected Network
- Rapid and Accurate Assessment of Road Damage by Integrating Data from Mobile Camera
- Assessment of Requirements, Costs, and Benefits of Providing Battery Charging for Battery Electric Heavy-duty Trucks at Safety Roadside Rest Areas Facilities
- Expanding Mobility Options for All: Optimizing and Extending the Biking Infrastructure to Generate Complete Street Networks in Atlanta
- End-to-End Development, Design and Implementation of a Crack Detection System for Tunnels and Other Underground Transportation Infrastructure
- Vision-based Sensor System for Site Monitoring: Wrong-Way Driving, Phase 1
- Multi-Criteria decision-making approach for Building Resilient and Sustainable Transportation Infrastructure
- Association between Transportation Infrastructure, and its environmental health exposures: Developing a Comprehensive Machine Learning Algorithm

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Public Transit and Shared Mobility



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Public Transit and Shared Mobility

- Increasing transit ridership is part of a balanced and diversified approach to address the urban congestion problem
- The popularization of shared mobility is also serving as an incentive to reduce the congestion and increase the traffic mobility
- Projects in this category are divided into:

Public Transits

Shared Mobility

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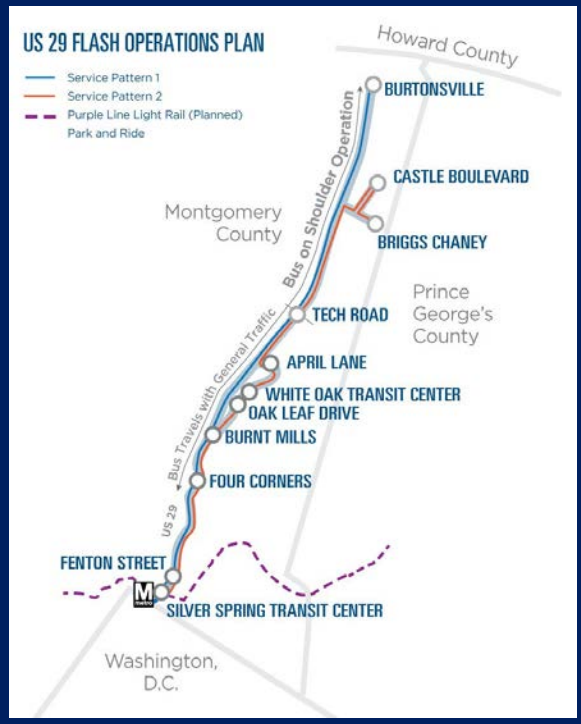
A Comprehensive Evaluation of I-275 Bus-on-Shoulder (BOS) Pilot Project

- ***Objective***
  - To evaluate **the effectiveness of bus-on-shoulder (BOS) operation**, including driver experience, ease of accessing the shoulders, adequacy of shoulder width, passenger car drivers' reaction, BOS motorist violations, etc.
  - To Evaluate **transit route system performance changes**, including BOS transit operations ridership, schedule reliability, safety (motorist, transit, law enforcement, passenger), frequency of use of BOS, and other indicators of transit level of service (LOS)
  - To Evaluate the effectiveness of BOS installed in both the northbound and southbound directions at the 38th Avenue N and 54th Avenue N on-ramps
  - To **Evaluate** whether I-275 BOS project leads to **traffic and safety impacts** to I-275 project segment and parallel local streets due to spill-over of traffic from on-ramps of I-275 segment
  - To provide recommendations that may **improve** the implementation and **operation of BOS,** such as training, marketing, traffic operations and control, etc.

Bus-on-shoulder

- "US 29 Flash" , U.S.29, Maryland

Source: BeyondDC, C.c.2.0



Source: https://www.montgomerycountymd.gov/dot-dte/projects/US29FLASH/index.html

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Evaluating Sustainability Impacts of Intelligent Carpooling System among Single Occupancy Vehicles Commuters

- ***Objective***
  - To contribute towards guidance on operational strategies to **achieve environmental and economic sustainability** for future **intelligent carpooling systems** in a complex urban traffic environment
- ***Methodology***
  - **Evaluation of economic benefits for users**
  - **Evaluation of the reliability of carpooling system in the presence of a sudden unanticipated demand (e.g., driver cannot drive due to vehicle failure)**
  - Systemic performance will be mapped to the link-level transportation network to allow for the estimation of the potential **benefits of traffic operations in terms of energy savings and emissions reduction** using the MOtor Vehicle Emission Simulator (MOVES) model

