Pima County
Regional Surface Transportation Network Management Vision

Status update

March, 2019

Performance Context

To evaluate network performance and propose enhancements reflecting the Federal Highway Administration performance-based approach described in U.S.C. § 450.206 of Title 23, jurisdictions require an evaluation platform addressing both infrastructure and traffic.

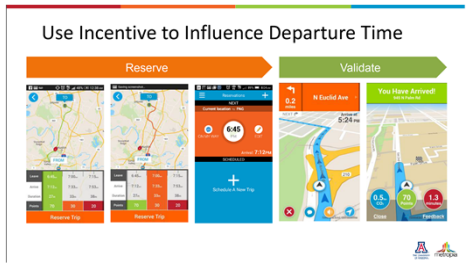
Performance Criteria

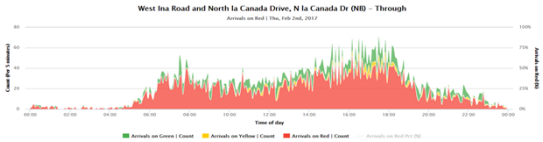
- Mobility
- Safety
- Accessibility
- Transit
- Freight
- Social justice
- Non-vehicular modes
- Economic development catalyst
- Environmental

Performance Evaluation

Highest value enhancements to be evaluated through observation and simulation to maximize return on investment (ROI) among

- Maintenance
- Construction/expansion of roadways
- Active demand management (ADM)
- Transportation systems management and operations (TSMO)

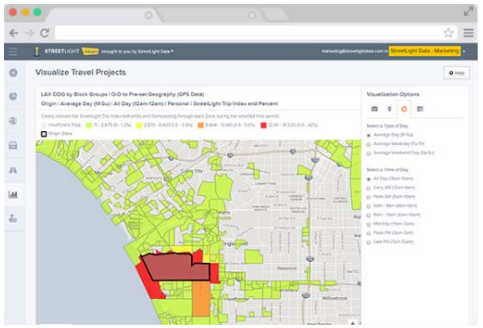




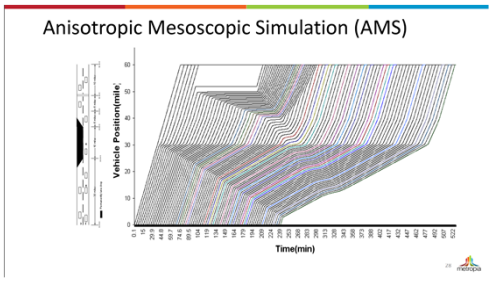
Performance Toolbox Components

1. Transportation Network Management System

2. Traffic Data

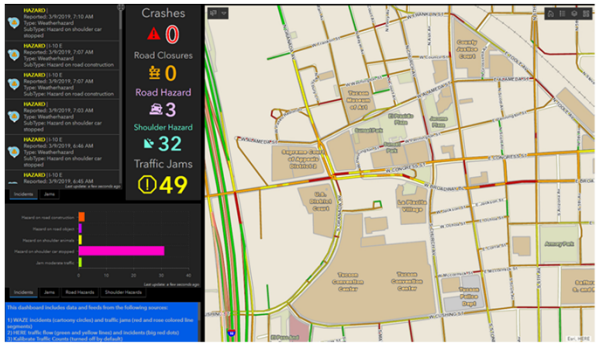


3. Dynamic Traffic Assignment



1. Transportation Network Management System (TNMS)

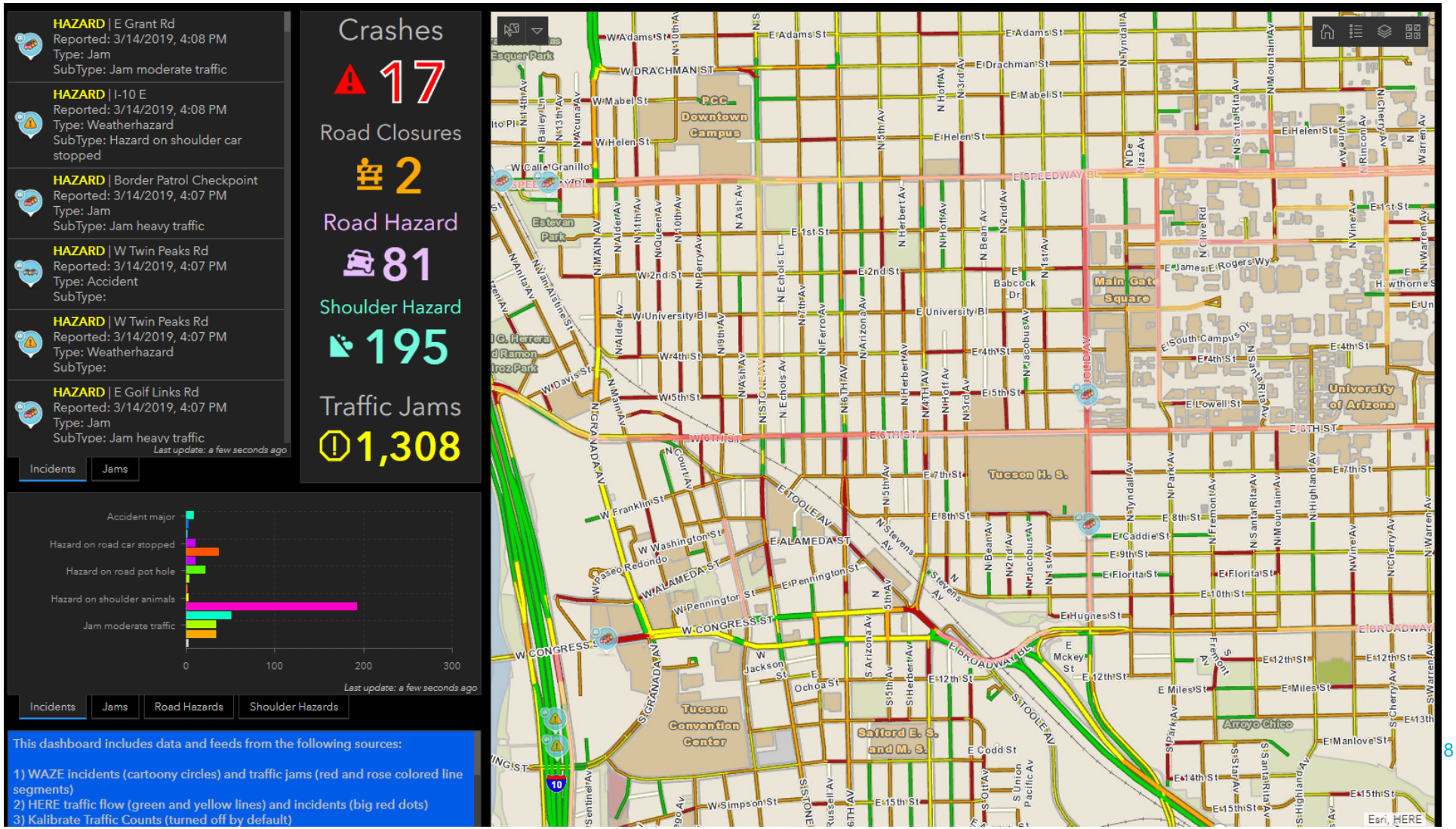
- Geographic information system (GIS) platform
- Infrastructure asset representation
- Safety elements (crashes and geometrics)
- Network screening analysis tools
- Operations management dashboard



1. TNMS Benefit

- Screen network for mobility, safety and other opportunities through regression analyses
- Evaluate and compare value and performance of assets, geometrics and other transportation infrastructure variables
- Provide an operations management dashboard to actively manage signals and road closures
- Actively manage traffic demand with live feed to navigation and traffic apps

