



Accelerating Europe's Best  
Traffic Mgt Practices –  
....Let's Go *Dutch!*

# LEARNING OBJECTIVES

At the end of this learning experience, I will be better able to...

- 1 Apply the Dutch approach to multi-faceted mobility including 22 elements such as Traffic Flow, Transit, Safety, Parking, and Last/First Mile, Congestion, Noise and GHG emissions
- 2 Understand how Artificial Intelligence can be engaged and deployed in your city, using Amsterdam as model - where their efforts alone may be credited with the entire nation possibly meeting their “Paris Accord” CO2 (aka, Greenhouse Gas) targets “singlehandedly”
- 3 Make quantifiable improvements in your city related to mitigating traffic congestion, reducing carbon emissions, noise and accidents. Most importantly, learn how they are transferable between Europe and the USA/Canada



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2. **Open** the "2024 PWX" app on your device.
3. **Click to open – sign in** for extra features!



# EDUCATION SESSION EVALUATIONS

Please fill out an evaluation for each session you attend using the PWX Conference Mobile App. Each submitted evaluation counts as an entry to the 2024 PWX Free Gift Card Drawing. This year's prize will be a \$10 gift card to Amazon. Don't miss your chance to receive a free gift card on us! Winners will be announced Monday and Tuesday morning via the mobile app!

1

Press the **"Schedule"** option on the app home screen

2

Find your **education session** on the calendar

3

Scroll down and press the **"Session Evaluation"** option

# *Introductions...*



## Today's Session



### **Dave Zelenok, PE**

- Public Works Director for 20 years in Centennial and Colorado Springs
- Emerging Technologies
- Founder and CEO ZK Engineers
- [dzelenok@zkengineers.com](mailto:dzelenok@zkengineers.com)
- 719-491-1547

### **Paul Hoekstra** Business Unit Director Technolution Move

[paul.hoekstra@technolution.com](mailto:paul.hoekstra@technolution.com)

408-537-3416



# How Fast Are New Technologies Being Adopted?



Telephone: 100 MM users = 75 Years  
Pokemon GO: 100 MM users ~ 30 days  
 $\frac{1}{2}$  BILLION < 8 Months



Pokemon Go app on an iPhone, Tokyo, Japan, July 22, 2016.  
*Toru Hanai | Reuters*

July 2023 – Twitter to Threads 150 MM users in 6 DAYS

# Has This Ever Happened Before - ?



***Complete Modal Transformation: 12 Years  
Infrastructure – Catching up 100 years***





# The 4 Industrial Revolutions...

1. Steam Power
2. Electricity
3. Computers
4. The 4<sup>th</sup> confluence of:
  - **Artificial intelligence**
  - Internet of Things (IOT)
  - Nanotechnology
  - Quantum computing
  - 3D printing
  - Data transmission / Smart Cities
  - Technologies that will fundamentally **change our world**



# More Global trends...

Say Hello To:

- Driverless Cars: Capacity Increases
- Sensors: “V2V” & “V2I”
- Gigabit 5G Telecom
- Roads without Traffic Signals
- Fiber: Utility meters & Fiber to the premises (FTTP)
- Fiber as the **Sensor Itself**
- **Wireless Gigabit Telecom**



*Courtesy: HR Green*



# The END of the LINE... Say GOODBYE to:

- Fortress Malls?
- Road Widening Projects?
- Privately Owned Vehicles?
- Car Ownership - Car
- Parking
- Mass Transit
- Gasoline
- Traffic Signs
- Gas Tax (Electric Vehicle – Full Adoption: 2040)?
- **Three-car** garages – who needs to **own** 3 cars?
- Congestion – Up AND down – profound changes



**Virtually Everything Virtually**

• Predicting Traffic Jams.....

• 2 minutes in the future (?)



