



TSMO & MOD Integration

February 12, 2021

Brad Freeze (Phillip.b.freeze@tn.gov)

TSMO Verses MOD

TSMO

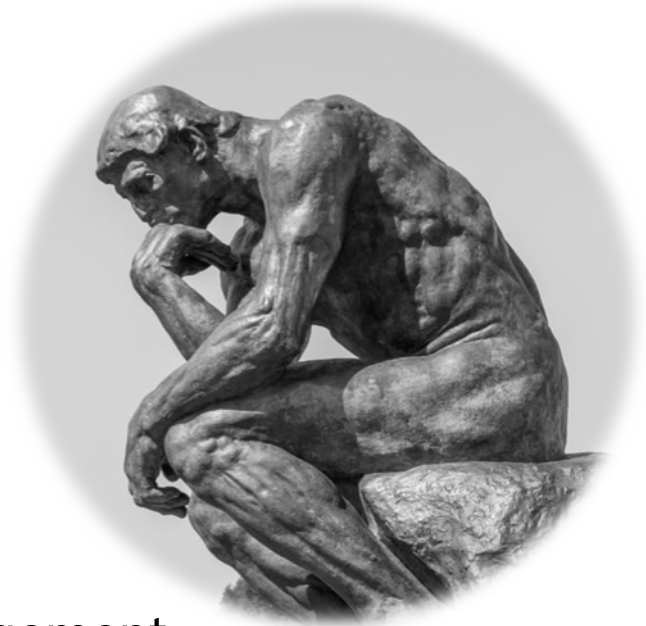
An **integrated** set of strategies to optimize the performance of existing infrastructure through the implementation of **multimodal** and intermodal, cross-jurisdictional **systems, services**, and projects designed to preserve capacity and improve security, **safety**, and reliability of the **transportation system**

MOD

An innovative, user-focused approach which leverages emerging mobility services, **integrated transit networks and operations**, real-time data, connected travelers, and cooperative **Intelligent Transportation Systems (ITS)** to allow for a more traveler-centric, **transportation system-of-systems** approach, providing improved **mobility options** to all travelers and users of the system in an **efficient** and **safe** manner.

TSMO Strategies Verses MOD

- Work Zone Management
- Traffic Incident Management
- Special Event Management
- Road Weather Management
- Transit Management
- Freight Management
- Traffic Signal Coordination
- Traveler Information
- Ramp Management
- Congestion Pricing
- Active Transportation and Demand Management
- Integrated Corridor Management
- Access Management
- Improved Bicycle and Pedestrian Crossings
- Connected and Automated Vehicle Deployment





**THE TIMES
THEY ARE
A-CHANGIN'
BOB
DYLAN**

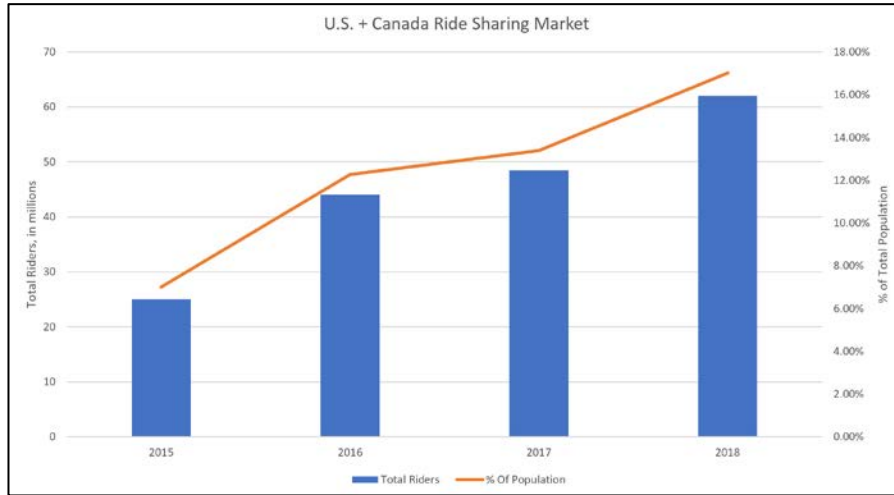
THE LONESOME DEATH OF RATTIE CARROLL
BOOTS OF SPANISH LEATHER
RESTLESS FAREWELL / WITH GOD ON OUR SIDE
THE TIMES THEY ARE A-CHANGIN'
ONLY A PAWN IN THEIR GAME
WHEN THE SHIP COMES IN / ONE TOO MANY MORNINGS
BALLAD OF MOLLIE BROWN / NORTH COUNTRY BLUES

The line it is drawn
The curse it is cast
The slow one now
Will later be fast
As the present now
Will later be past
The order is
Rapidly fadin'
And the first one now
Will later be last

For the times they are a-changin'.

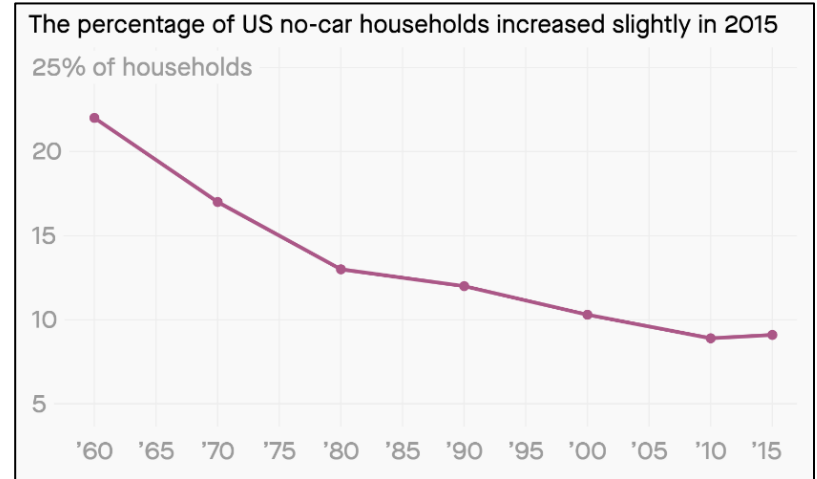
“The Times, They are A-changing”

Use of Ride Hailing Services



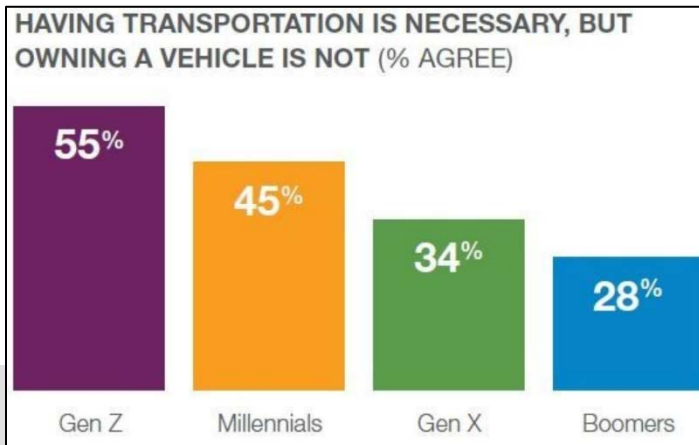
Source: Second Measure & Lyft

Car Ownership Dropping?



Source: US Census & Quartz

Owning a Car is not necessary



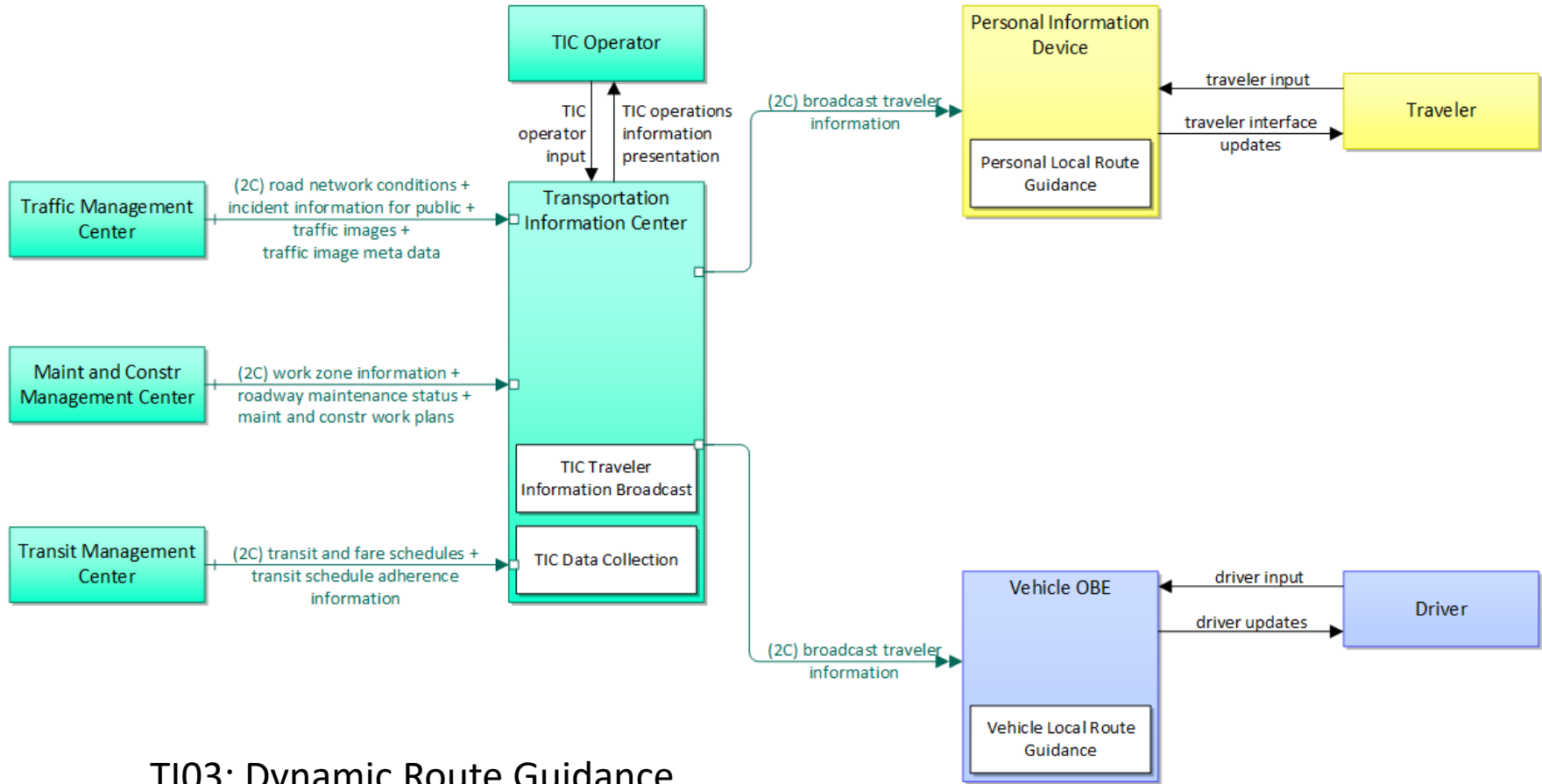
Source: Cox Automotive

Dynamic Routing Systems, Curse or Cure?

Email Example:

“As a resident of the upper Cosby area near Lindsay Gap and Groundhog road we are experiencing a tremendous amount of tourist traffic that GPS is directing from interstate 40 to exit 447. This is the Hartford exit. From there drivers take Hartford Road to Lindsay Gap then to Groundhog to Highway 32 and then 321 to Gatlinburg. This has been an extreme strain and burden on the local county roads, specifically Lindsey Gap, Groundhog Rd and even Trail Hollow. On the weekends we have cars at a rate of 200 an hour on these small one lane roads. This is an extreme safety issue for children riding school buses and for the safety of our entire community.”

ITS Architectures & Dynamic Route Guidance



TI03: Dynamic Route Guidance

TI03: Dynamic Route Guidance			
4	Physical	Mar 5, 2020	NAT

Connected Vehicle Applications

V2I Safety

- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

Agency Data

- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

Environment

- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

Road Weather

- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

Mobility

- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization

Smart Roadside

- Wireless Inspection
- Smart Truck Parking

Mobility On Demand Integration?



I-24 Smart Corridor (Integrated Corridor Management)

I-24 Smart Corridor Mission:

To improve the **safety and reliability of all travel** along the corridor through the proactive management of intelligent and connected infrastructure, and the formation of strong operational partnerships between local and state agency stakeholders.



I-24 Smart Corridor Goals:

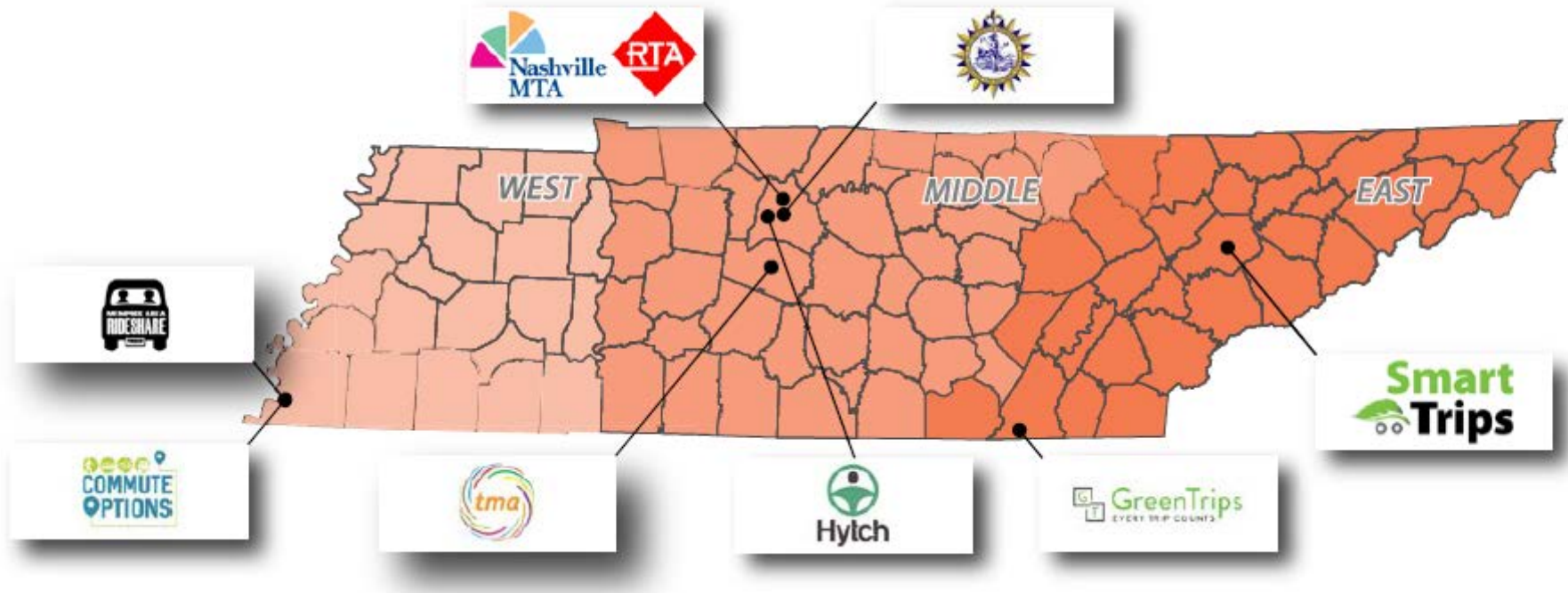
Goal 1: Increase Travel Time Reliability

Goal 2: Increase Mobility of all Modes

Goal 3: Reduce the Concentration of Crashes

Goal 4: Develop Agency Coordination

Travel Demand Management & CMAQ Program





Thank You



Integration of MOD and Public Transit

Nashville Experience

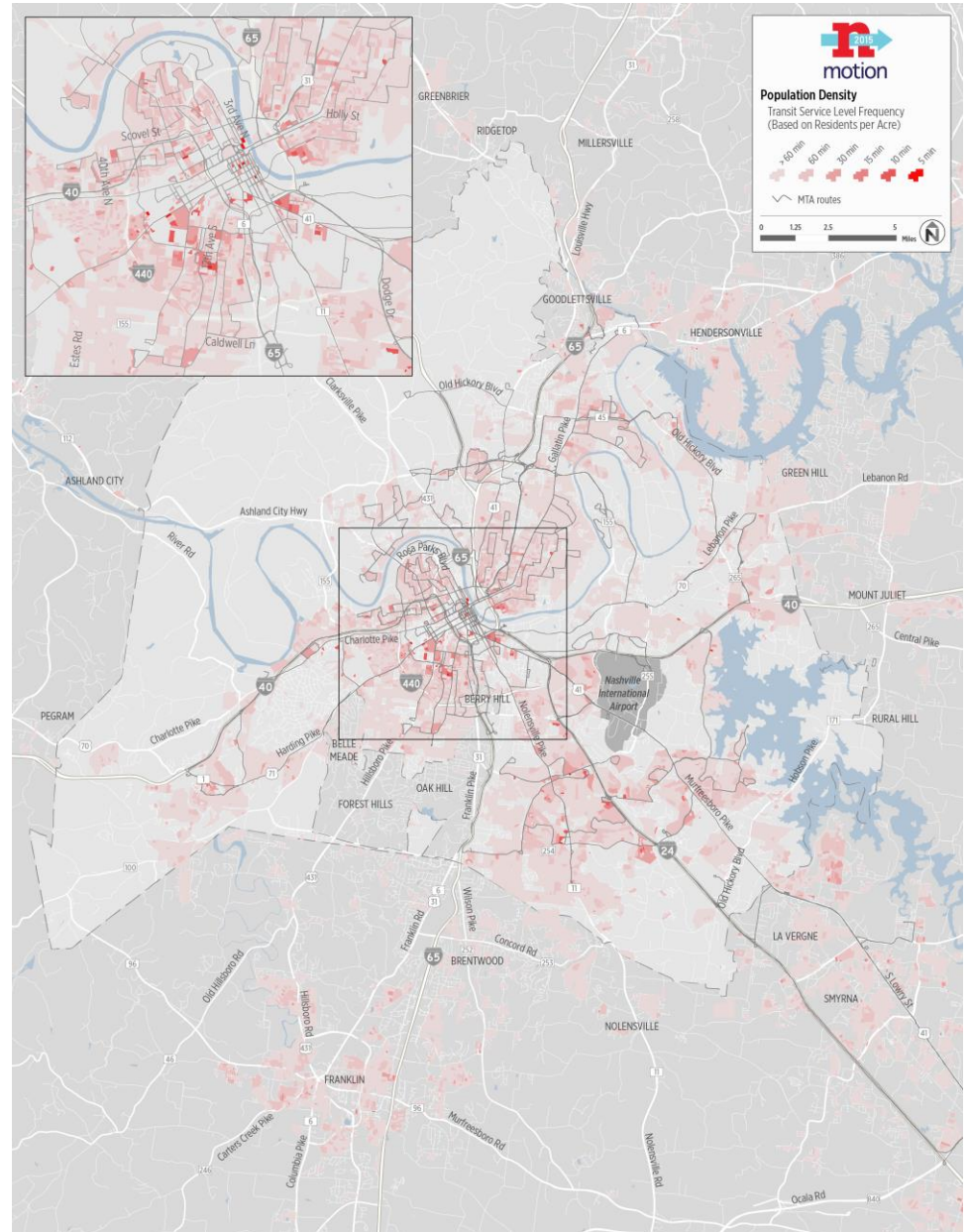


Overview

- Context for Public Transportation in Nashville
- Opportunities and Challenges for the Public Transportation Network
- Experiences to Date with Mobility on Demand
- Upcoming Projects
- Implementation Issues

