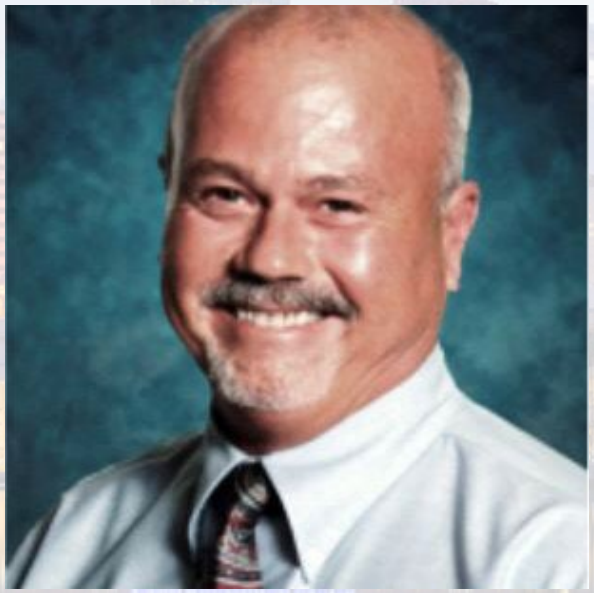
2023 FAV Summit: Emerging Data



Moderator: John Krause, PSM
Civil Integrated Management Officer
Florida Department of Transportation

Thursday, September 7
1:30 pm-3:00 pm

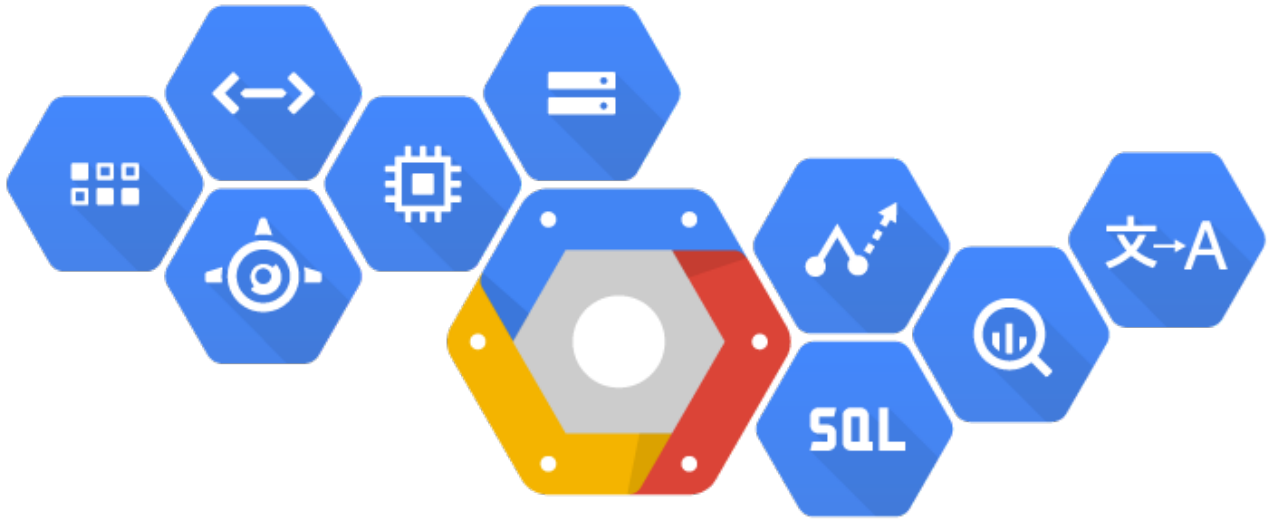
Emerging Data, AI and Analytics for Transportation Management

Monali Shah
Strategic Business Executive
Google

Emerging Data, AI and Analytics for Transportation Management

Monali Shah, FAV 2023

Google

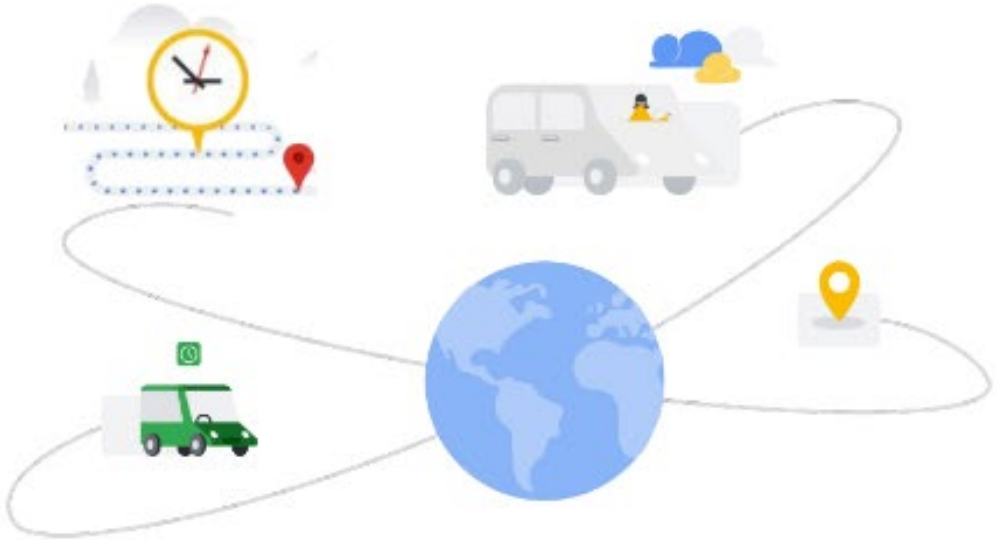


Organize the world's information and make it universally accessible and useful

Google

Enable an open ecosystem

with data, platforms, and insights



Consumer

Automotive & Enterprise

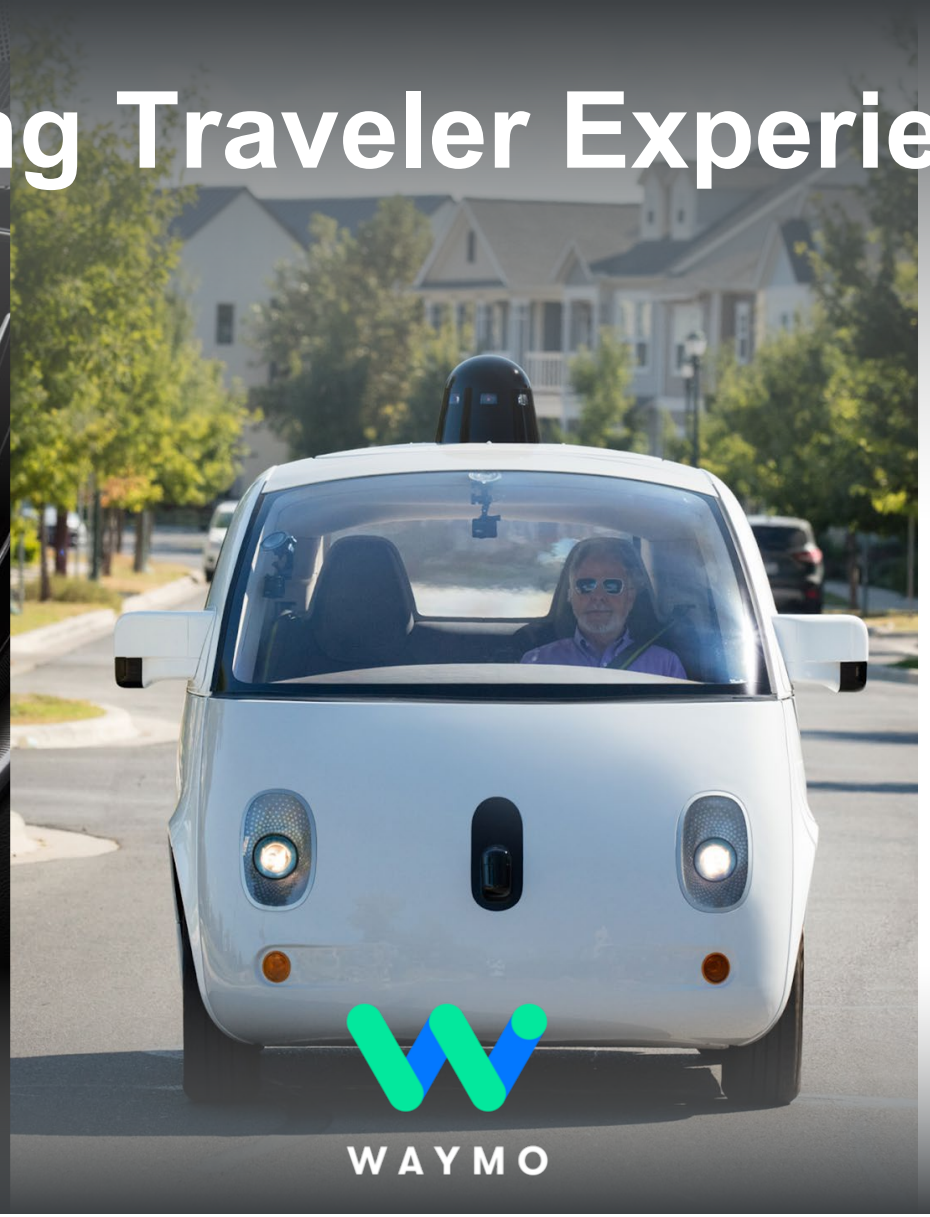
Public Sector

Google Cloud

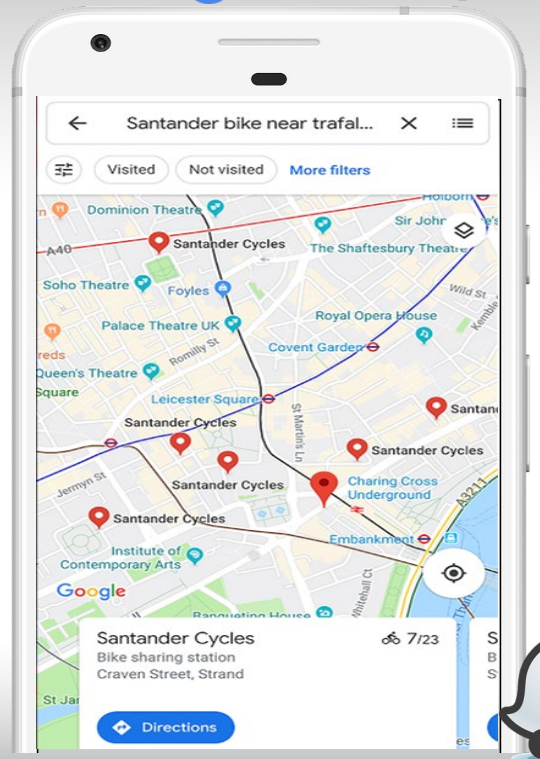
Software enabled experiences

Google

Transforming Traveler Experiences



Google Maps

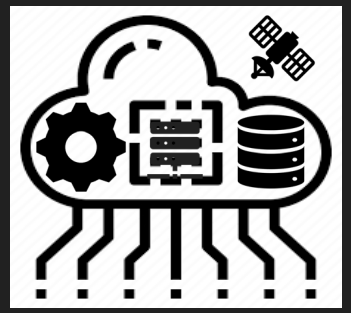


waze

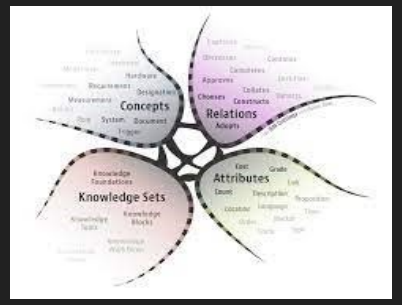
Google

Moove.ai

Platform that integrates datasets and extracts unique insights to understand Safety and Risk conditions



SEAMLESS INTEGRATION OF DIVERSE VEHICLE BEHAVIOR, ROAD CHARACTERISTICS & ENVIRONMENT DATA



DATA ONTOLOGY WITH SPATIAL TEMPORAL DIMENSION ML-AI MODEL(S)