# More Global trends...

- Bricks vs “Clicks - Online sales
- Digital Twins
- DeCarbonation – Greenhouse Gasses

**Expect: Disruption as the NORM**



# Autonomous – Self-Driving - Driverless



**Crucial will be:  
“Totally Managed Systems”**

# Autonomous: Teslas & Audis Today



# Autonomous – Self-Driving – Driverless

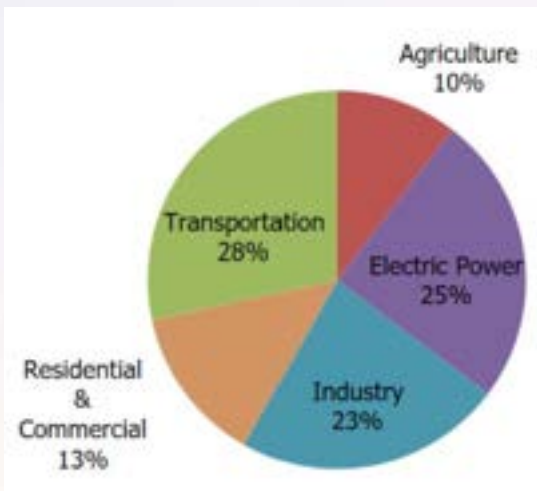
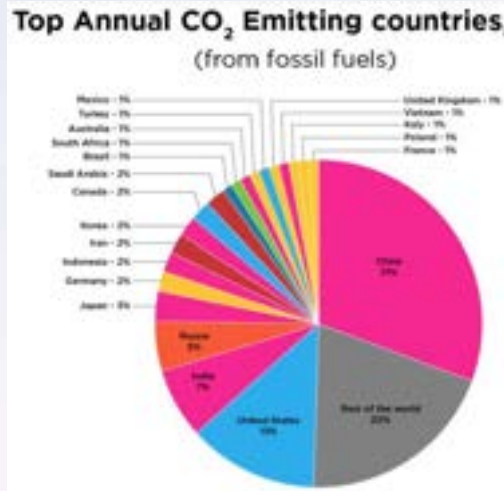


- Transit  
5% (maybe)
- Carpooling  
5% (maybe)
- Telecommuting  
10-20% (maybe)
- Driverless  
capacity  
300 (yes) 300%

COGs 2040 Plans?

# GHG Primer... What's it all about?

- Transportation & Power each amount for ~1/4 CO<sub>2</sub> (4BB tons/yr)
- Power will go to zero (solar, wind, renewables)
- Global Goal is net zero in ~20 years
- Car at idle ~ 4 lbs per hour of CO<sub>2</sub>, Per year ~ 1 ton of CO<sub>2</sub>
- Single Intersection – 26% reduction – NO change in controllers





# “Perimeter Control”

## Maastricht, NL – ‘City gate’ mechanism

Loops at traffic signals: counting vehicles in the city center

“Dosing lights” at the entrance routes (gates) of Maastricht

“... Dosing” the number of vehicles that can enter the city center

(Courtesy: TNL)



London?  
New York?  
(UN)POPULAR?!?!



Getty  
Images

Courtesy: TU Delft





# Dynamic Bus Lanes...

- **Intermittent dynamic bus lanes (IDBL):** Activation/deactivation of a dynamic bus lane segment in front of buses



- **Bus lane density control (BSDC):** Control of the vehicle density of a dynamic bus lane segment between the upcoming two bus stops



Courtesy: TU Delft

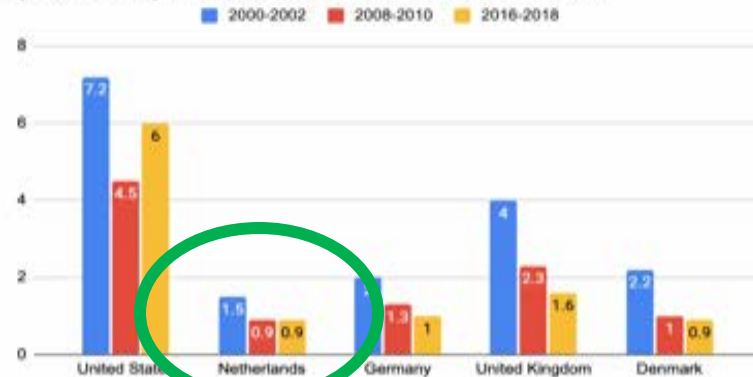
# So how does the US Compare?