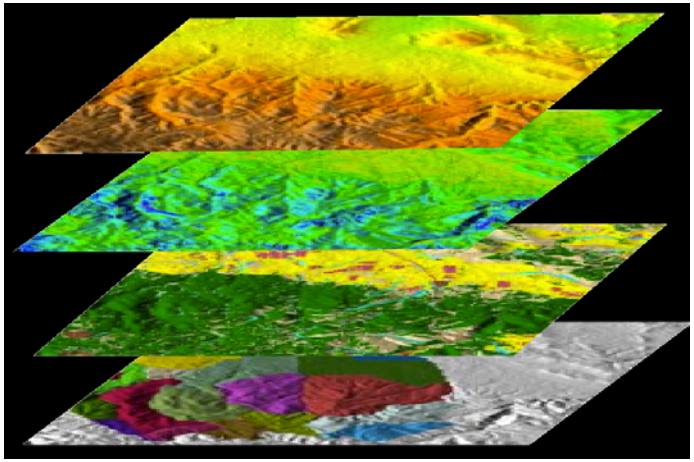
TNMS-Pima County Platform



TNMS - Network Screening

TNMS – Assets & Features

- Assets
  - ArcGIS LRS
  - LiDAR
  - Geometrics
- GIS Features
- Traffic analytics



TNMS - Traffic Analytics

Safety

- Crashes
- LOSS—Safety Performance Functions
- USRAP
- Safety Analyst

Volume

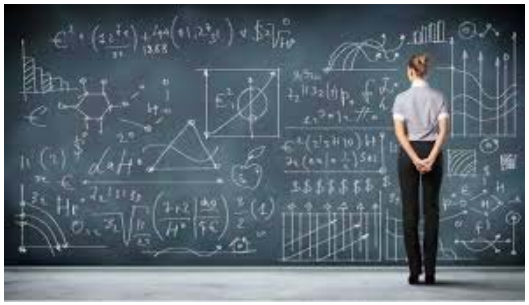
- Traditional counting devices
- Probe

Analysis

- Regression analysis to determine statistical significance among elements

TNMS - Supply Management

- Infrastructure need and design optimization
- Intersection control optimization
- Transit/share stop/route optimization
- Freight management
- Access management
- Pavement optimization



- Construction project/special event/crash mitigation
- Flood barrier mitigation

TNMS - Active Demand Management

Mobility

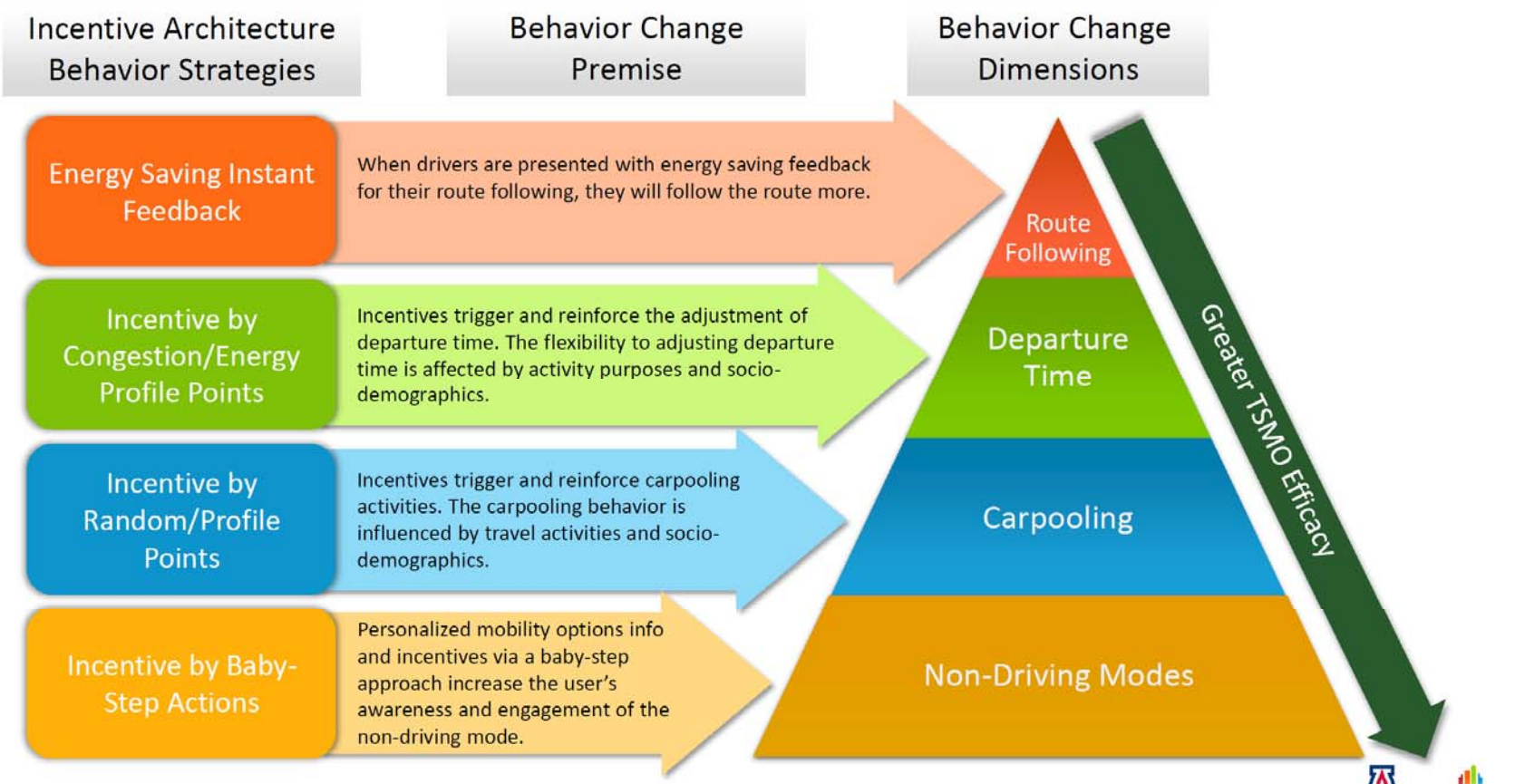
- Distributed routing
- Peak-load shifting
- Mode distribution
- Economic basis for travel incentives
- Enhanced TDM program

TNMS - Active Demand Management

Safety

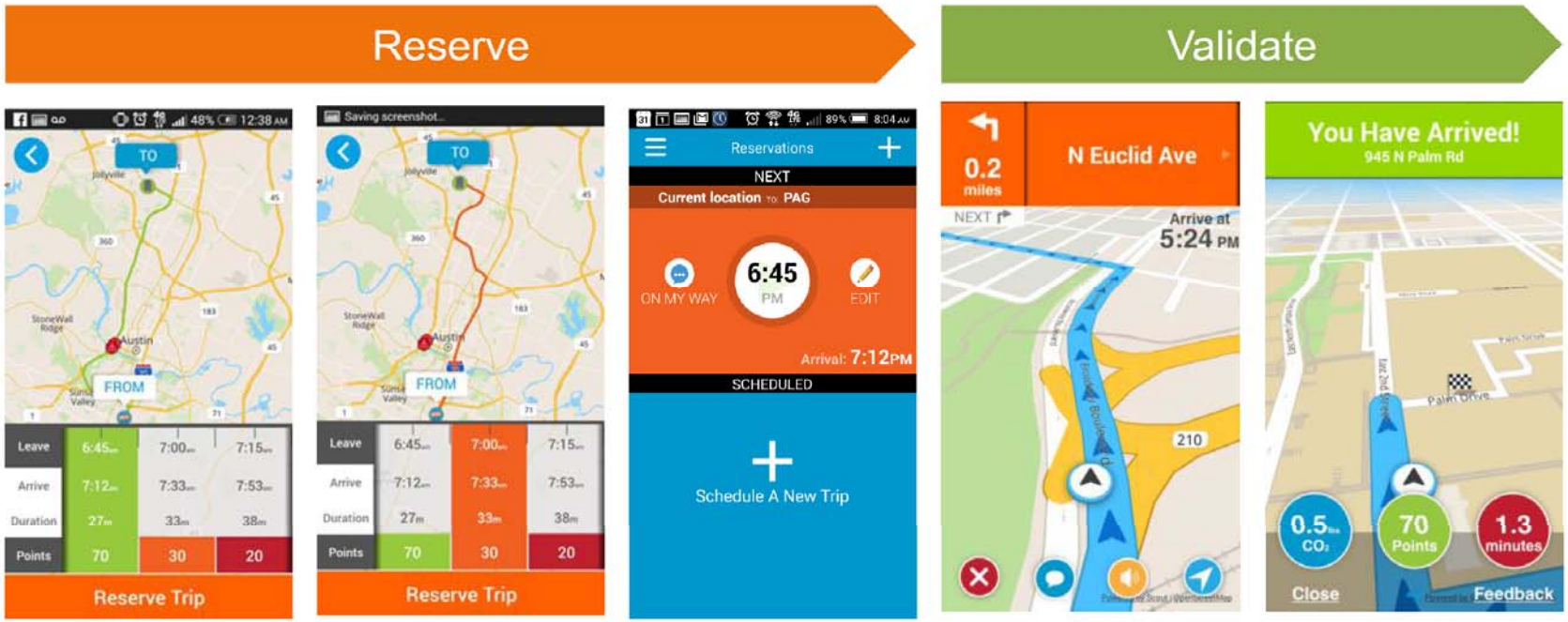
- Incentivize transit
- Incentivize low acceleration/deceleration
- Incentivize max speed within 10 mph of posted speed limit
- Reward not touching driver smartphone when vehicle in motion