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Lists of Projects

- ***Public Transits***
  - Targeting Transit Incentives to Congestion Sources
  - Evaluation Tools for Automated Shuttle Transit Readiness of the Area
  - An Analysis of the Impacts of the Fixed-Route Transit in Florida
  - Bus Rapid Transit IVI Lane Assist Technology Requirements
  - A Comprehensive Evaluation of I-275 Bus-on-Shoulder (BOS) Pilot Project
  - Fare Free Public Transportation: A full-scale real-world experiment in Alexandria, Virginia
  - Effects of Automated Transit and Pedestrian/Bicycling Facilities on Urban Travel Patterns
  - Integrated Corridor Management (ICM) Demonstration for Transit: Utility of Real-Time Transit Vehicle Data
  - Integrating Transit Paths and Transit Occupancy Data into Activity-Based Travel Demand Model Outputs to Support Sustainability Analysis across Modes

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Lists of Projects

- ***Shared Mobility***
  - Evaluating Sustainability Impacts of Intelligent Carpooling System among Single Occupancy Vehicles Commuters
  - Evaluating Sustainability Impacts of Intelligent Carpooling/Vanpooling System among SOV Commuters –Phase II: Interactions with the Transit System
  - Examining Market Segmentation to Increase Bike-share Use: The Case of the Greater Sacramento Region
  - If pooling with a discount were available for the last solo-ridehailing trip, how much additional travel time would users have accepted and for which types of trips?
  - Annual Investigation of Nationwide Mobility Trends: “The Pulse of The Nation” on the 3 Revolutions
  - Peer-to-Peer (P2P) Carsharing: Understanding Early Market Dynamics and Social and Environmental Impacts
  - Real-Time System Prediction & Optimal Rebalancing Strategies for Public Bike Sharing Systems
  - Develop, Refine, and Validate a Survey to Assess Adult's Perspectives of Autonomous Ride-Sharing Services for Human Factors and Traffic Operational Observations
  - Establishing a Dual Generational Modality Dataset: Comparing the Ride-Sharing Adoption Trends and Perspectives of Consumers from Two Generational Cohorts, Millennials and Gen X’ers
  - Bike-sharing as a Safety Intervention: Evidence from Nine Large US Cities

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Modeling

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Modeling

- Modeling is playing a critical element in capturing relations and interactions between **vehicles and vehicles**, **vehicles and the roadside infrastructure**, **travelers and traffic networks**, and **vehicles and environmental implications**
- Projects in this category are divided into:

Traffic Flows

Human Factors

Travel Time and Travel Behavior

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Reconstructing Fundamental Diagrams of Heterogeneous Traffic from Trajectory Data

- ***Objective***
  - To reconstruct fundamental diagrams of **heterogeneous traffic** from trajectory data
- ***Methodology***
  - NGSIM data is the basis of the study, with some filtering methods applied to look at the traffic states that sustain a period of time
  - Focus on auto and truck data, considering four vehicle-following types:
    - Auto following auto
    - Auto following truck
    - Truck following auto
    - Truck following truck
  - The speed-density relations under the four categories are plotted using kernel smoothing regressions

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Big Data Visualization and Spatiotemporal Modeling of Aggressive Driving

- ***Objective***
  - To develop a big data analytics framework and visualization tool to conduct spatiotemporal modeling and **classify aggressive driving behaviors** using data from emerging technologies
- ***Methodology***
  - Utilizing unsupervised and supervised learning methods, as well as open-source visualization development tools, risky driving moments were identified
  - Principal Component Analysis (PCA) was used to reduce the data dimensions

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Estimating the Impact of COVID-19 on Travel Behaviors and Perceptions: An Investigation of Commuting Travel and Intercity Travel in the Northeast Megaregion

- ***Objective***
  - To understand future travel demands (both in trip generation and mode choice) for trips generated from a major anchor institution for both routine comminuting and intercity transportation
- ***Methodology***
  - Through a survey of more than 400 members of the faculty and staff at the University of Pennsylvania and other sites about travel behaviors prior to the COVID-19 pandemic and their perceptions and plans for travel in the future