CONTEXTUALIZATION & CLASSIFICATION DERIVED FROM A GROWING STACK OF DIVERSE LARGE DATASETS

10+ TRILLION VEHICLE EVENTS

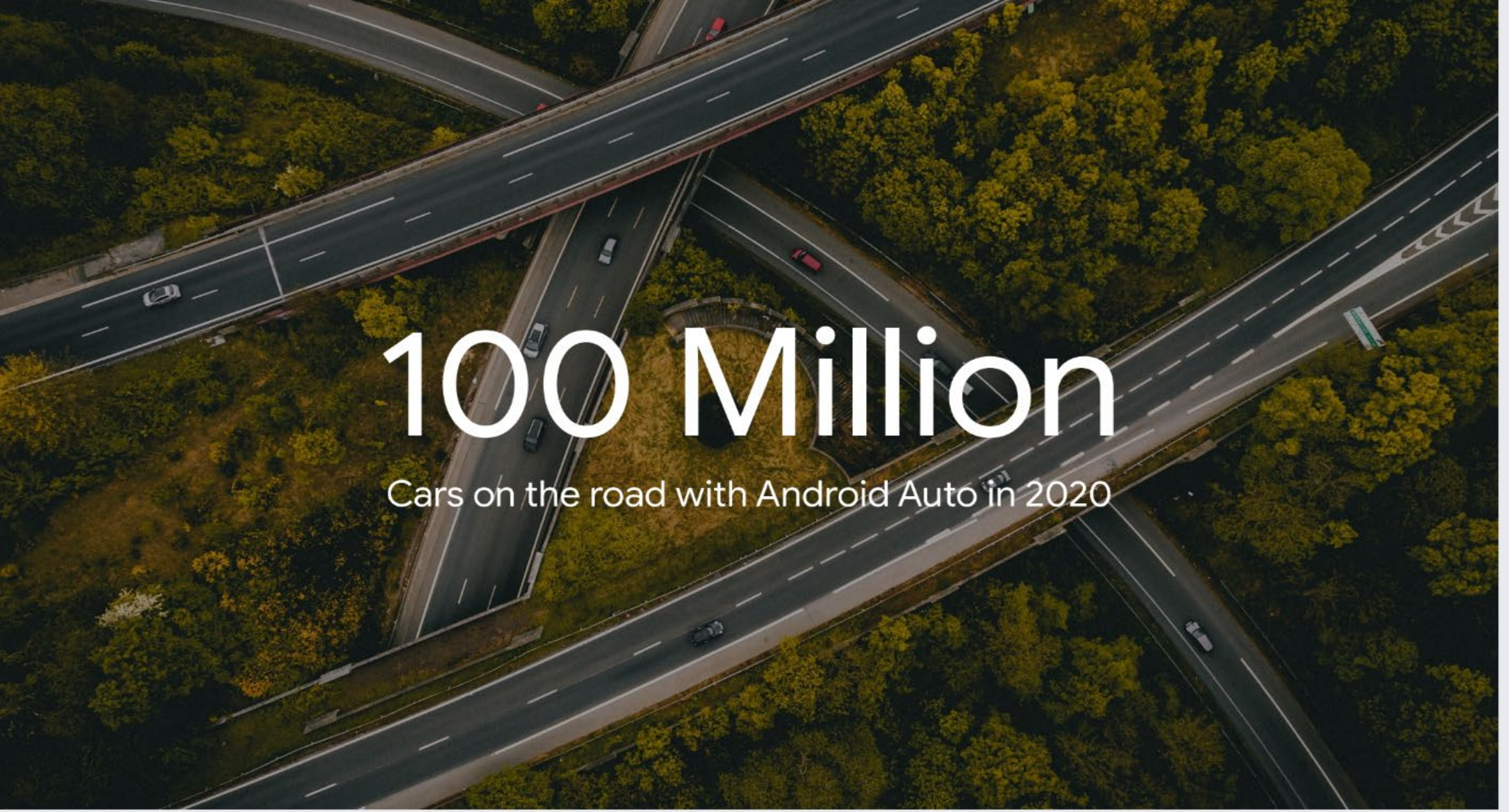
15M+ CONNECTED VEHICLES

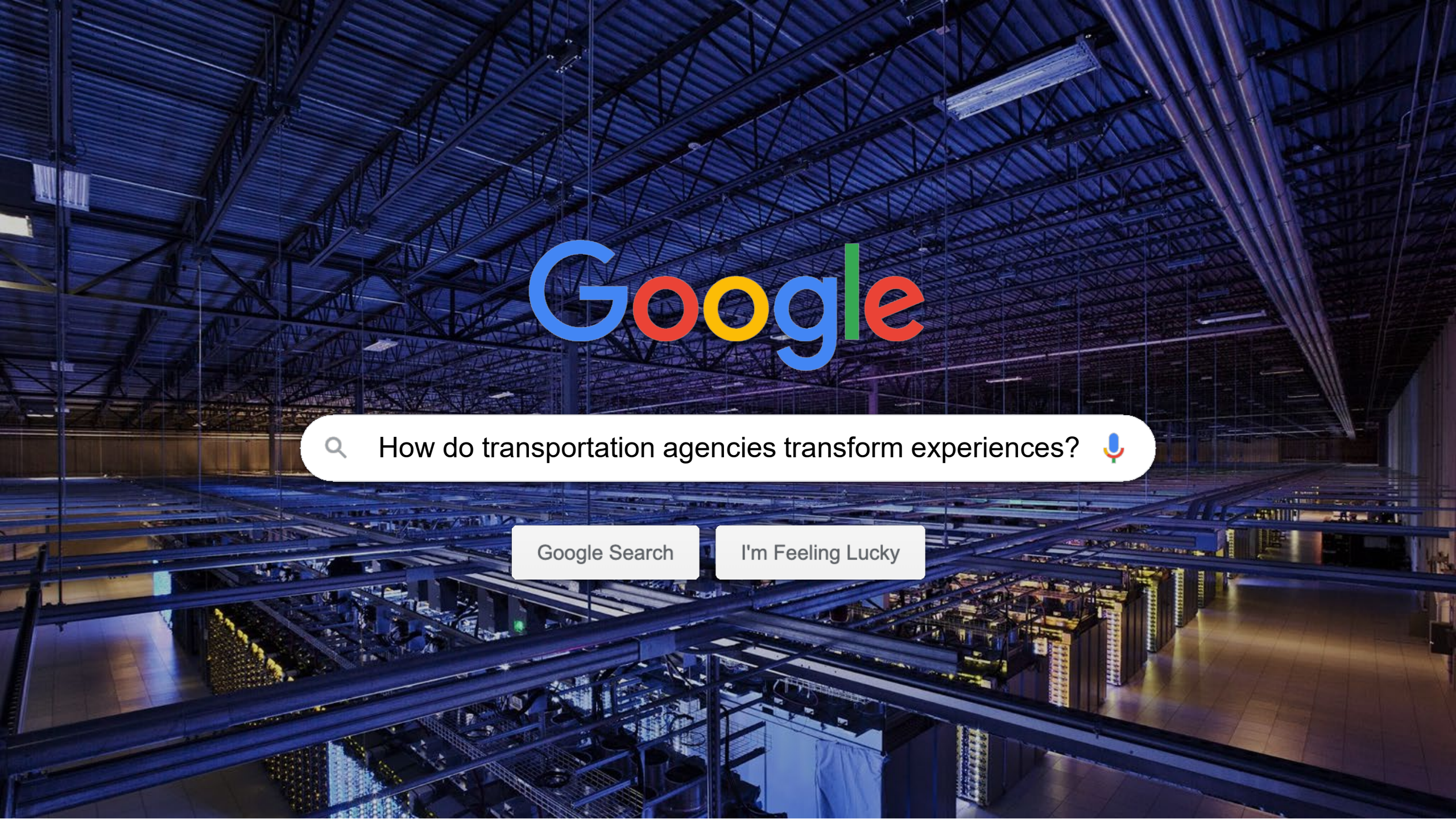
+100 ROAD WEATHER CONDITIONS

60+ BILLION ROAD FEATURES

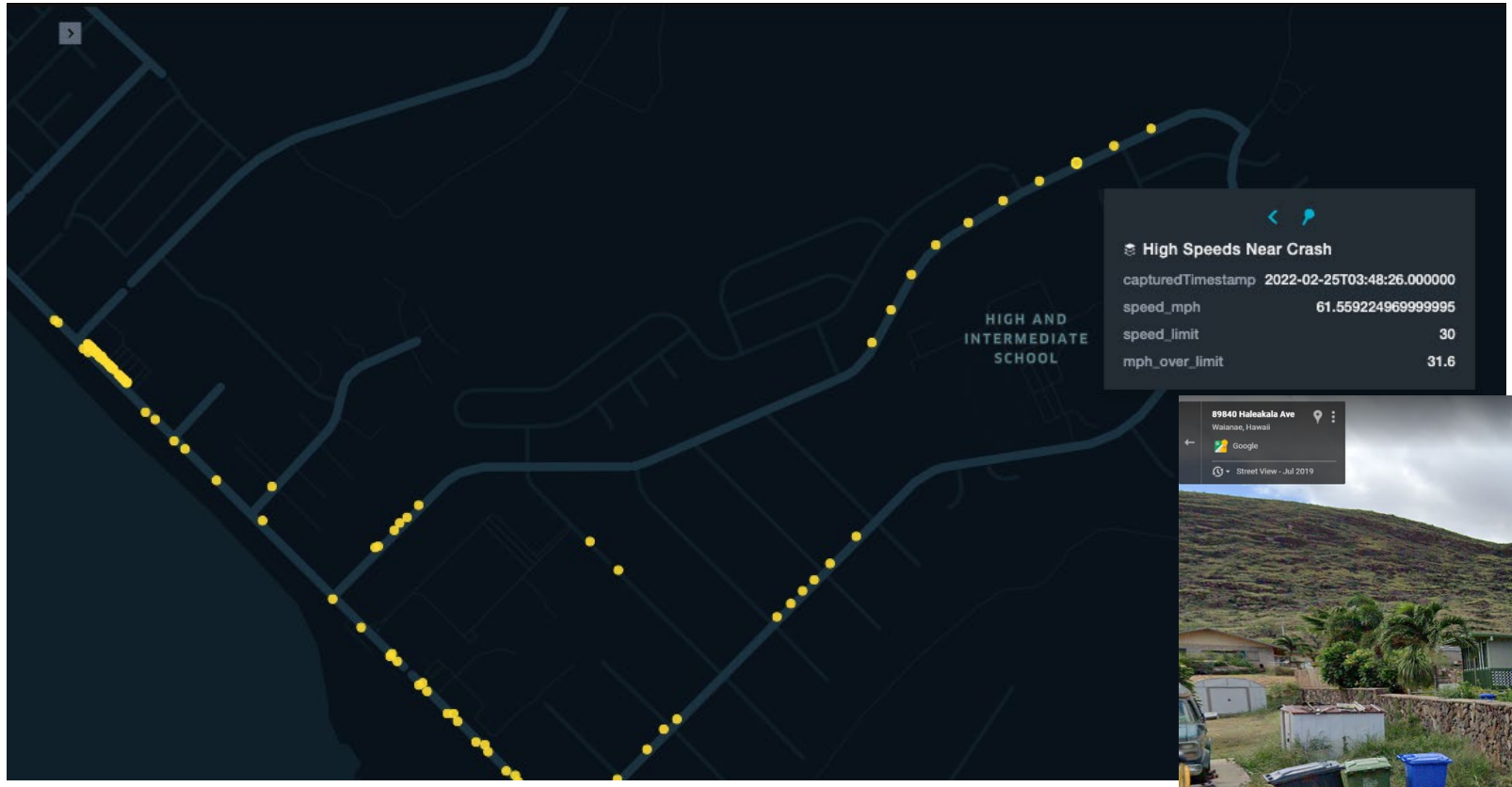
50+ MILLION ROAD SEGMENTS

REALTIME LOCAL HAZARD ALERTS


100 Million
Cars on the road with Android Auto in 2020


Google
How do transportation agencies transform experiences?
Google Search
I'm Feeling Lucky

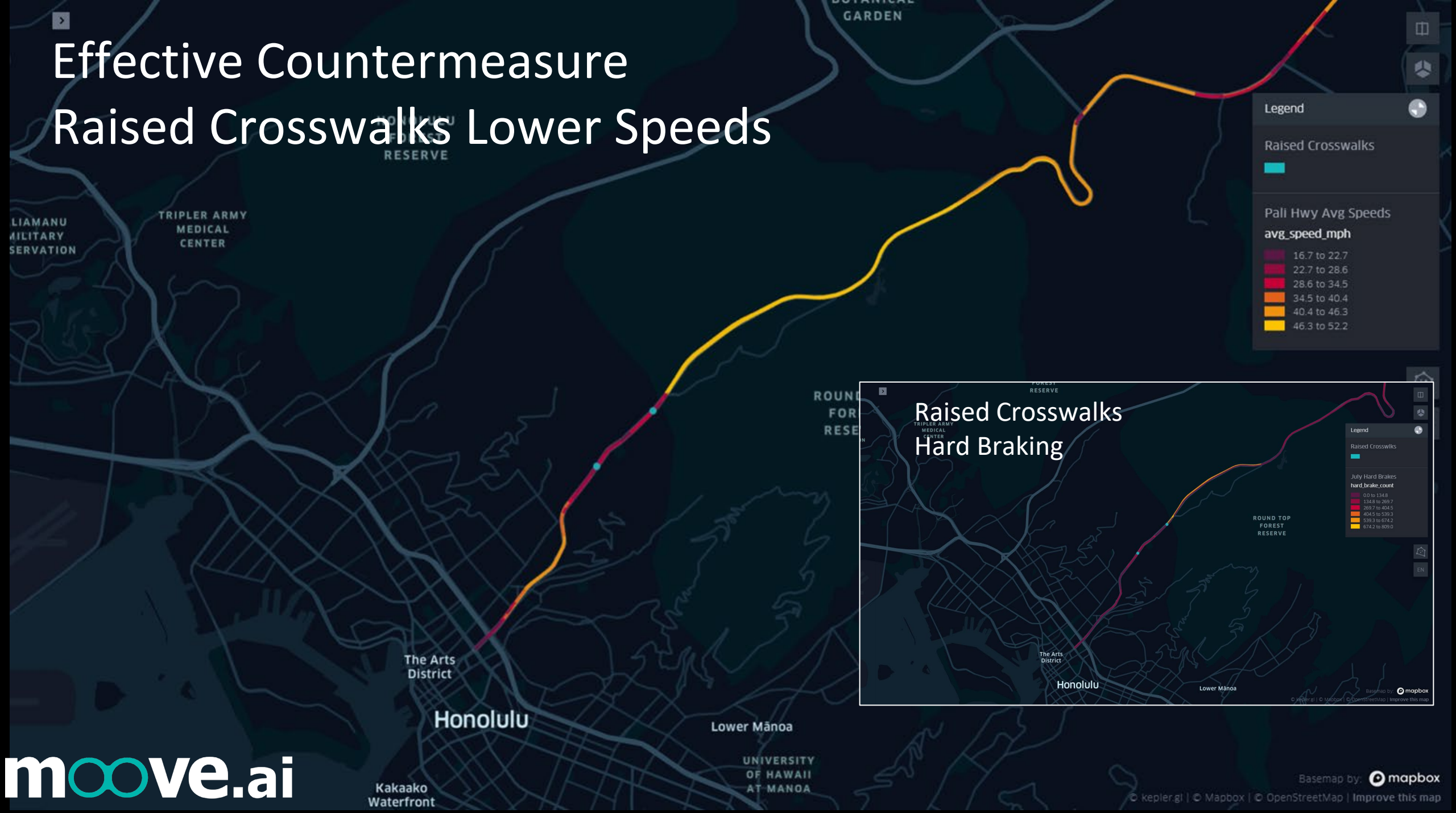
Actionable Intelligence for Safety



moove.ai

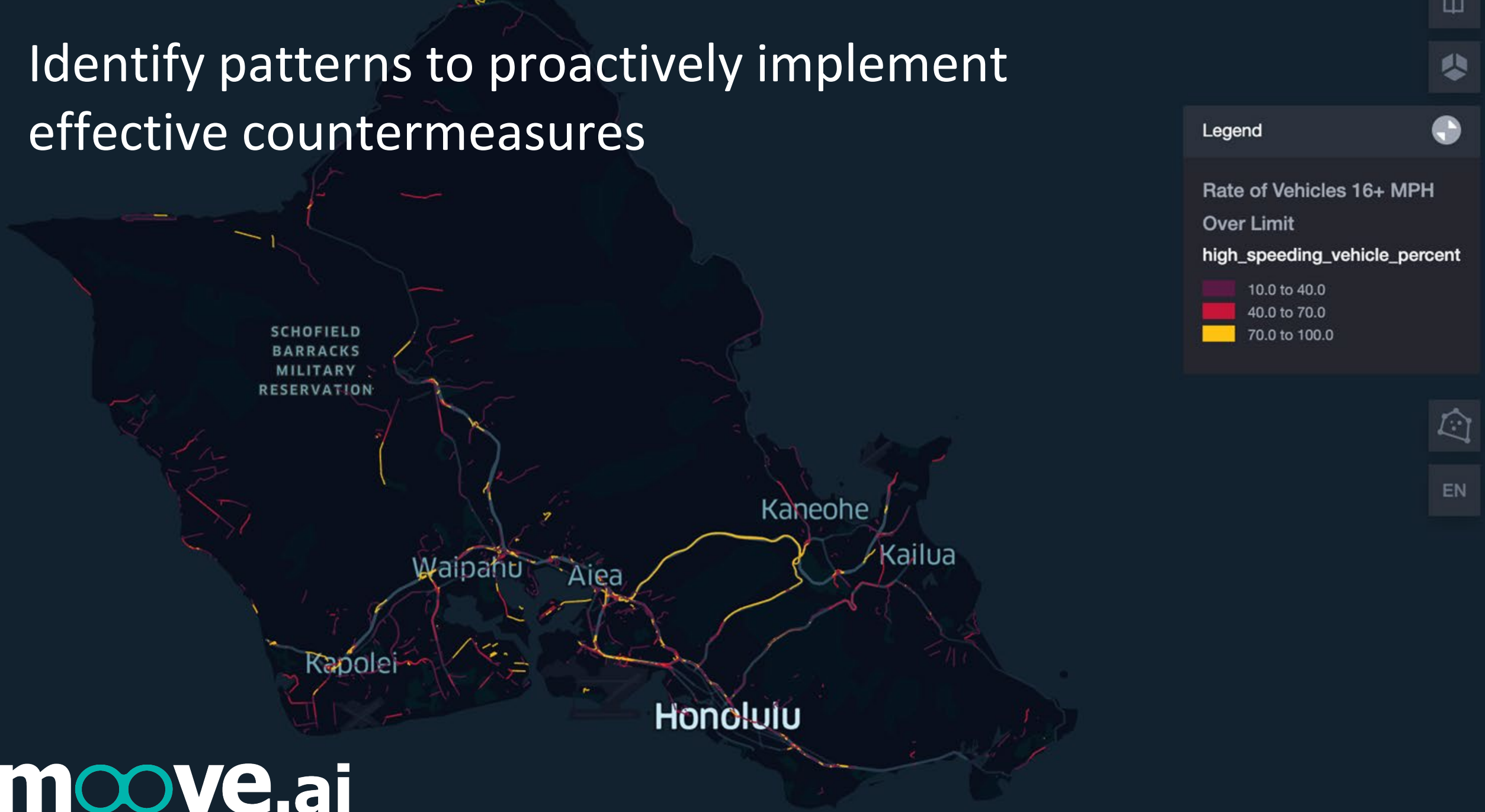
State of Hawaii
Department of Transportation

Effective Countermeasure
Raised Crosswalks Lower Speeds



moove.ai

Identify patterns to proactively implement effective countermeasures

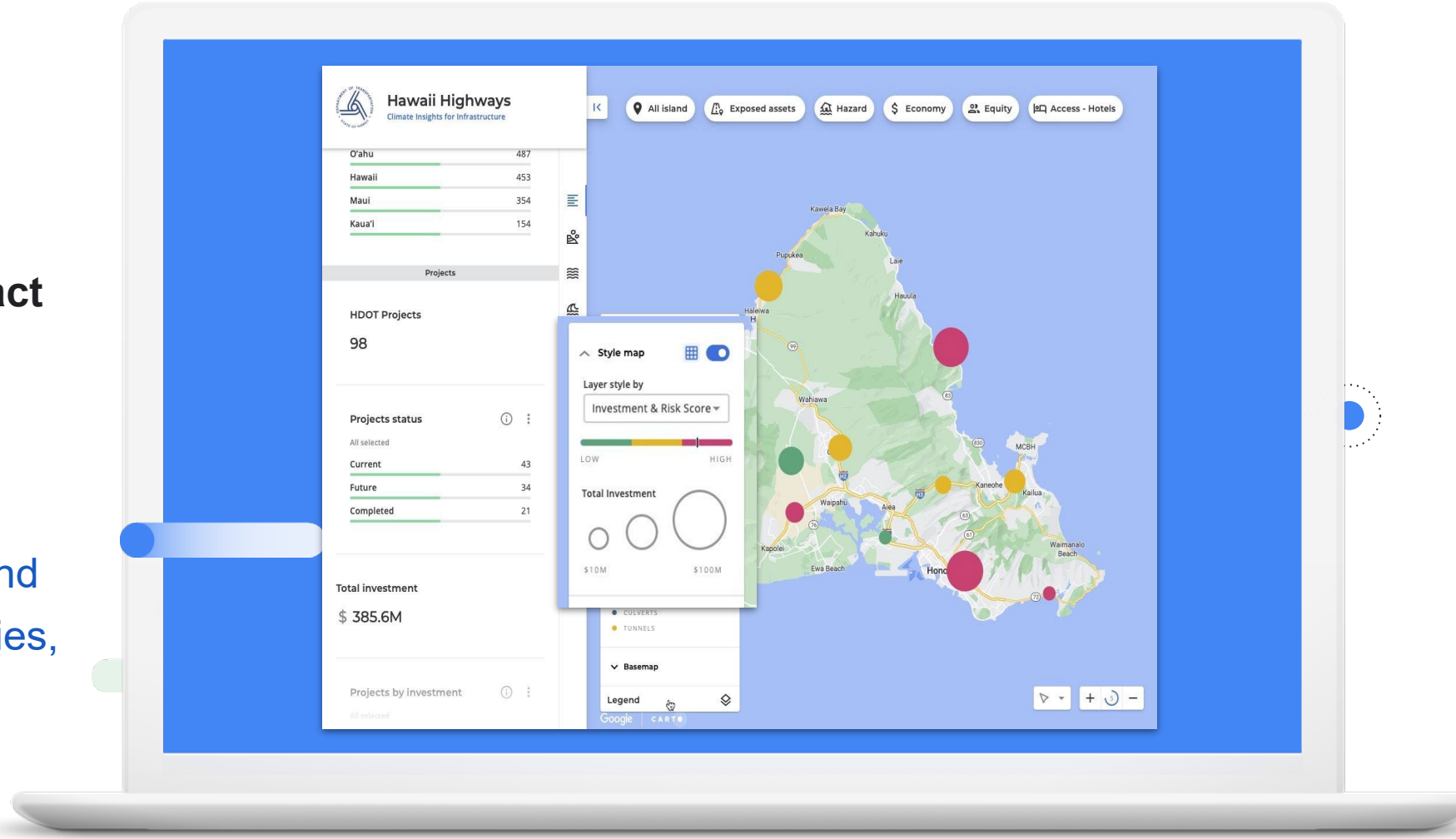


moove.ai

Insights for Investments in Infrastructure

State of Hawaii
Department of Transportation

- **Characterize risk**
- **Prioritize investments**
- **Collaborate for decisions**
- **Analyze and measure impact**
- **Tell the story**



> Our goal is to have a common data-driven platform to collect and share information across agencies, counties, and cities.