Metropia strategies



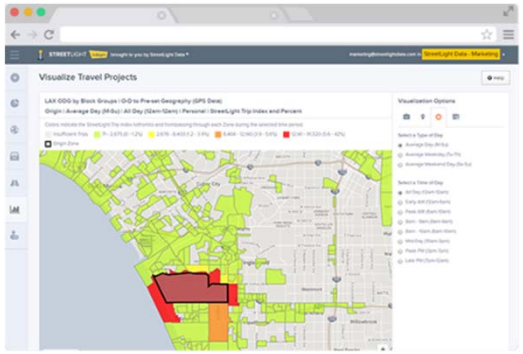
Metropia-user interface

Use Incentive to Influence Departure Time



2. Advanced Traffic Data

- Locally sourced multi-modal permanent counters: miovision
- Probe data through partnerships: here, INRIX, waze, metropia (Driving a better city)
- Purchased network flow data and analytics tools (Streetlight)
  - Origin-destination analysis
  - Zone analysis (visitor, home, work)
  - Traveler demographics and trip purpose
  - Segment analysis (speed, duration, length)
  - Bike/ped/freight/transit analysis



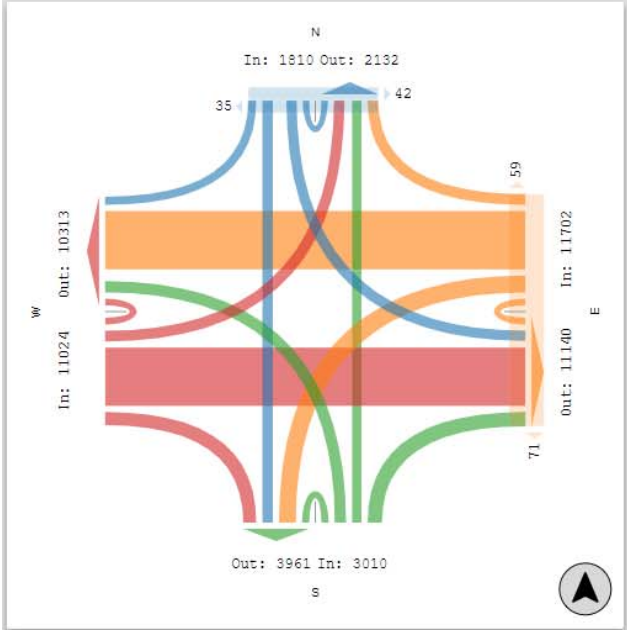
2. Advanced Traffic Data benefit

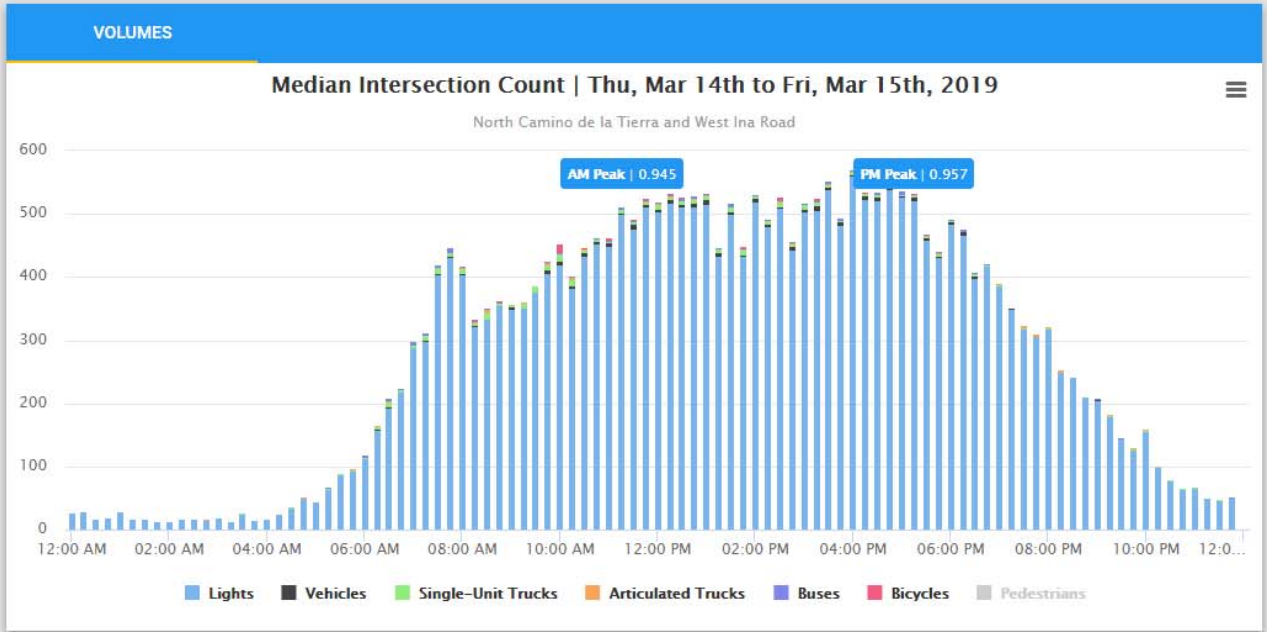
Identifies potential demand or infrastructure improvement strategies through analysis of:

- Congestion (prioritize needs)
- Mode (infrastructure to accommodate or incentivize transit or bike share program on short trip corridors)
- Trip purpose (prioritizing employment, shopping, recreation access or location)
- Special events (e.g., Gem Show ride-shares)
- Demographics (prioritize affordable housing and at-risk health populations mobility needs)