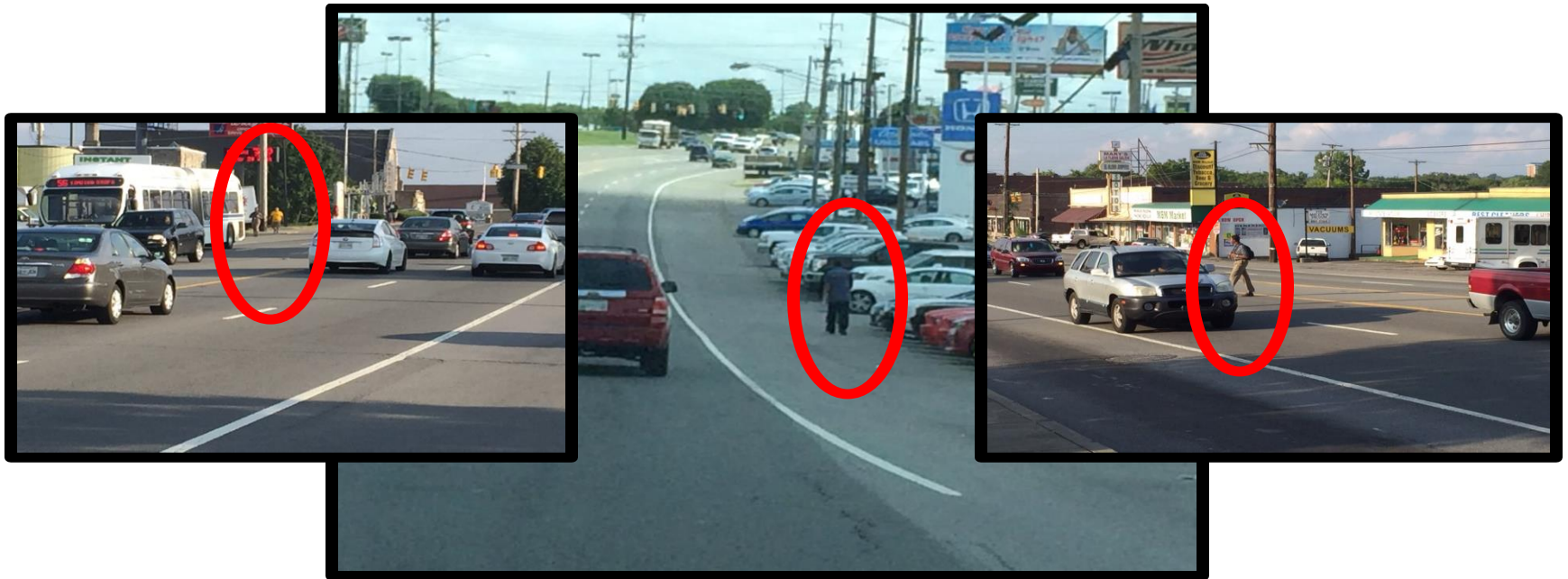
A Tough Place for Traditional Public Transit

- Generally Low Population and Job Density
- Radial Transportation Network
- Gentrification Issues Exacerbate Challenges



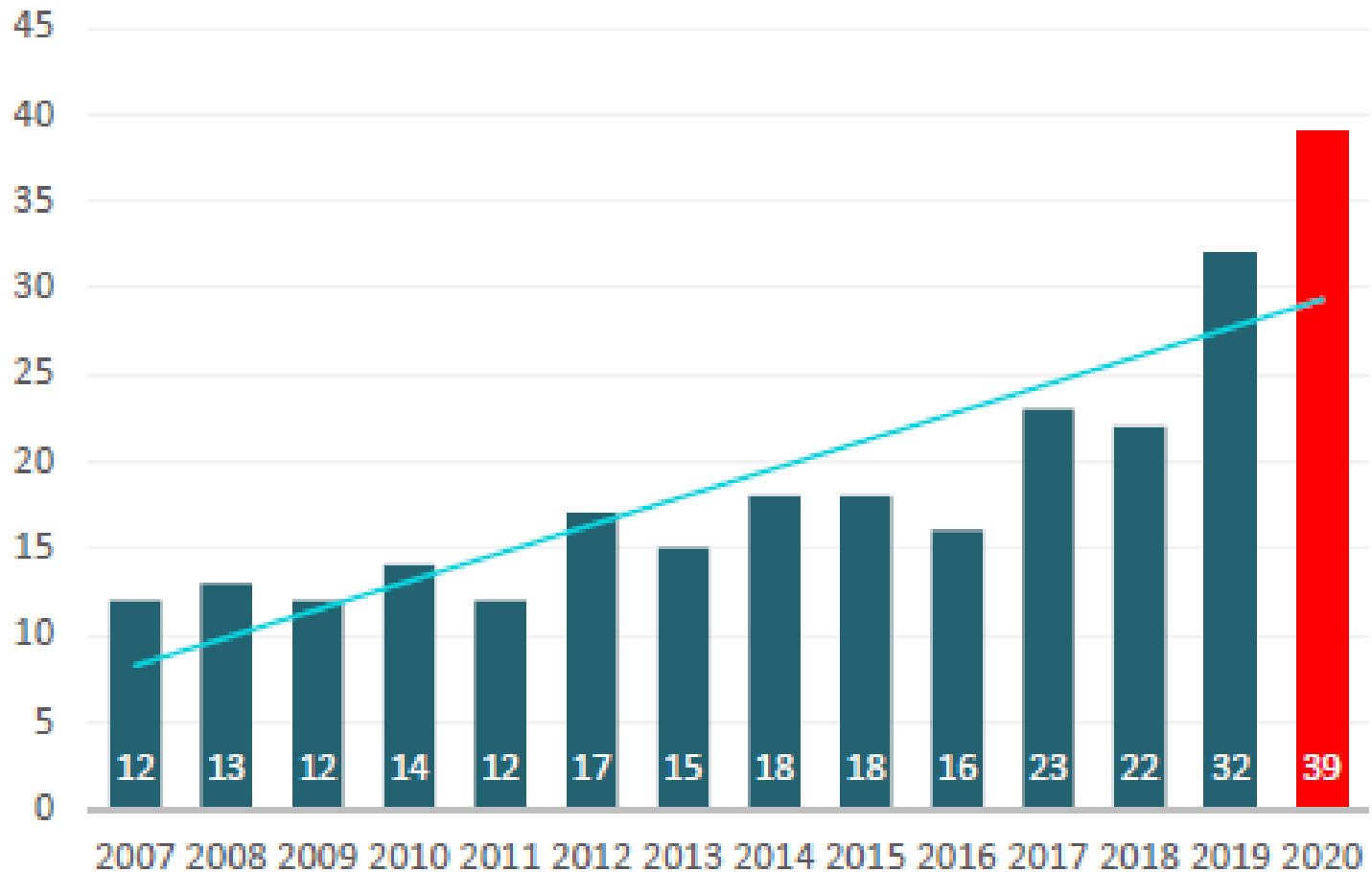
A Tough Place for Traditional Transit

- Infrastructure Not Designed for Transit Users

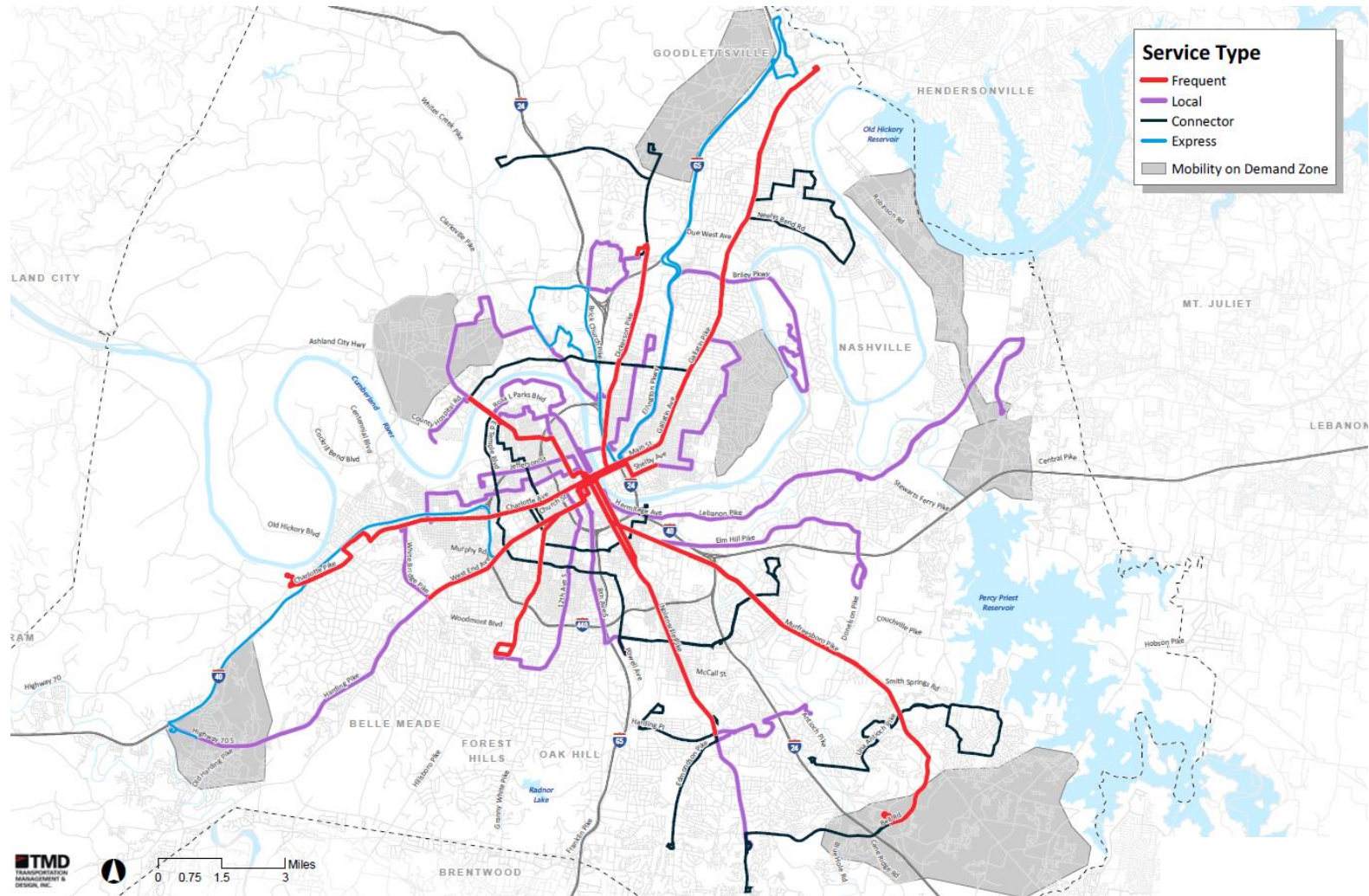


...or Pedestrians

Pedestrians Killed in Nashville



But Some Opportunities



Mobility on Demand: Setting 1

Access on Demand

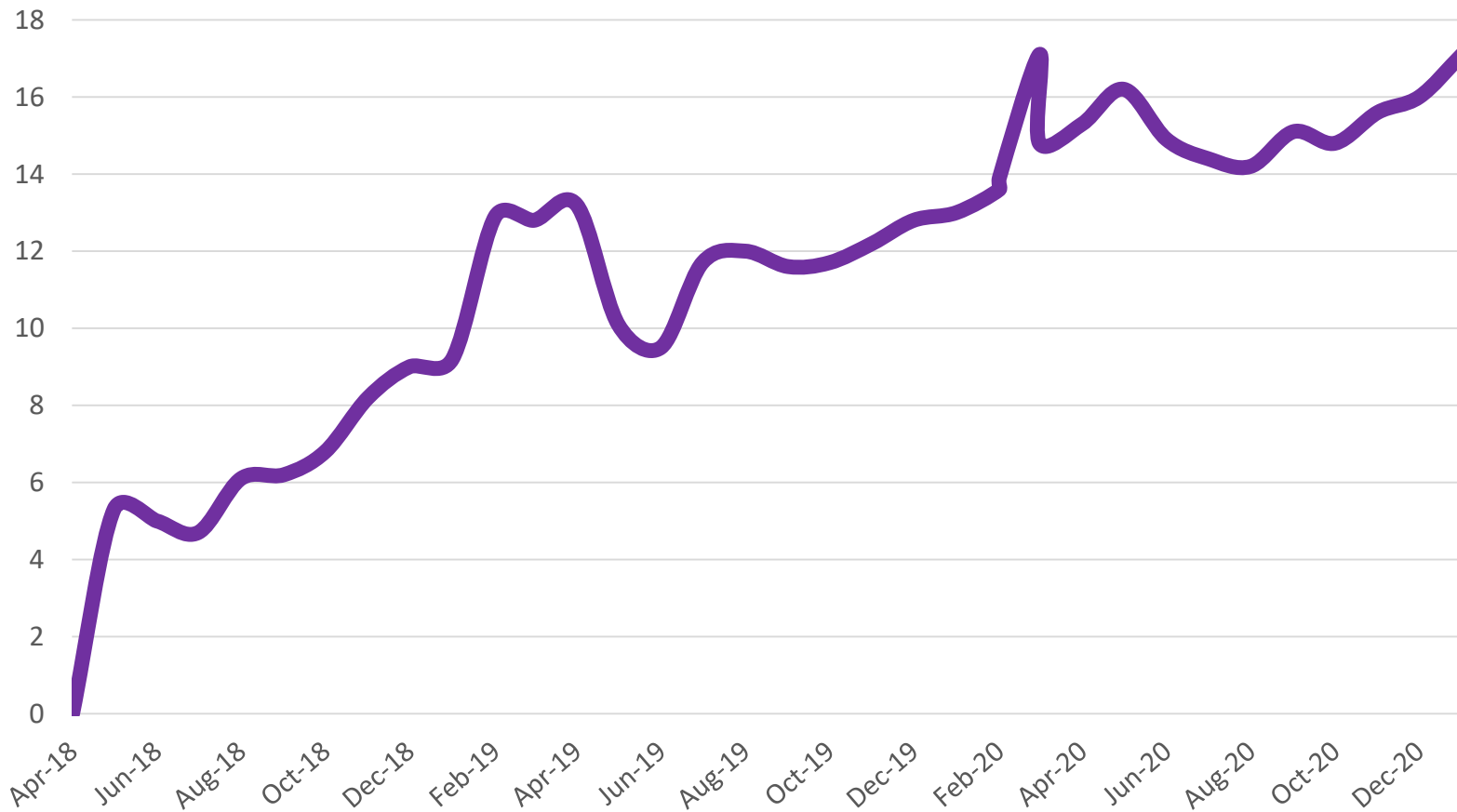


Access on Demand Parameters

- Premium Service Exceeding ADA Requirements
 - 2 Hour v. 24 Hour Advance Reservation
 - Higher Fare (\$7 + Zone Charges v. \$3.70)
- TNC Contractors, But Not The Uber/Lyft Model
 - Drivers Employed, Certified and Trained by TNC
 - 3 Contractors – User Choice Model
 - Wheelchair Accessible Vehicle Availability

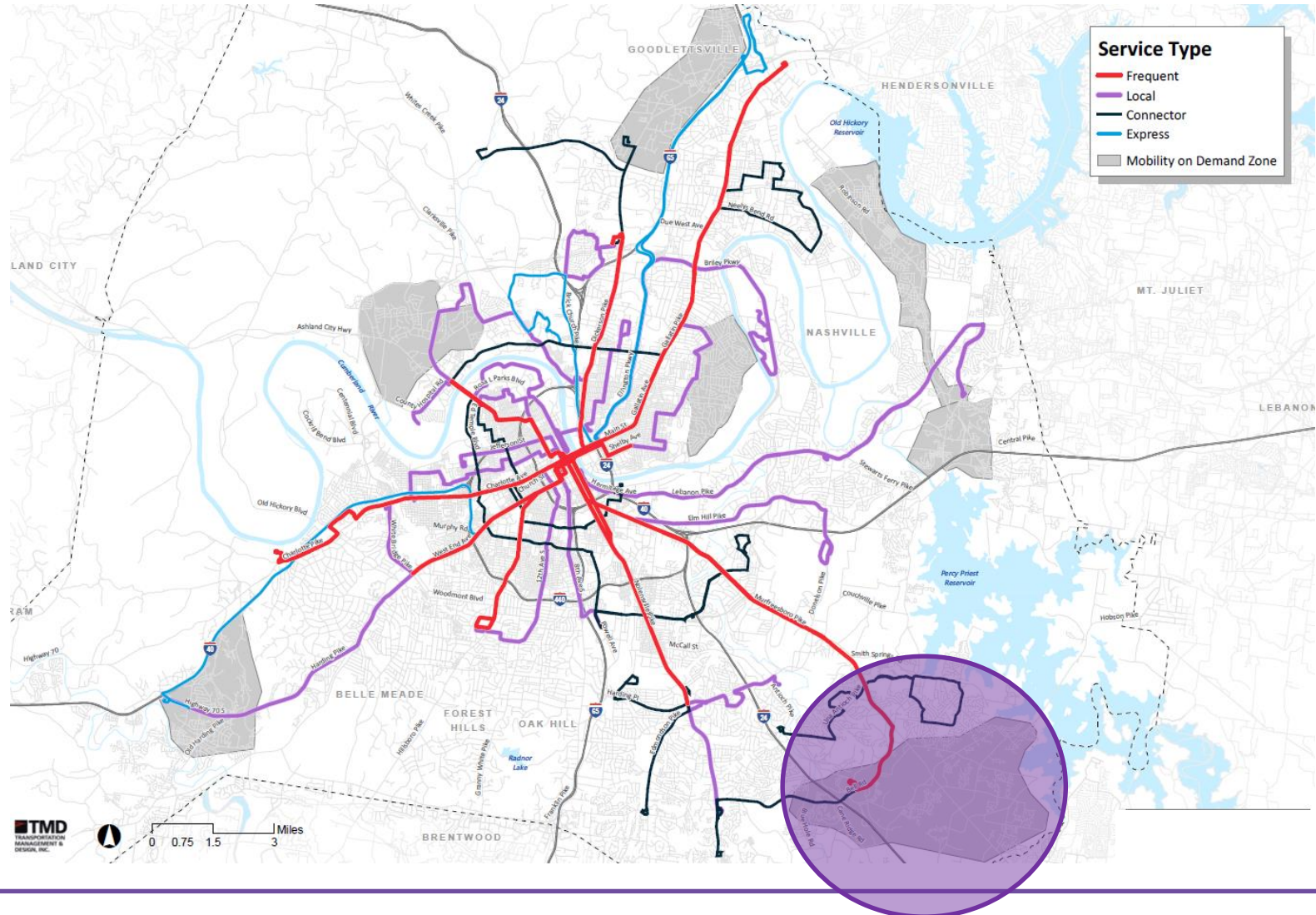
Access on Demand Market Growth

Access on Demand Ridership as a Percentage of Total Paratransit Ridership



Mobility on Demand: Setting 2

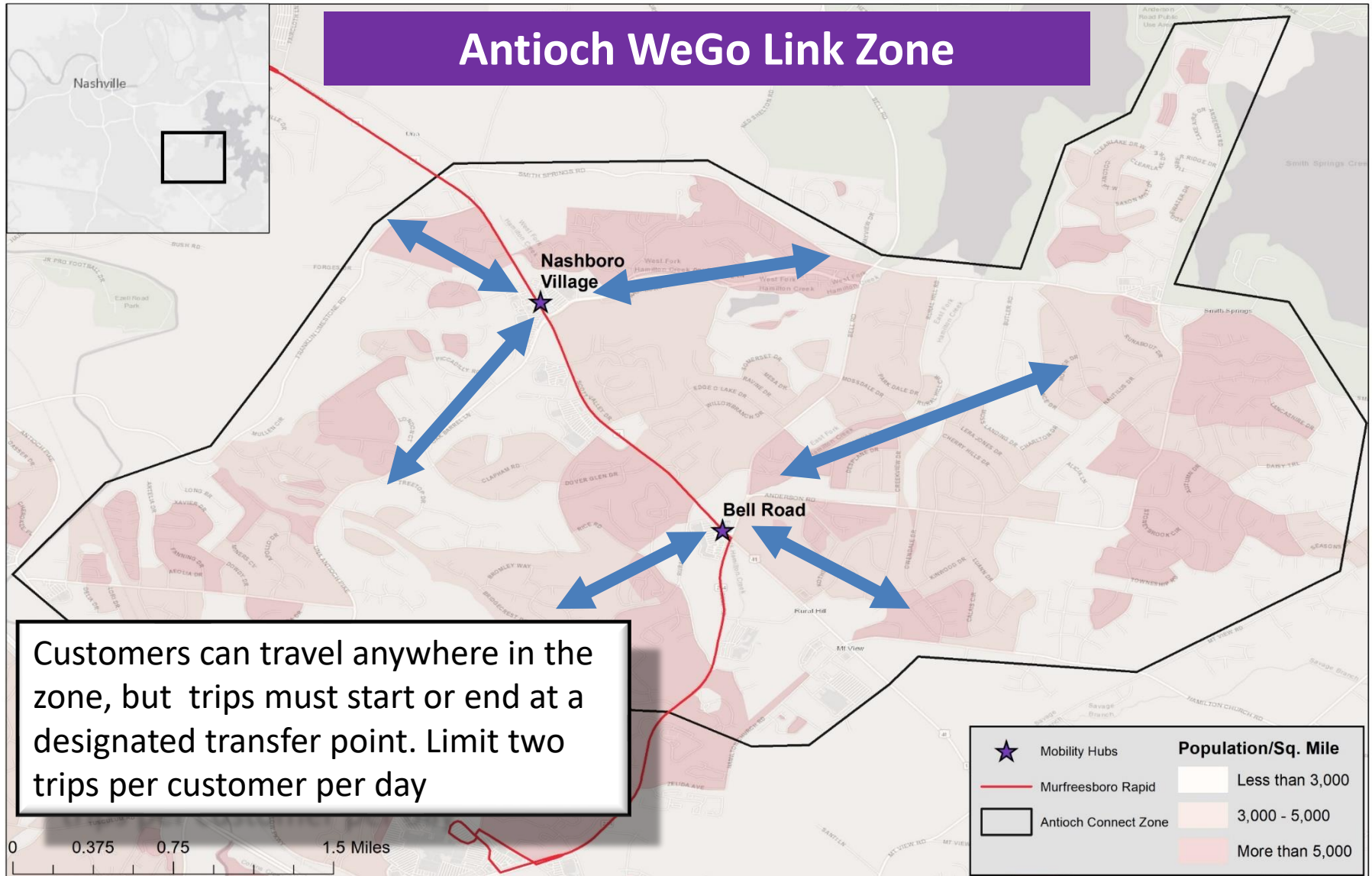
WeGo Link



MOD Zone Evaluation Process

- Evaluated on Weighted Criteria, Including:
 - Minority and low-income population density
 - Zero and one vehicle households
 - Employment density and ridership generators
 - Access paratransit trip volumes
 - Proximity to frequent bus routes with ADA-accessible stops and shelters
- 5-8 Square Mile Zones
- Antioch Identified as Most Promising Area Without Significant Existing All-Day Bus Service