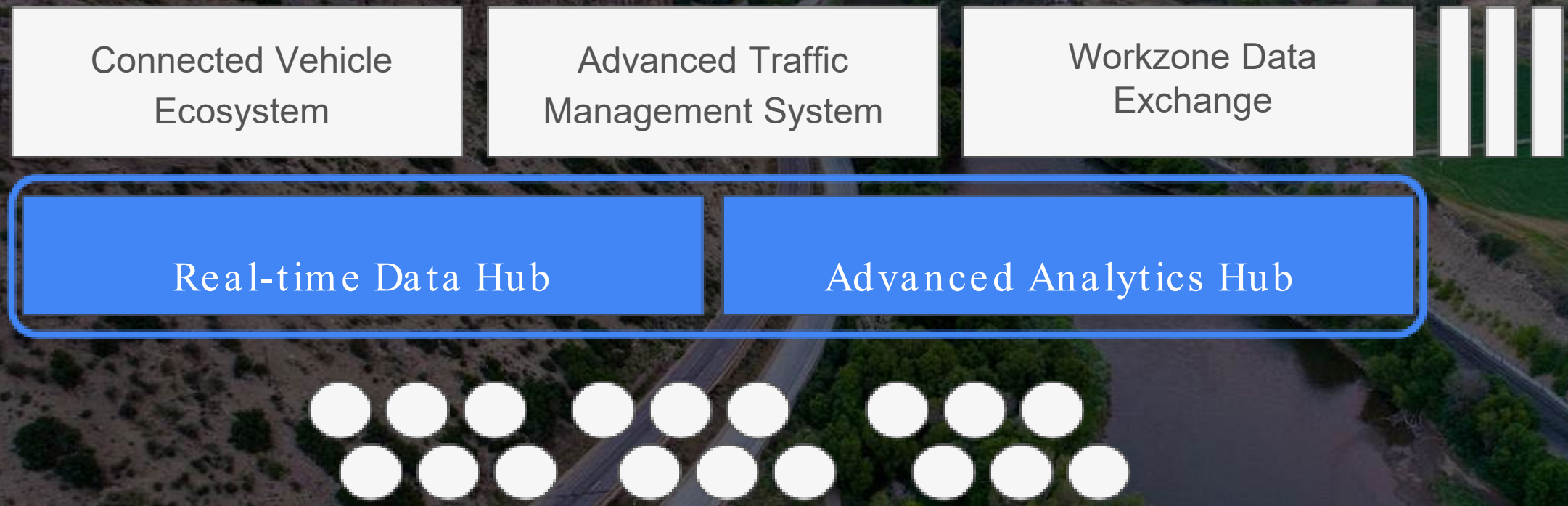
Ed Sniffen
Deputy Director Highways
Hawaii Department of Transportation

Google Cloud

Google Cloud

Colorado DOT Digital Infrastructure

An integrated interoperable platform, breaking down data silos



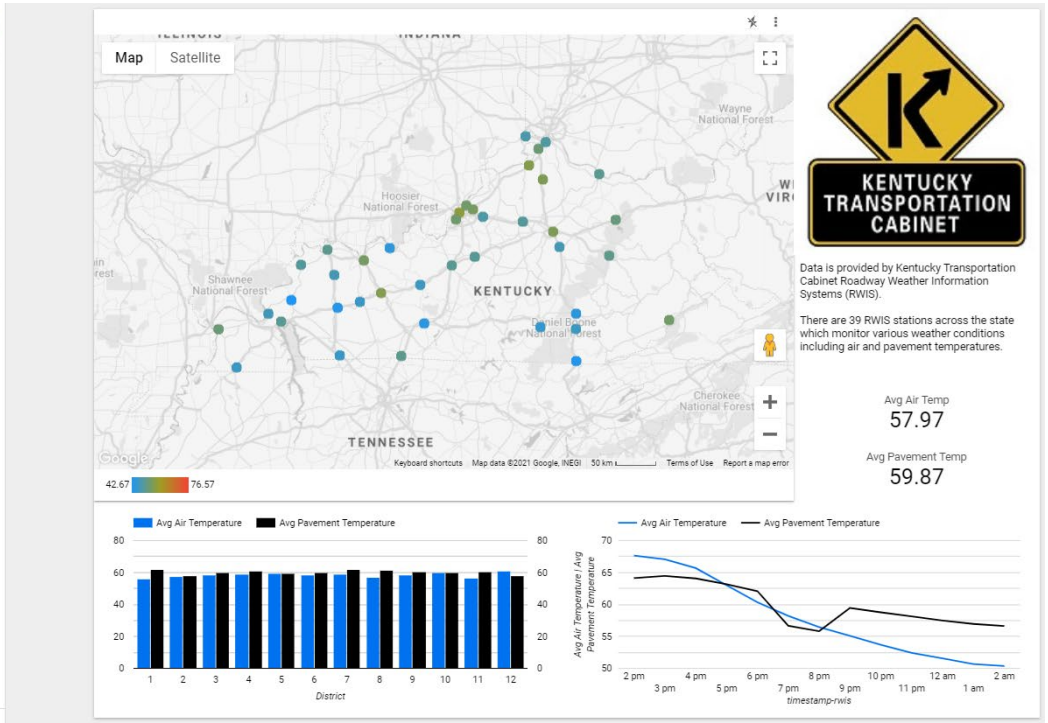
> CDOT has undergone significant digital infrastructure modernization to enable interoperability, access and analytics using Google Cloud," says Ashley Nylen, Assistant Director for Mobility Technology. "We have been able to break down data and organizational silos to make data and information more accessible and usable for our teams.
>
> Ashley Nylen
> Former Head of Policy and Innovation, Colorado DOT, now USDOT senior strategist for Automation & Safety

KENTUCKY TRANSPORTATION CABINET

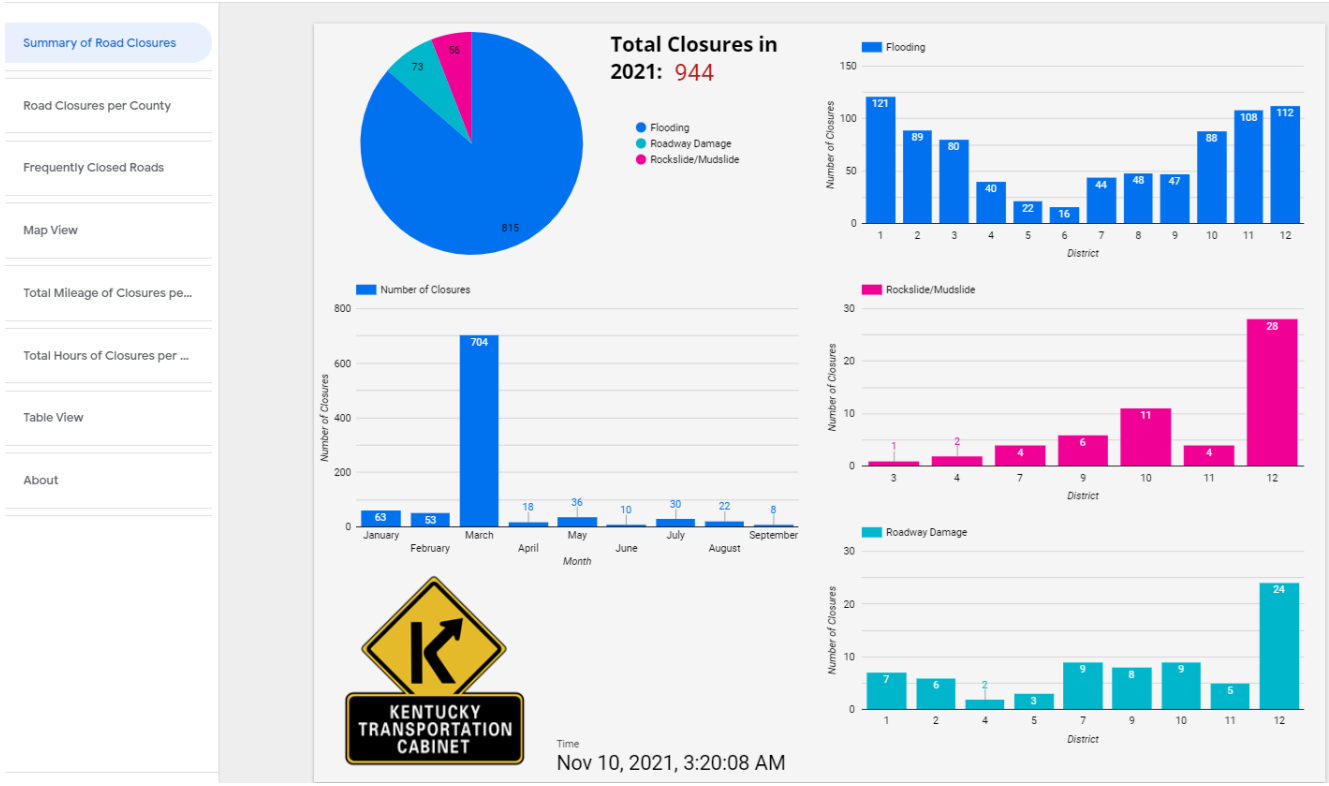
Roadway Weather/Snow & Ice Operations
Incident Detection
Work Zone Monitoring

26-36 Millions Records processed per day

Roadway Weather Information



Road Closure Summaries



Takeaways

..

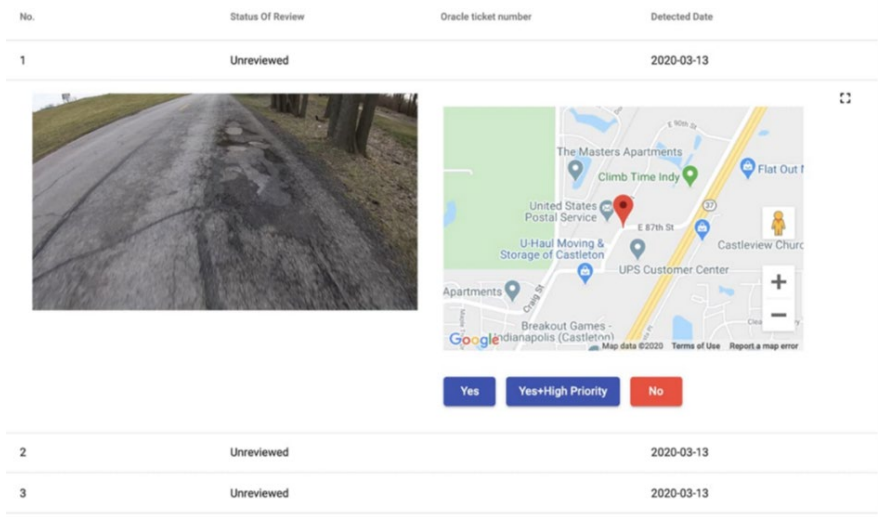
1. Democratize Analytics & AI
by making it accessible, fast and useful
for enterprises, agencies and developers

2. Turn data into insights for needs you have today. Weeks not years

3. Start now to accelerate the path
safer, greener, smarter transportation for all

Google Cloud


STAX
STAX MUSEUM
OF
AMERICAN SOUL MUSIC
STAX MUSEUM
OF
926
855
MATA
Code Red Means You Save Green
MATA



Application used by public works employees to evaluate potholes

AI to detect conditions

Potholes & property conditions

Prioritize and optimize

Integrate into maintenance workflows

City of MEMPHIS

Google Cloud

Snow & Traffic Management

Powerful insights for optimized road treatment, improved mobility and increased road safety

Google Cloud

Democratize the science and technology

Make it easy, accessible, and actionable

Thank you

Monali Shah

Google Cloud

Vehicle-to-Everything (V2X) Data Exchange Platform

Michael A. Brown
Institute Engineer
Southwest Research Institute

State of Florida Department of Transportation
Vehicle-to-Everything (V2X) Data Exchange Platform (DOT-ITN-20-9104-SJ)
Agreement/Contract No: BEB93

Vehicle-to-Everything (V2X) Data Exchange Platform

FAV Summit - Emerging Data Session

September 7th, 2023

amazon aws

FIU FLORIDA INTERNATIONAL UNIVERSITY

Google

FORD MOBILITY

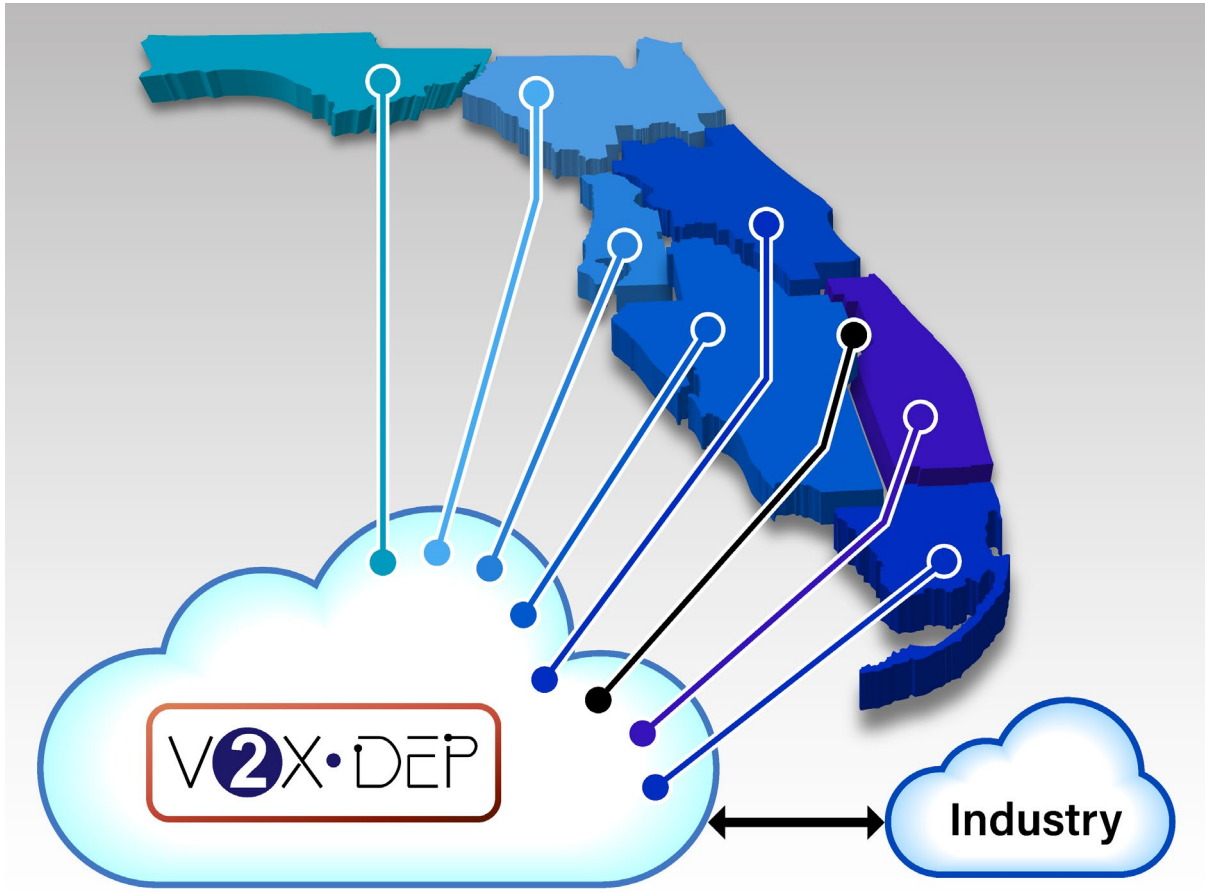
iteris®

kodiak

SwRI® SOUTHWEST RESEARCH INSTITUTE

Agenda

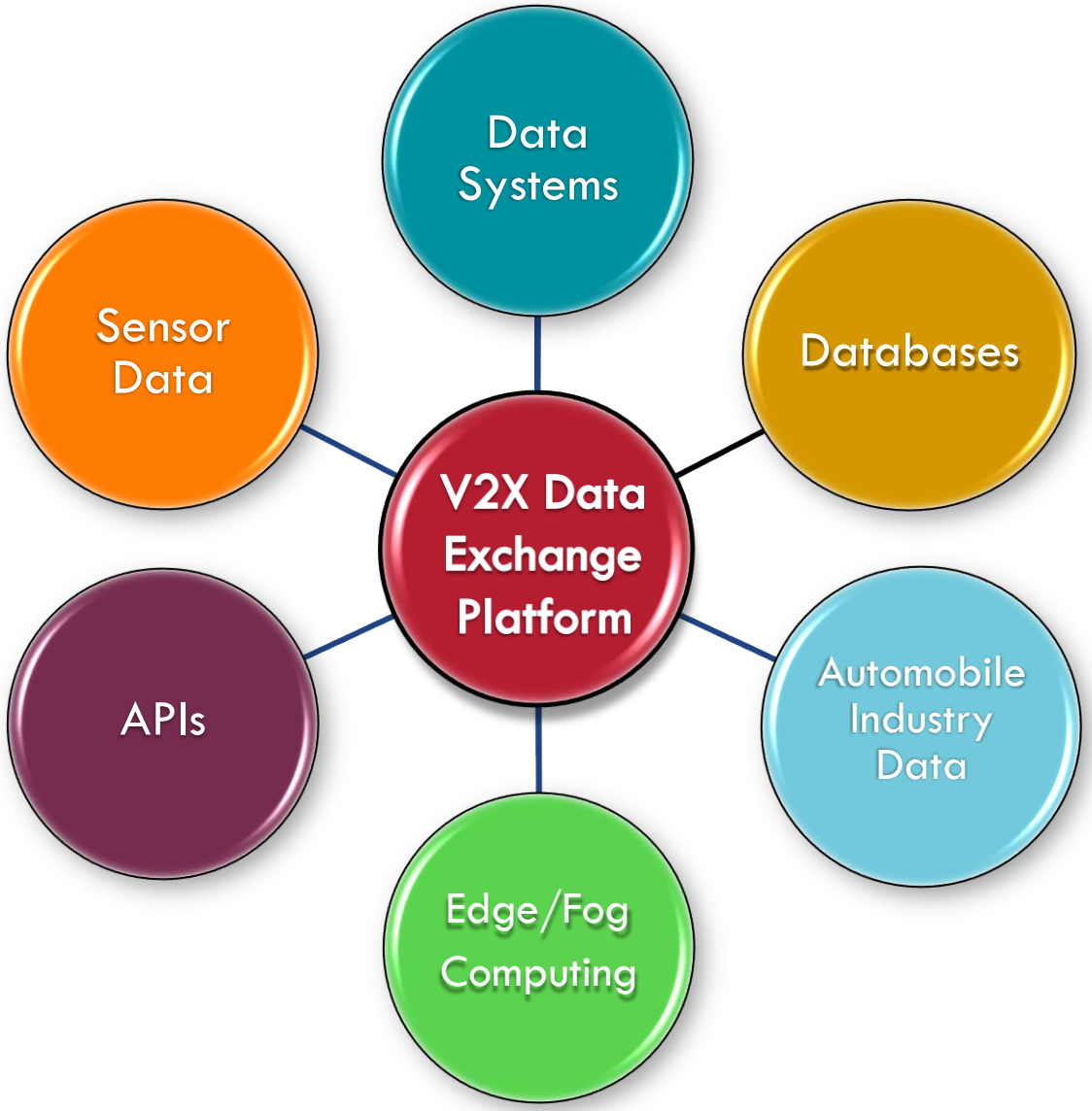
- V2X Data Exchange Platform Background
- Architecture
- Emerging Data / APIs
- Connected Vehicle Data Framework
- Questions