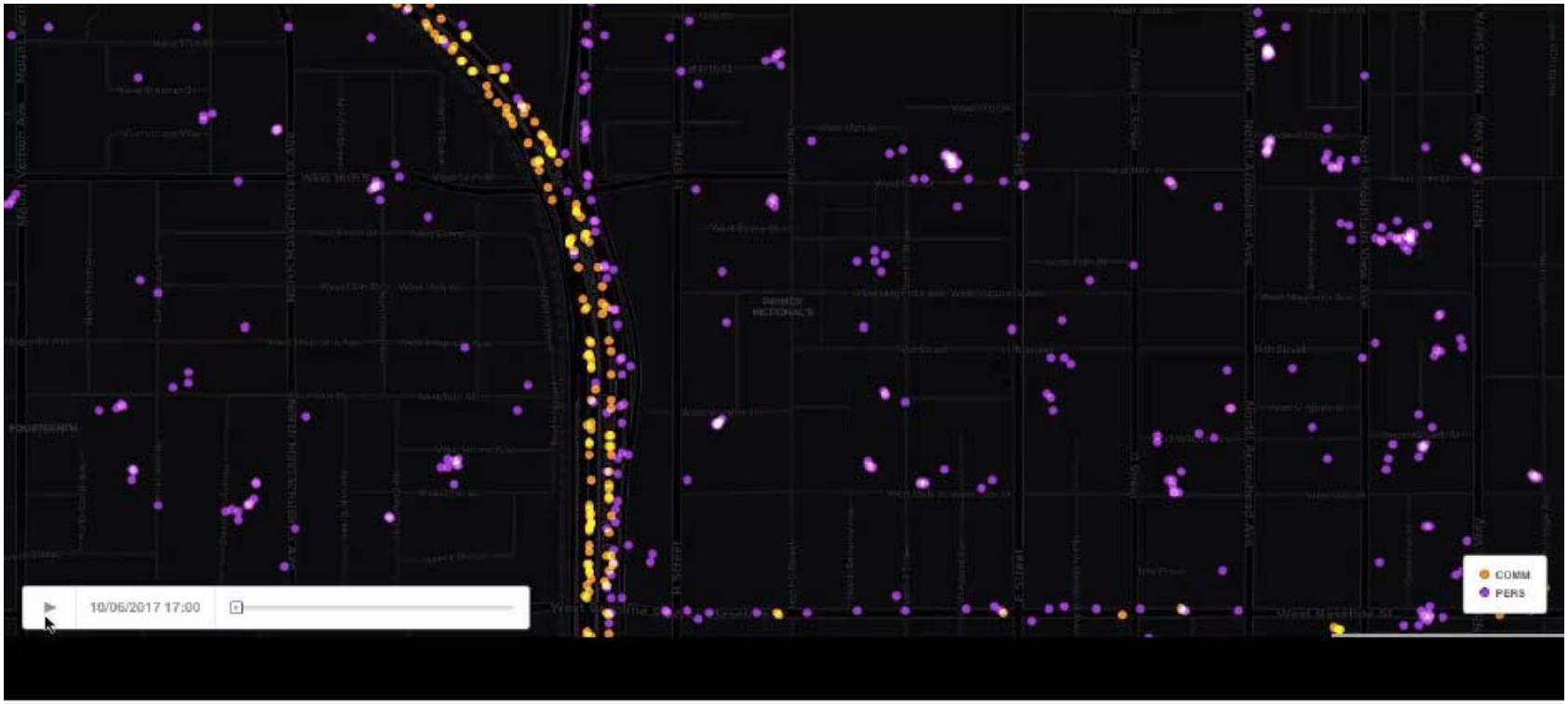
Traffic Data: Miovision

Total Vehicles	Total Pedestrians	Total Bicycles BETA	Truck Pct (%)	AM Peak	PM Peak
27,501	207	45	2%	1,751	2,185
Median Volume	Median Volume	Median Volume	% of Vehicle Traffic	From 10:00 to 11:00 AM	From 4:00 to 5:00 PM





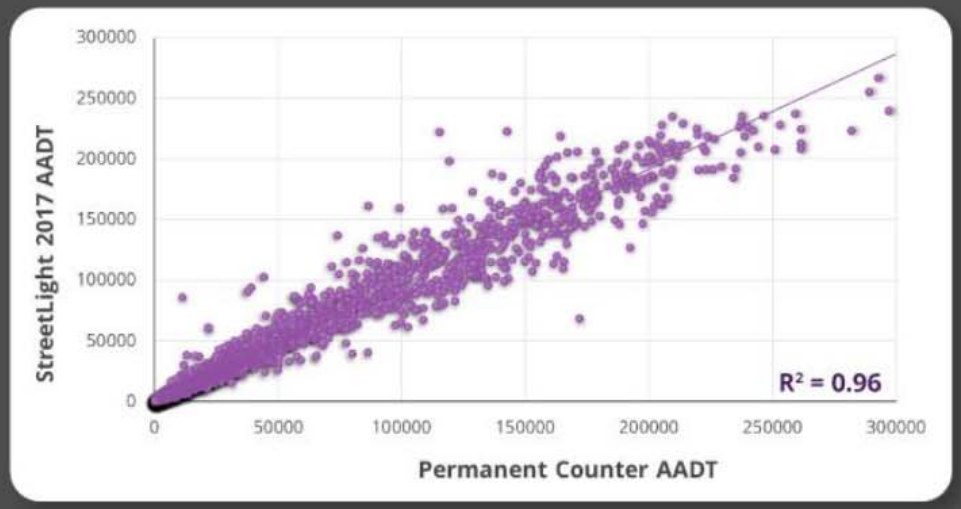
Traffic Data: StreetLight



Mobile device data from ~23% of US and Canadian adults and ~12% of commercial truck trips.

Traffic Data: StreetLight

Unmatched accuracy, validated via permanent counters

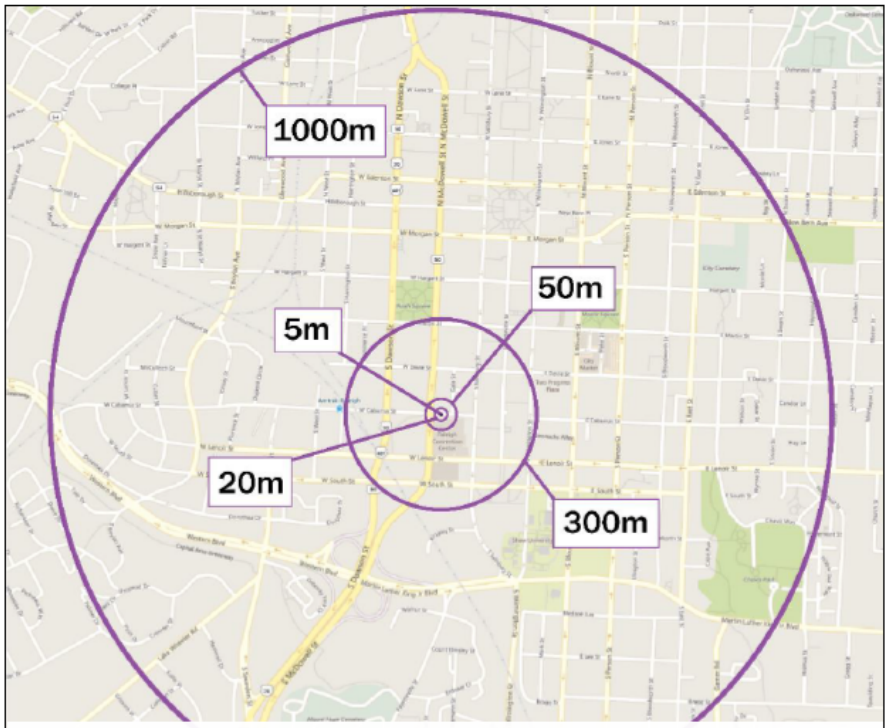


- Trained and validated with 2,400+ permanent count stations, spanning range of road types and weather conditions
- Better than temporary counter AADT for most roadway classifications
- R^2 is .96
- Both absolute and root mean square error rates exceed industry targets