## The Safest Streets in the World

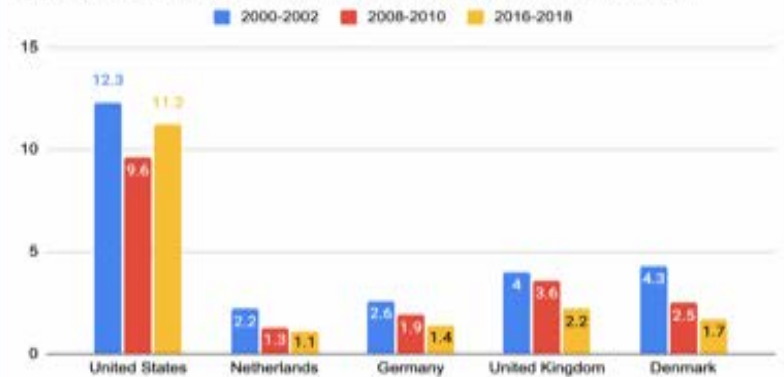


"If the U.S had achieved the same improvements in traffic safety as the Netherlands [since 1970], 22,000 fewer Americans would have died on our roads in 2015." – Vox

Cyclist fatality rate per 100 million kilometres biked



Pedestrian fatality rate per 100 million kilometres walked



# Dutch Priorities...

- Livable Space
- Pedestrian First in Downtowns –
- The Car is “guest”
- Speed is slower than pedestrians
- Modes are separated
- Zones and connections between them
- Urban Planning
- Standardized infrastructure



*Thanks: John Burke, City Engineer, Westminster*

# Today's American Traffic Management...

•Let's do a whole buncha STOP SIGNS!



# Speed *Humps*...

- **HUMP** AHEAD Signs –
- Um...tend to get **stolen**?!?