Service Concept: 1st/Last Mile Feeder



Transfer Location Criteria

- Covered Shelter
- Inbound/Outbound Pairs
- ADA Compliant Stop
- Real-Time Digital Transit Information
- Safe Off-Street Drop Off/Pick Up Area for TNC Vehicles



Fare Structure

- \$2.00 Base Fare with \$8.00 subsidy cap*
 - **Example 1: Total trip cost = \$7.00**
 - » Customer pays initial \$2.00 (base fare)
 - » WeGo pays \$5.00 (remaining trip cost)
 - **Example 2: Total trip cost = \$12.00**
 - » Customer pays \$4.00 (base fare plus overage beyond \$10.00 total trip cost.)
 - » WeGo pays \$8.00 (maximum agency contribution)
- Based on Existing Provider, the Vast Majority of Trips Would only Cost the Customer \$2.00
- Limited to 2 Trips Per Day

**More for wheelchair-accessible trips*

Customer Experience

- Customer chooses between Uber (via app) or one of our 3rd party Access-on-Demand service providers (via phone)
- Customer provides location and preferred bus stop transfer point
- Trip subsidy and customer fare is automatically calculated and applied during booking
- Customer can track vehicle ETA within the Uber app or by calling the Access service provider
- Customer billed for their portion of Uber trip through Uber account, WeGo billed for subsidy portion

Implementation Issues

- **Contracting Issues**
 - Indemnification and Insurance
 - Data Sharing/User Information
- **User Equity Issues**
 - ADA Accessibility
 - Smart Phone Availability
 - Access to Credit Cards
 - Language Barriers
- **Social Justice Issues**
 - Employment Status of Rideshare Drivers
- **Labor Relations Issues**
- **Regulatory Issues**
 - FTA Reporting Eligibility
- **Market Adoption**
- **Long-Term Systems Integration Issues**
 - Fare Collection
 - Itinerary Planning Apps
 - User Seamlessness

Thank You!

PENNDOT TSMO PERFORMANCE PROGRAM

Ryan McNary
Manager, Traffic Systems and Performance

TSMO PERFORMANCE PROGRAM

Program Overview

EDC-4 – Incident Timeline

- Crowd-Sourced Data Validation
 - Result: Traffic Alerts App For TMCs

Crashes in Congestion

- Congestion Pie Chart
 - Result: Virtual HAR

Traffic Volume

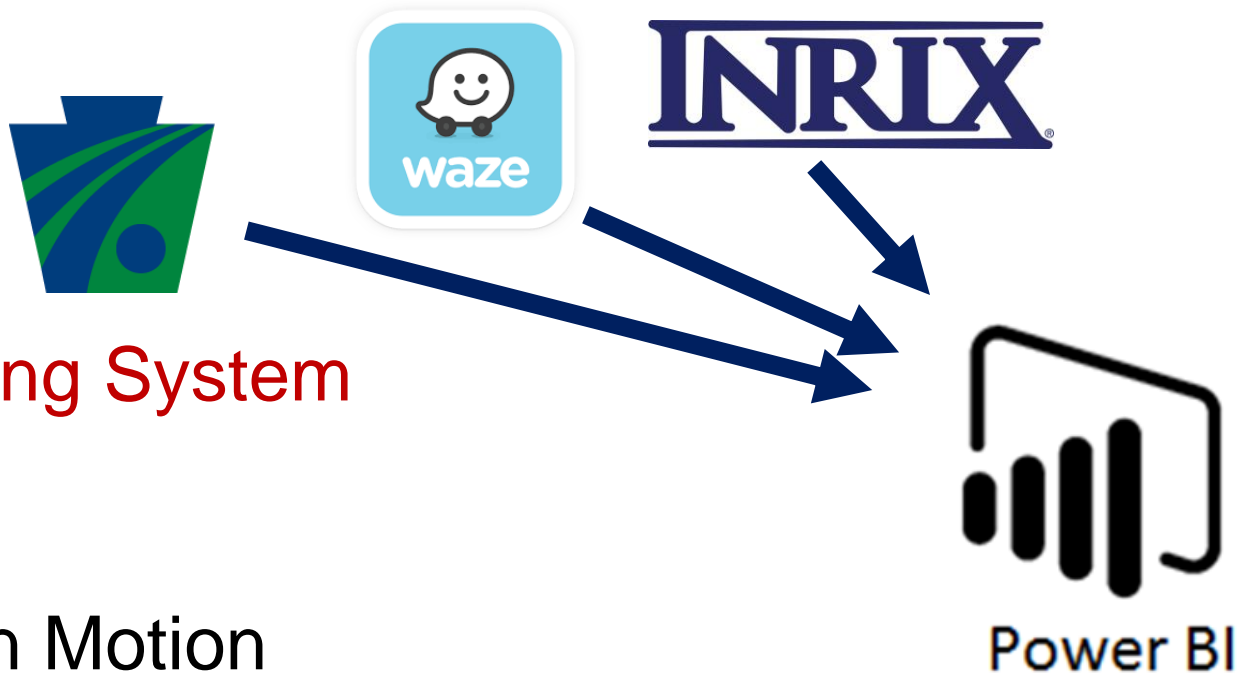
- COVID-19
- Fuel Tax Revenue
 - Result: Traffic Volume Dashboard

Work in Progress



TSMO ANALYTICS DATA

- **Crash Records**
- **Road Condition Reporting System**
- Maintenance Database
- Weather Stations
- Traffic Counter/Weigh in Motion
- ATMS DMS Message History
- ITS Device Locations

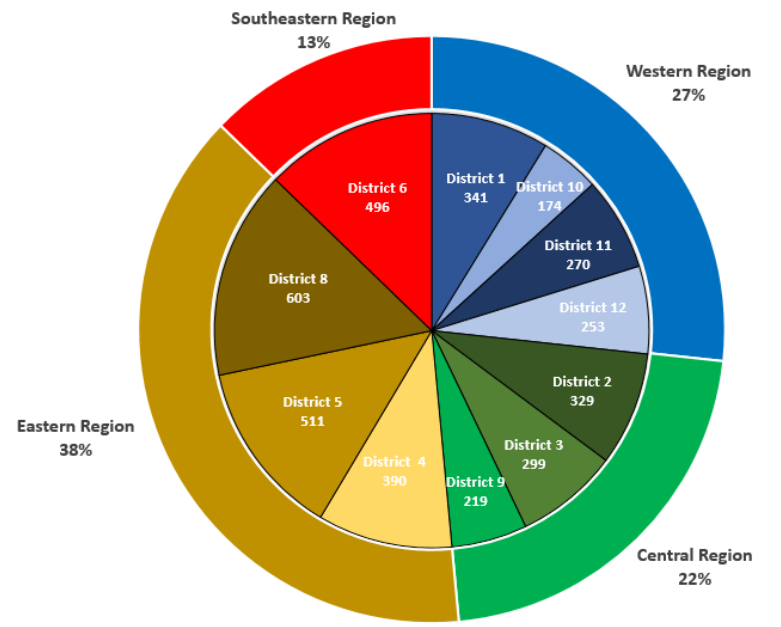
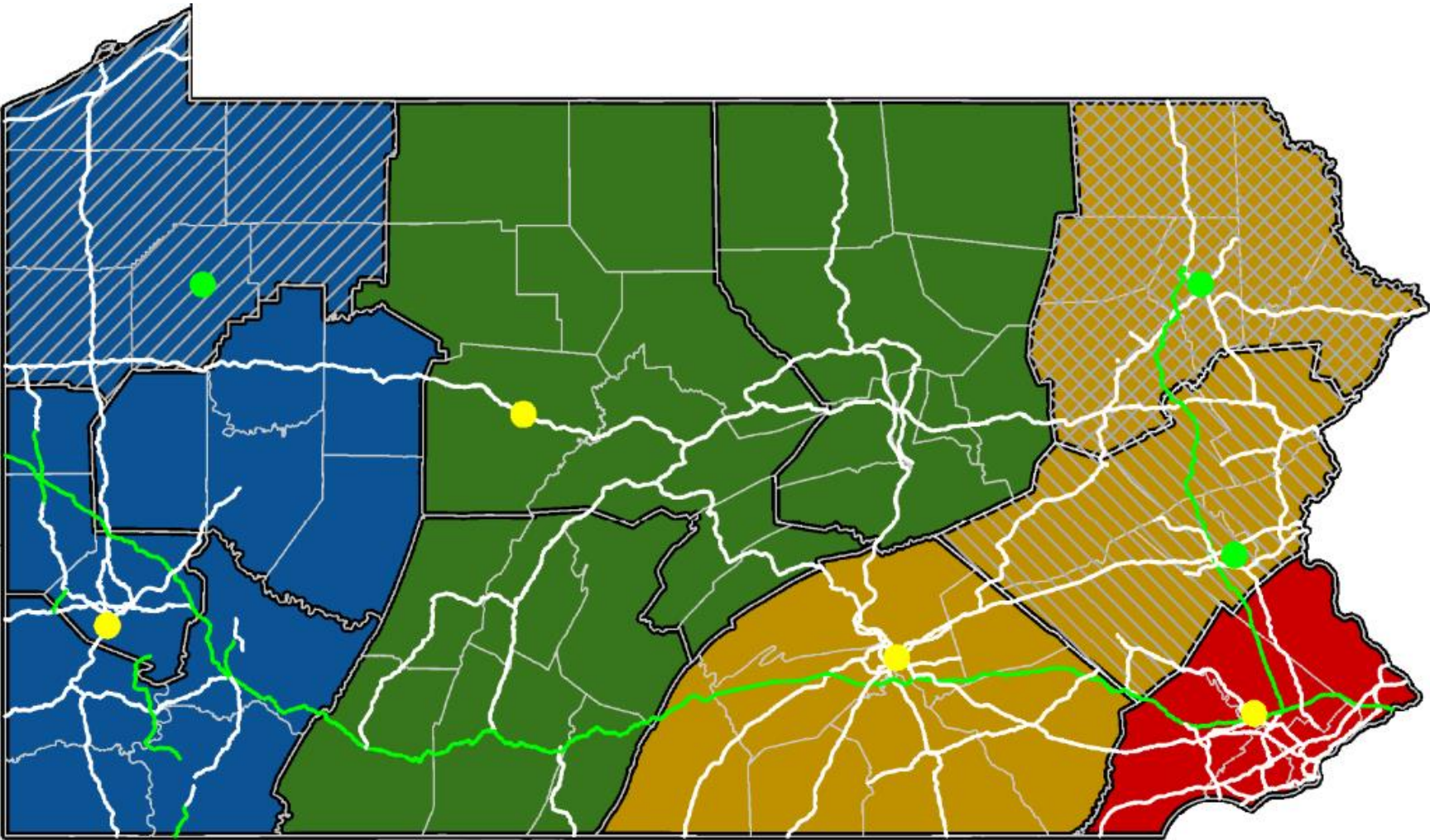


Performance Reports Located at:

<https://www.penndot.gov/ProjectAndPrograms/operations> or Google "PennDOT TSMO"



ANALYSIS ON PENNSYLVANIA "CORE NETWORK"



- District Offices
- PennDOT Core Road Network
- District 1 (24/7 November 1st to April 1st)
- Eastern Region
- District Offices
- District 5 (M-F 05:45 to 20:00)
- Western Region
- Central Region
- Pennsylvania Turnpike Network
- District 4 (M-F 06:00 to 18:00)
- Southeastern Region

EDC-4 - INCIDENT TIMELINE



INCIDENT TIMELINE

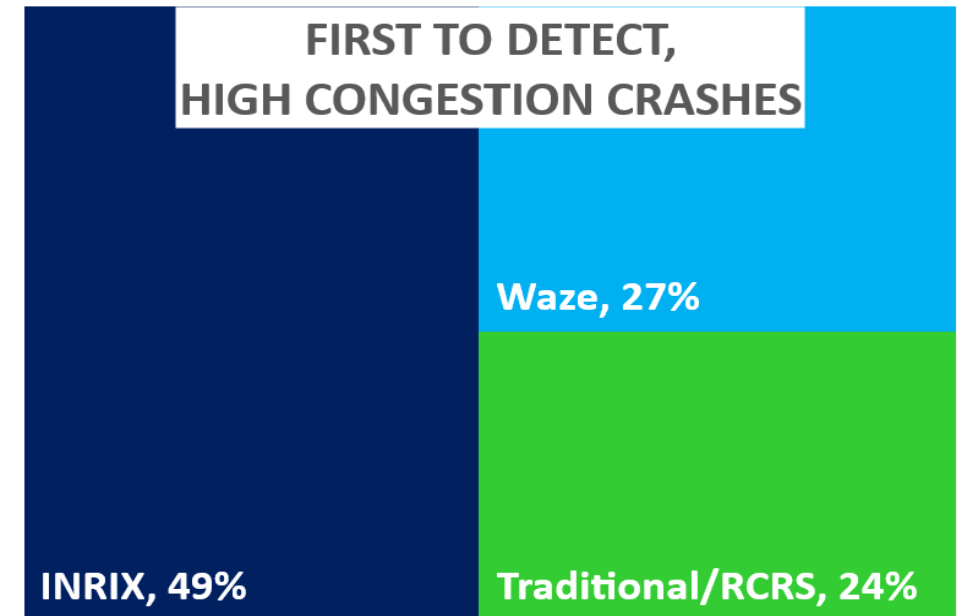
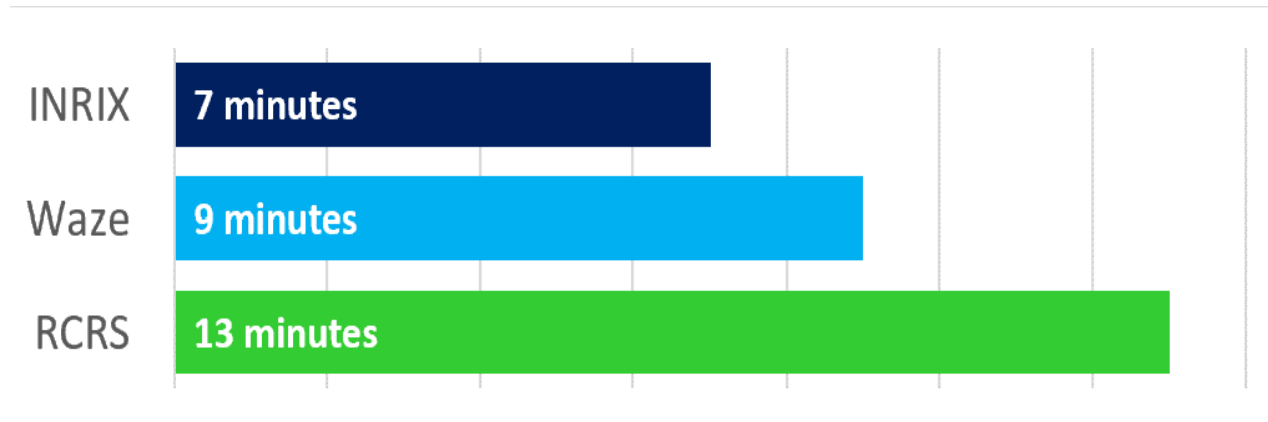
	2017 Incident Clearance Time (min)	2017 Incident Count	2018 Incident Clearance Time (min)	2018 Incident Count	Change
I-90	171	30	124	41	-47
ERIE	171	30	124	41	-47
I-376	62	994	61	977	-1
ALLEGHENY*	62	983	60	964	-2
BEAVER*	68	3	117	7	49
LAWRENCE*	147	6	313	4	166
MERCER	51	2	148	2	97
I-79	122	329	86	350	-36
ALLEGHENY*	85	241	81	263	-4
BUTLER*	511	21	115	14	-396
CRAWFORD	292	6	156	2	-136
ERIE	142	2	66	10	-76
GREENE*	195	6	94	23	-101
MERCER	114	6	81	6	-33
WASHINGTON*	106	47	109	32	3
I-279	66	211	78	248	12
ALLEGHENY*	66	211	78	248	12
I-579	53	25	52	29	-1
ALLEGHENY*	53	25	52	29	-1
I-99	120	76	90	100	-30
BEDFORD	N/A	0	61	1	N/A
BLAIR	96	21	117	39	21
CENTRE	136	55	73	60	-63

New Milestone: **“Incident Influence Time”** is measured from time the incident occurs until traffic returned to historically normal speeds



CROWD-SOURCED INCIDENTS

- INRIX/Waze combined detect **86.7%** of reportable crashes



CROWD-SOURCED INCIDENT APP

Filter & Legend

Search:

Source	District	Road	Direction	AlertType	Severity	Congestion	Reported Time	Status
Waze/Inrix	D04	I-80	Westbound	Congestion(Inrix)	2-Moderate	2.84 miles	6:07 PM (a minute ago)	active (v.40)
RCRS/Inrix	D05	US-22	Eastbound	Incidents(Inrix)	2-Moderate	1.59 miles	6:04 PM (4 mins ago)	active (v.2)
Waze/RCRS/Inrix	D06	I-76	Eastbound	Congestion(Inrix)	2-Moderate	2.20 miles	6:01 PM (7 mins ago)	active (v.34)
Waze/Inrix	D06	I-95	Southbound	Congestion(Inrix)	2-Moderate	2.56 miles	5:57 PM (11 mins ago)	cleared (v.34)
Waze	D08	US-30	N/A	Minor Accident	1-Low	N/A	5:56 PM (11 mins ago)	active (v.1)
Waze/Inrix	D04	I-81	Northbound	Incidents(Inrix)	3-High	0.00 miles	5:53 PM (15 mins ago)	active (v.11)
Waze/Inrix	D06	I-476	None	Incidents(Inrix)	3-High	0.38 miles	5:51 PM (17 mins ago)	active (v.15)
Waze/Inrix	D04	I-80	Westbound	Incidents(Inrix)	3-High	1.49 miles	5:51 PM (17 mins ago)	active (v.9)
Waze/RCRS/Inrix	D05	US-22	Eastbound	Congestion(Inrix)	2-Moderate	2.41 miles	5:51 PM (17 mins ago)	active (v.4)
Waze/Inrix	D05	US-22	Westbound	Congestion(Inrix)	2-Moderate	1.31 miles	5:43 PM (25 mins ago)	cleared (v.6)
Inrix	D08	US-30	None	Incidents(Inrix)	2-Moderate	0.00 miles	5:38 PM (30 mins ago)	active (v.1)
Waze/Inrix	D04	I-80	Westbound	Congestion(Inrix)	2-Moderate	2.07 miles	4:20 PM (an hour ago)	active (v.34)
Waze/Inrix	D04	I-80	Westbound	Congestion(Inrix)	3-High	3.90 miles	3:36 PM (2 hour ago)	active (v.15)
Inrix	D05	US-222	Northbound	Incidents(Inrix)	3-High	2.03 miles	3:27 PM (2 hour ago)	active (v.1)

Inrix Incident Details

[Incident Timeline](#)

Inrix v40: Delays of three minutes and delays easing on I-80 Westbound in Hetlerville. Average speed 25 mph.