STREETLIGHT InSight AADT

Traffic Data: StreetLight

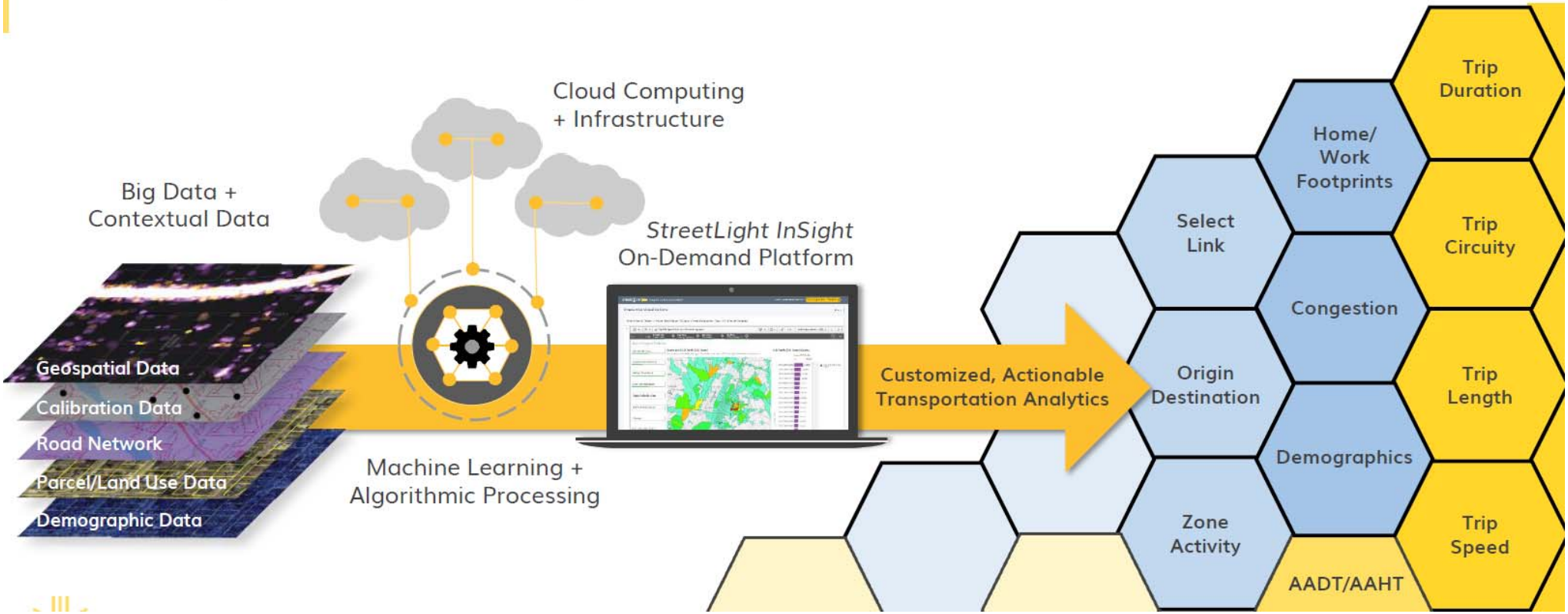
Key Characteristics of Our Locational Big Data	
Multiple Types of Data	• Location-Based Services records • Navigation-GPS records
Sample Size	• Covers ~23% of adult population in US and Canada • Unbiased sample backed up with automated normalization
Spatial Precision and Coverage	• As precise as 5-25 meters, average better than 18 meters • 4-carrier coverage – no rural gaps
Temporal Precision	• One-hour intervals • Weekends vs. weekdays
Archival Data	• Monthly data periods from 2014 through "month before last"
Privacy Protection	• All data is de-identified by our suppliers • No personally identifying information • Metrics are aggregated into groups



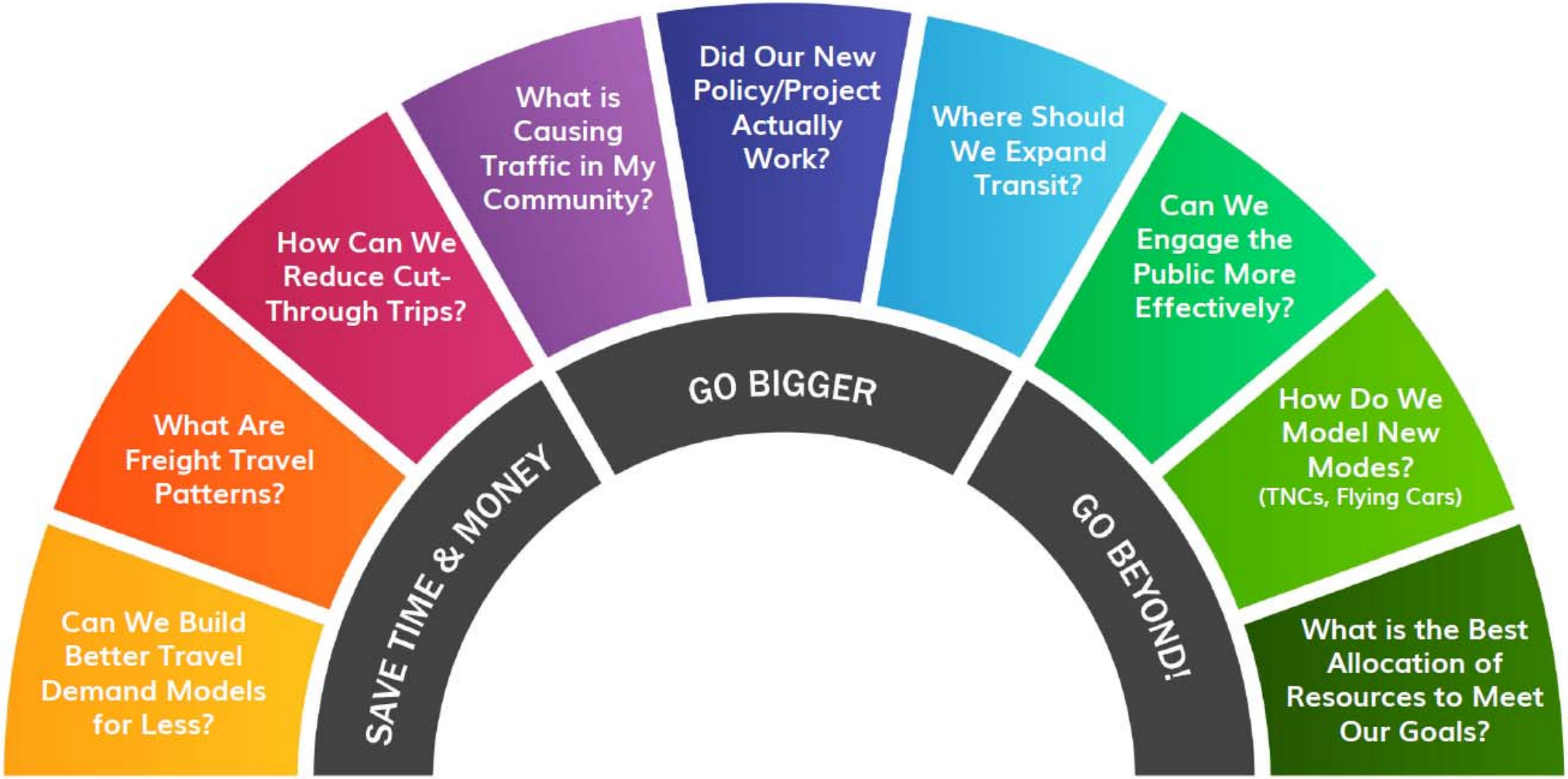
This image shows a location record's potential location at different levels of spatial precision. At 300m to 1000m spatial precision, records cannot provide corridor- or intersection-level insights.

Traffic Data: StreetLight

StreetLight InSight turns Big Data into actionable transportation analytics on demand



Traffic Data: StreetLight



Traffic Data: StreetLight

San Diego's MPO Assessed the Impact and Equity of New Toll Road Pricing

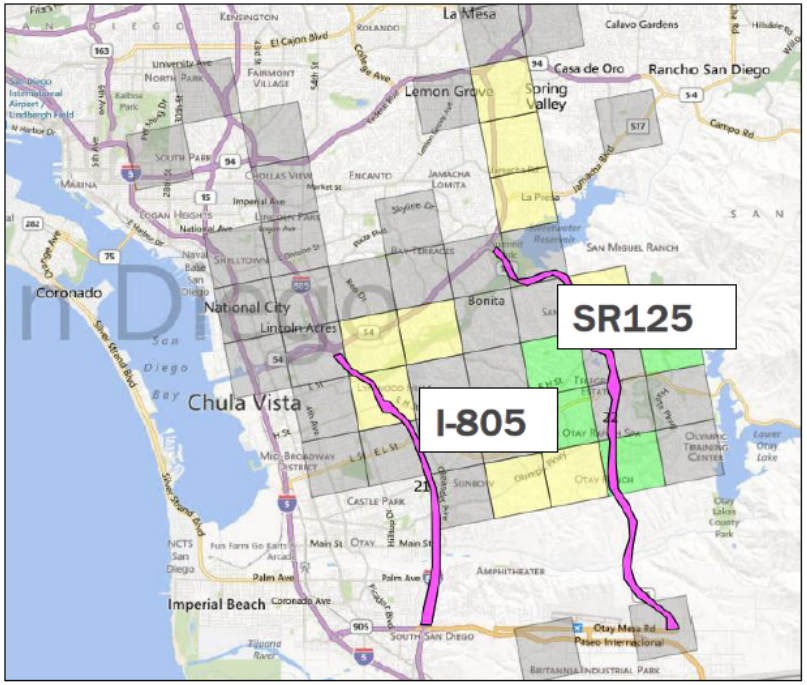
Challenge

SANDAG reduced tolls on SR 125 to shift traffic from congested I-805, but lacked a way to determine if this benefitted all income groups equally.

