# U.S. DOT's Small Business Innovation Research (SBIR) Program


## SBIR Fiscal Year 2024.2 Phase I Awards: Complete Streets Artificial Intelligence Initiative

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|---|---|
| Artificial Intelligence Approach to Generate and Analyze Complete Streets Data at Scale | Aiwaysion, Inc |
| Data Processing and Analysis Framework for Infrastructure Planning to Promote Active Transport | Creare LLC |
| Scalable and Sustainable AI Solutions for Complete Streets Data Creation and Maintenance with Off-the Shelf Dash Cams | JC-TECHS Corp |
| Safe Routes for All (SR4A) - Using AI-Based Image Recognition and Machine Learning Algorithms for Network-Wide Assessment and Routing of Multimodal Trips Based on Level of Traffic Stress | Kittelson and Associates |
| Complete Urban To Rural Balanced Streets By Artificial Intelligence Design (CURBS-AID) | Kitware, Inc. |
| Safe Accessible Multimodal Mobility Intelligence (SAMMI) for All Road Users | Numobility LLC |
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| AI for Complete Equitable Streets (ACES): Using Computer Vision and Machine Learning to Deliver Data-Driven Guidance for Complete Streets | State of Place |
| Complete Pavement Markings for Safe and Complete Streets | TrAnalytics LLC |
| Informing Infrastructure Interventions via Novel Near-Miss Data Collection | VELO.AI, INC. |
| Complete Street Data Collection and Assessment using Machine Vision | WCEC Engineers, Inc. |

# Aiwaysion, Inc. (Seattle, WA)

## Artificial Intelligence Approach to Generate and Analyze Complete Streets Data at Scale

**Geographic Focus Area**: Tucson, AZ

**PI Name:** Wei Sun **PI Email:** wsun@aiwaysion.com

**Abstract:** The project aims to enhance complete streets planning through innovative AI-driven tools and methodologies. The project focuses on developing a comprehensive decision-support system that leverages advanced data collection, integration, and artificial intelligence technologies to address critical gaps in Complete Streets planning.

Phase I of the project involves the creation of a robust data collection framework and the development of AI and computer vision algorithms to generate and analyze diverse datasets. This framework will identify and address data deficiencies, particularly in areas such as traffic volume, pedestrian infrastructure, and demographic representation, thereby supporting more equitable and effective urban planning. The project will also produce a prototype decision-support tool that integrates these technologies into a user-friendly platform, enabling planners and policymakers to visualize and manipulate data for better-informed decision-making.

**Company Website:** https://www.aiwaysion.com/

# Creare LLC (Hanover, NH)

## Data Processing and Analysis Framework for Infrastructure Planning to Promote Active Transport

**Geographic Focus Area**: Denver, CO

**PI Name:** Mattheus Ueckermann **PI Email:** mpu@creare.com

**Abstract:** The U.S. Department of Transportation (DOT) seeks a suite of decision-support tools to help state, local, and tribal transportation agencies adopt Complete Streets policies. The guiding philosophy behind the Complete Street framework is to provide safe roadways for all users, regardless of age or physical ability, and include active transportation modes. This framework complements the Vision Zero strategy that aims to eliminate all traffic fatalities and severe injuries while increasing safe and equitable mobility. However, to design, implement, and evaluate Complete Streets policies, users need high quality, local data relevant to their community. These data need to accurately capture: (1) existing infrastructure; (2) traveler behavior; and (3) context explaining traveler behavior. Unfortunately, infrastructure and traveler behavior data for active transport modes are incomplete or non-existent.

Creare proposes to develop StreetPulse, a system that automatically generates user-specified infrastructure data and enables customized community-specific analyses needed to implement Complete Streets policies. It uses data formats that closely follow existing and emerging standards, providing interoperability with existing Geographic Information System (GIS) analysis tools and pipelines. StreetPulse aims to enable data-driven decision support tools, enabling state, local, and tribal communities to implement safer, more effective transportation networks.