Waze v4: Accident Minor, Hazard On Shoulder Car Stopped reported on this Congestion(Inrix).

InrixID: 130292031

Status: **active**

Severity: **2-Moderate**

Impacting: Yes

Road: I-80

Type: Congestion

Direction: Westbound

Location: between I-80 and I-80

Reported Time: Starts at 6/11/2020 3:34 PM, ends at 6/11/2020 6:45 PM.

Delay Impact

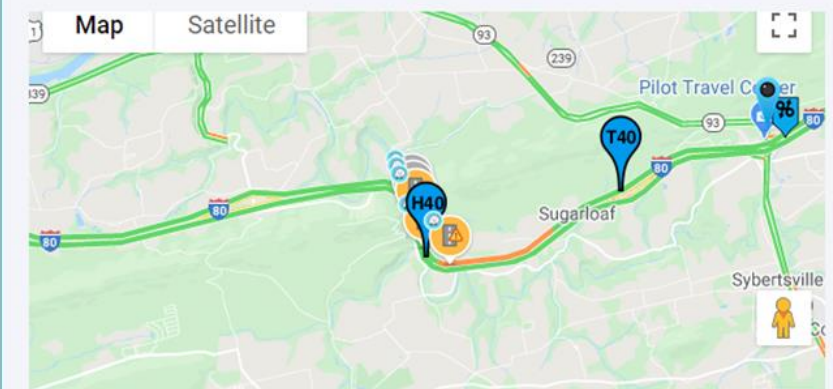
Delay Minutes: 3.00 mins

Abnormal: No

Congestion Length: 2.84 miles

DMS SignBoard

- DMS-04-044 located on Located on right side of roadway..4.8 miles before Rt. 93 Exit 256, and 8.7 miles before I-81/I-80 Interchange..Old #23 is junk and will cut up in 2019



“REAL-TIME” INCIDENT TIMELINE

TRAFFIC ALERTS

pennsylvania
DEPARTMENT OF TRANSPORTATION

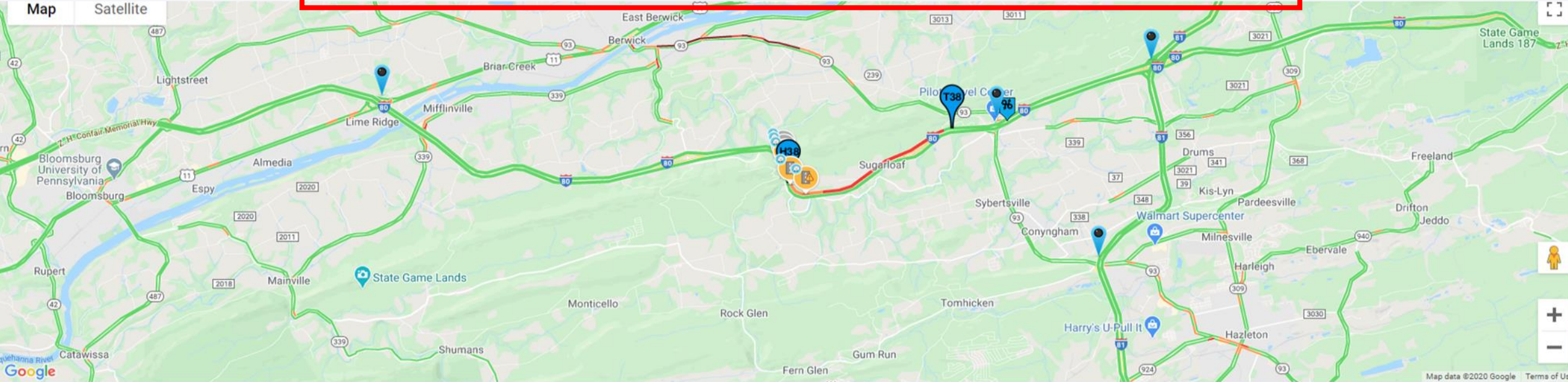
Versions: 1

38

40

Legend

Map Satellite



D04 active (V38) : Congestion upto 4.07 miles on I-80 with severity 2-Moderate.

Updated time: Jun 11, 2020 6:01:05 PM (6 mins ago)

Inrix: Delays of six minutes and delays easing on I-80 Westbound in Hetterville. Average speed 25 mph.

Waze: Hazard On Shoulder Car Stopped, Accident Minor reported on this Congestion.

RCRS: Open(V8) reported on this .

InrixID: 130292031

Status: active

Severity: 2-Moderate

Impacting: Yes

Road: I-80

Type: Congestion

Direction: Westbound

Reported Time: Starts at 6/11/2020 3:34 PM, ends at 6/11/2020 6:40 PM.

Location: between I-80 and I-80

Delay Impact:

Delay Minutes: 5.00 mins

Congestion Length: 4.07 miles

Abnormal: No

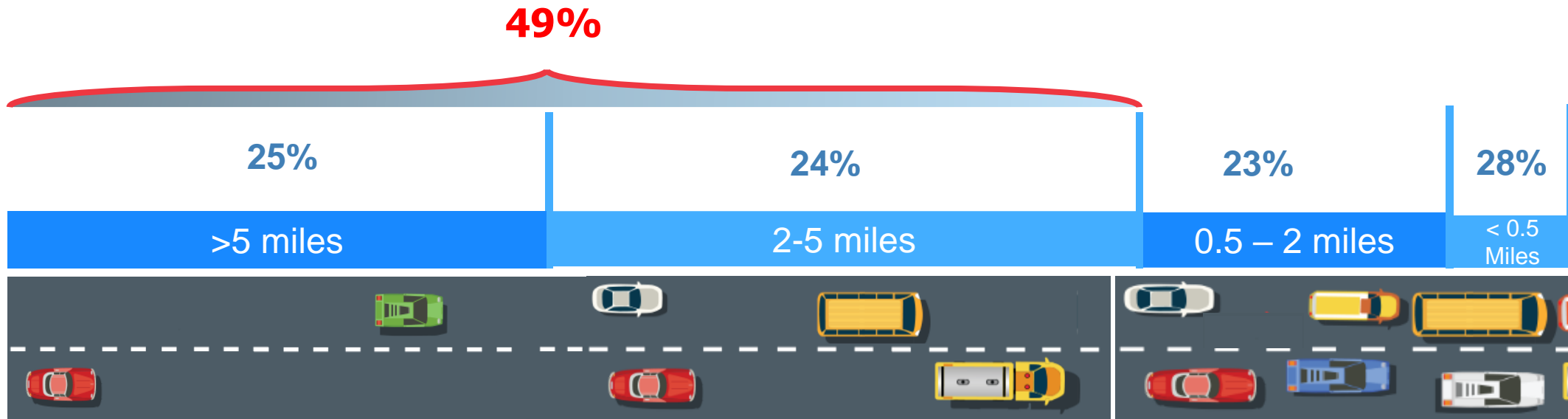


CRASHES IN CONGESTION



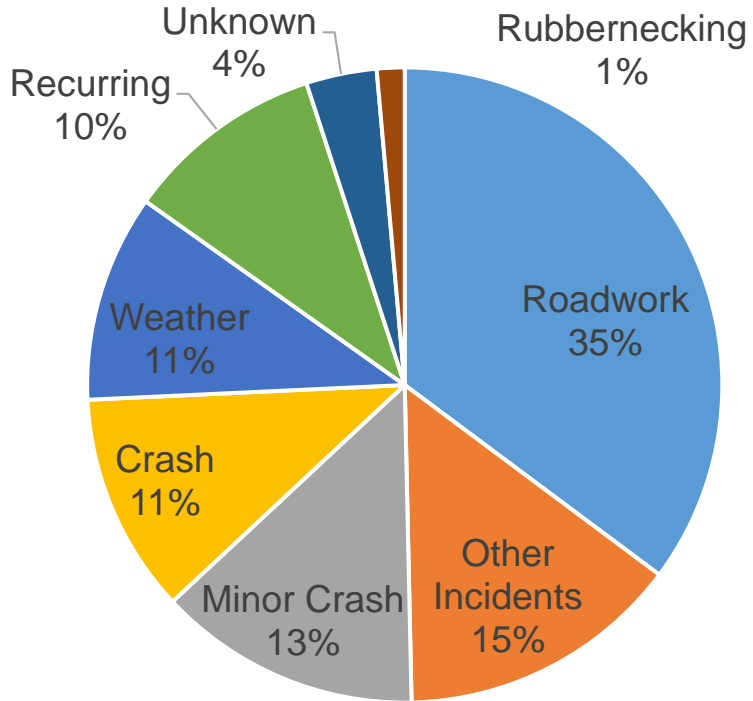
SECONDARY CRASHES

- **1,122 Secondary Crashes** in 2019
 - 6 fatalities
 - 712 injuries
- **81% > 15 minutes** after primary crash
- **46% > 1 hour** after primary crash