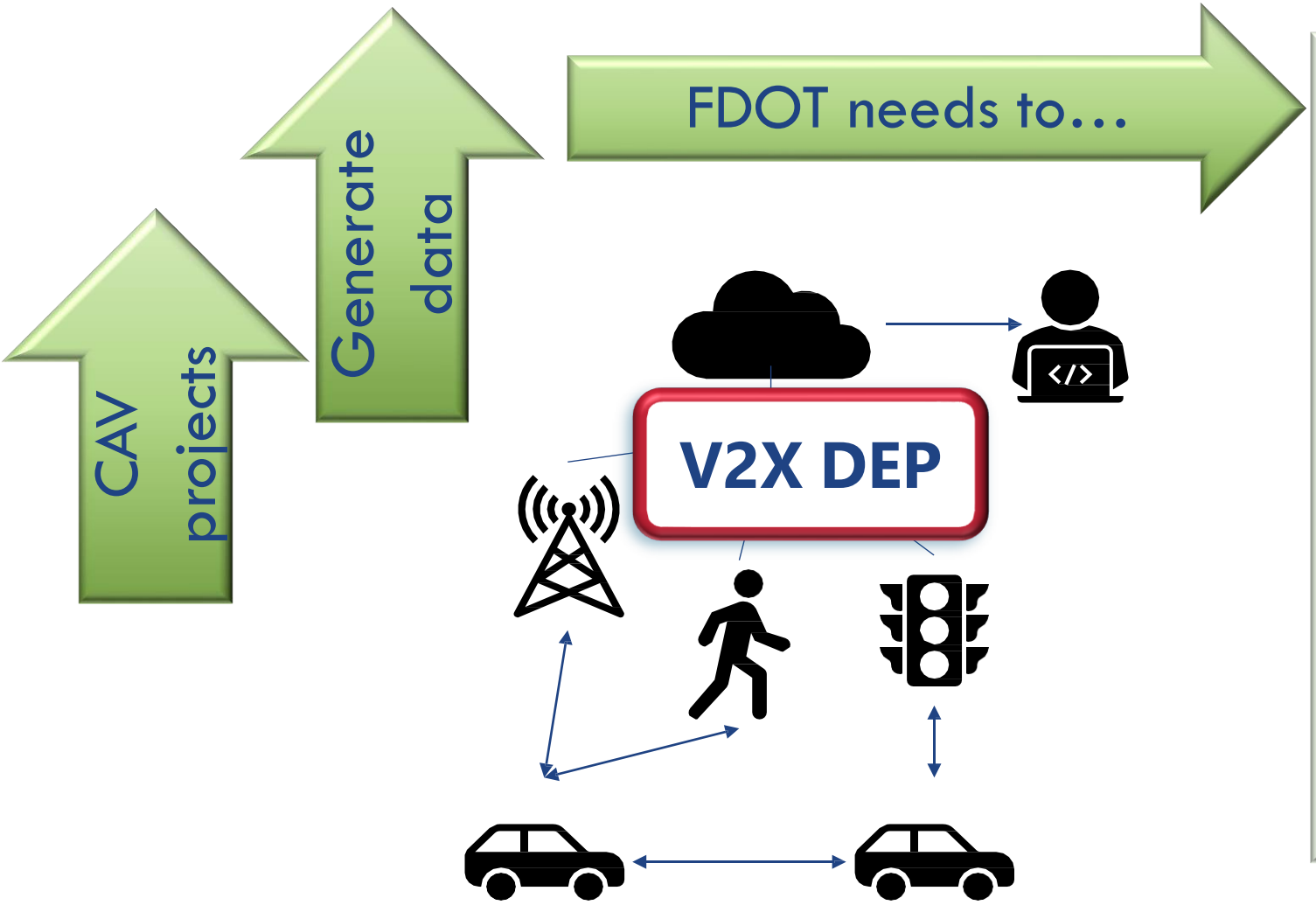
V2X Data Exchange Platform Concept

- V2X data platform:
  - Ingests data from **CAV devices** (roadside units (RSUs) and on-board units (OBUs))
  - Ingests data from **ITS devices**
  - Ingests data from **third parties**
  - Potentially interacts with **SunGuide®**
  - Allows data to be shared between computer programs, data systems, and users

- Ultimate solution for data generated in all CAV projects in Florida

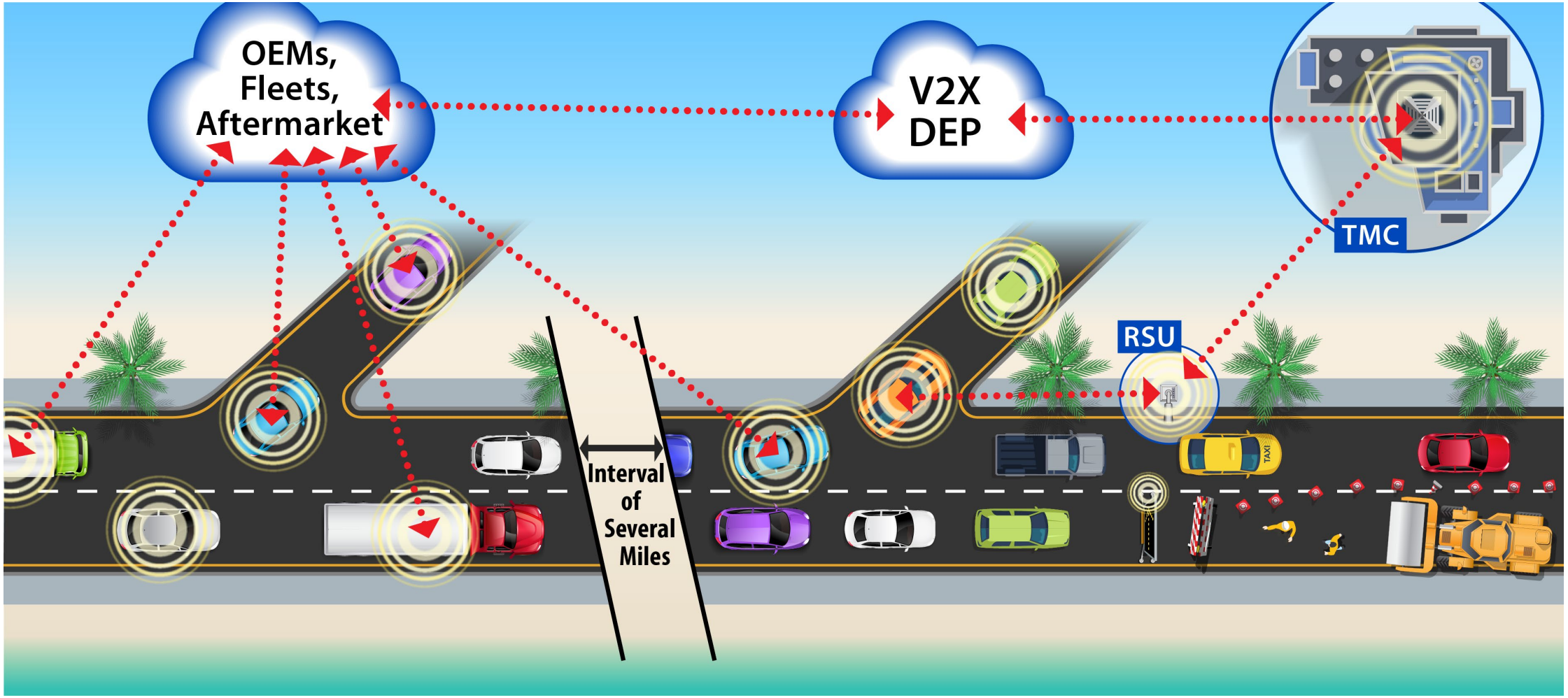


Purpose and Need of V2X DEP



- Collect, manage, and store CAV data
- Coordinate with and integrate additional data sources and systems
- Normalize, filter, aggregate, and disseminate data
- Send and receive data from automobile OEMs (reduce OBU purchasing)
- Develop real-time and predictive analytics
- Leverage existing infrastructure
- Provide visualization

The DEP in Action



DEP bridges the gap

What can we exchange?

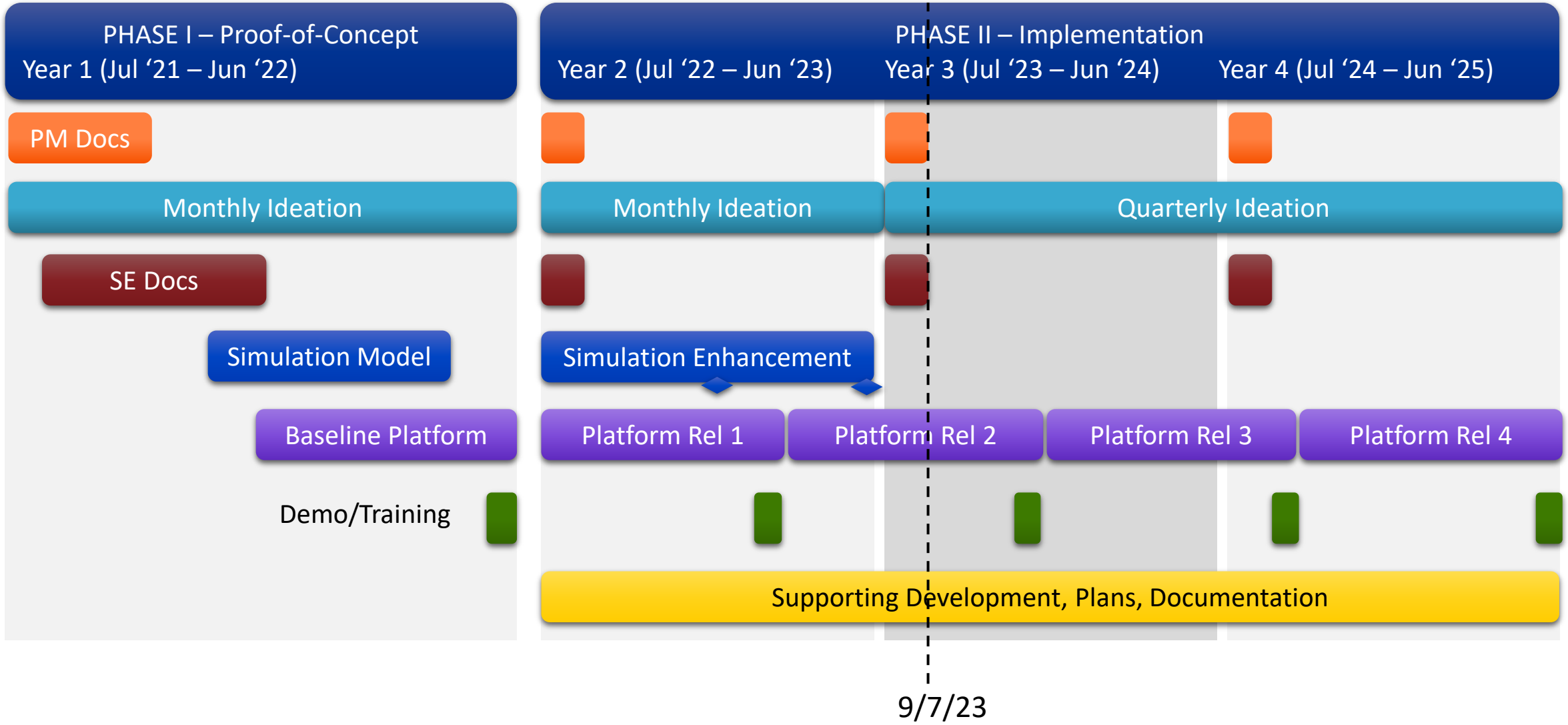
Deliver information to
to improve safety, mobility
and efficiency