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Modeling

- ***Traffic Flow***
  - Reconstructing Fundamental Diagrams of Heterogeneous Traffic from Trajectory Data
  - Modeling Traffic Flow at Merge Bottlenecks Considering Merging Location Choice
  - Bounded Acceleration and Capacity Drop at Merging Bottlenecks
  - Robust Traffic Assignment via Convex Optimization
  - Developing an Intelligent Connected Vehicle based Traffic State Estimator
  - Development of a Methodology for Calibration and Validation of a Mesoscopic Traffic Simulation Model
  - Combining Different Data Sources to Predict Origin-Destinations and Flow Patterns for Trucks in Large Networks
  - TO-14020: Lane Change/Merge Fundamental Research: Phase 1
  - Agent-Based Game Theory Modeling for Driverless Vehicles at Intersections
  - Assessing and Addressing Deficiencies in the HCM Weaving Segment Analyses – Project J5 (Phase II of Project K2)
- ***Human Factors***
  - Big Data Visualization and Spatiotemporal Modeling of Aggressive Driving
  - Modeling Driver Responses During Automated Vehicle Failures
  - Modeling Driver Car-following Behavior
  - Quantitatively Evaluate Work Zone Driver Behavior Using 2D Imaging, 3D LiDAR and Artificial Intelligence in Support of Congestion Mitigation Model Calibration and Validation

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Modeling

- ***Travel Time and Travel Behavior***
  - Social Networks and Travel Behavior
  - Advanced Travel Forecasting (TRANSIMS)
  - Microscopic Analysis of Travel Behavior Change
  - Methods to Analyze and Predict Interstate Travel Time Reliability – Phase II
  - Impact of Dedicated Bus Lanes on Intersection Operations and Travel Time Model Development
  - Development of Bayesian Multi-State Travel Time Reliability Models
  - Estimating the Impact of COVID-19 on Travel Behavior and Perceptions: An Investigation of Commuting Travel and Intercity Travel in the Northeast Megaregion
  - Emerging econometric and data collection methods for capturing attitudinal and social factors in activity and travel behavior modeling
- ***Other Projects***
  - Modeling and Evaluating Multimodal Urban Air Mobility
  - Analytical Model for Traffic Congestion and Accident Analysis
  - Calibration of Traffic Micro-simulation Models for Microscopic Vehicle Emission Modeling
  - Modeling the Impacts of Regulations and Safety Constraints on UAVs Costs and Emissions

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Transportation Management and Planning

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Transportation Management and Planning

- Projects in this category focus on the planning and decision making that defines the most efficient transport scheme according to given parameters and transportation execution that allows for the implementation of transportation plans
- Based on the purpose of applications, projects in this category are further divided into:

Non-recurring Events

Congestion Management

Urban Transportation Planning

Megaregion

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Non-recurring Events

- Non-recurring events are those incidents that are **not repeatedly occurred** (e.g., traffic incident or work zone)
- Projects in this sub-category focus on:
  - **Evaluating and predicting the impacts** of such events on the transportation system
  - **Developing corresponding response** to adjust, accommodate and mitigate the negative those impacts

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Application of Big Data Approaches for Traffic Incident Management (TIM)

- ***Objective***
  - To demonstrate the feasibility and practical value of **Big Data approaches** to improve **TIM**
  - To provide guidelines, including techniques and tools, to address the findings and recommendations of NCHRP Research Report 904
- ***Major Components***
  - Developing use cases and scenarios that identify data resources and possible analyses for enhancing TIM
  - Exploring the potential of nontraditional data sets and data fusion with TIM related sources
  - Building a data environment in which data can be will stored and analyzed
  - Developing case studies for a variety of geographic scales and population densities to demonstrate real-world use of the TIM
  - Documenting and developing a user guide with identified techniques and tools for use by state DOTs and other agencies

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Congestion Management

- A congestion management process (CMP), defined by FHWA, is a systematic and regionally-accepted approach for managing congestion that
  - **Provides accurate, up-to-date information** on a transportation system's performance
  - **Assess alternative strategies** for congestion management
- How to effectively **identify**, **predict**, **evaluate**, and **mitigate** the traffic congestion are of concerns

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Quantifying the Impact of On-Street Parking Information on Congestion Mitigation

- ***Objective***
  - To investigate the effects of **different types of parking information on travelers' parking choice behaviors** and circulation time through a driving simulator and a stated preference survey
- ***Major Components***
  - A simulator-based driving experiments in a 3.47 mi^2 network developed in the Chinatown area of Washington, D.C. with different traffic, driving condition, and information provision scenarios
  - A multinomial logistic regression model, linear regression, and t-tests were applied to analyze the collected data

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Urban Transportation Planning

- Transportation planning is the process of looking at the current state of transportation in the region, designing for future transportation needs, under the constraints of budgets, and the guide of established goals and policies
- Projects in this sub-category are further divided into:
  - **Dynamic Traffic Management**
  - **Transportation Demand Management**
  - **Smart City**
  - **CV, AV, CAV Related**

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A Geospatial Framework for Dynamic Route Planning Using Congestion Prediction in Transportation Systems