**Company Website:** https://www.creare.com

# JC-TECHS Corp (University Place, WA)

## Scalable and Sustainable AI Solutions for Complete Streets Data Creation and Maintenance with Off-the Shelf Dash Cams

**Geographic Focus Area**: Tacoma and Lakewood, WA

**PI Name:** Wei Cheng **PI Email:** contact@jc-techs.com

**Abstract:** The creation of a complete street data set is the first step in enabling new services for pedestrians, bicyclists, scooter users, EV drivers, delivery/ride share drivers to reduce traffic congestion and illegal parking, save drivers' travel time and gas, improve travel safety and comfort, optimize planning for extending connectivity, equity, and reachability. This project will study AI techniques for efficiently creating and maintaining a complete street data set via analyzing the street videos collected by off-the-shelf dash cams. The objectives of this research are to (1) study AI technologies for creating the complete street data from street videos, (2) develop routing algorithms and mobile app for data maintenance, (3) design secure and privacy protection data storage schemes, and (4) develop a cross validation system to demonstrate the collected data's accuracy and design APIs for sharing the data in standard formats.

**Company Website:** https://www.jc-techs.com/

# Kittelson and Associates (Wilmington, NC)

## Safe Routes for All (SR4A) - Using AI-Based Image Recognition and Machine Learning Algorithms for Network-Wide Assessment and Routing of Multimodal Trips Based on Level of Traffic Stress

**Geographic Focus Area**: Tampa, FL

**PI Name:** Bastian Schroeder **PI Email:** bschroeder@kittelson.com

**Abstract:** This proposal will leverage artificial intelligence (AI) and machine-learning (ML) to fundamentally alter the approach to data generation for Complete Streets, and dramatically improve the capabilities of agencies looking to provide network-wide assessments and prioritization of improvements to multimodal facilities. Specifically, this research will (1) use AI-based image processing to extract missing geometric attributes from high-resolution aerial imagery to generate all necessary inputs for segment and crossing level of traffic stress (LTS) methods, and (2) use ML-based routing algorithms and optimization to identify low stress routes that match user preference and help identify most critical infrastructure investments to unlock the low-stress network. The research will overcome a major obstacle in the evaluation of complete networks that are safe and comfortable for all users, which is the availability and coverage of spatial data. This research will generate all necessary input data for industry-standard LTS methods for both segments and crossings, and integrate the results in network-wide routing that considers LTS and user preferences. Using AI and ML technologies, this research will fill critical data gaps needed to empower agencies to accurately and efficiently assess their multimodal networks, and inform investment decisions for creating complete networks for walking and bicycling.

**Company Website:** https://www.kittelson.com

# Kitware, Inc. (Clifton Park, NY)

## Complete Urban To Rural Balanced Streets By Artificial Intelligence Design (CURBS-AID)

**Geographic Focus Area**: New York Capital Region (Albany, Schenectady, Troy, and suburbs)

**PI Name:** Connor Greenwell **PI Email:** connor.greenwell@kitware.com

**Abstract:** Complete Streets planning is currently limited in scope by human bandwidth. Modeling and analyzing traffic infrastructure is time-consuming, and manually annotating transportation networks does not scale to large study areas. Kitware, along with NYU and MJ Engineering, proposes to build a Complete Streets AI assistant that can analyze infrastructure, answer queries, and make suggestions at scale. The foundation of this capability is an accurate traffic model; initially, we will build an accurate and complete digital traffic network capturing walkways and their interactions using state-of-the-art computer vision algorithms.

In Phase I, we will extend our prior work to automatically extract walkway networks from overhead image surveys, incorporating computer vision techniques on ground-level imagery to enhance accuracy and provide finer details such as curbs and sidewalk conditions.

If successful, our approach will automate the generation of walkway networks at a national scale with minimal cost. Phase II will develop an LLM assistant to interact with planners through a retrieval augmented generation framework that can respond to queries by indexing the traffic network and generating proposals. Finally, we will use our team's web-based visualization tools to create an interface for planners to interact with the assistant and visualize proposed network alterations.

**Company Website:** https://www.kitware.com/

# Numobility LLC (Atlanta, GA)

## Safe Accessible Multimodal Mobility Intelligence (SAMMI) for All Road Users

**Geographic Focus Area**: Atlanta (GA), Gwinnett Co (GA), Bellevue (WA), King County (WA), Austin (TX), and Phoenix (AZ).