SwRI
V2X Platform

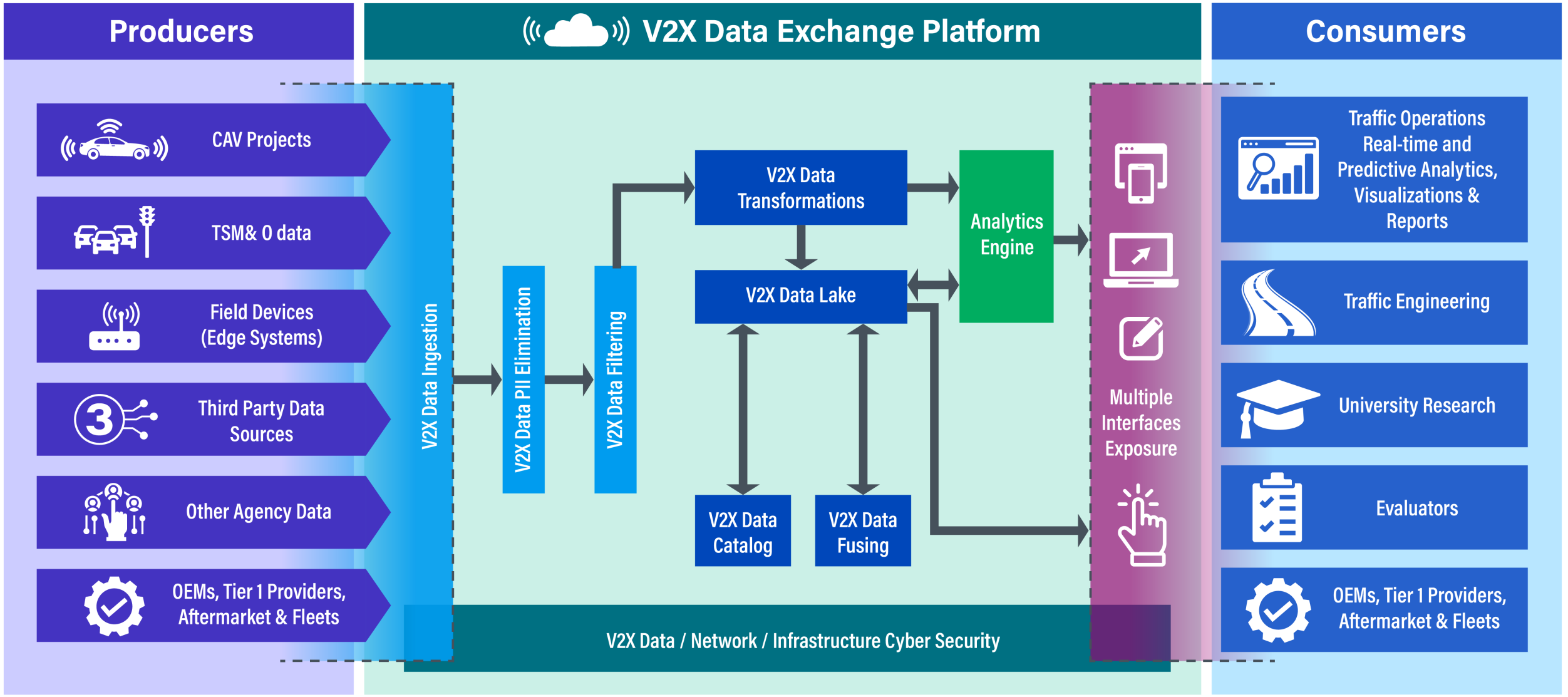
FDOT

Provide data to FDOT to improve
operations and planning

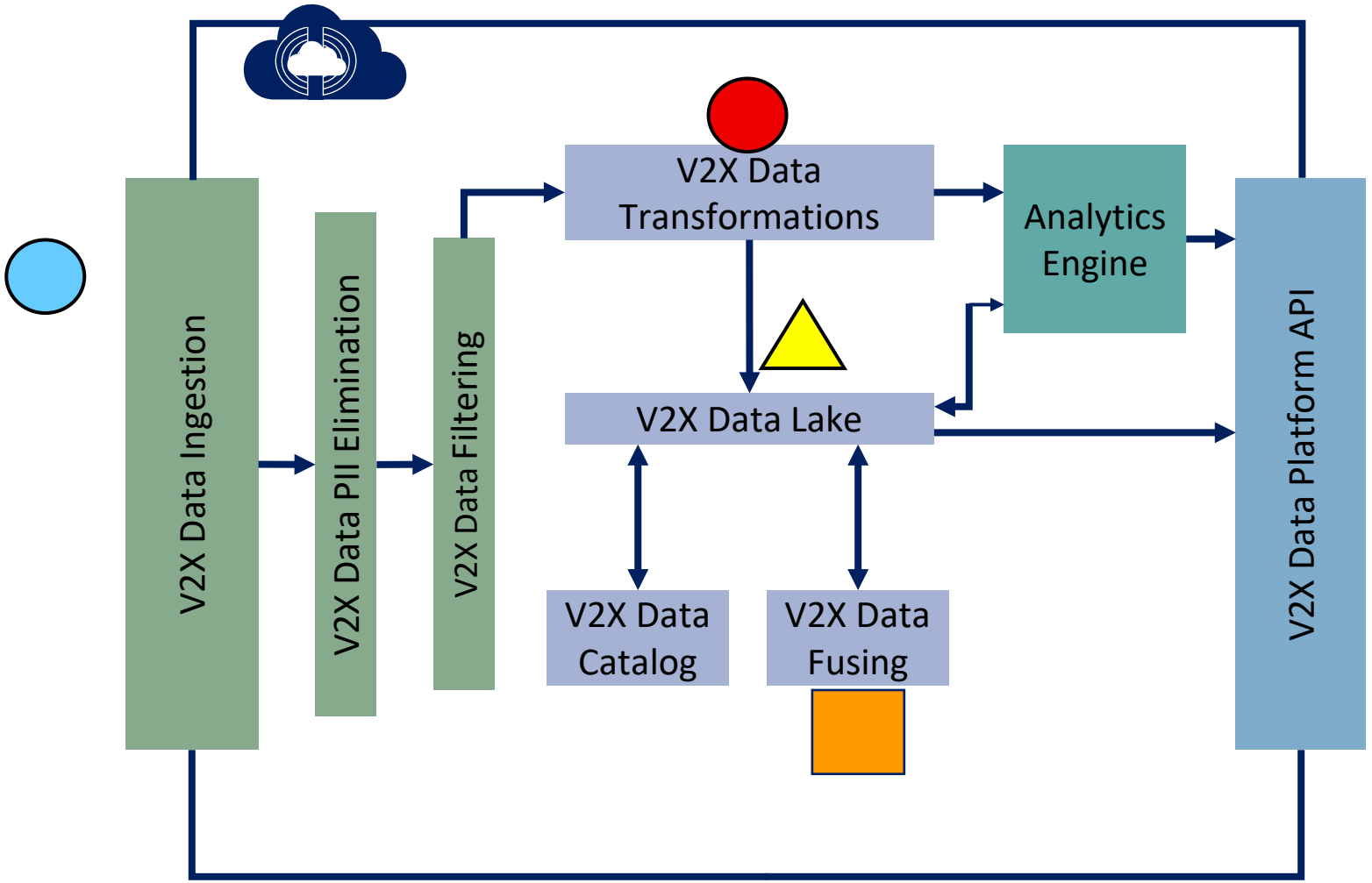
Program Schedule



High Level System Architecture

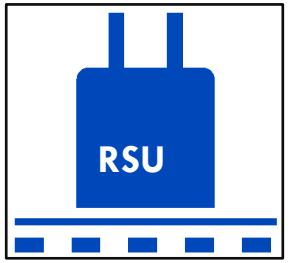


Data Flow



What data is currently entering the system?

Original Sources of Data



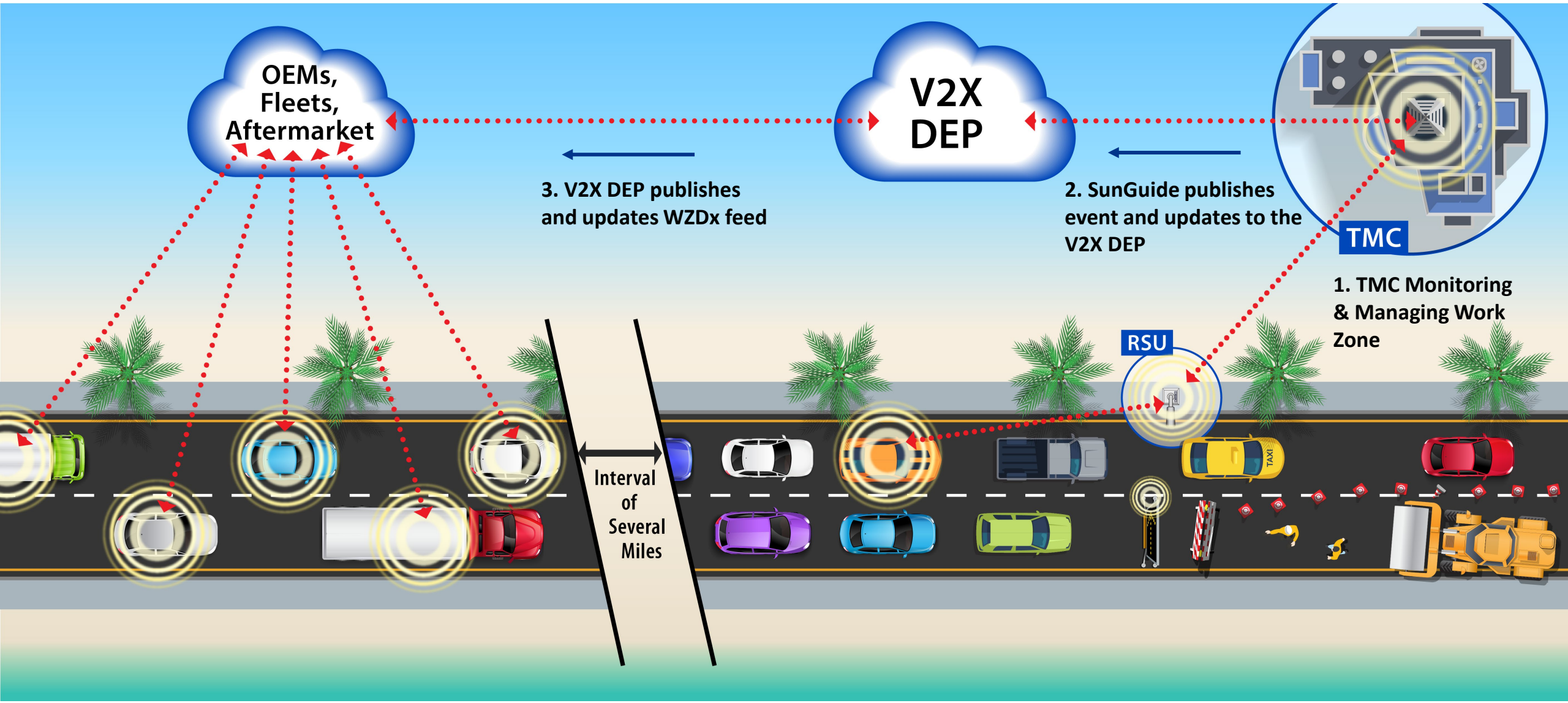
Ability to integrate with many different sources

Information available to DEP Consumers

Data Type	Description	Example Producers
Traffic	Aggregate information about many vehicles or flow of traffic in general at a roadway location.	• SunGuide TSS • HERE Flow
Vehicle	Status pertaining to a single vehicle	• J2735 RSU BSM • Ford
Event	Roadway or traffic events outside of normal operation like closures, crashes, incidents, etc.	• SunGuide EM • Waze Alerts and Jams
Message	Messages to the traveling public.	• SunGuide DMS
Map	Intersection or roadway configuration	• J2735 RSU MAP
Spat	Intersection current signal timing and status	• J2735 RSU SPaT
Weather	Weather and environmental sensor information	• SunGuide RWIS

Platform curated representation

Use Case: Work Zone Data Exchange (WZDx)



Distributing Traveler Information Messages via the Connected Vehicle Data Framework API

1. TMC Operator generates TIM

SunGuide

4. TIM sent to V2X DEP

V2X Platform

5. TIM transmitted via CVDF API

OBU Backend

2. SunGuide sends TIM to RSU

RSU

CV Radio

3. RSU broadcasts TIM

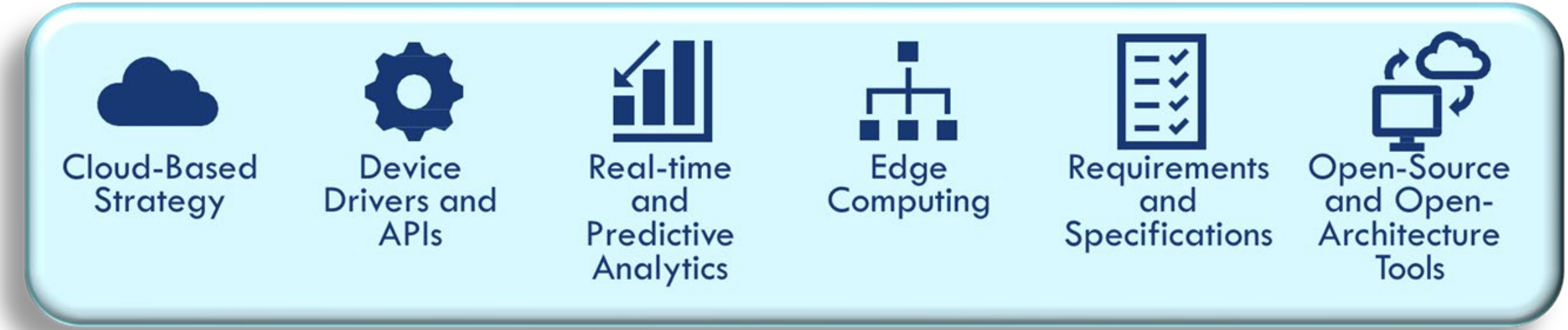
OBU (Short Range)

CV Radio

6. OBU receives and displays TIM

OBU (LTE Connected)

Questions / Discussion



Automated Driving and Emerging Datasets

Bill Schumacher
Sr. Director of Global Industry Solutions HERE Technologies

HERE Technologies

We’re the world's leading location data and technology platform.*

We provide data and software that helps our customers and partners build better solutions, better services and a better future.

The HERE platform is a location toolkit with which you can upgrade everything from urban mobility and driver safety to resilient logistics and sustainable operations.

*According to Omdia, Counterpoint Research and Strategy Analytics, 2022-23

A platform operating at scale

35+
years of experience in map-making and location technology

1.3k
enterprise customers – from automakers and tech leaders to global logistics and telecoms brands

550k
direct developers

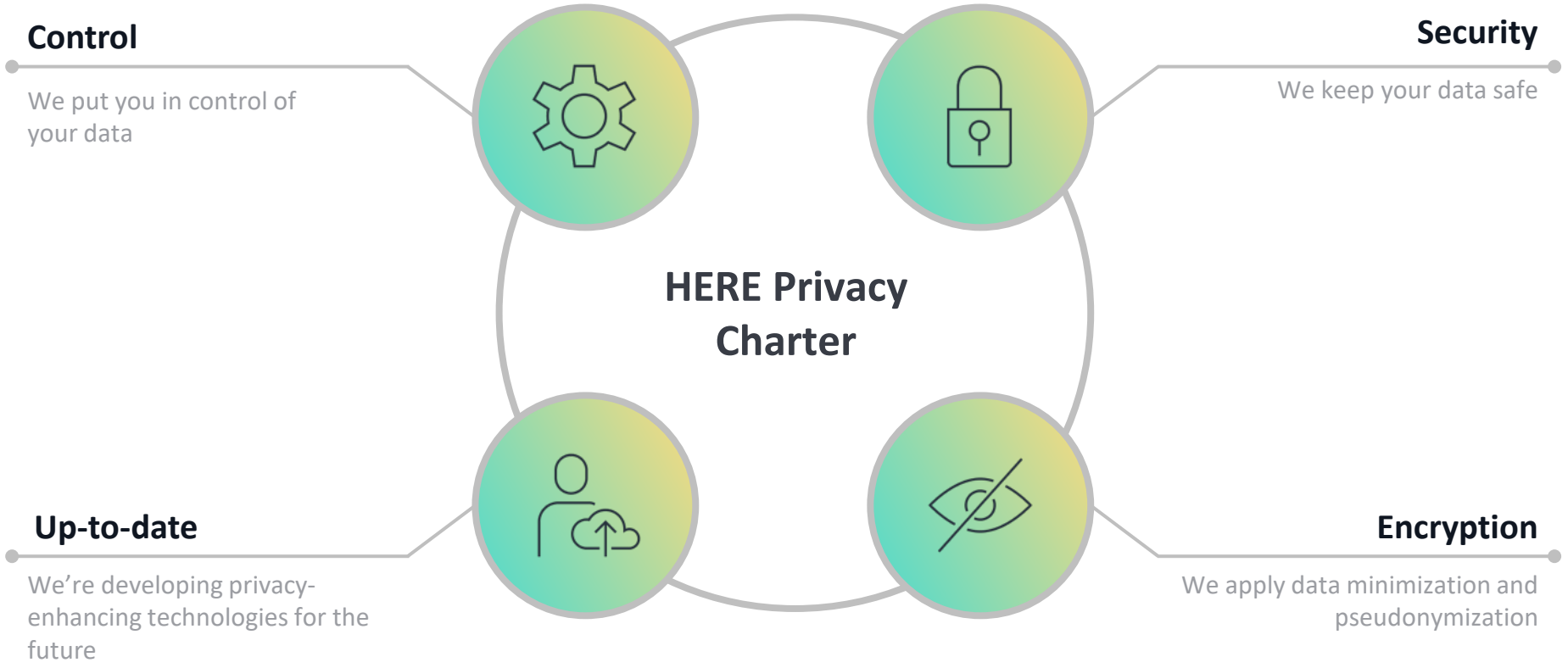
153bn
API calls per month

40m
vehicles supplying real-time probe and sensor data

24/7
customer access to map content; update visibility for all data products within 24 hours via UniMap

Built with privacy in mind

We go beyond mere regulatory compliance and make privacy an integral part of our corporate culture



Automated Driving Today and in the Future

Assisted/Automated Driving

Two development paths

Autonomous Transportation

As a Product

SAE **L2+/L3 up to L4**

Developed by **OEMs**

Evolving from **ADAS**

Revenue **Ownership based**

Timeline **2022 -**

- Automation taking over in routine driving situations
- First L2+ and L3 on the road starting from highway

As a Service

SAE **L4 and L5**

Developed by **Mobility & Tech**

Evolving from **Shared Mobility**

Revenue **Usage based**

Timeline **2025 -**

- Automation Replacing drivers in ride hailing/delivery services

HERE offerings solve challenges across Automated Driving

Four key solutions

Road safety and awareness

Informing the driver with signals and warnings

ADAS

Supporting the system and the driver with temporary assists in either steering and/or accelerating/breaking

AD

Automated operation in certain defined conditions and circumstances

Development and testing

Enable faster testing and development for a variety of scenarios in different environments

Enabled by a location platform

Automated Driving use cases supported by HERE services

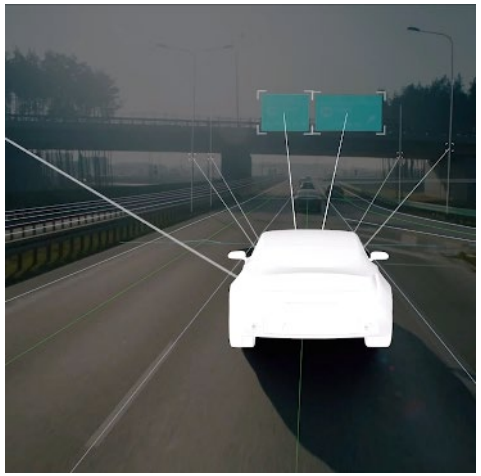
Redundancy

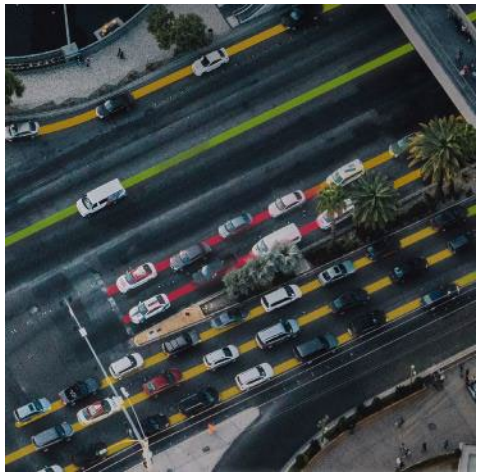
Precise localization

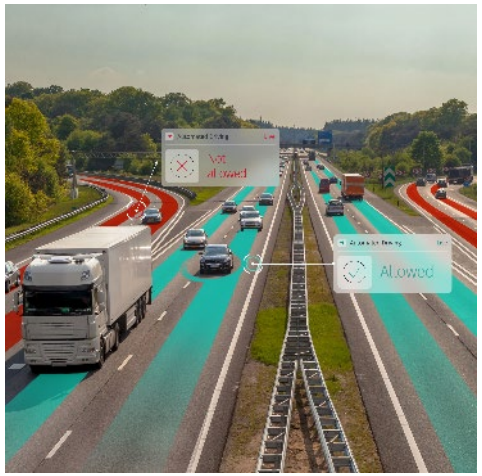
Path planning

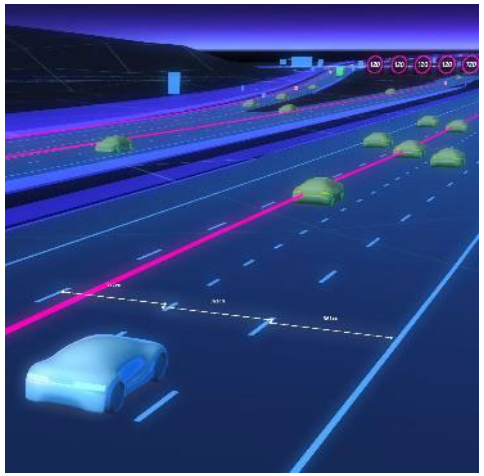
Operational Design Domain definition

Simulation









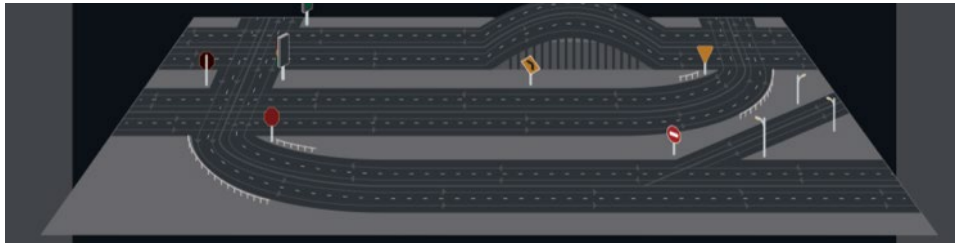
HD Map features for AD Sensing & Planning