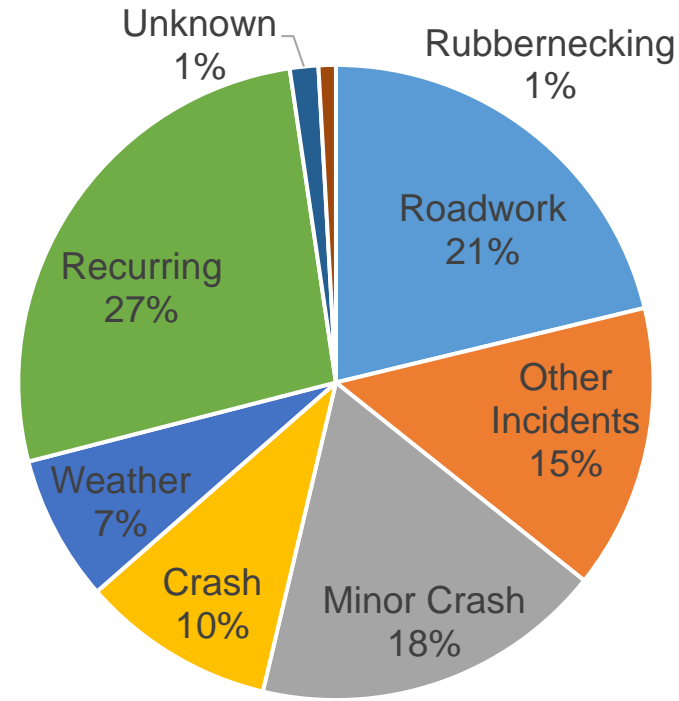


2019 CONGESTION PIE CHART

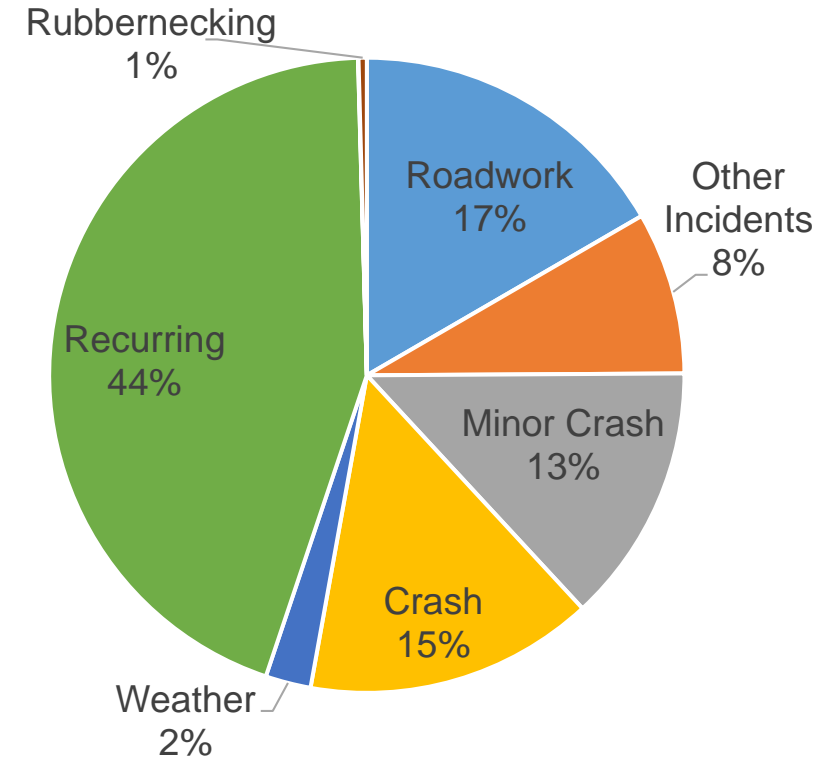
Pennsylvania



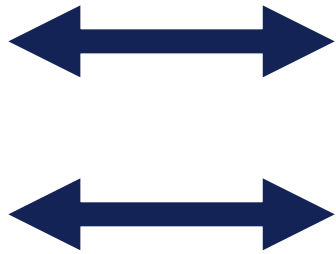
Philadelphia Metro



I-95 in Philadelphia



VIRTUAL HIGHWAY ADVISORY RADIO



ATMS

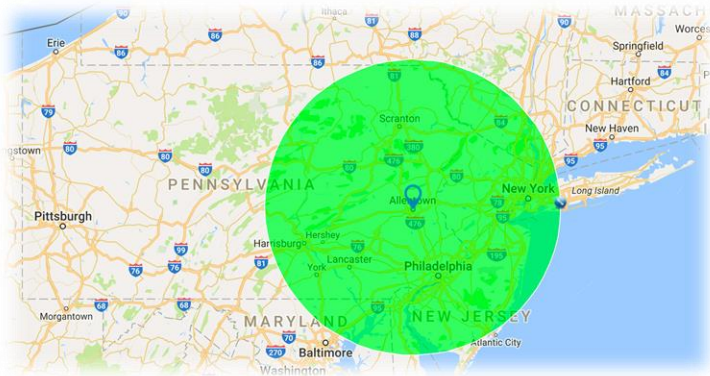


511PA Website with voice

IVR – **Priority Floodgate**

Geofenced **DriveMode**
Voice Alert

Geofenced **Push**
Notifications with voice

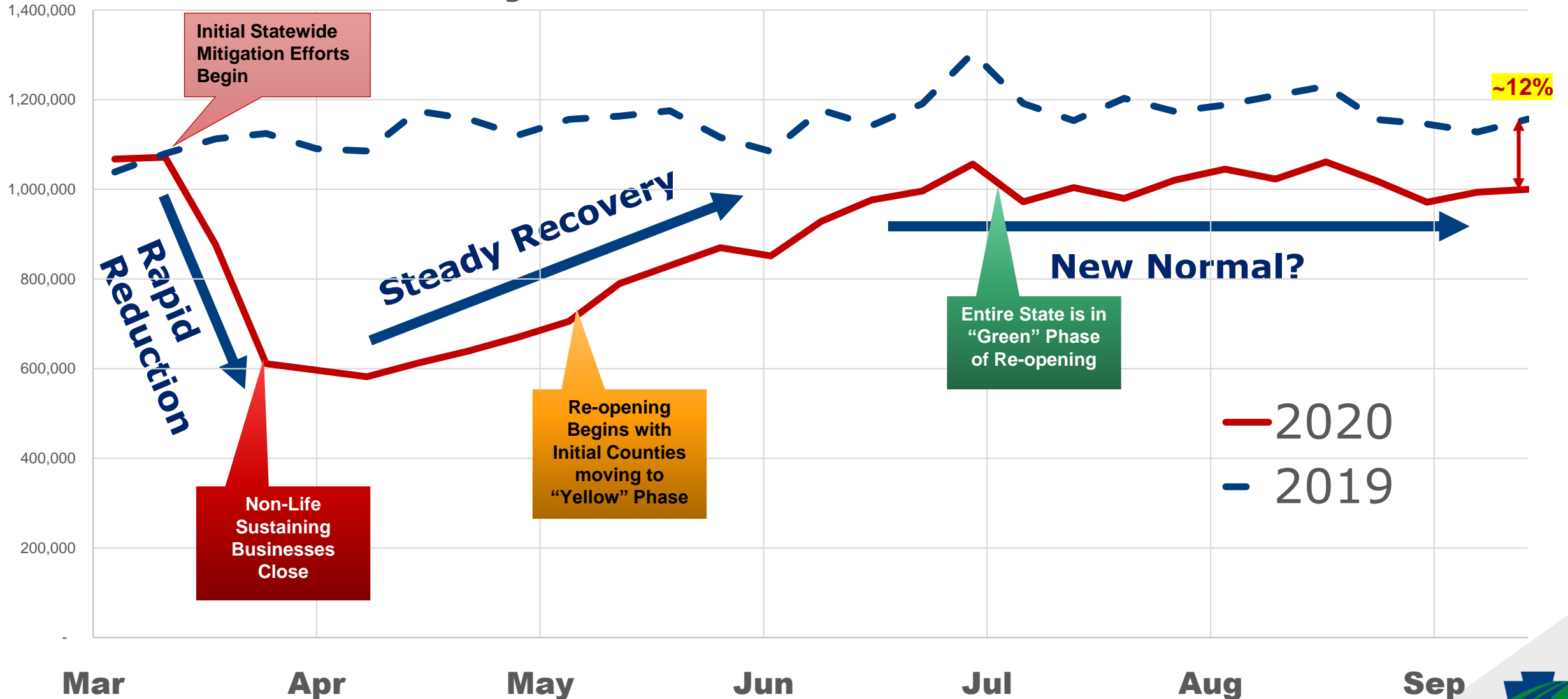


TRAFFIC VOLUME

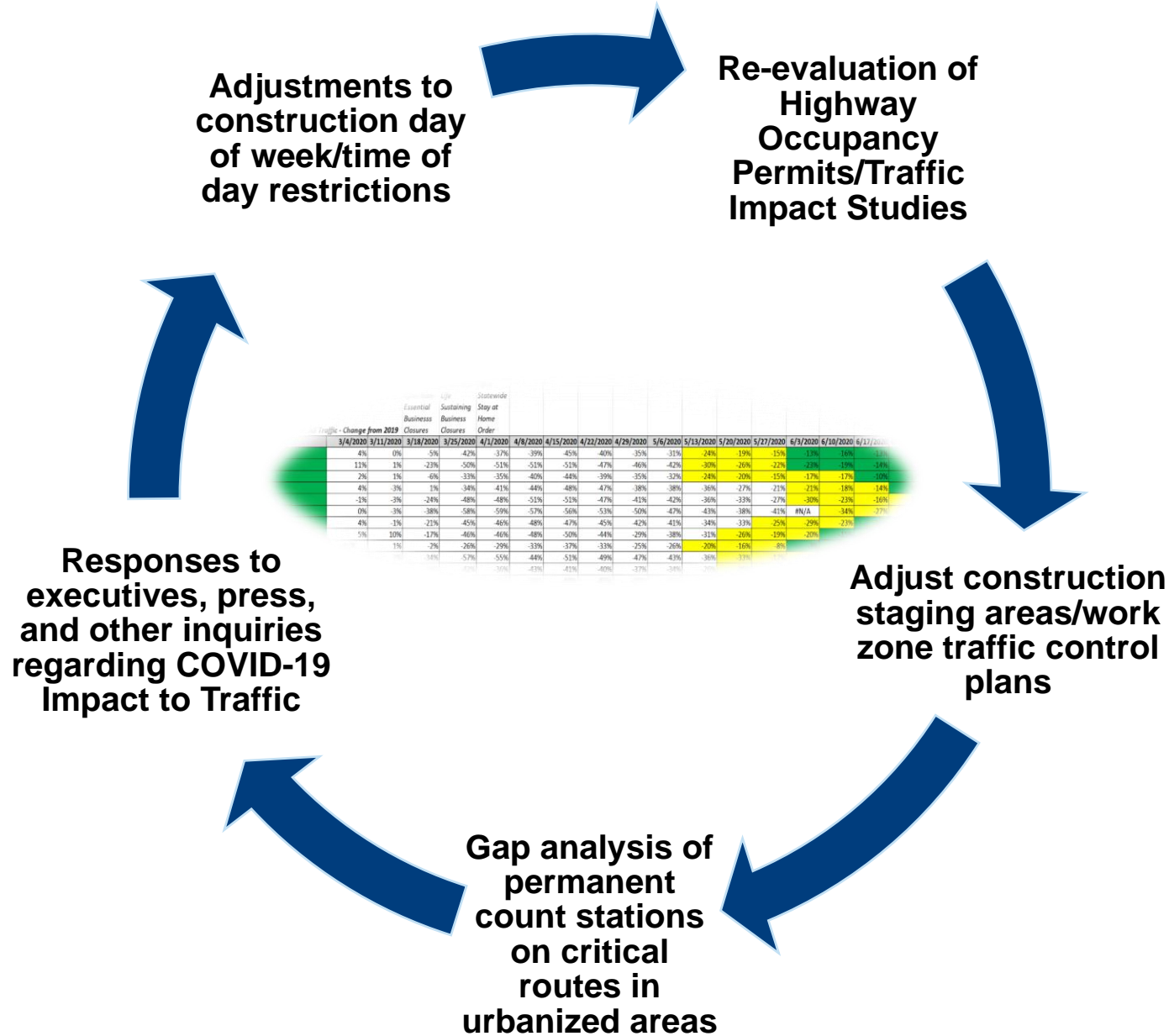


LEARNING FROM COVID-19

Pennsylvania Core Network Volumes



Twice a Week Traffic Report



ADAPTING TO COVID-19 - FUNDING

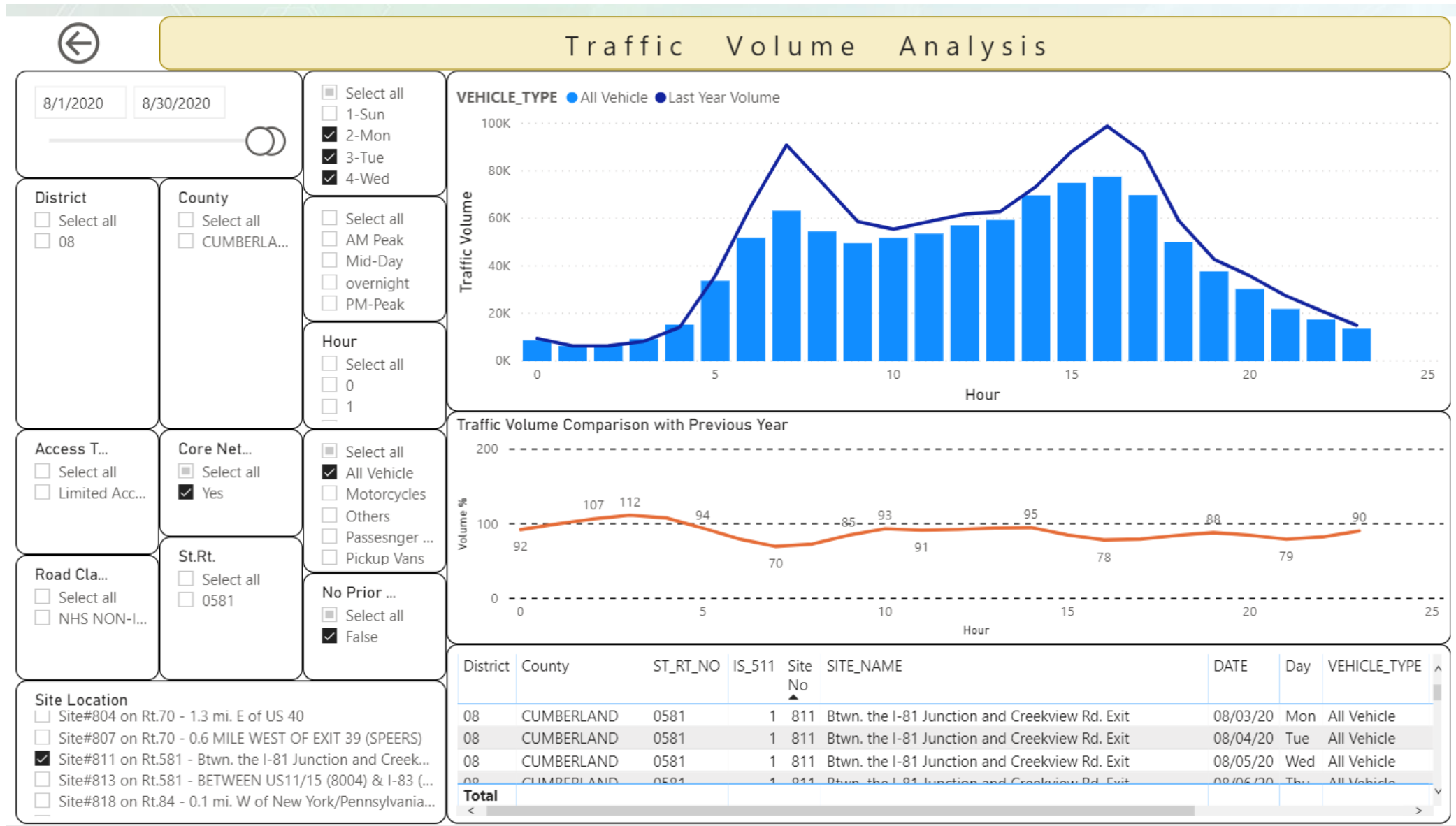
Gas and Diesel Monthly Projection =

$$\begin{matrix} \text{Gallons} & \times & & \times & & + & & \times & & \times \\ \text{Of Gas} & & \text{\$0.576} & & \% \text{ VMT} & & \text{Gallons} & & \text{\$0.741} & & \% \text{ VMT} \\ & & & & \text{Estimate} & & \text{Of Diesel} & & & & \text{Estimate} \end{matrix}$$

- **97.5%** Fuel Tax Revenue is from Gas and Diesel Sales
- Monthly Shortfall Report for Executive Planning
- Refining sources and model for better predictions



Traffic Volume Dashboard



A WORK IN PROGRESS...

- Weather Analysis to Automate Protection Messaging for Adverse Driving Conditions (whiteouts) – **Safety/TMC Operations/TIM**

Hazardous Winter Conditions Highway Safety Performance		
Condition	Greater Likelihood of Crash (Times More)	
	Commercial Vehicle	Non-Commercial Vehicle
Low Visibility ¹	2.2 x	3.2 x
High Wind ²	7.4 x	2.6 x
Freezing Surfaces ³	2.4 x	1.7 x
Freezing Rain ⁴	1.9 x	1.7 x
Slippery Surfaces ⁵	1.8 x	1.2 x

Notes:

¹ Low Visibility is based on a deficient RWIS visibility rating (<5)

² High Wind is defined as wind speeds 25 MPH or greater.

³ Freezing Surfaces include non-dry road surfaces with a surface temperature under 33°.

⁴ Freezing Rain includes non-snow precipitation with an air temperature under 33°.

⁵ Slippery Surfaces include a deficient RWIS grip level (<65) with an air temperature under 40° and some precipitation in the past three hours.



THANK YOU

Ryan McNary
Manager, Traffic Systems and Performance



CONNECTING

Mobility and Operations

Tracy Larkin Thomason, PE, PTOE
ITSA

Nevada Projects
February 12, 2021

Mobility On Demand



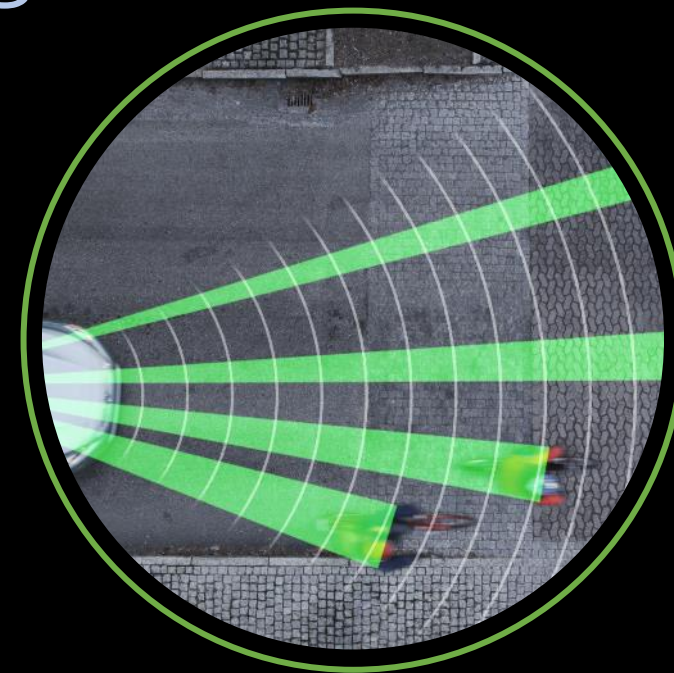
An aerial photograph of a city grid, showing streets and buildings, with a white hexagonal frame overlaid in the center. The text "CONNECTIVITY And SAFETY" is written in white, sans-serif font within the frame. The word "CONNECTIVITY" is in all caps, "And" is in title case, and "SAFETY" is in all caps.

CONNECTIVITY
And SAFETY



Pedestrian Safety Pilot Program

- Innovative technology reducing pedestrian injuries/fatalities
- First pedestrian pilot using LiDAR
- Future phases – Advance alerts

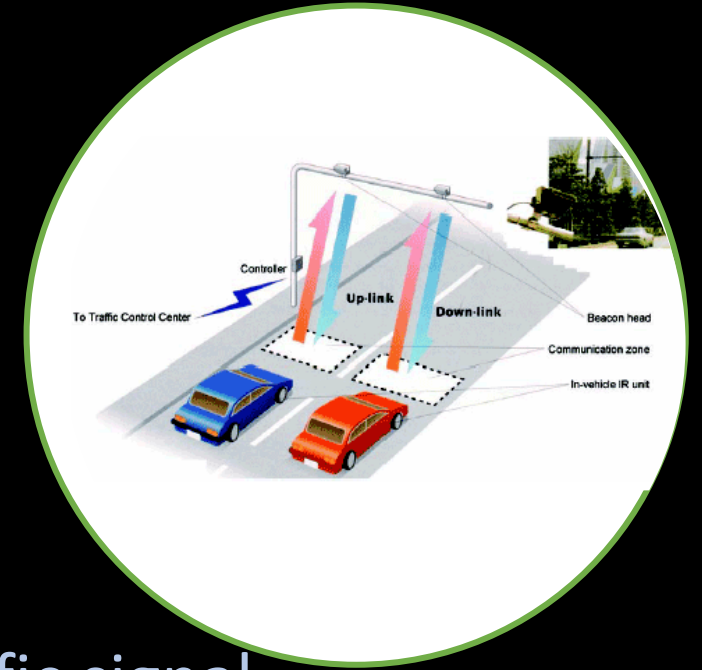


**Clark Avenue between
Casino Center
Boulevard and 3rd
Street in the
Las Vegas Innovation
District**



City of Henderson Technology Initiatives

- GPS-based pre-emption using GTT Opticom
- Thermal Traffic Signal Detection— thermal image traffic signal detection of vehicles, bicycles, and pedestrians
- Traffic Performance Monitoring— Wi-Fi reader that provided travel time, delay, speed, and origin-destination data





waycare

LOCAL GOVERNMENT AND REGIONAL COLLABORATION



Cloud architecture allows multiple agencies and drivers on the road to connect



Traffic Control



Freeway
Service Patrol



Law
Enforcement



Emergency
Services



Digital Message
Signage



Navigation
Providers



Social Media



In-vehicle
applications



External data sources





Nexar



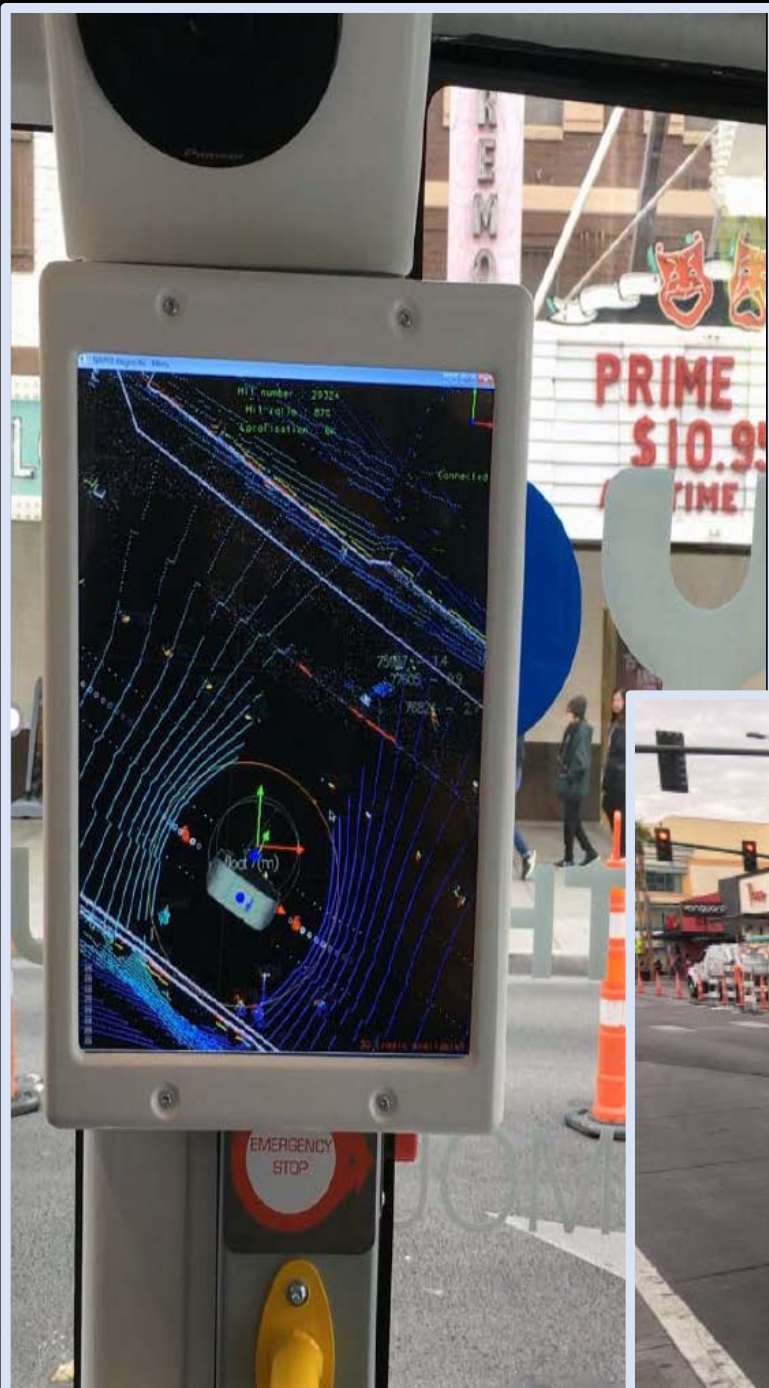
AVAILABILITY





Downtown Shuttle

Inaugural Pilot
November 2017





**Downtown LOOP
Service Route and
Pick-up/Drop-Off Locations**

What's Next?



-MOTIONAL-





PARATRANSIT RIDE ON-DEMAND PILOT





MaaS-A



lyft



Questions?



Tracy Larkin Thomason, PE, PTOE
tlarkinthomason@itsa.org



Mobility on Demand Survey – Update

Adam Cohen
Senior Research Manager
Transportation Sustainability Research Center
UC Berkeley
February 12, 2021



Berkeley
UNIVERSITY OF CALIFORNIA



Transportation Sustainability RESEARCH CENTER
UNIVERSITY OF CALIFORNIA BERKELEY

MOD Survey | General Description

Survey Participation

- The survey was distributed in December 2020 and data collection is ongoing
- Participants represent a variety of stakeholders in the transportation industry, geographies, and built environments

Things to Note

- **Data collection is ongoing and findings are subject to change**
- Survey responses were aggregated
- Respondents could skip questions so key findings may not represent the nuance of every participant's feedback
- For many of the questions respondents could select multiple responses, so the number of responses may not match the total number of survey takers
- The percentages of responses may not total 100% due to rounding

Participant Information | Sector and Role

Organization Sector

Sector	Percentage of Responses N=119
Academic/research institution	9.2%
Consulting firm	18.5%
Mobility service provider	9.2%
Non-government organization, non-profit organization	5.9%
Public transit agency	6.7%
Local public agency	5%
Regional public agency	2.5%
State public agency	3.4%
State transportation agency	35.3%
Federal public agency	1.7%
Technology and data vendors	2.5%

Organizational Role

Role	Percentage of Responses N=100
Agency Staff	2%
C-Suite	11%
Department Director	13%
Elected Official	1%
Engineer	20%
Planner	6%
Practitioner	3%
Program Manager	20%
Researcher	16%
Technology/Developer	1%
Other	7%

Participant Information | Operational Area

Geographic Location and Built Environment Type

Location	Urban n=142	Suburban n=130	Edge City n=137	Exurban n=101	Rural n=77	Total N=587
Entire U.S.	22.5%	20%	19%	11.9%	15.6%	18.4%
Continental U.S.	9.2%	10%	9.5%	8.9%	5.2%	8.9%
Northeast/New England	6.3%	7.7%	9.5%	7.9%	6.5%	7.7%
Mid Atlantic	6.3%	6.2%	7.3%	6.9%	6.5%	6.6%
Midwest	13.4%	16.2%	15.3%	18.8%	19.5%	16.2%
Southeast	9.2%	10.8%	8.8%	9.9%	13%	10.1%
Great Plains	4.9%	3.8%	4.4%	5%	3.9%	4.4%
Rocky Mountains	0.7%	6.9%	7.3%	8.9%	9.1%	7.7%
Southwest	7.7%	6.9%	6.6%	7.9%	7.8%	7.3%
Pacific Coast/Western US	13.4%	11.5%	12.4%	13.9%	13%	12.8%

MOD and MaaS | Concept Familiarity and Available Services

Concept Familiarity

- Most respondents were relatively familiar with MOD and MaaS
 - Over half of the participants ranked their familiarity with MOD a score of at least seven out of 10.
 - Over half of the participants ranked their familiarity with MaaS a score of at least six out of 10.