StreetLight InSight Solution

SANDAG and Fehr & Peers analyzed the incomes of SR125 and I-805 users before and after the change, and determined all income groups were equally impacted.

Share of Trips that Shifted to SR 125 in San Diego



Color	Description
	Heavy amount of trips switched to SR125
	Some trip switch to SR125
	About the same/very few trips

Traffic Data: StreetLight

Napa's Congestion Management Agency Invests Strategically in Transit to Mitigate Traffic Jams

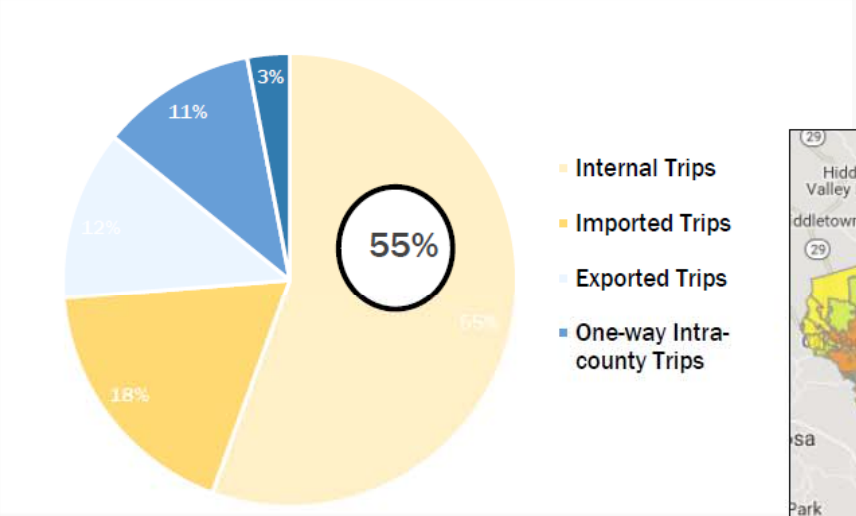
Challenge

Residents blamed traffic jams on tourists and tech industry commuters, but the local transportation authority needed evidence to invest strategically.

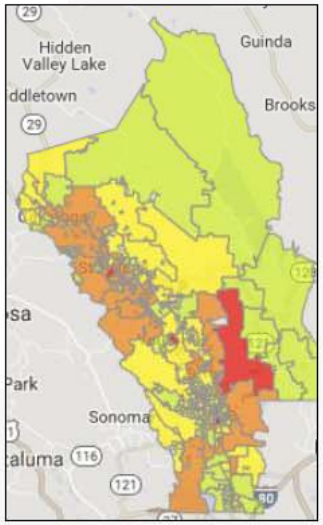
StreetLight InSight Solution

Napa determined that internal trips and Napa's own workers caused congestion. They began prioritizing transit for these groups, and justified their decisions to the public.

Trip Share in Napa



Internal Trip Starts



Traffic Data: StreetLight

Corridor + Facility Improvement

Corridor Impact in Canada

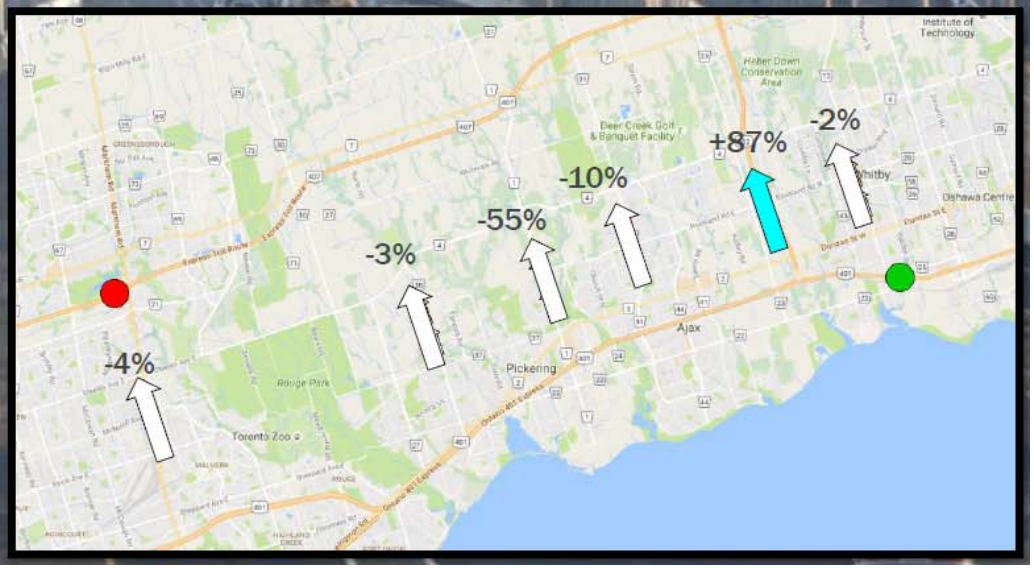
Need: Route choice between 2 highways to measure the impact of offering a new option.

Zones: 6 routes, 3 origin zones, 6 destinations zones.

Metric: O-D with Middle Filter

Months: May, June 2016

Time to Run: 2 min for each month.



Traffic Data: StreetLight

Using StreetLight InSight for Data-Driven Infrastructure Prioritization in Northern Virginia

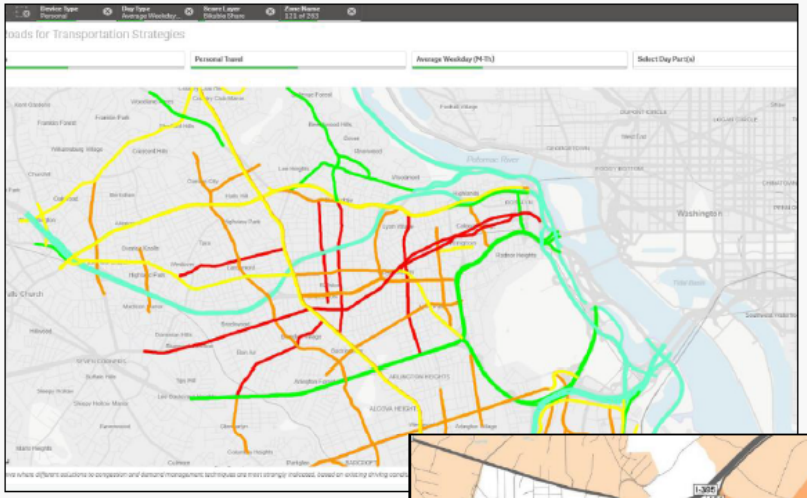
Challenge

Northern Virginia's severe congestion cannot be addressed by highway expansion. VDOT needs to reduce travel in single occupancy vehicles.

StreetLight InSight Solution

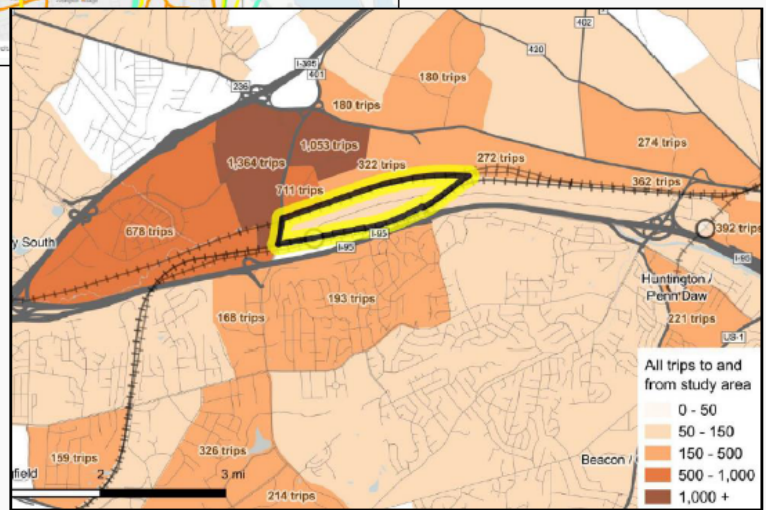
VDOT compared every single regional corridor for mode-shift potential creating, which lead to far more effective cost/benefit process and expenditures of infrastructure dollars.