Role of location data

Location data

Example Use Cases

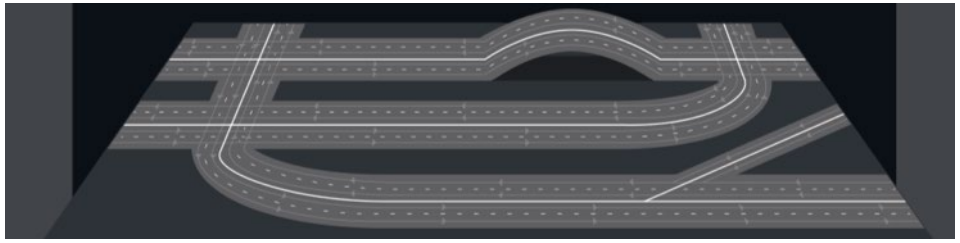
HD localization data



- Pole like objects
- Traffic lights
- Traffic signs
- Barriers
- Obstacles
- Bridge geo
- Tolls geo
- Tunnel Geo

Localization

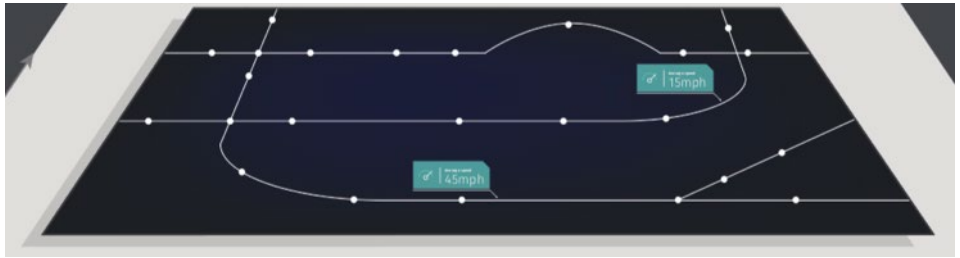
HD lanes model



- Lane Attributes (f.i Marking Type, Lane Type, Access Characteristics)
- Lane Topology (Count, Travel Direction, Connectivity)
- Lane Geometry (Boundaries, Drive Path/Centerline)

Path planning

Road Model



- Road network
- Road type
- Road curvature,
- Road elevation,
- Roundabouts
- Speed limits
- Built up areas

Redundancy and route planning

HD Map Layers

Attributes

HERE is currently the only map provider to supply AD programs

BMW in USA and Canada

Highway Assistant – 80 mph

https://www.here.com/about/press-releases/en/here-powers-hands-free-driving-for-bmw

Mercedes in Germany, Nevada, California

Drive Pilot- 40 mph

https://www.here.com/about/press-releases/en/mercedes-benz-deploys-here-hd-live-map-for-drive-pilot-system

The future: emerging datasets

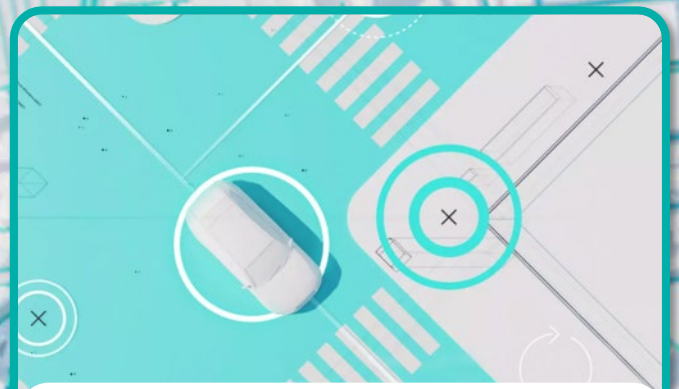
A new era of mapmaking

2023

Introducing UniMap

HERE's new automated mapping system revolutionizes how maps are created, updated and used.

UniMap rapidly fuses large quantities of data from diverse sources – including vehicle sensors, industrial lidar and satellites – into a fully aligned and unified global map, stored in a single environment.



Shrinks detection-to-the-map time to hours, minutes or seconds

Semantic consistency across SD, HD and other map content

Customers can combine datasets and create new products in hours

A new era of mapmaking

UniMap powers emerging use cases

2023

- Next-generation in-vehicle experiences

- Automated driving

- Predictive logistics

- EV services

- Private mapping

HERE Road Alerts

HERE Road Alerts provides access to road conditions, incident data and hazard warnings to easily integrate dynamic content into solutions that ensure that the road network status is updated, and drivers are informed on a timely basis of upcoming road conditions

- Built on HERE's high quality map and data
- Consolidates all Incident and Hazard data into one single format
- Sourced from sensor data (pooled across several OEM brands), 3rd party data, probe data, community data, etc.
- Supports various types of incidents and road data

HERE Road Alert service

Vehicle sensor sourced alerts

Broken down vehicle

- Hazard lights active
- Door open
- V= 0 mph

Accident

- Airbag deployment
- Automatic e-Call (EU only)

Slippery road

- ABS/ASR active for > 500ms
- V= >5 mph, <40 mph

Heavy rain

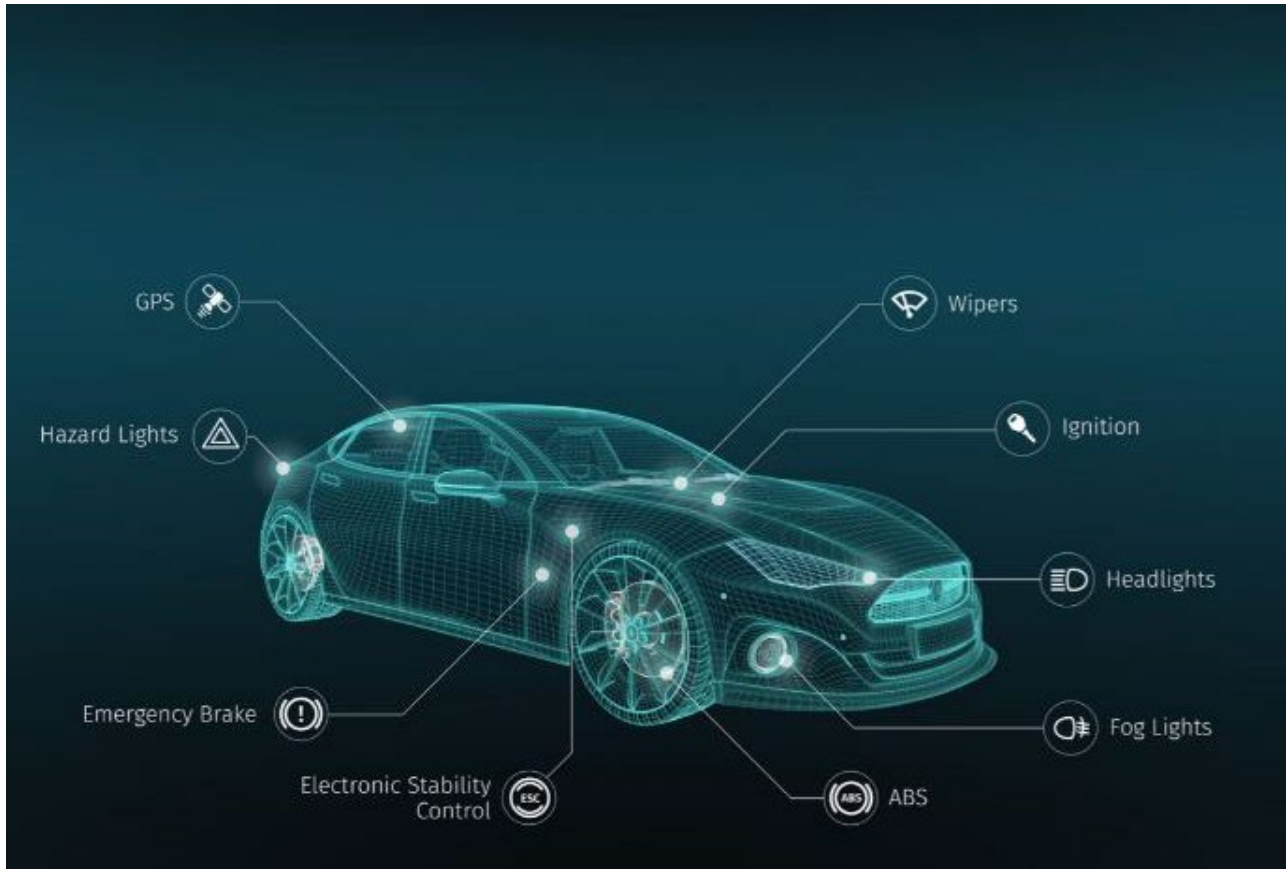
- Wiper state
- Rain sensor
- Low-beam light

Fog

- Fog lights on
- Rear fog light

Roadworks

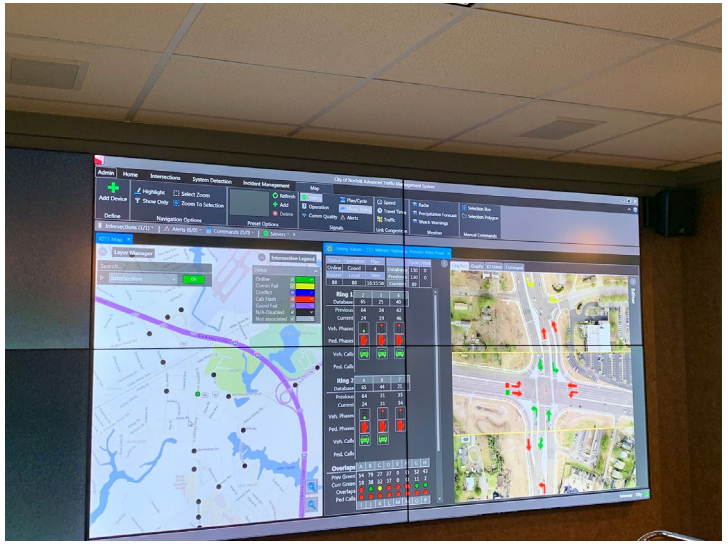
- Road sign imaging
- Cone imaging



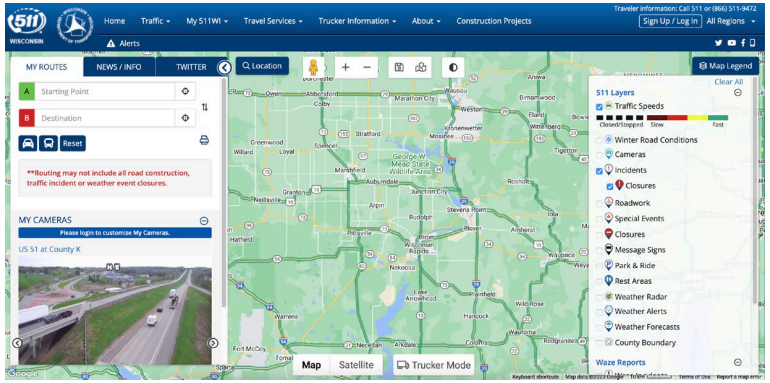
HERE's Work with DOTs

How we work with DOTs

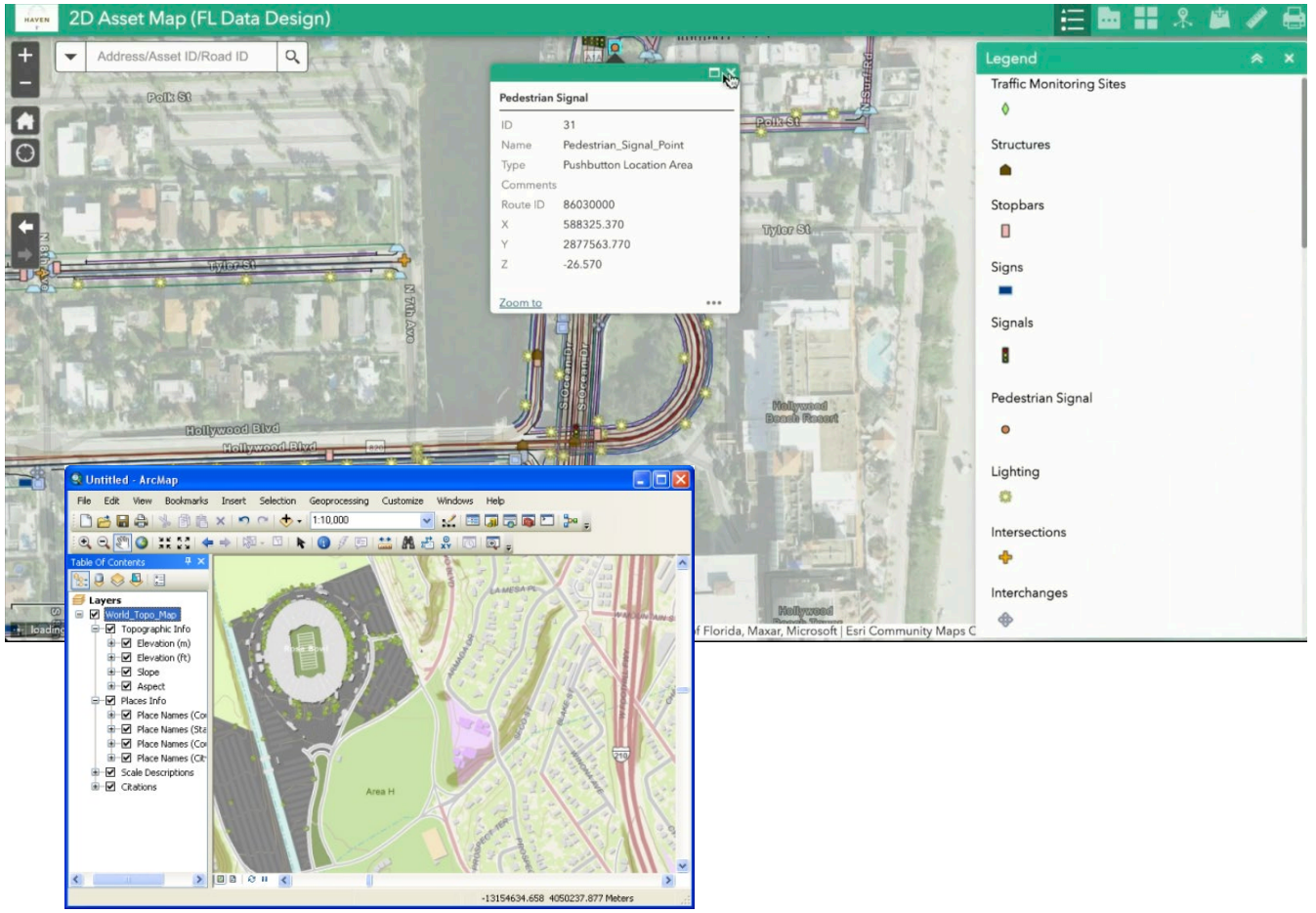
Powering State DOT operation centers



Providing real-time traffic conditions for 511s



Performing Road Asset Collection for Asset Management, Maintenance, and MIRE



Powering ESRI tools used by State DOTs

Data Management in CAV World

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Director, Autonomous & Connected Mobility Evaluation (ACME)
USF CUTR

Data Management and Performance Evaluation of CAV Deployments

Sisinnio Concas, Ph.D.
Director, Autonomous & Connected Mobility Evaluation (ACME)
USF Center for Urban Transportation Research

Center for Urban Transportation Research (CUTR)

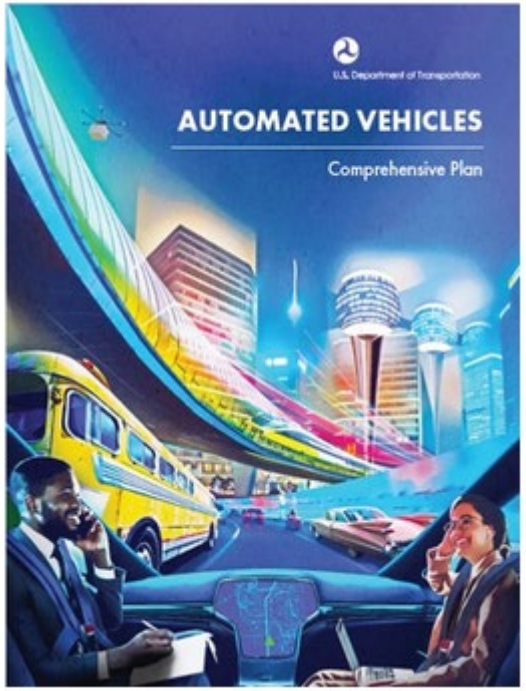
University of South Florida – College of Engineering

- Created by the Florida Legislature in 1988
- Over 200 active research projects
- Focus areas include autonomous vehicles and systems, bicycle/pedestrian safety, public transportation, workforce development, and more
- Provides research, technical training/workforce development, and technical assistance to a wide range of sponsors at local, regional, state, and national levels
- Clients include FDOT, Tampa Hillsborough Expressway Authority, US Department of Transportation, U.S. Department of Energy, National Academy of Sciences

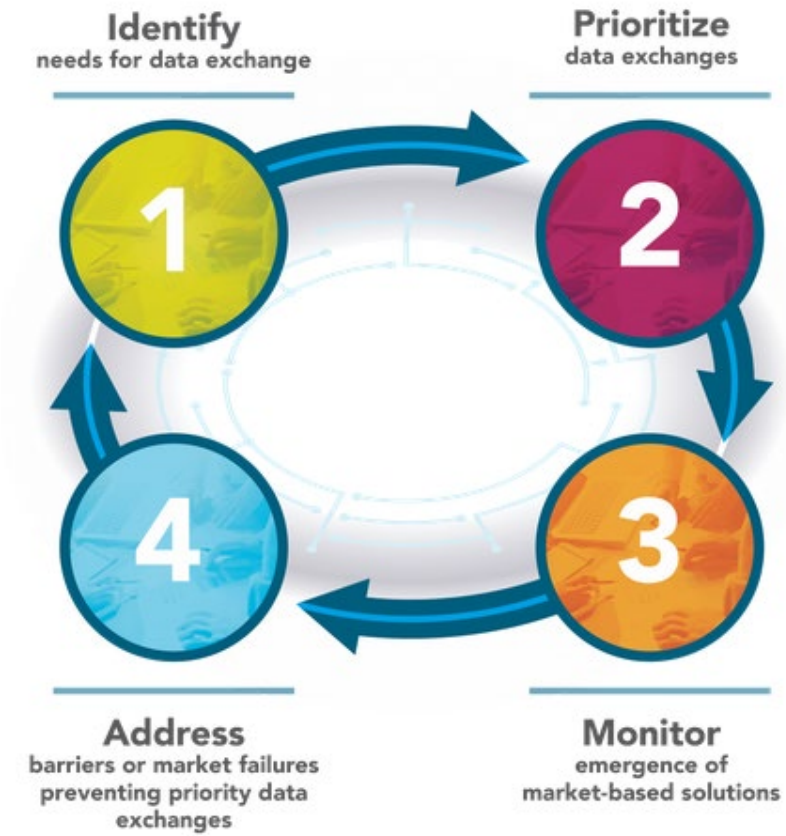
Topics

- Managing CAV Data
- Overview of CAV Deployments
- Use Cases

Why Manage CAV Data?