Available Services

- Most widely available MOD modes, from most to least widely available:



1. Paratransit
2. Taxis
3. Courier Network Services (CNS)
4. Bikesharing – most places with a dockless model also had a docked model
5. Transportation Network Companies (TNCs)
6. Ridesharing (i.e., carpooling and vanpooling)

Opportunities

1. Environmental Benefits

- Transportation criteria pollutant emissions
- Transportation greenhouse gas emissions (GHG)
- Vehicle miles traveled (VMT) decrease

2. Accessibility and Mobility

- Congestion management
- Employment access
- Goods access
- Residential mobility

3. Supplemental Services

- Availability of transportation options during off-peak hours
- Complements to public transit
- User health

Challenges

1. Traveler Protections

- Compliance with health protocols
- Cybersecurity
- Device/vehicle sanitation
- Physical distancing
- Privacy protection for travelers
- Security
- Traveler safety

2. Equity

3. Environmental - vehicle miles traveled/GHG emissions

4. Enforcement

5. Protecting Proprietary Information

6. Supportive Infrastructure

Opportunities and Challenges

1. Cost and Pricing

- Affordability for users
- Pricing stability
- Revenue for public agencies
- Affordability/cost for public agencies

2. Accessibility

- Accessibility for un- and under-banked households
- Accessibility for people with disabilities
- Device location
- Reliability
- Ease of use for travelers
- Equity and inclusion
- Reliability

3. Liability for Agencies and Users

4. Institutional, Political, and Public Support

5. Data Sharing

Policy Supports | Support by Government Level

Policy Support by Government Level





















Sector	Local	Regional	State	Federal
Legislation			X	
Policy Guidance	X	X		
Regulation				X

Desired areas of policy support:

- **Legislation:** Privacy and cybersecurity (including personal and proprietary information protection); accessibility; environmental impacts; ease use for travelers; and physical distancing;
- **Policy Guidance:** Data sharing policies and privacy protections; curbspace and rights-of-way management; and accessibility; and
- **Regulation:** Environmental impacts; revenue and subsidies for public agencies; insurance and liability; pricing stability, affordability, and consumer protections; and expanding technology access

MOD and MaaS | Use Cases and Partnerships

Transportation Services

	First- and Last-Mile	Low-Density Service	Medical Transportation	Off-Peak Service	Paratransit
Local Agencies					
State Agencies					
Federal Agencies					
Non-Profit Organizations					

Key



In-house



Partnership



Vendor

The COVID-19 pandemic is changing MOD by:

- Changing partnerships, terms, and/or conditions;
- Creating new partnerships with new providers; and/or
- Suspending partnerships.

Data Sharing | Data Management, Sharing, and Use

In order of greatest to least importance shared data is used for:

**Greatest
Importance**



1. Managing assets and rights-of-way in real-time
2. Altering fleet management
3. Informing planning decision and public transit schedules
4. Measuring performance
5. Modeling demand management
6. Informing policy decisions
7. Informing real-time traffic operations
8. Informing public transit schedules
9. Managing mobility availability in real-time
10. Altering regulations

**Least
Importance**

Most survey respondents stated that shared data is not in real-time, but they would like to receive real-time data.

Public Agencies | Pricing Strategies

Public Agency Pricing Strategies

Sector	Currently Have n = 24	Planning For n = 17	Interested In n = 25	Total N* = 66
Congestion	16.7%	-	16%	12.1%
Cordon	-	11.8%	12%	7.8%
Curbspace Usage	8.3%	17.6%	16%	13.6%
Loading Zone	4.2%	17.6%	8%	9.1%
Parking Permit	16.7%	-	8%	9.1%
Road Toll	29.2%	5.9%	4%	13.6%
Road Use Charge	8.3%	5.9%	16%	10.6%
Vehicle Characteristics	-	11.8%	8%	6.1%
Vehicle Occupancy	12.5%	11.8%	4%	9.1%
Zone	4.2%	17.6%	8%	9.1%

COVID-19 Impacts | Transportation Concerns

**High Level
of Concern**



1. Public health and safety (i.e., COVID-19 containment)
2. Revenue generation
3. Ridership/use rates
4. Service availability for users
5. Employee/contractor availability
6. Affordability for users
7. Availability for users
8. Communication of new policies
9. Goods delivery

**Lower Level
of Concern**

COVID-19 Impacts | Transportation Industry Workplace Changes

Common Workplace Changes



1. Allowing staff to work from home
2. Changing the physical workplace
3. Identifying alternative funding sources
4. Requiring operators and staff to wear personal protective equipment (PPE)
5. Enhancing cleaning requirements/cleaning more frequently
6. Changing roles and responsibilities
7. Requiring passengers to wear PPE
8. Providing PPE to staff and operators
9. Modifying operations to support enhanced cleaning
10. Expanding sick leave policies

Less Common Workplace Changes



COVID-19 Impacts | Modal Impacts

Anticipated Modal Impacts

Mode	High Decrease	Moderate Decrease	Slight Decrease	No Change	Slight Increase	Moderate Increase	High Increase
Active Transportation						→	
Bikesharing			←		→		
Carsharing	←						
Courier Network Services						→	
Microtransit		←					
Paratransit		←					
Personal Vehicles		←			→		
Public Transit	←						
Ridesharing			←				
Scooter Sharing		←					
Taxi	←						
TNCs		←					
TNCs – pooled rides		←					

Thank You | Questions and Contact Information

We would like to thank the MOD Alliance, American Association of State and Highway Transportation Officials (AASHTO), Institute of Transportation Engineers (ITE), Intelligent Transportation Systems of America (ITS America), and PTV Group for supporting this effort.

Please remember ... findings are preliminary ... data collection is still ongoing.



Adam Cohen

Senior Research Manager
Transportation Sustainability Research Center (TSRC)
University of California, Berkeley

(661) 912-2986

apcohen@berkeley.edu

LinkedIn: AskAdamCohen

Twitter: @AskAdamCohen

TSMO and MOD Integration Peer Exchange

Topic #2: Defining MOD and TSMO Overlaps

FEB 12, 2021

Laurie Matkowski

Director of Connected and Automated Vehicle Services

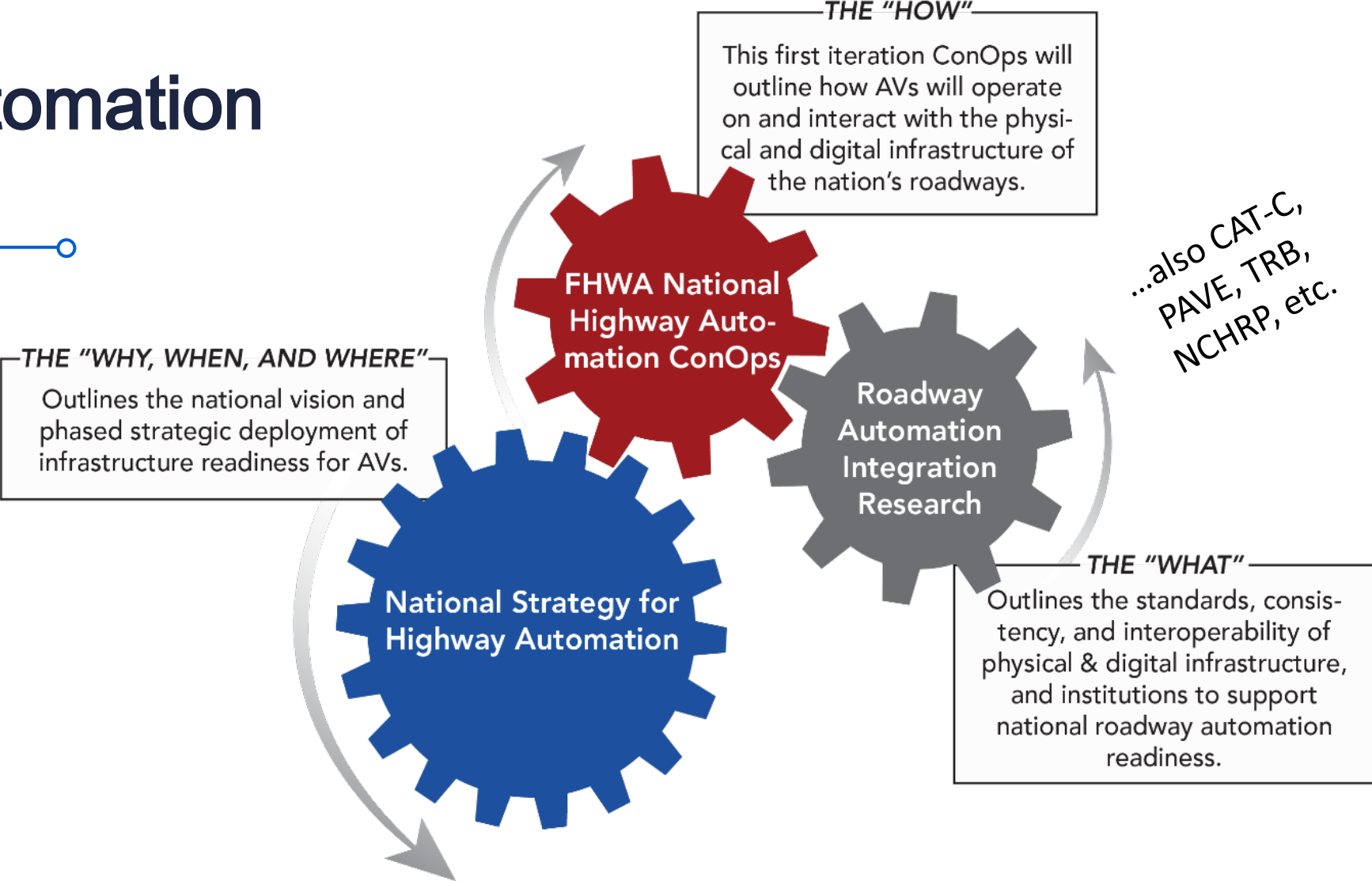




Advanced Mobility: Two Sides of the Spectrum

National Transportation Automation Intersection

- Addressing challenges with 21st century solutions
- Leading transformational improvements to mobility
- Innovation & technology to benefit safety and mobility



Current Major Work

2020 ACTIVE TRANSPORTATION AUTOMATION READINESS PROJECTS



NATIONAL



- National Strategy on Highway Automation
- National Roadway Automation Concept of Operations
- FHWA AV Infrastructure Readiness



MULTI-STATE



Regional Assessment of Readiness for Automated Vehicles



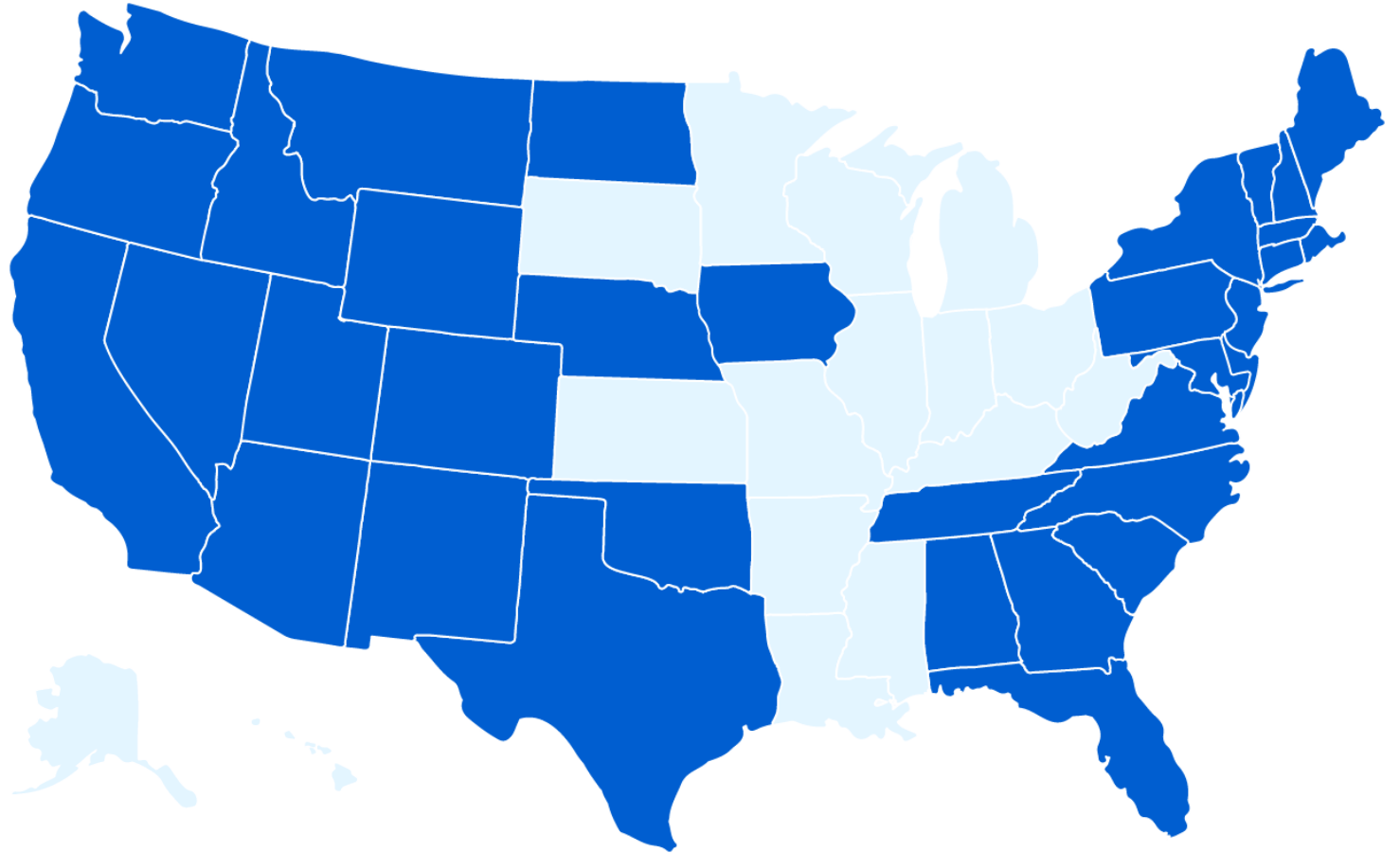
AV RUC Demonstration



STATE/LOCAL



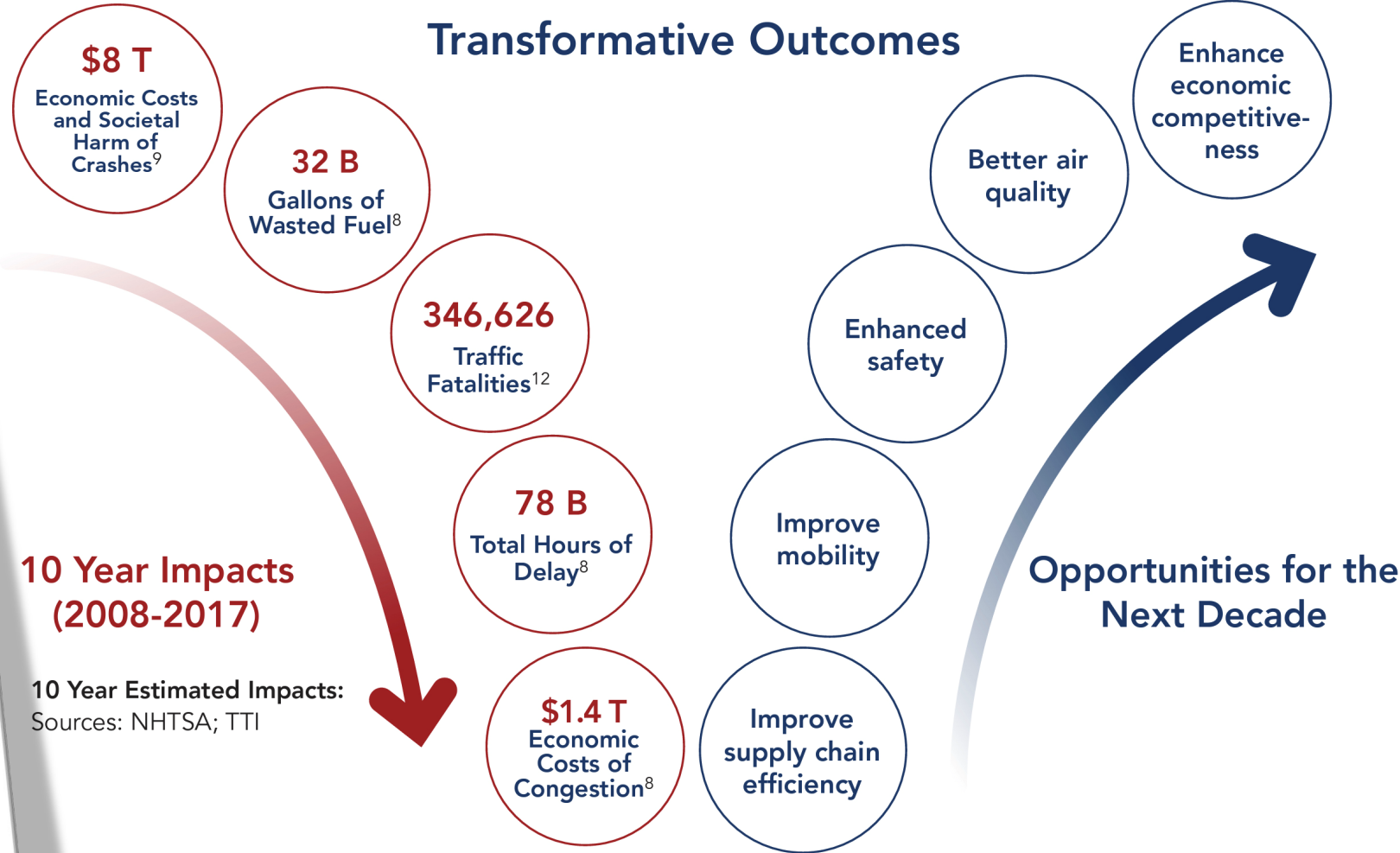
NEW JERSEY DEPARTMENT OF TRANSPORTATION



AASHTO National Strategy



Transformative Outcomes

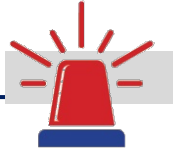


AASHTO National Strategy: Business Case



GLOBAL ECONOMIC COMPETITIVENESS & GROWTH

- Improve supply chain efficiency
- Reduce costs of traffic congestion
- Reduce cost of crashes
- Improve mobility for underserved groups
- Improve workforce capabilities



NATIONAL SECURITY & EMERGENCY MANAGEMENT

- Military readiness
- Logistics mobility
- Improve mass evacuations
- Coordinated emergency management
- System resiliency



PUBLIC HEALTH & SAFETY

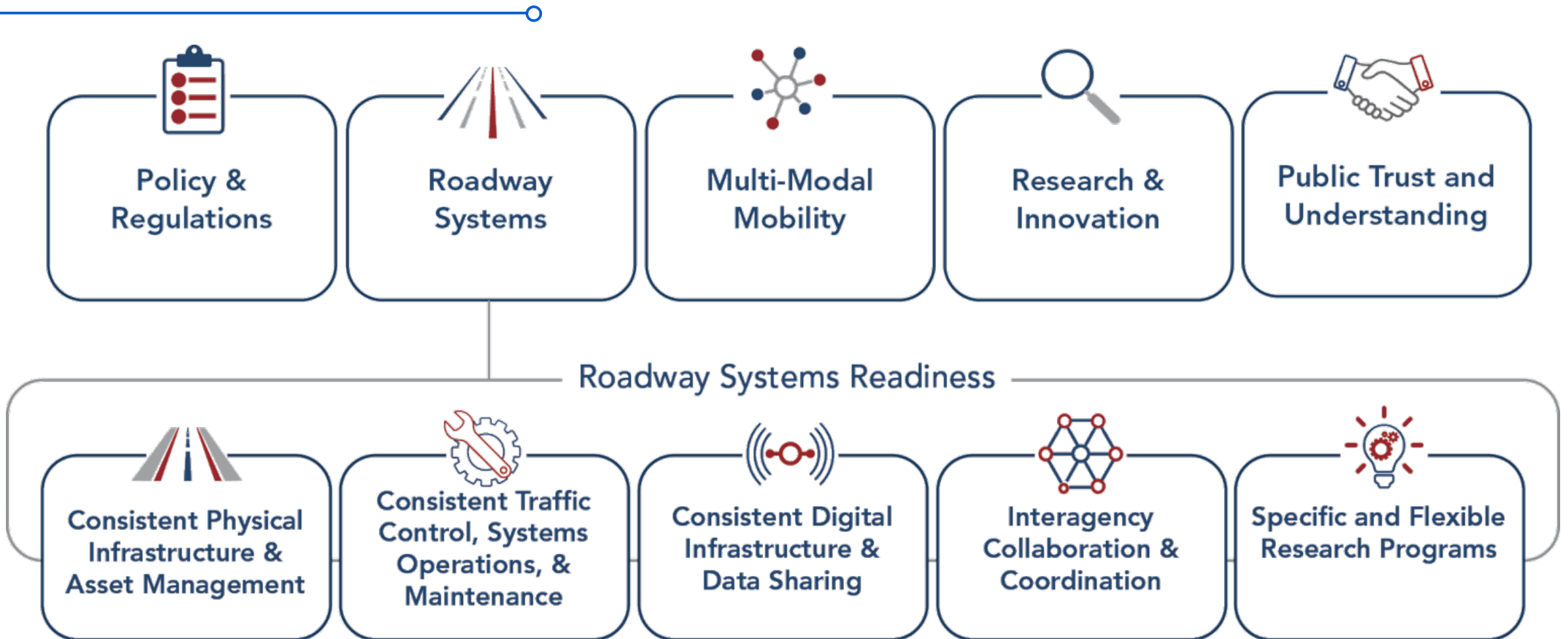
- Reduce fatal and serious injury crashes
- Better air quality
- Enhance safety for vulnerable users
- System sustainability
- First responder safety