Corridors with High Shares of Bikeable Trips



Visualization by the State Smart Transportation Initiative: www.ssti.us

Length of Trips to Van Dorn Metro Station



3. Dynamic Traffic Assignment Model

What-if simulation of network changes

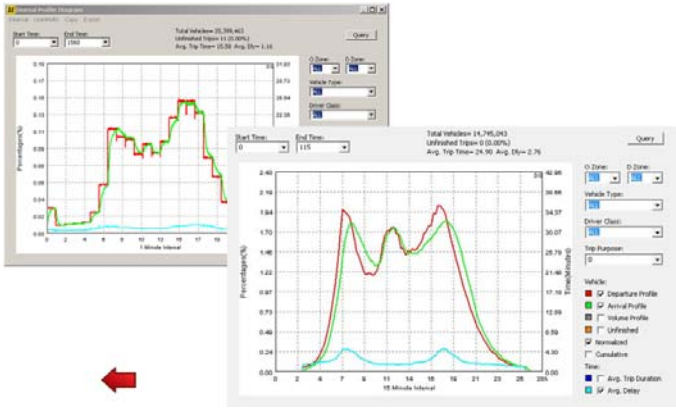
- Infrastructure changes
- Demand management changes

DynusT platform

- University of Arizona development
- Accepts locally defined street network
- Accepts origin-destination data
- Accepts signalized intersection timing/phasing inputs

3. DTA Model Benefit

- Evaluate effect of potential solutions flushed out by TNMS or Advanced Traffic Data tools
- Optimize performance of different strategies (demand vs supply)
- Can evaluate future scenarios by applying growth factors to current origin-destination data



DTA: DynusT

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Development and calibration of the Anisotropic Mesoscopic Simulation model for uninterrupted flow facilities

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ABSTRACT

This paper presents the development, analysis, and calibration of the Anisotropic Mesoscopic Simulation (AMS) model for uninterrupted flow facilities, such as freeways. The proposed AMS model is a vehicle-based mesoscopic traffic simulation approach that explicitly considers the anisotropic property of traffic flow into the vehicle state update at each simulation step. The advantage of AMS is its ability to address a variety of uninterrupted flow conditions in a relatively simple, unified and computationally efficient manner.

The discussions focus on the key modeling concepts, the analytical properties and

TRANSPORTATION RESEARCH CIRCULAR E-C153

Dynamic Traffic Assignment

A Primer

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MICHAEL MAHUT
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TRAVIS WALLER
JIM HICKS

for the
Transportation Network Modeling Committee

June 2011

Transportation Research Board
500 Fifth Street, NW
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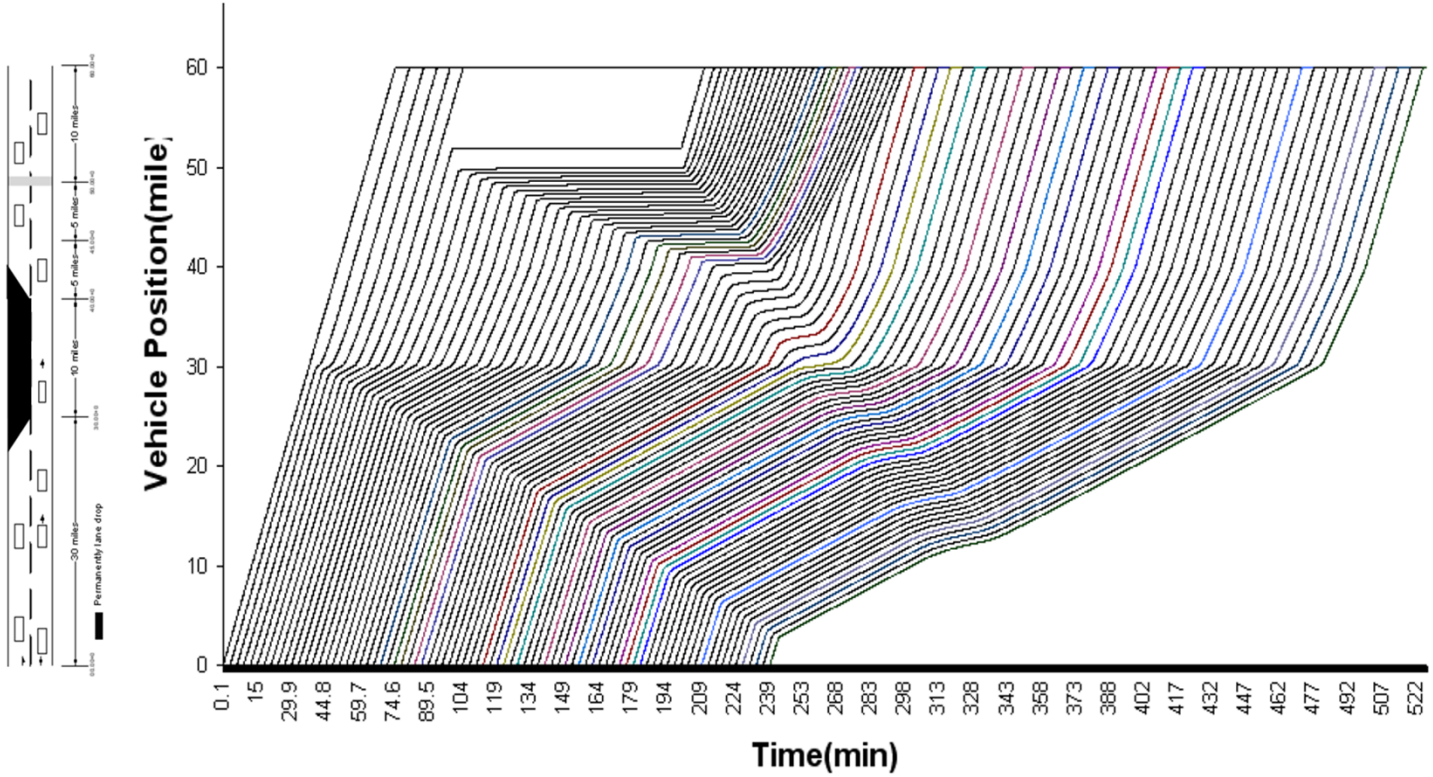
www.TRB.org

DTA: DynusT

Anisotropic Mesoscopic Simulation (AMS)