USDOT Automated Vehicles Comprehensive Plan

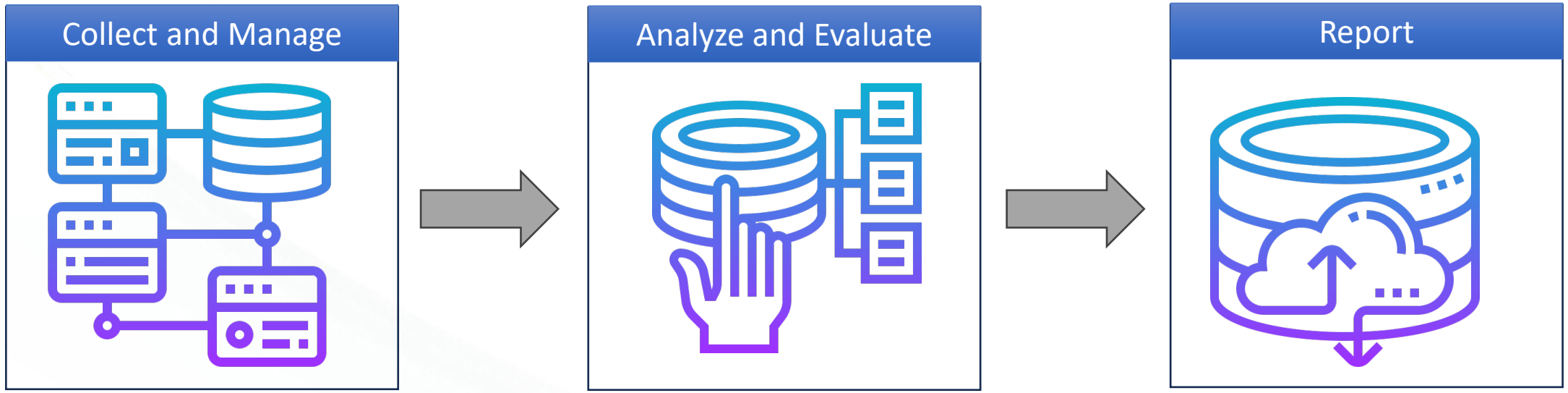


USDOT Data for Automated Vehicle Integration (DAVI)

Data access is a "**Critical enabler** for the safe, efficient, and accessible integration of AVs into the transportation system."

USDOT DAVI
https://www.transportation.gov/av/data

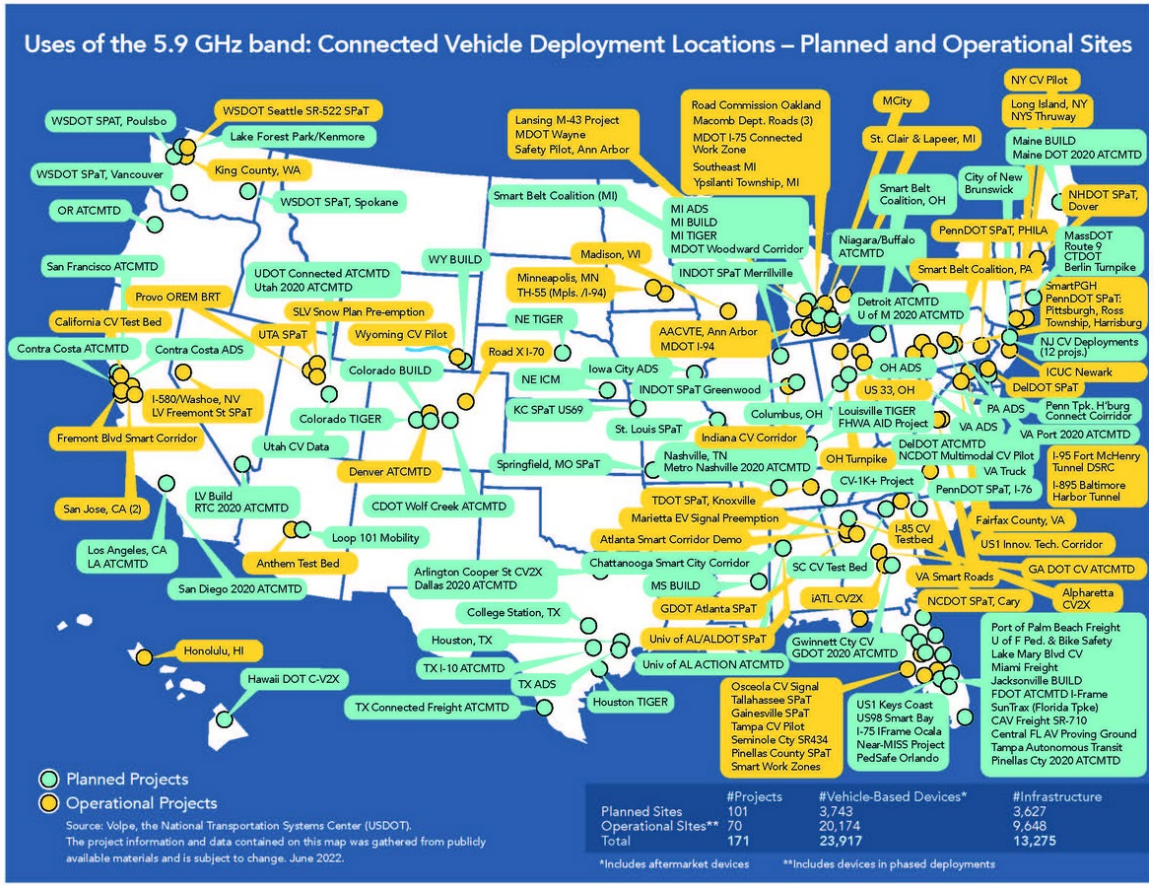
Project Performance Evaluation



Several federally funded advanced transportation technology deployments are subject to reporting under the FAST (Fixing America's Surface Transportation) Act. As outlined in 23 U.S.C. 503(c)(4)(F), **grantees must produce annual reports that describe the findings from their deployments, including data on benefits, costs, effectiveness, and lessons learned, among other data**.

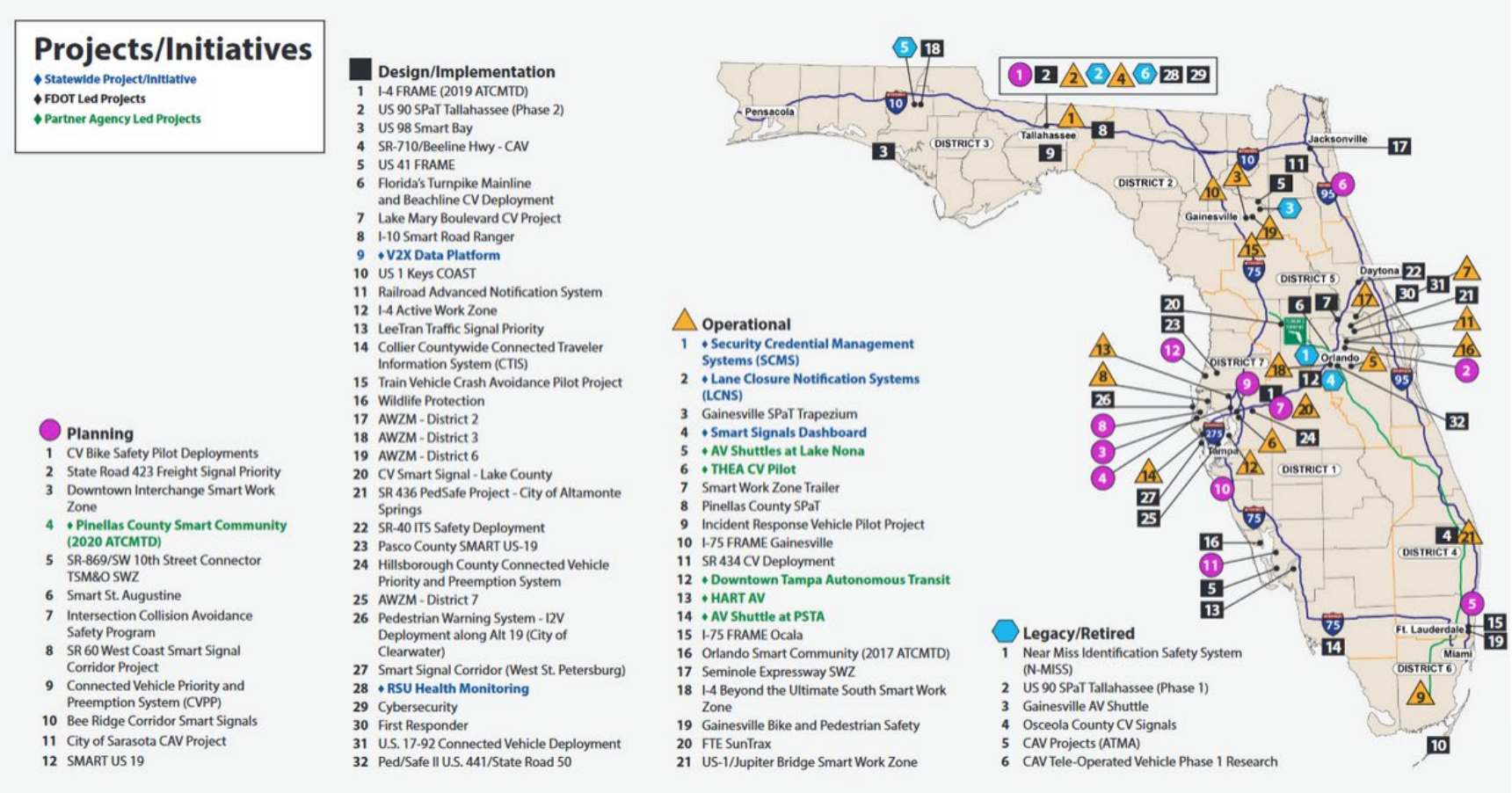
Source: https://www.fhwa.dot.gov/bipartisan-infrastructure-law/attain.cfm

CV Deployments in the US



- 170 projects
  - ✓ 70 operational
  - ✓ 101 in different planning stages
  - ✓ 24 in Florida (7 operational)

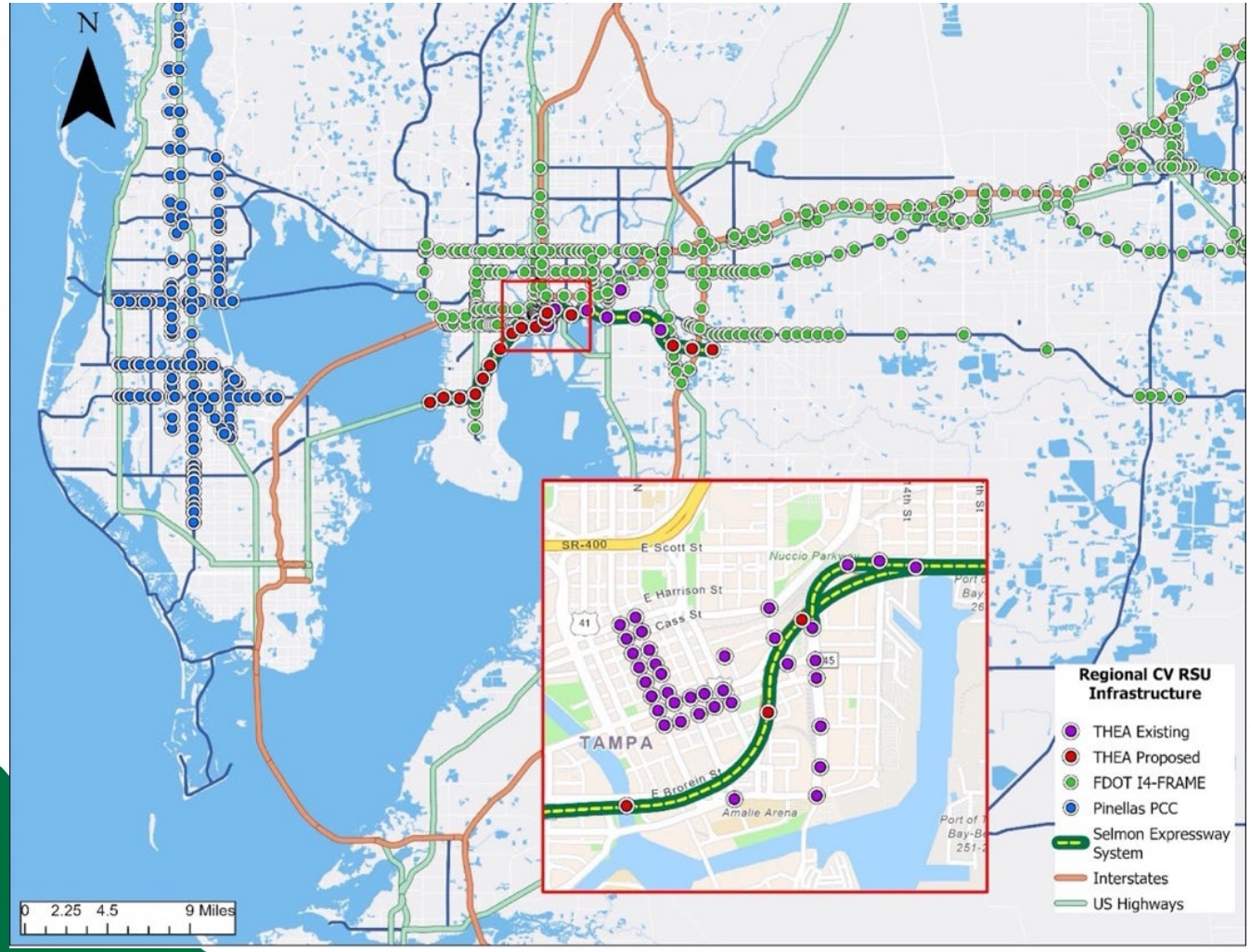
CAV Initiatives in Florida



FDOT has been supporting CAV-related initiatives with:

- Stakeholders
- Private sector
- Academic partners

Managing Data in an Expanding Connected Vehicle Infrastructure



- **THEA CV Pilot**
  - ✓ 50+ RSUs on Selmon Expressway System
  - ✓ Planned increase and integration with FDOT projects
- **Florida's Regional Advanced Mobility Elements (I-4 FRAME)**
  - ✓ 77 miles of I-4
  - ✓ Over 200 miles of other routes and arterials
  - ✓ ~600 RSUs
  - ✓ Statewide Security Certificate System
- **Pinellas County Connected Community (PCC) Project**
  - ✓ Artificial Intelligence Congestion Prediction
  - ✓ Congestion Balancing
  - ✓ 100+ RSUs

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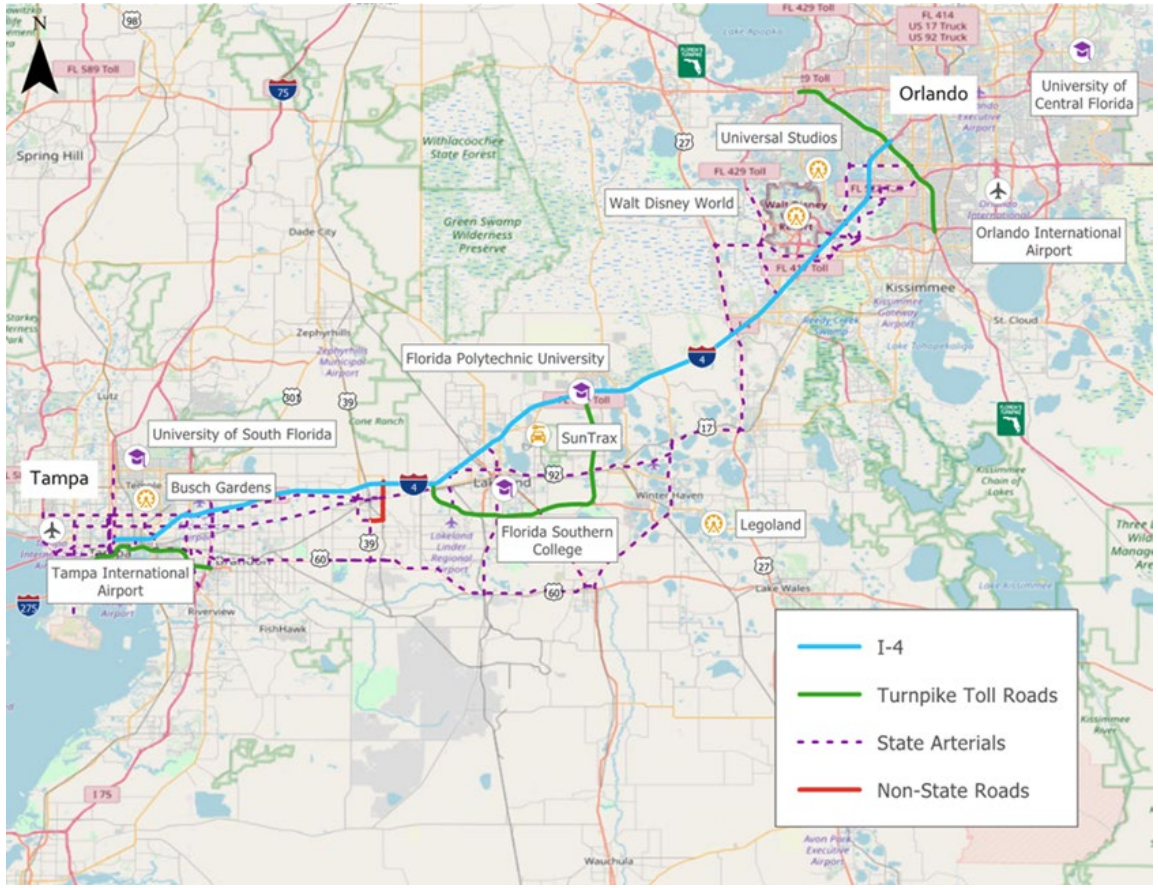
Use Case 1: FDOT Interstate 4 (FRAME)