**PI Name:** Ximon Zhu **PI Email:** ximon@numobility.ai

**Abstract:** The proposed Safe and Accessible Multimodal Mobility Intelligence (SAMMI) project aims to revolutionize Complete Streets development with an AI-driven decision support system. SAMMI addresses the lack of a comprehensive, data-driven approach to identifying and prioritizing complete streets projects, which currently relies on limited data and historical crash information, delaying interventions. The SAMMI system will integrate diverse data sources on travel behavior, infrastructure conditions, and environmental context to provide actionable insights for proactively identifying high-priority complete streets projects. By leveraging emerging technologies, such as computer vision and machine learning, SAMMI will enable efficient data generation and analysis. The incorporation of Generative AI techniques will enhance the accessibility of design standards and guidelines, streamlining the planning process. The Phase I effort will focus on establishing a foundation for SAMMI by understanding user requirements, demonstrating data generation capabilities, and exploring GenAI data processing techniques. A proof-of-concept report will be developed to validate the approach and lay the groundwork for Phase II prototype development. SAMMI has the potential to significantly improve safety, accessibility, equity and sustainability in transportation by empowering data-driven decision-making and accelerating the implementation of Complete Streets nationwide.

**Company Website:** *website currently not available*

# OpalAI Inc. (Beverly Hills, CA)

## AI for City

**Geographic Focus Area**: Los Angeles, CA

**PI Name:** Ryan Alimo **PI Email:** ryan@opal-ai.com

**Abstract:** The rapid urbanization of cities has created complex demands on roadways, necessitating a shift toward multimodal and sustainable transport solutions that prioritize safety, efficiency, and accessibility. The Complete Streets concept embodies this shift by incorporating all users into the design, operation, and maintenance of transportation networks. However, many urban road networks still lack essential features like sidewalks, bike lanes, and crosswalks, posing significant safety risks. In California alone, inadequate roadway design costs the state billions in accident-related expenses and has led to a 53% increase in pedestrian fatalities in recent years. This proposal addresses these issues by introducing the Strategic Mapping, Analysis, & Road Transformation (SMART) framework for improved safety analysis and street design. The project will achieve three key objectives: comprehensive data collection using multi-sensor mobile mapping, automated extraction of road features meeting Complete Streets criteria, and optimized decision-making with multi-objective algorithms. This framework will be tested in Los Angeles, where it will integrate demographic, topological, and equity-informed travel data to deliver actionable insights that maximize safety and accessibility. Phase I deliverables will include technical feasibility demonstrations, software prototypes, and comprehensive documentation, setting the stage for Phase II scalability and ensuring that the SMART tool can guide data-driven and equitable street improvement projects nationwide.

**Company Website:** www.opal-ai.com

# Skylite Group (Bethesda, MD)

## CSAI Phase I - Skylite Group

**Geographic Focus Area**: Washington, D.C. Area and Southern Montgomery County, MD

**PI Name:** Eugene Polishchuk **PI Email:** eugene@skylitelabs.com

**Abstract:** The foundation of any system that aims to effectively facilitate data-driven decisions relies on the quality of the data inputs into the system. For Phase I of Complete Streets Artificial Intelligence Initiative we propose an approach that focuses on the quality of the data, data attribution and data fusion. Significant advances in recent years in computer vision allow for accurate extraction of data from both overhead and surface based imagery. These datasets can be combined with GeoSpatial data in order to form a more complete picture of the situation on the ground. Anonymized and aggregated GPS tracks from Strava is a freely available dataset for infrastructure development purposes. This dataset would allow for rapid identification of unsafe road crossings, analysis of utilization of existing bike lanes, as well as areas where new ones might need to be established. For data fusion, we propose deploying a GeoLLM to build a system that would take a prompt like “show all crosswalks over 45 mph roads, with Strava pedestrian traffic during the last month and serious traffic incidents within 500m during last year” and convert it into queries across multiple data sources to display data with attributes on the map.

**Company Website:** https://www.skylitelabs.com

# State of Place (Natick, MA)

## AI for Complete Equitable Streets (ACES): Using Computer Vision and Machine Learning to Deliver Data-Driven Guidance for Complete Streets

**Geographic Focus Area**: Philadelphia, PA

**PI Name:** Mariela Alfonzo **PI Email:** mariela@stateofplace.co

**Abstract:** Gaps in jurisdiction-wide, street-level infrastructure, traveler behavior/safety, and context data inhibit advancement of “Complete Streets” (CS) - safe streets that accommodate all users. Existing data collection methods are either not scalable (e.g., manual collection), expensive (e.g., deploying sensors jurisdiction-wide), non-representative (e.g., smartphone data), or incomplete or too aggregated (e.g., federal datasets). This Phase I proposal (ACES) uses 130 visual machine learning (VML) models to generate street-level data on 50 Infrastructure and 88 Context features, and vehicle, bicyclist, and pedestrian mix and counts (building on our 119 existing VML models for 127 built environment features). We apply VML to extract this, one-time-point, Infrastructure, Traveler Behavior, and Context data from anonymized street-level images, collected via an image capture prototype, mounted on Southeastern Pennsylvania Transit Authority (SEPTA) buses (in conjunction with SEPTA) and deployed on a minimum of 50% of the bus system. Using this and other relevant data, we produce a novel machine learning (ML) model to predict street-level travel mode mix and counts, jurisdiction-wide for three time points. Backup image sourcing mitigate project risk. ACES produces a comprehensive dataset to inform CS Siting, Prioritization, Design, Implementation, & Evaluation and a scalable, expandable CS data collection methodology.