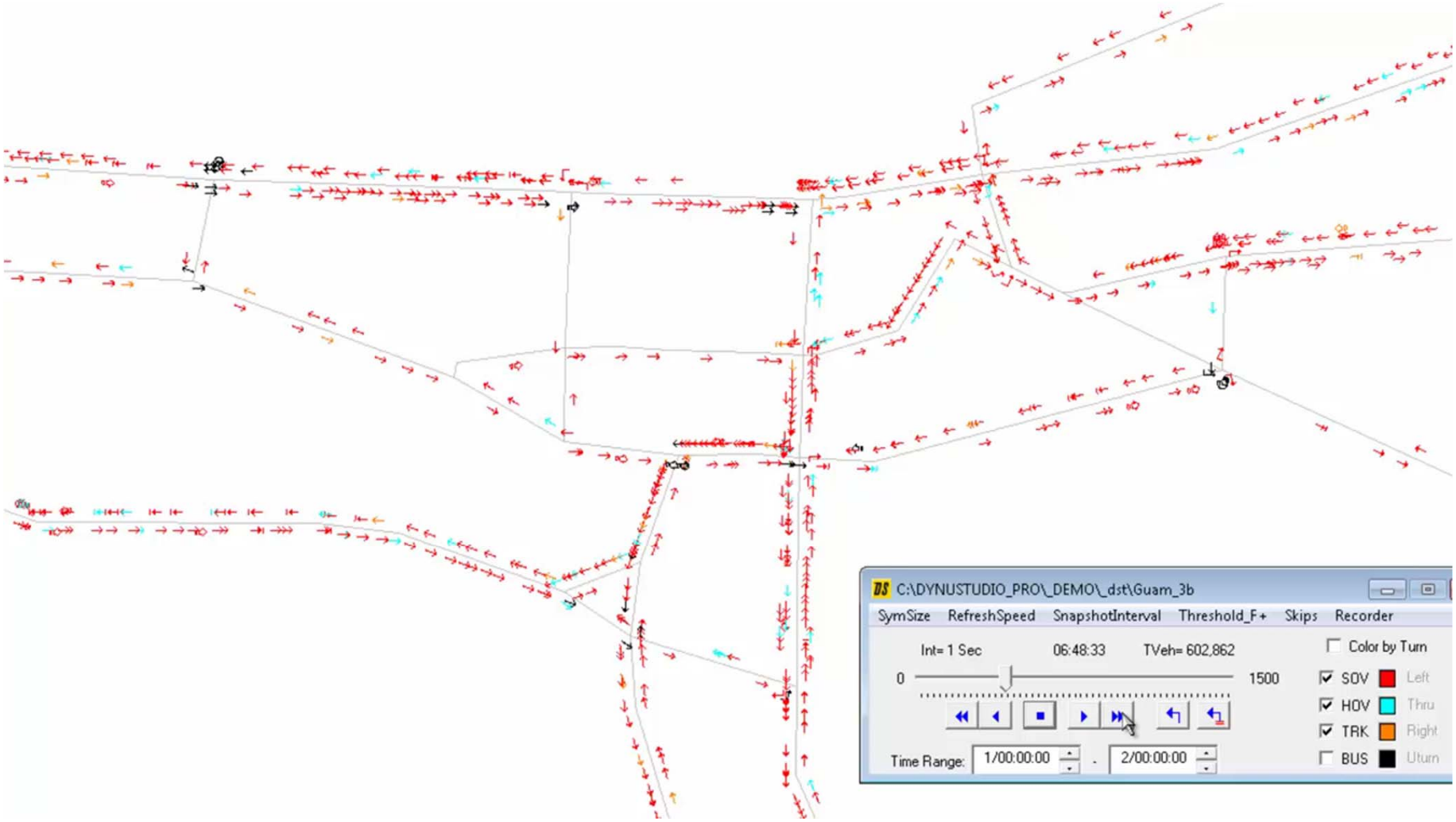


DTA: DynusT

DynuStudio Visualization
Output Link
Performance Measures

Density+Flow

DTA: DynusT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RefreshSpeed
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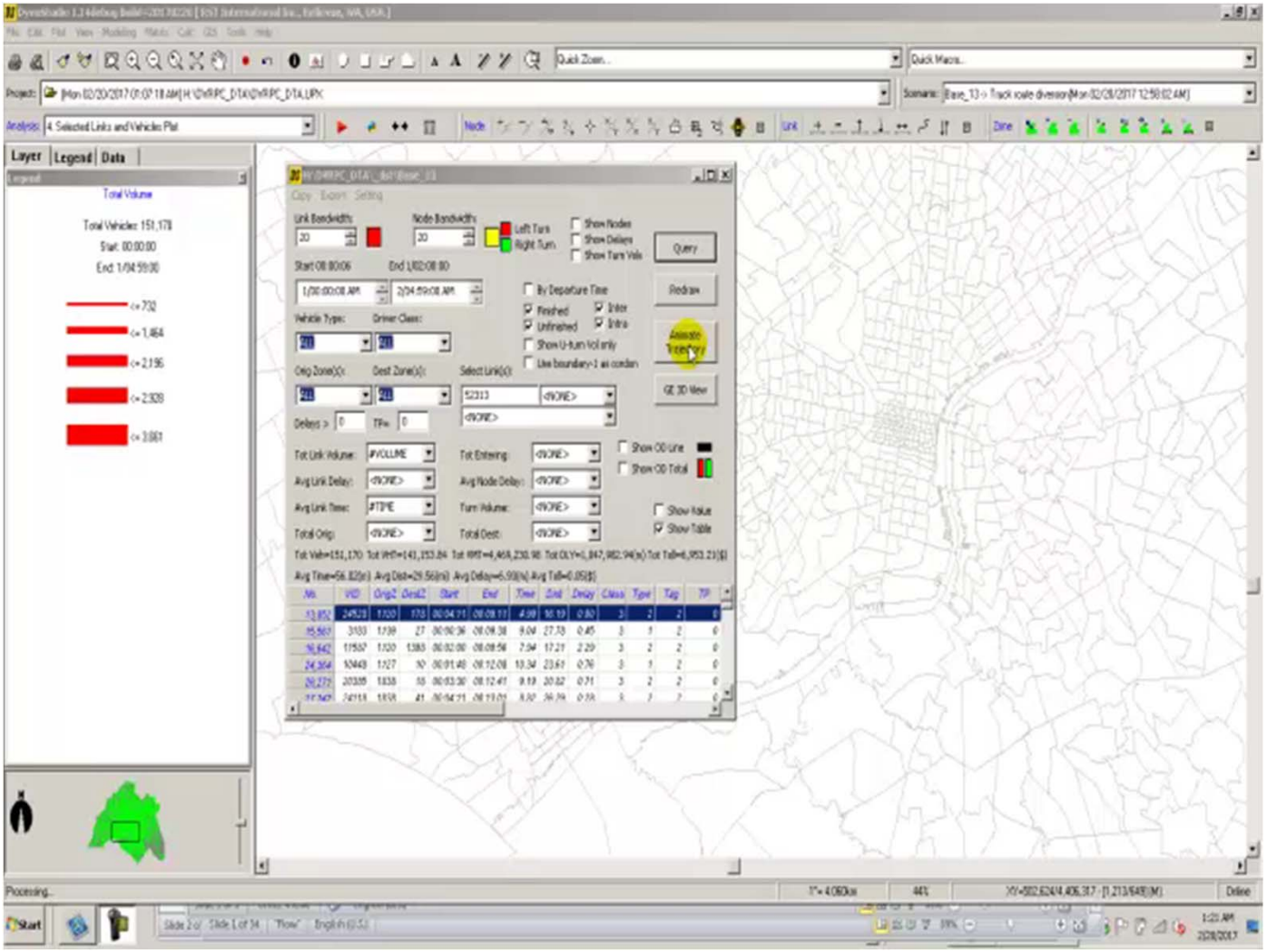
DTA: DynusT



Recap
Performance Toolbox Components

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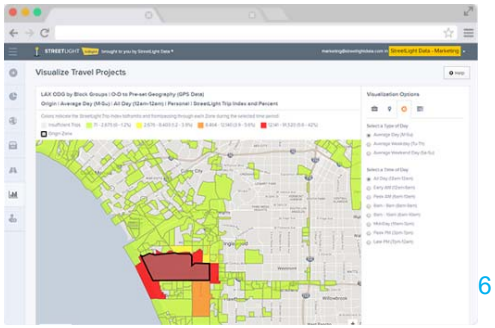

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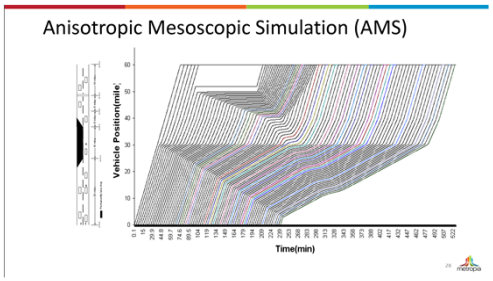

Synthesis of toolbox benefit

- Smart-Community deployment with currently available technology
- Does not require large infrastructure investment (sensors, etc.)
- Provides most connected vehicle benefits with exception of collision avoidance
- Actively manages supply and demand to maximize performance and return-on-investment

Regional Partnerships

- Managing travelers cross jurisdictional boundaries requires regional coordination
- Regional transportation mobility partners to include City of Tucson and other governments
- Coordinating agencies include law enforcement, emergency management, health, economic and community development

- Operational expertise in smart transportation infrastructure, modeling and demand management at the University of Arizona College of Engineering could be leveraged to create a regional transportation operations and research center.