- Over 77 miles of I-4
- Over 200 miles of other routs an arterials
- About 600 Roadside Units

Goals

- Reduce crashes including secondary crashes
- Improve travel-time reliability
- Improve throughput
- Reduce delay
- Reduce open-lane clearance times



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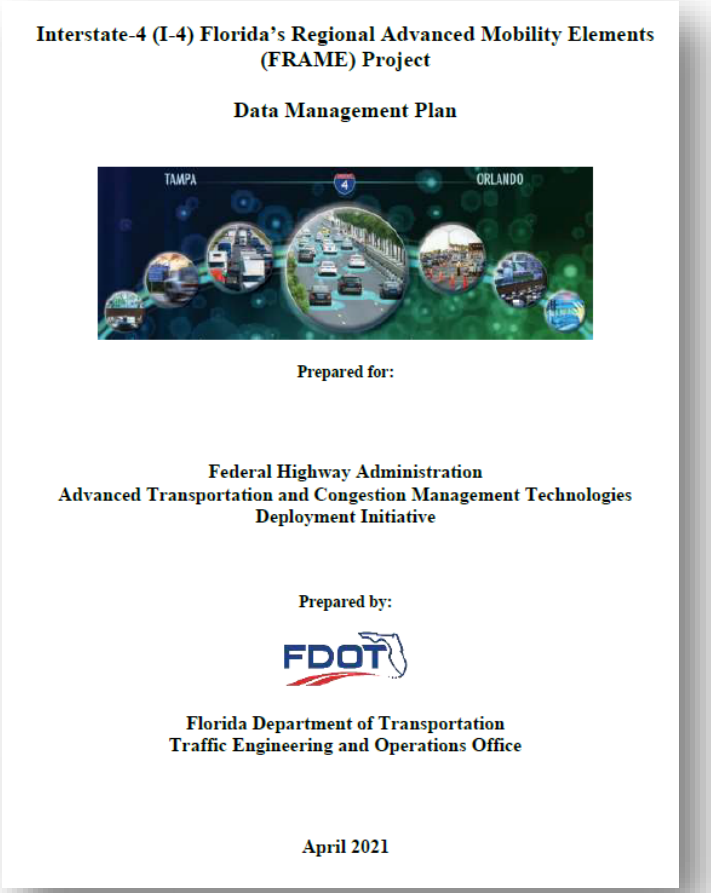
USE Case 1: I-4 FRAME Data Management Plan (DMP)

- Follows USDOT guidelines for extramural research activities
- Must include:
  - Data description
  - Data access policies
  - Data storage and retention approach
- Defines the process to manage, store, and share information with project stakeholders
- Document is integral to the Performance Measurement and Evaluation Plan (PEP)



Interstate-4 (I-4) Florida's Regional Advanced Mobility Elements (FRAME) Project

Data Management Plan

Prepared for:

Federal Highway Administration
Advanced Transportation and Congestion Management Technologies Deployment Initiative

Prepared by:

FDOT

Florida Department of Transportation
Traffic Engineering and Operations Office

April 2021

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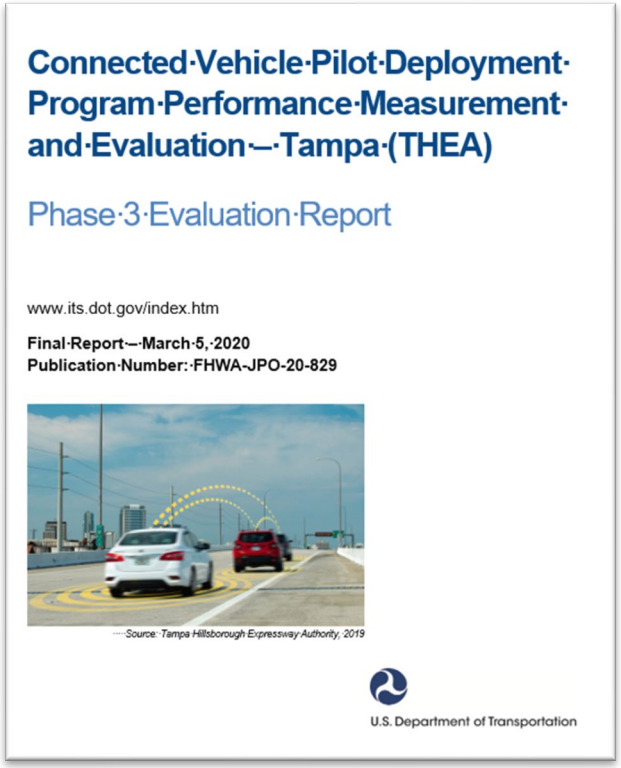
Use Case 2: THEA CV Pilot Deployment

- Operational:
  - ✓ Four phases (2016-2022)
  - ✓ Data Management
  - ✓ Performance Measurement and Evaluation



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Use Case 2: THEA CV Pilot Deployment Managing a Near-Real Time CV Database

- 3.5 billion Basic Safety Messages (BSM)
- 26.4 billion Signal Phase and Timing Messages (SPaT)
- 47.2 million MAP messages
- 1.6 billion Traveler Information Messages (TIM)
- 152,571 interactions between OBU-equipped vehicles
- 8.6 million transit API calls

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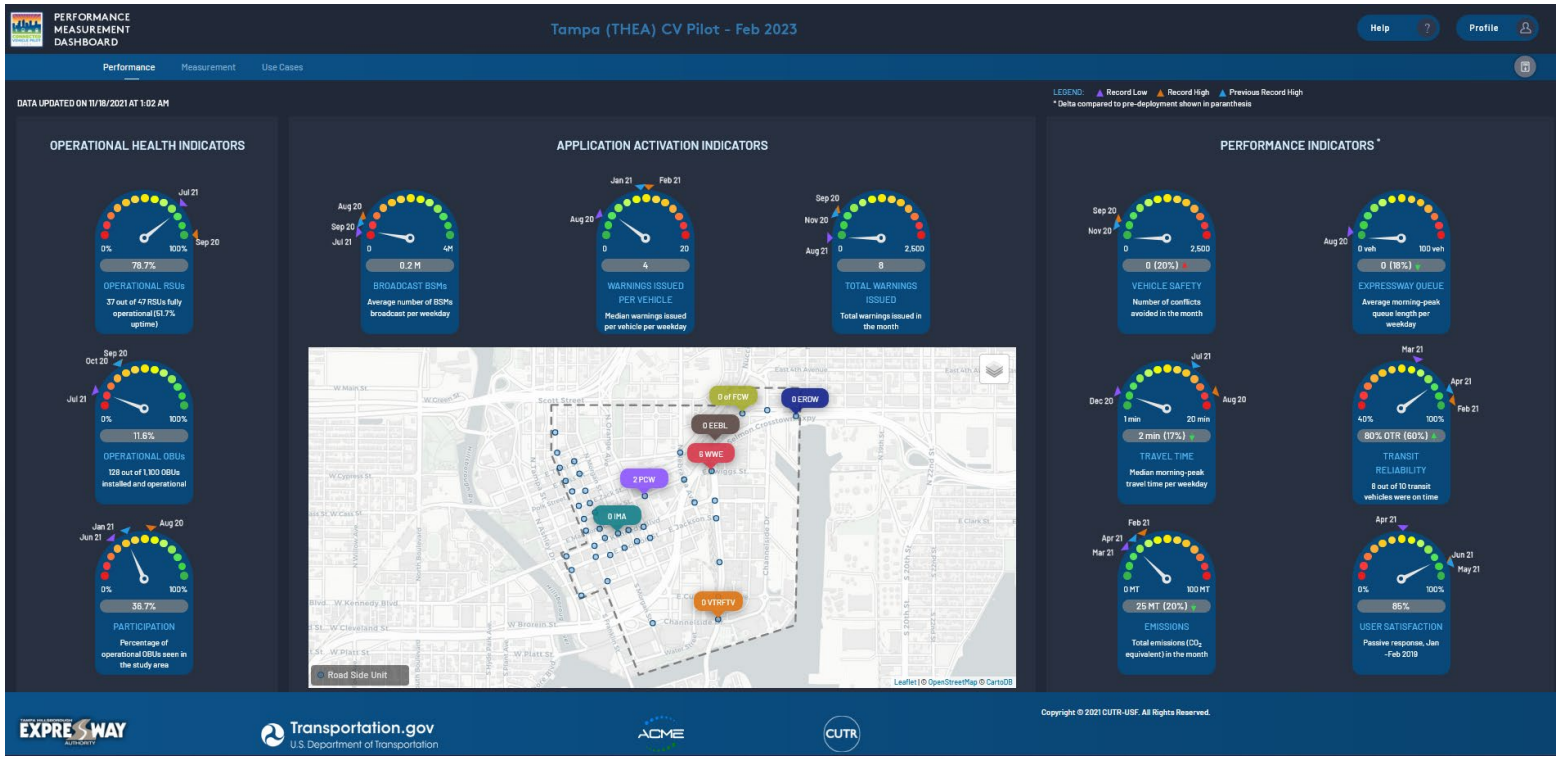
Use Case 2: THEA CV Pilot Deployment Performance Measurement Dashboard

- 16+ Billion Obs CV Database
- Multiple stakeholders
  - USDOT management
  - USDOT analysts
  - Independent evaluators
- Near-real time reporting
- Downloadable reports
- Custom queries
- V2V and V2I false positive assessment
- Overall impact evaluation



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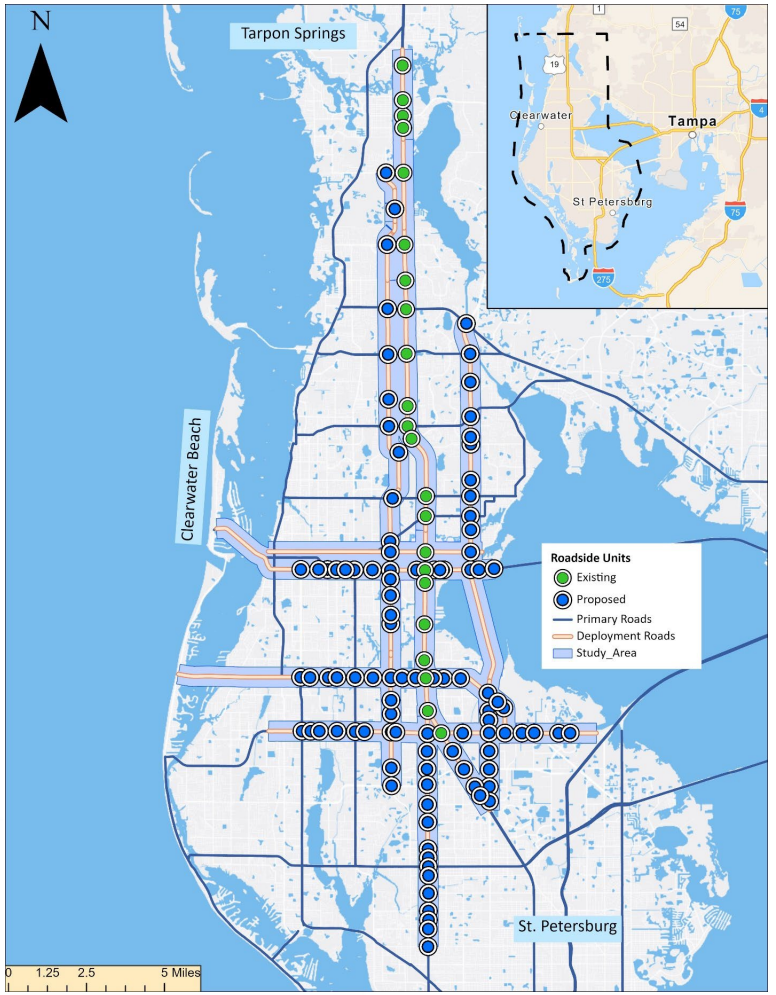
Use Case 3: Pinellas County Connected Community Evaluation

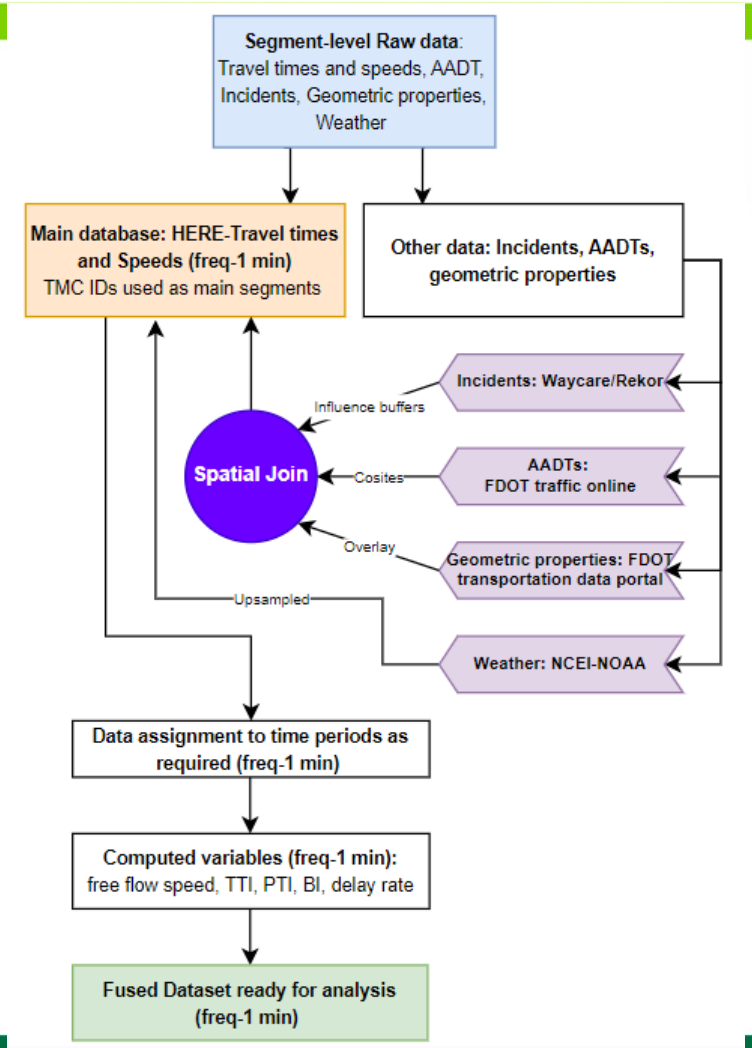
Goal Area	Objective
Improve Safety	• Reduce traffic related fatalities. • Reduce traffic related injuries. • Reduce traffic crashes. • Reduce pedestrian-related fatalities. • Reduce pedestrian- and bicyle-related crashes.
Improve Mobility	• Enhance use of existing capacity. • Reduce delay. • Improve travel time and travel time reliability. • Improve throughput. • Improve transit travel time and schedule adherence.

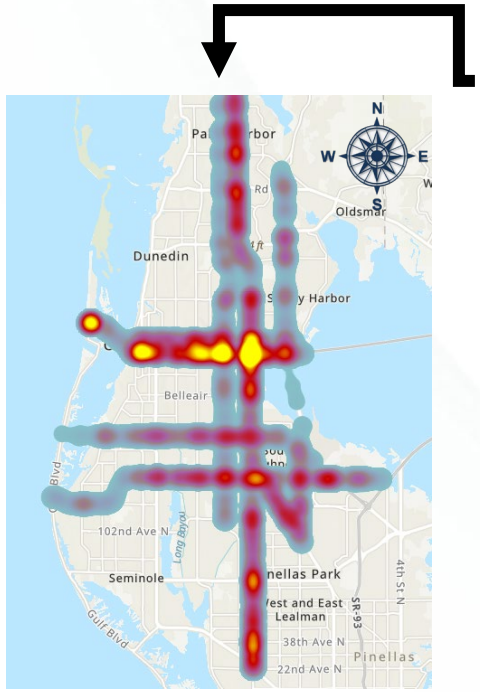
Reduce Costs and Increase Economic Benefits	• Reduce costs to agencies and increased societal benefits:
	  ○ Reduced excess fuel consumption
	  ○ Reduced crash costs.
	  ○ Increased travel time savings.

Share Institutional Benefits	• Develop lessons learned and recommendations for future deployers. • Assess reproducibility and technology transfer of deployed technologies.



Use Case 3: Pinellas County Connected Community Data Management





Data fusion

- Travel times: By traffic message channels (TMC) in HERE probe data
- Incident data: Marked as completed in Waycare/Rekor
- AADTs: FDOT traffic online by roadway
- Weather: National Oceanic and Atmospheric Administration (NOAA)
- GIS network of study corridors i.e., US-19, US-19 frontage, Belcher road, SR-693, SR-60, SR-590, SR-686, SR-688, CR-611
- Compute free flow speeds (filtering adverse weather, incidents, weekends and public holidays) and generate performance metrics i.e., travel time index (TTI), planning time index (PTI), buffer index, and delay rate

Thank You!

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