- ***Objective***
  - To extend GeoDec, which was originally built as a generic system for decision-making in geospatial environments, to support **decision-making in transportation systems with dynamic and real-time data**
- ***Major Components***
  - Conduct fundamental research at the data-tier of GeoDec to design new dynamic index structures
  - Develop new services and interfaces at the integration and presentation tiers of GeoDec to support fusion and querying of real-time data
  - Develop a novel proof-of concept application, namely **dynamic vehicle route planner** using congestion prediction, to demonstrate the benefits of our new framework

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Demand-Side Management of Auto Traffic

- ***Objective***
  - To quantify **the current and anticipated future contributions of urban parcel delivery** to urban **congestion** and related problems, such as traffic accidents
  - To identify opportunities for **incentivizing consumers and delivery services to modify their behaviors i**n order to reduce the congestion impacts of urban parcel delivery
- ***Methodology***
  - A model of urban congestion that is sensitive to parcel delivery activities will be developed and integrated with models of consumer and service provider choice

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Developing an Intelligent Transportation Management Center (ITMC) with a Safety Evaluation Focus for Smart Cities

- ***Objective***
  - To develop an intelligent transportation management center (ITMC) that adopts **automated video data analysis to evaluate safety**
- ***Major Components***
  - Demonstrate how intelligent transportation systems (ITS) technologies and big data analytics can be utilized to **proactively assess transportation safety** at signalized intersections
  - Adopt safety surrogate measures (SSMs) to identify near crash situations that can be applied in proactive risk calculations

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Developing an Intelligent Transportation Management Center (ITMC) with a Safety Evaluation Focus for Smart Cities

- ***Objective***
  - To investigate and develop **alternative tolling options** for the transportation system in a **connected vehicle environment**
- ***Methodology***
  - Investigate future possibilities for open toll lanes in a connected vehicle environment by analytical approaches and simulations
  - Conduct behavioral surveys by two parts: online stated preference survey and in-class game
  - Incorporate the collected data into a mathematical model

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Megaregion

- Megaregion is a group of **two or more roughly adjacent metropolitan areas**, which may be somewhat separated or may merge into a continuous urban regions
- Projects in this sub-category focus on:
  - **Implementing appropriate transportation planning strategies**
  - **Developing reliable models considering the mega-travel**
  - **Evaluating the multi-modal transportation investment on a megaregional scale**

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Develop a GIS-based Megaregion Transportation Planning Model

- ***Objective***
  - To fill the gaps to develop a GIS-based operational model for **megaregion transportation planning**
  - To **extends the spatial scale of a regional transportation model to megaregion**, which accommodates larger areas, more passenger and freight trips, and more complex transportation networks
  - To balance the priorities in both academic research setting and operational planning setting
- ***Case study***
  - It selects Texas Triangle, including Austin, Dallas, Houston, and San Antonio metropolitan areas, as an empirical case to demonstrate the procedure of analytical framework design, data inventory, model development, and model implementation

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Lists of Projects

- ***Non-recurring Events***
  - Experimental Studies of Traffic Incident Management with Pricing, Private Information, and Diverse Subjects - Second Year
  - Application of Big Data Approaches for Traffic Incident Management (TIM)
  - Saxton Transportation Operations Laboratory Task Order 11: User Friendly Traffic Incident Management (TIM) Program Benefit-Cost Estimation Tool
  - Analysis and Prediction of Spatiotemporal Impact of Traffic Incidents for Better Mobility and Safety in Transportation Systems
  - Effects of Major Transportation Incidents and Disruptive Events
  - Effectiveness of Work Zone Transportation Management Plan (TMP) Strategies
  - Improving Work Zone Mobility through Planning, Design, & Operations
  - Developing a Methodology to Evaluate Detours for Major Construction Projects in the Era of Real-Time Route Guidance

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Lists of Projects

- ***Congestion Management***
  - Dynamic Congestion Pricing Considering Spatial Interactions of Queues
  - Congestion Management Process: A Guidance Document
  - Proactive Congestion Management
  - Smartphone-Based Incentive Framework for Dynamic Network-Level Traffic Congestion Management
  - Congestion Using New Mobility Platforms: Understanding Curb Management and Targeted Incentive Policies to Increase Pooling
  - Congestion Reduction via Personalized Incentives
  - Quantifying the Impact of On-Street Parking Information on Congestion Mitigation
  - Development of Congestion Factors for Adjusting Traffic Counts During Congested Periods: Phase 1 - Literature Review and Survey
  - Targeting Transit Incentives to Congestion Sources
  - Traffic Congestion Identification and Prediction based on Image Processing and Deep Learning Methods
  - Micro-Mobility as a Solution to Reduce Urban Traffic Congestion
  - Identifying and Mitigating Congestion Onset
  - Mitigating Network Congestion by Integrating Transportation Network Companies and Urban Transit