**Company Website:** https://www.stateofplace.co

# TrAnalytics LLC (Bedford, MA)

**Geographic Focus Area**: Greater Boston Area (Arlington, Belmont, Cambridge, Everett, Medford, Newton, Somerville, and Watertown)

**PI Name:** David Raucci **PI Email:** draucci@tranalytics.us

**Abstract:** Safety is central to any complete street project. This research aims to utilize LiDAR data to automatically detect and evaluate pavement marking conditions. These markings are essential for delineating bike and bus lanes and communicating safety-critical traffic rules such as yield and stop signs to road users. Poorly maintained markings, if faded or worn out, significantly jeopardize the safety of vulnerable road users and can expose transportation agencies to substantial legal liability. Additionally, degraded markings can compromise the functionality of complete street projects by causing confusion and misunderstanding among drivers and vulnerable road users. This project will demonstrate the feasibility and cost-effectiveness of using large-scale LiDAR data to automatically assess pavement marking conditions, with a particular focus on retro-reflectivity. We will concentrate on bike lanes in a region serving a population of over half a million. We will explore two data collection methods: mobile LiDAR mounted on a vehicle and airborne LiDAR, with the latter enhancing the scalability of the proposed solution. The results will be delivered in an accessible GIS format.

**Company Website:** https://tranalytics.us/

# VELO.AI, INC. (Pittsburgh, PA)

**Geographic Focus Area**: Pittsburgh, PA

**PI Name:** Galen Clark Haynes **PI Email:** gch@velo.ai

**Abstract:** Bicyclist fatalities have increased 77% since 2010. Using infrastructure to eliminate conflict with motor vehicles, meanwhile, is the most effective means of protecting bicyclists. Crash data indicates where interventions are needed, but near misses provide a richer dataset and can predict future incidents. To date, there is no single source of near-miss data for infrastructure managers. Velo proposes a fleet of bicycle-mounted sensors, leveraging autonomous vehicle technologies, to collect near-miss data—in particular vehicle overtakes, passing distances, and prevailing traffic speeds—to identify risk patterns in the Pittsburgh region. We leverage an existing, commercially-deployed sensor fleet and build an equitable fleet via Bike Share Pittsburgh. We focus on creating observational models of risk, using near-miss data to identify hotspots. In collaboration with Carnegie Mellon University's Mobility Data Analytics Center, we further extrapolate to unseen regions by augmenting our dataset using satellite imagery, traffic flow, and road geometry. Velo's capabilities include hardware and software development, focusing on autonomous vehicle algorithms, and is supported by the Robotics Factory and Innovation Works facilities. Our anticipated results include validated predictive models capable of scaling via bike share and consumers to various regions, with potential future applications for pedestrian and transit scenarios.

**Company Website:** https://www.velo.ai

# WCEC Engineers, Inc. (Salt Lake City, UT)

**Geographic Focus Area**: Salt Lake City, Utah and surrounding areas

**PI Name:** Clancy Black **PI Email:** clancy.black@wcg.us

**Abstract:** Poorly designed streetscapes contribute to traffic crashes, poor economic performance, neighborhood decline, and many other societal impacts. Designing streets that are focused on the users, complete streets, can have a significant impact on safety and quality of life in our communities. A primary challenge of designing and improving streetscapes is understanding where improvements are needed and what really contributes to a complete street. The purpose of this project is to develop a robust machine vision data collection program that can recognize, identify, and understand streetscape assets and define their impact on the complete street environment.

Our team already has extensive experience applying machine vision models to various infrastructure problems, including asset identification and rating the safety of roadside hazards. We also have proven success commercializing these and other technologies. Our team proposes to use this SBIR funding to expand our models to capture assets in urban contexts and be able to identify areas with high-quality complete streetscapes and areas where improvements are needed to better serve users. The model will be built to work with a variety of data sources including street-level imagery and aerial imagery.

**Company Website:** https://wcg.us