COROLLARY TECHNOLOGICAL ADVANCEMENT

- Support telecommunications and connectivity
- Advance automation and artificial intelligence
- Scalable electric vehicle infrastructure
- Support for connected devices and Smart Cities

AASHTO National Strategy: Readiness Categories



AASHTO National Strategy: Readiness Categories



CONSISTENT PHYSICAL INFRASTRUCTURE & ASSET MANAGEMENT

- Structural Integrity
- Pavement condition
- Bridge capacity
- Roadway geometry



CONSISTENT TRAFFIC CONTROL, SYSTEMS OPERATIONS, & MAINTENANCE

- Pavement Marking Standards
- Traffic signals phasing/timing, countdown status
- Active traffic control systems management
- Managed Lane strategies



CONSISTENT ACTIVE DIGITAL INFRASTRUCTURE & DATA SHARING

- Fiber Optics
- Connectivity to/from AVs
- Cybersecurity
- Historic, regulatory, real-time, future data sharing
- Scalable data analytics
- Digital mapping
- Data specifications



CONSISTENT MULTI-AGENCY OPERATIONS INSTITUTIONS

- Build/mature existing institutions
- Consistency & standards
- Information sharing
- Workforce development



FOCUSED AND NIMBLE RESEARCH & DEVELOPMENT

- Dedicated R&D program
- National vision and roadmap should inform R&D needs
- Focus SHRP 3 on automation readiness
- More R&D on underserved users and markets

AASHTO National Strategy: Phased Approach



Building Smarter Infrastructure: Leveraging TSMO

Infrastructure ...withINSIGHTS

Catalyzing a Bold Vision

Creating a more affordable, sustainable and equitable communities through TSMO, MOD and improved public service delivery.

Digitally Transforming Government Operations

At an annual net savings to states and municipalities.

Providing an Innovative Platform for New Technologies

Such as big data computing and artificial intelligence.

Virtually Linking Government Service Sectors

This will enhance public benefit.

SMART ROADWAYS

ADVANCED ROADWAY ENGINEERING

CLEAN ENERGY SYSTEMS

OPERATION CENTERS

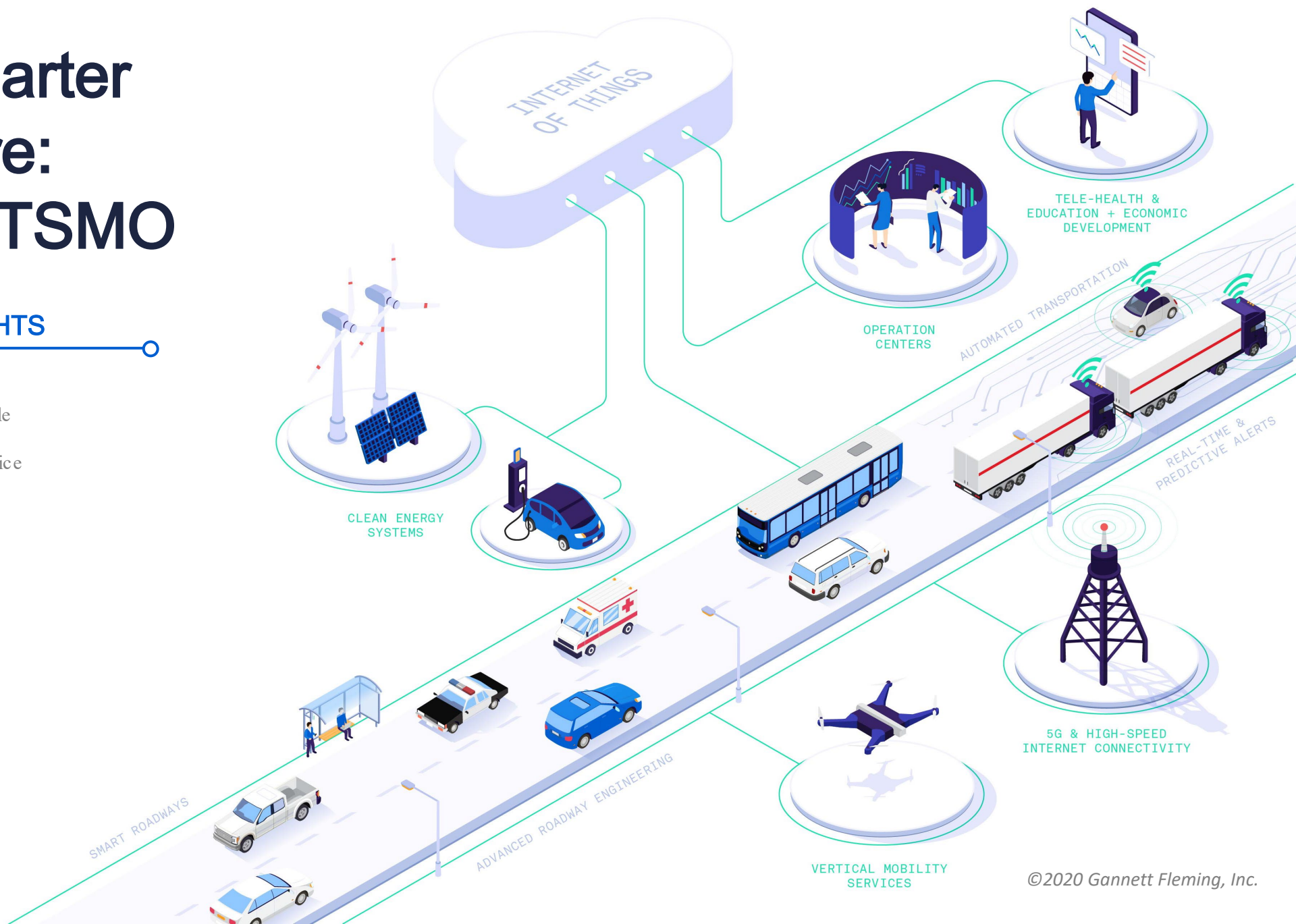
AUTOMATED TRANSPORTATION

TELE-HEALTH & EDUCATION + ECONOMIC DEVELOPMENT

REAL-TIME & PREDICTIVE ALERTS

5G & HIGH-SPEED INTERNET CONNECTIVITY

VERTICAL MOBILITY SERVICES



Thank You!

Laurie Matkowski
lmatkowski@gfnet.com
215.880.2220

The Role Of Transportation Systems Management and Operations (TSMO) in Mobility as a Service (MaaS): New Perspectives on Fully Integrated Mobility Marketplaces

Carol Schweiger

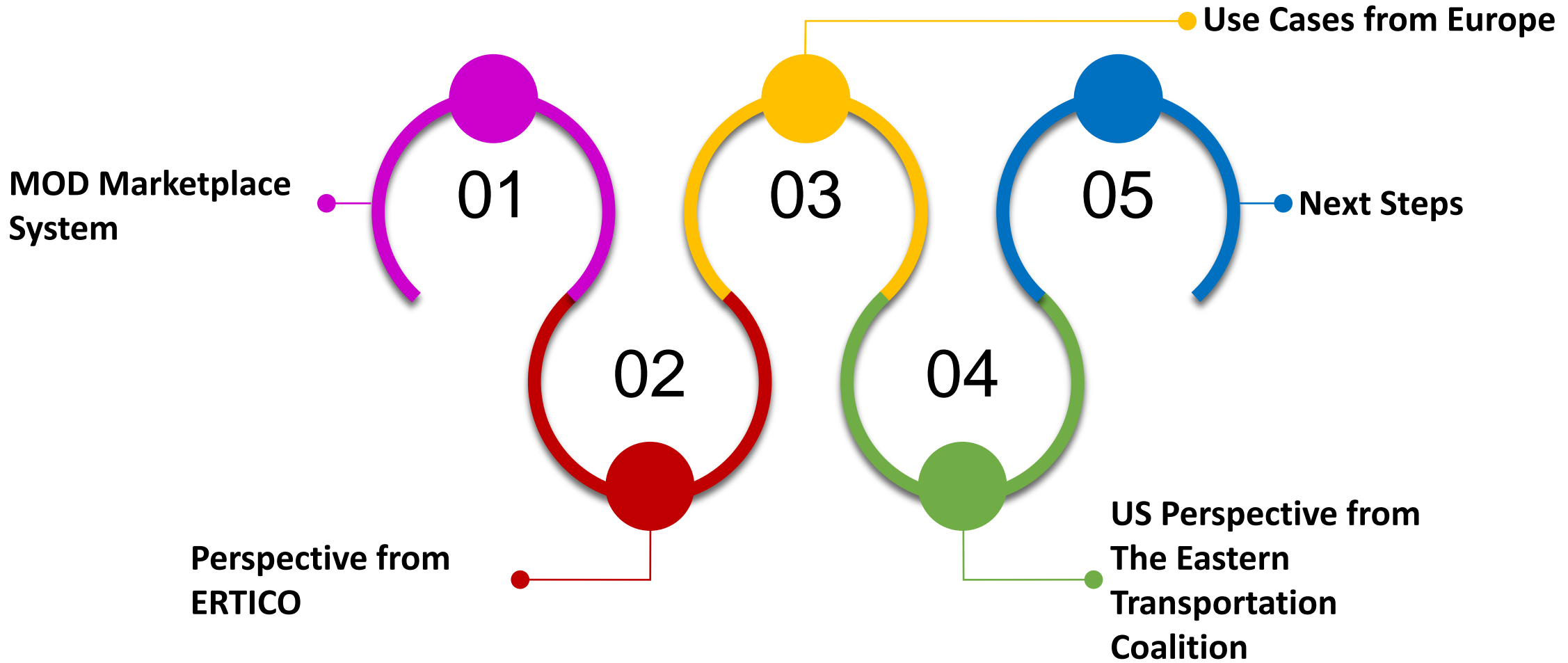
President, Schweiger Consulting

TSMO And MOD Integration Peer Exchange

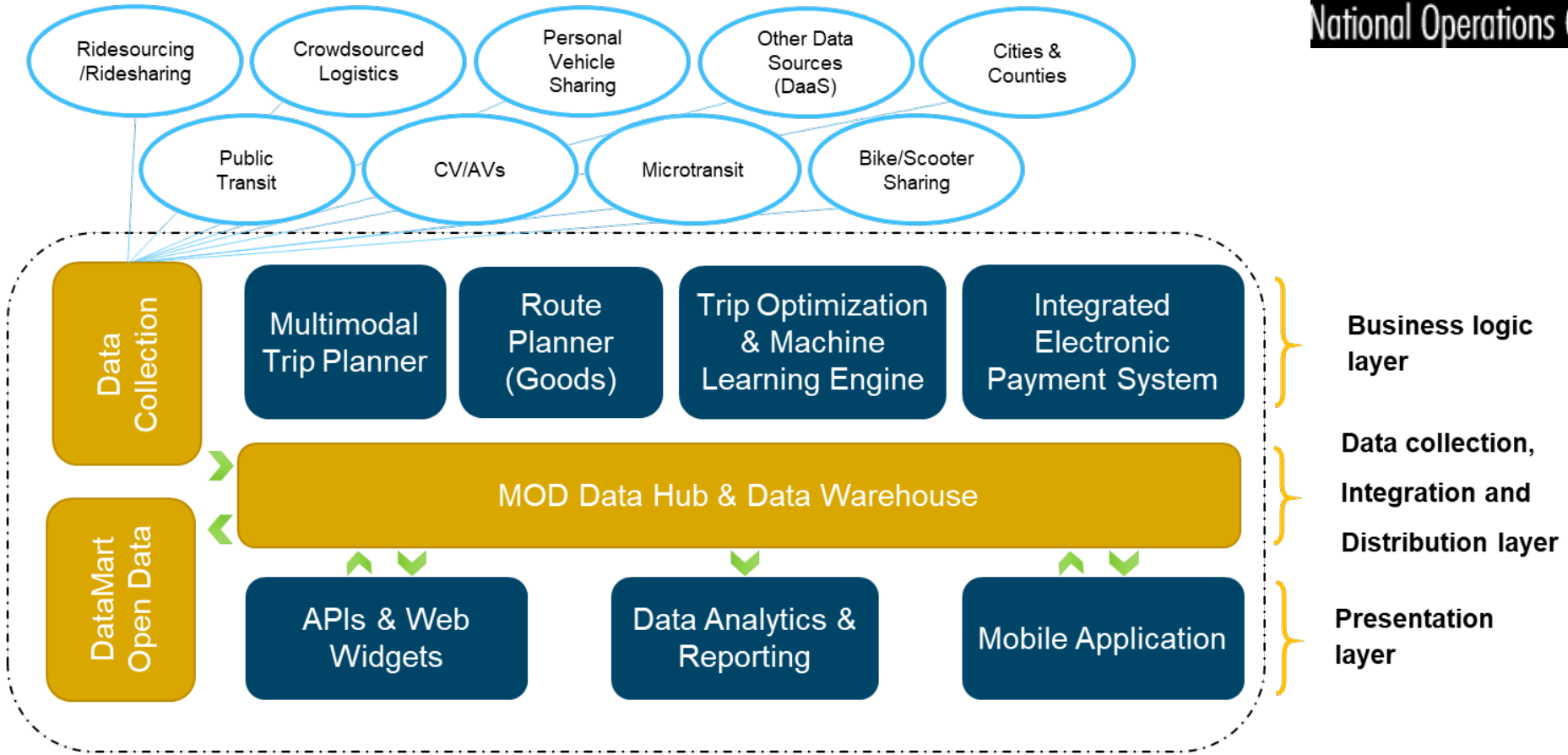
Friday, February 12, 2021



PRESENTATION OUTLINE



MOD MARKETPLACE SYSTEM



Employers, universities, medical centers and Businesses

Transportation Service Providers

3rd Party Solutions Developers

Operations, Planning, Performance Eval.

Users

Image: USDOT - MOD Marketplace ConOps

MOD MARKETPLACE CONOPS BLUEPRINT: OPERATIONAL SCENARIOS

Use Case Scenarios

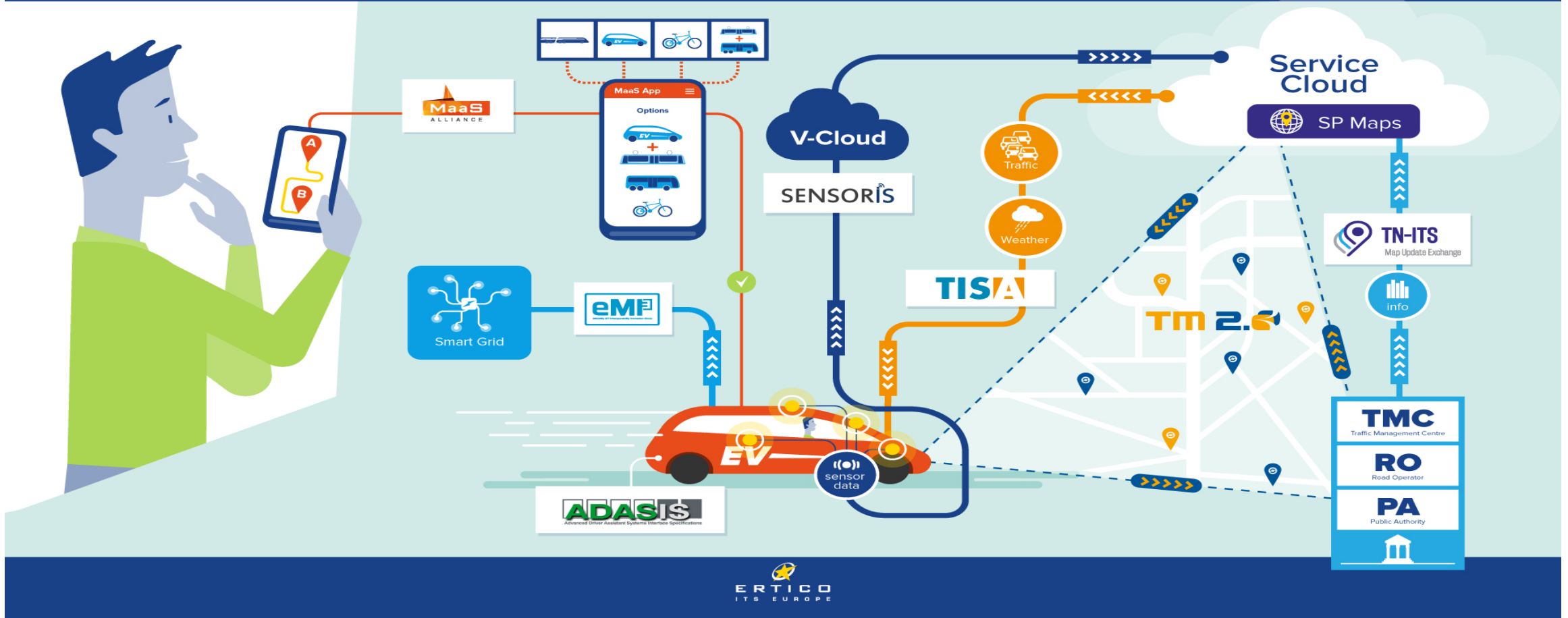
- Leverage shared MOD data to analyze infrastructure conditions and improve transportation operations
- Fill gaps in existing transportation networks and provide travelers with additional options and flexibility
- On-Demand Neighborhood/Campus/Retirement Community/Employer Services
- On-Demand door-to-door and paratransit services
- Plan trip using integrated multimodal application
- On-Demand first/last mile services
- Flexible Goods Delivery Services

User-System Interactions

- Primary actors, supporting actors, stakeholders and interests
- Scenario descriptions
- Preconditions
- Postconditions
- Performance goal
- Basic workflow
- Alternative workflow
- Special Requirements
- Assumptions
- Notes and issues