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Lists of Projects

- ***Urban Transportation Planning***
  - ***Dynamic Traffic Management***
    - A Geospatial Framework for Dynamic Route Planning Using Congestion Prediction in Transportation Systems
    - Development of Dynamic Traffic Management System
    - Empirical Analysis to Determine Effectiveness of Dynamic Mobility Management Systems
    - Dynamic Traffic Assignment vs. Frank-Wolfe Route Assignment Impacts on Emissions and Energy Inventories
  - ***Transportation Demand Management***
    - Supply-Side Management of Auto Traffic
    - Demand-Side Management of Auto Traffic
    - App-based Data Collection to Characterize Latent Transportation Demand within Marginalized and Underserved Populations
    - Project UCARE: Uniform Cost Accounting and Reporting Elements for Transportation Demand Management Programs
    - Exploration of Corridor-Based Tolling Strategies for Virginia's Express Toll Lanes
    - Reducing VMT, Encouraging Walk Trips, and Facilitating Efficient Trip Chains through Polycentric Development

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Lists of Projects

- ***Urban Transportation Planning***
  - ***Smart City***
    - Developing an Intelligent Transportation Management Center (ITMC) with a Safety Evaluation Focus for Smart Cities
    - San Diego Integrated Corridor Management (ICM), Phase 3 Demonstration and Evaluation
    - Evaluation of Transportation Network Infrastructure, Safety, and Travel Route Characteristics of Bike Share, Electric-Powered Pedal-Assist Bike Share, and Electric Scooter System Operation
    - Transportation Mobility Assessment and Recommendations for Smart City Planning
    - Developing an Intelligent Transportation Management Center (ITMC) with a Safety Evaluation Focus for Smart Cities
    - Use of Persistent Wide-Area Video for Transportation Planning and Operations

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Lists of Projects

- ***Urban Transportation Planning***
  - ***Other Projects***
    - Moving Towards A More Sustainable California: Exploring Livability, Accessibility, and Prosperity
    - Modeling Habitat Fragmentation in Relation to Road Systems: A Tool for Transportation Planning in California
    - Strategic Prioritization and Planning of Transportation Infrastructure Maintenance, Rehabilitation, and Improvements Incorporating Continuously-Sensed Data
    - Alternative Intersections Comparative Analysis
    - Use of Mobile Data for Weather-Responsive Traffic Management Models
    - An Open-Source Traffic Assignment Tool for Assessing the Effects of Roadway Pricing and Crash Reduction Strategies on Recurring and Non-Recurring Congestion
    - Modern Project Prioritization for Transportation Investments
    - Assessment of Transportation Systems Resilience for Vulnerable Communities and Populations
    - Emerging Mobility Services for the Transportation Disadvantaged
    - Real-Time Data-Based Decision Support System for Arterial Traffic Management
    - Feasibility for a New Concept of Integrated Active Transportation Systems
    - Before-and-After study Evaluation of Interstate 4 (I-4) Florida's Regional Advanced Mobility Elements (FRAME) Project - Evaluating the Impact of Communication Technologies on Safety and Mobility Measures

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Lists of Projects

- ***Megaregion***
  - Multi-city Direct-Demand Models of Peak Period Bicycle and Pedestrian Traffic
  - Mega-Regions and Transportation
  - The Evolving Texas Megaregion: Developing a Sustainable Megaregion Mobility Planning Blueprint
  - Virtually There: Estimating the Potential of Teleconference to Reduce Travel within and between Megaregions in the Aftermath of a Global Pandemic
  - Megaregional Transportation System Resilience Planning
  - Global Transportation Megaregion/Megaproject Best Practices Manual
  - Robustness of Transportation Networks under Megaregion Evacuations
  - Develop a GIS-based Megaregion Transportation Planning Model
  - Beyond Political Boundaries: Constructing Network Models for Megaregion
  - Mega-Travel in Megaregions: An Update on Growth Trends and Research Needs
  - Significance and Prospects of Transportation Planning at the Megaregional Scale
  - The Right Structure for the Right Incentives: Multimodal Transportation in America's Growing Megaregions
  - An Operational Platform for Modeling Multi-Modal Transportation Investments in the Northeast Corridor Megaregion
  - Risks and Recoveries from Extreme Disruptions in Freight Transportation System in a Megacity: Case Study for the Greater Los Angeles Area

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Lists of Projects

- ***Other Projects***
  - PPRC14: Support for the Highway Performance Monitoring System (HPMS)
  - Assessing the Health Impacts of Transportation Projects - a Synthesis

Mid-block signal

Bus-on-shoulder

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