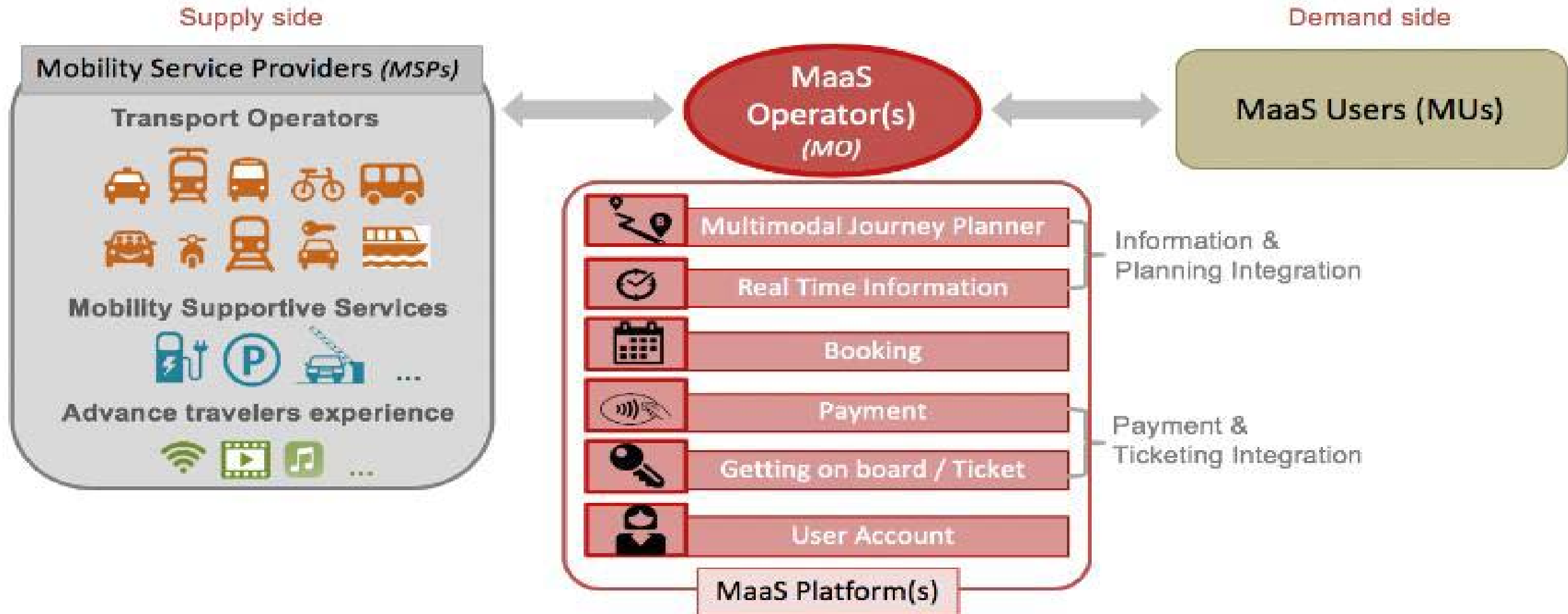
MAAS AND TM 2.0*

SMART MOBILITY DEPLOYMENT BY ERTICO PARTNERSHIP



*Dr. Johanna Tzanidaki, "MaaS & TM 2.0: Network Mobility Management," 2020 ITS World Congress, SIS4018, October 8, 2020, https://gateway.on24.com/wcc/eh/2537028/lp/2615792/the_role_of_transportation_systems_management_and_operations_tsmo_in_mobility_as_a_service_maas_new_perspectives_on_fully_integrated_mobility_marketplaces/

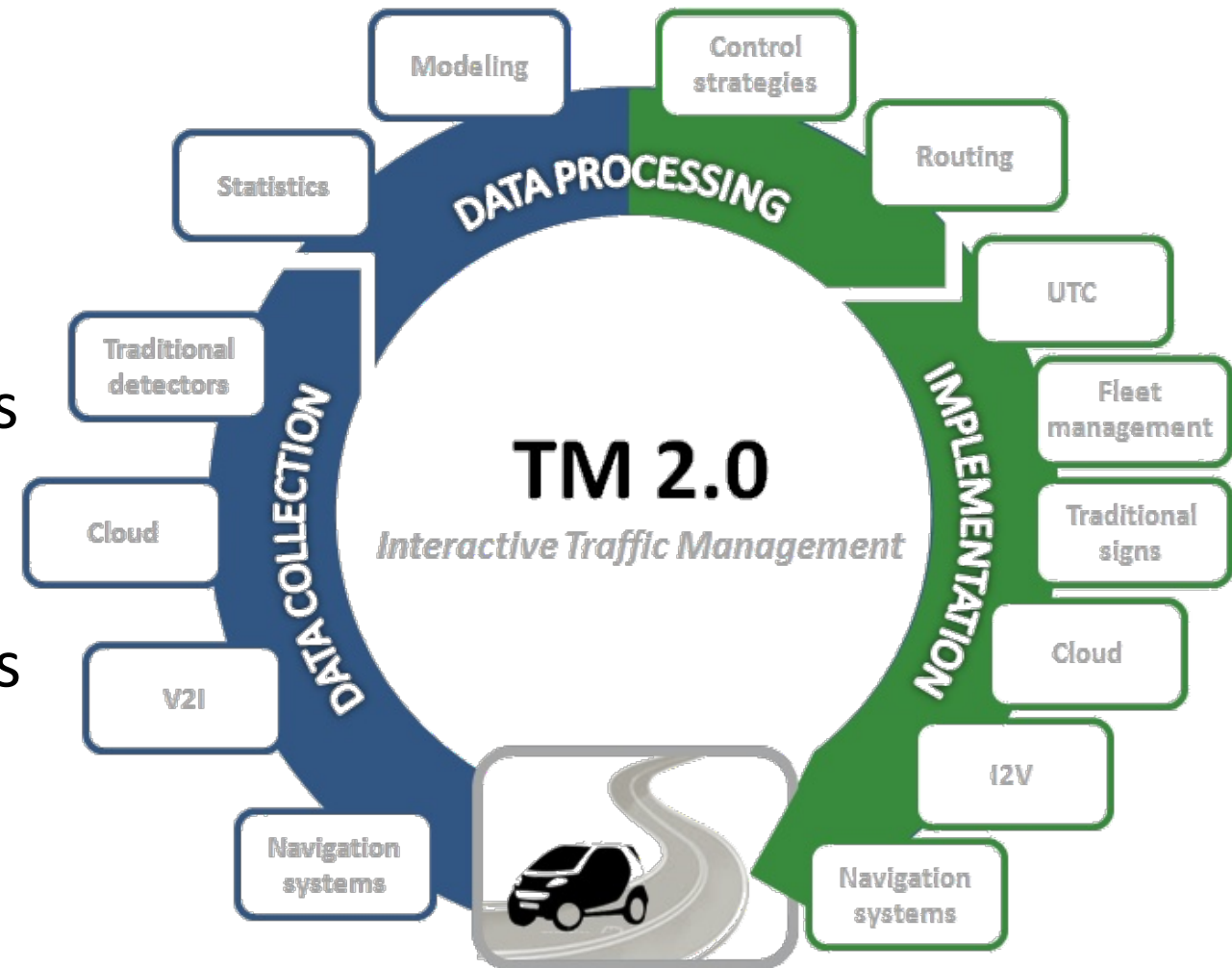
MAAS ECOSYSTEM*



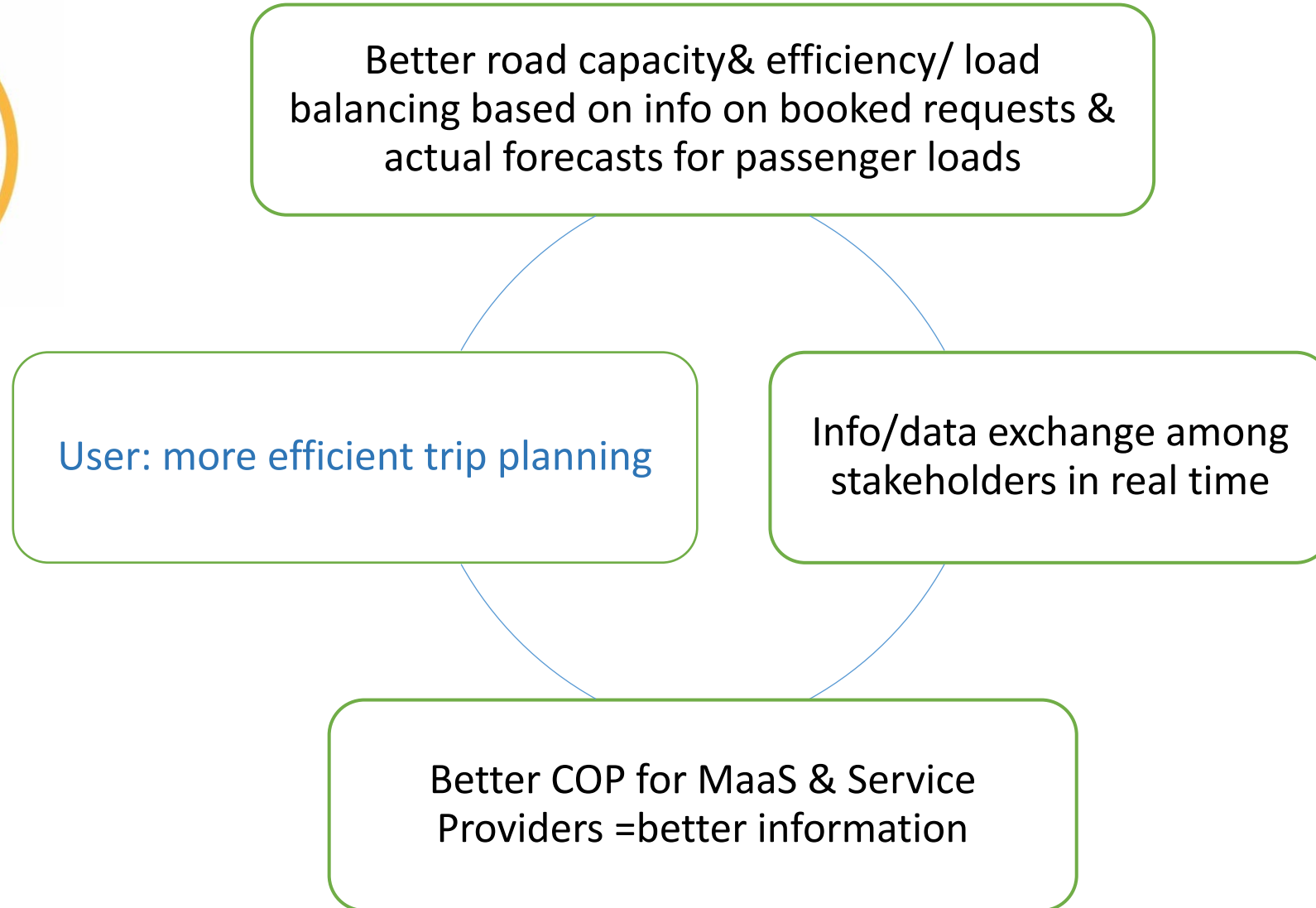
MaaS Concept and ecosystem (source: UCL – MaaS Lab)

TM 2.0: ENABLE VEHICLE INTERACTION WITH TRAFFIC MANAGEMENT*

1. Collaboration and trust
2. Alignment of information to drivers and consistency
3. Understanding among stakeholders (**co-opetition**)



MULTIMODAL MOBILITY MANAGEMENT / MOBILITY NETWORK MANAGEMENT*



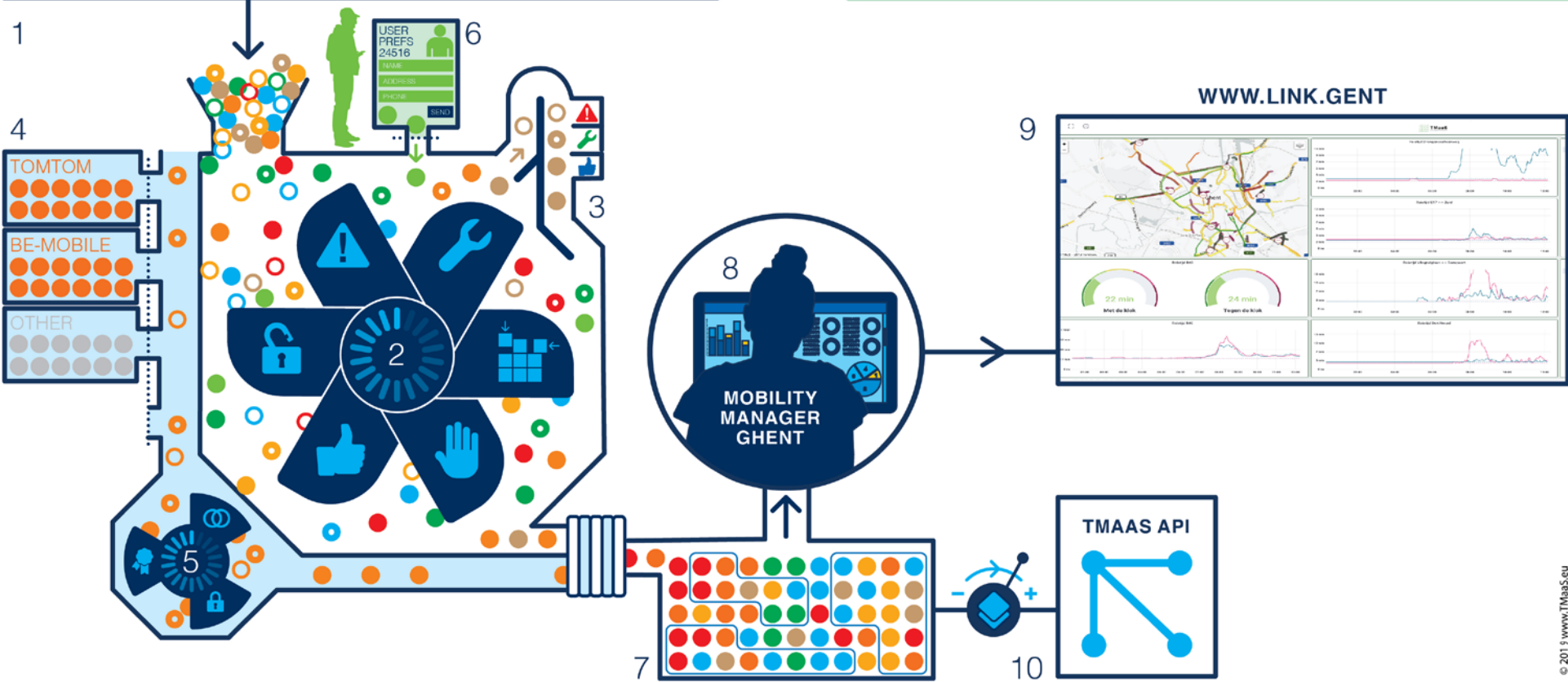
THE GHENT CHALLENGE

MAKE CITIZENS CHOOSE SMARTER BEFORE STARTING THEIR TRIP



LEGENDA

- 1. DATA TYPES
- 2. PROCESSING BLOCK
- 3. CONTROL DASHBOARD
- 4. PRIVATE PARTNERS
- 5. NEUTRAL PROCESSING BLOCK
- 6. USER PREFERENCES
- 7. AVAILABLE DATA
- 8. MOBILITY MANAGER GHENT
- 9. FIELD APPLICATIONS
- 10. TMAAS API



Use Case:
Ghent,
Belgium**

© 2015 www.TMAaS.eu

**Stephanie Leonard, Head of Policy & Innovation, TomTom, "SIS4018: Connecting Traffic Management & MaaS," 2020 ITS World Congress, October 8, 2020, https://gateway.on24.com/wcc/eh/2537028/lp/2615792/the_role_of_transportation_systems_management_and_operations_tsmo_in_mobility_as_a_service_maas_new_perspectives_on_fully_integrated_mobility_marketplaces/

Illustrator is Wim Vandersleyen

INNOVATION FOR TRAFFIC MANAGERS AND CITIZENS**

Warnings on pre-defined routes



Dynamic vehicle positions on a map



Show locations of useful PoI on a map



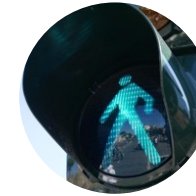
Real-time and historical statistics of KPI's



Immediate insights in real-time traffic events



Asset monitoring



Data editor



2-Way communication

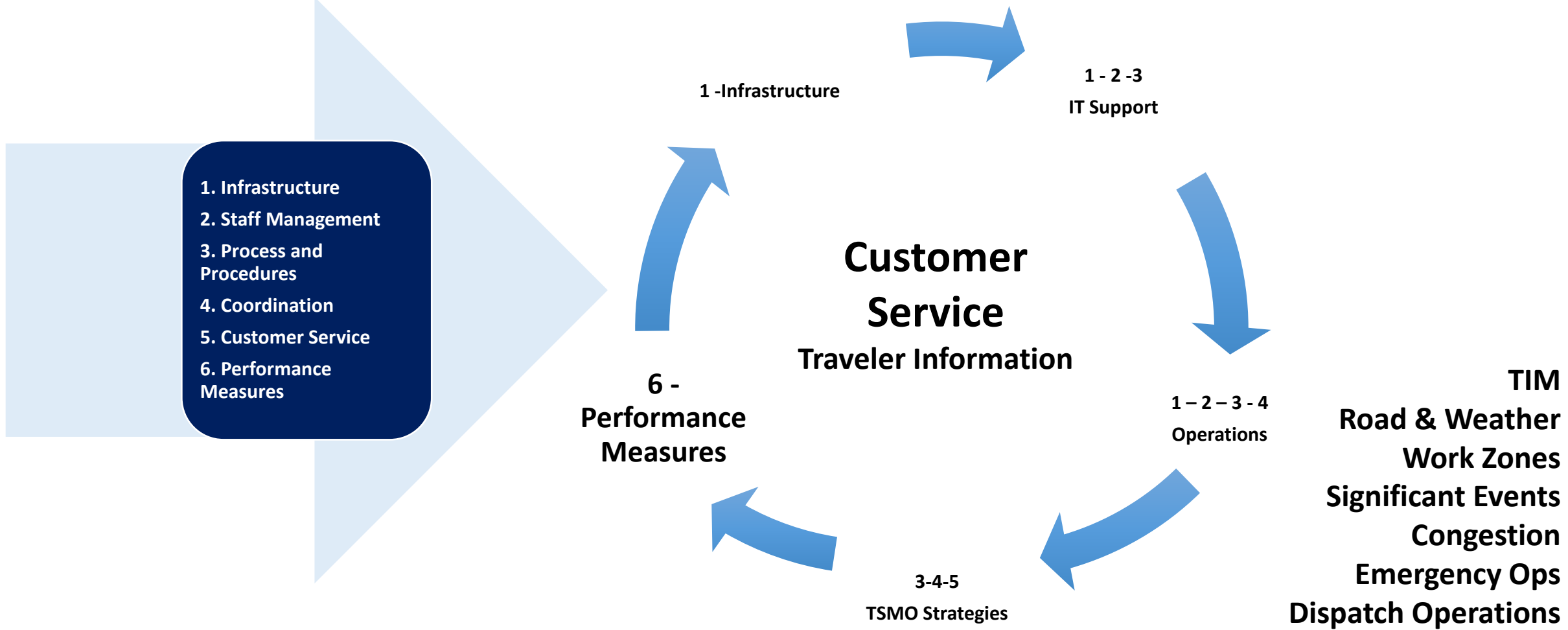


City management panel



www.TMaaS.eu

TSMO - HOW DOES IT WORK IN A TMC?***



***Denise Markow, Director, TSMO, The Eastern Transportation Coalition, "The Role of TSMO in Maas," 2020 ITS World Congress, SIS4018, October 8, 2020, https://gateway.on24.com/wcc/eh/2537028/lp/2615792/the_role_of_transportation_systems_management_and_operations_tsmo_in_mobility_as_a_service_maas_new_perspectives_on_fully_integrated_mobility_marketplaces/

TMC STAKEHOLDERS ARE EVENT FOCUSED***

Maintenance Forces - Road and Weather Operations

Significant Events

Crashes

Emergency Operations
Evacuation Routing

Daily Commute

Construction
Extended Lane
Closures

Secondary Crashes

Security Operations

Transit Scheduling
and Routing

Freight Routing
Permitting

Dispatch Operations

OVERLAP OF TMC'S & MAAS***

*Today:
"It's in the
network info
messaging"*

*"Seamless
payment
systems are
being
developed"*

TSMO Strategy	MaaS Component
Congestion	Travel Times
Crashes	DMS, Third Party Vendors
Construction	Work Zone Closures
Emergency Operations	Road Closures
Significant Events	Roadway network status
Snow and Ice Operations	Road Conditions
Use of Data	Speed and Volume Use Cases

THANK YOU!

Carol Schweiger
President
Schweiger Consulting LLC
carol@tech4transit.com