# American Traffic Calming...



*How about ROUNDABOUTS -  
...WITH STOP SIGNS?*



# Amsterdam's Traffic Ops Center





Rotterdam: Network: 5 Modes Concurrently

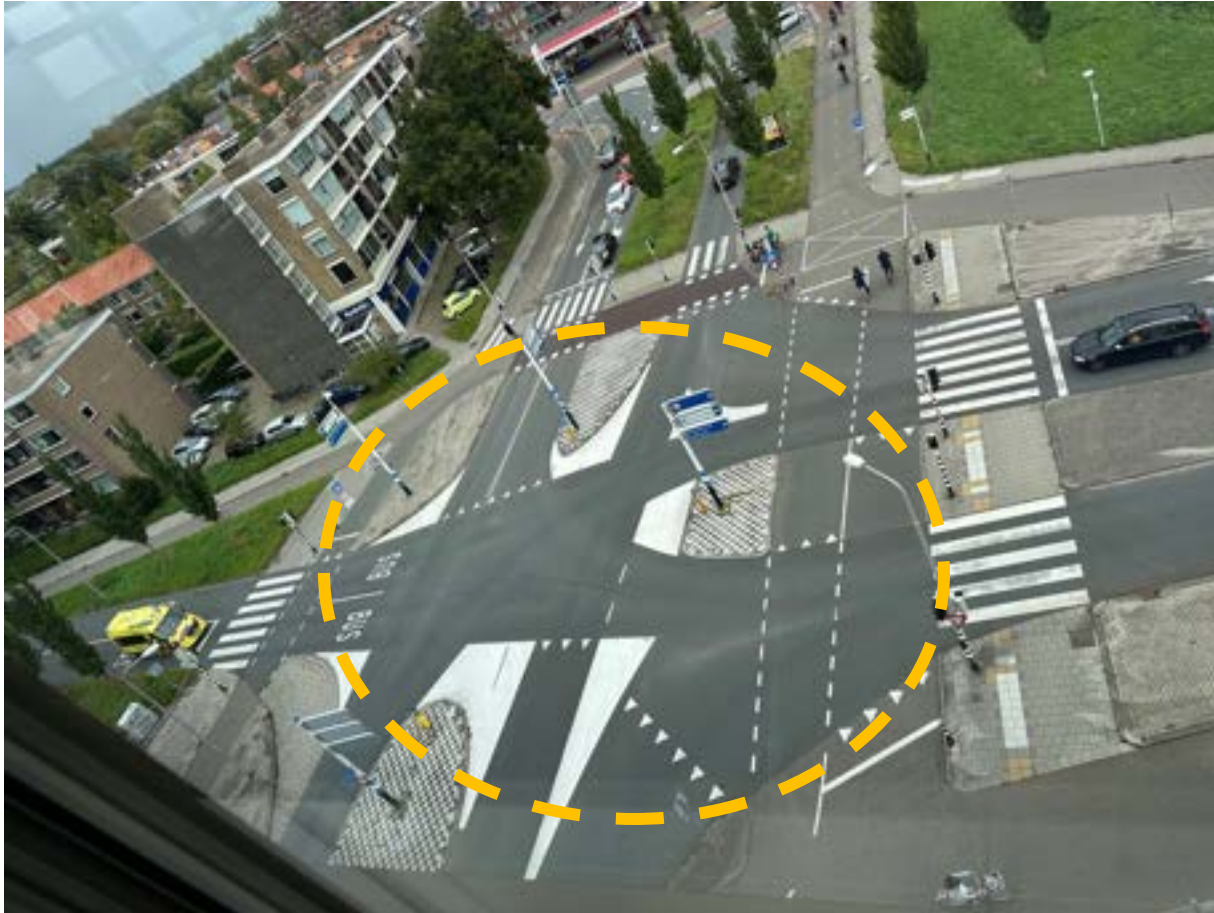
# Biking... *Facilities & Truly Intermodal!*



# Biking... Separated!



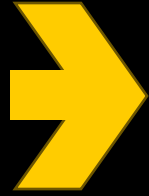
# Goodbye Roundabouts... *Fully Protected Intersections*



# Dutch Priorities...What Can You Really DO?

- ✓ Advanced Traffic Management
- ✓ Dynamic and Intelligent Access Control
- ✓ Short-Term Prediction
- ✓ Adaptive Flow Management
- ✓ Multi-Modal Traffic Flow Optimization





# Going Dutch

Making dramatic improvement on existing infrastructure

September 10, 2024



SCAN ME

Redefining  
**solutions**



# Becoming part of standard: Manual on Uniform Traffic Control Devices (MUTCD)

## *Portland Near-side Bike Lights with Countdown*

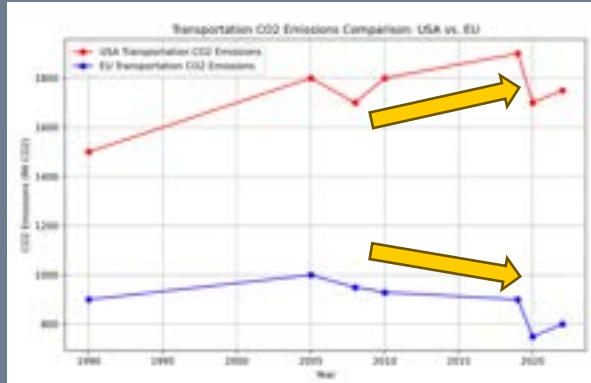
- Portland BoT installed Dutch Near-side Bike lights with Countdown on intersections along Naito Parkway
- Oregon State University documented and published that will make the case for why a Dutch-style countdown would be a good thing to incorporate into a future MUTCD
- The average percentage of users who committed a red-light violation decreased from 30.8% to 14.8% (52%)
- The average wait time increased by +5.4 seconds with a median increase of +3.6 seconds.” ([Carr, S. 2024](#))
- The installations produced significantly positive outcomes for micromobility users



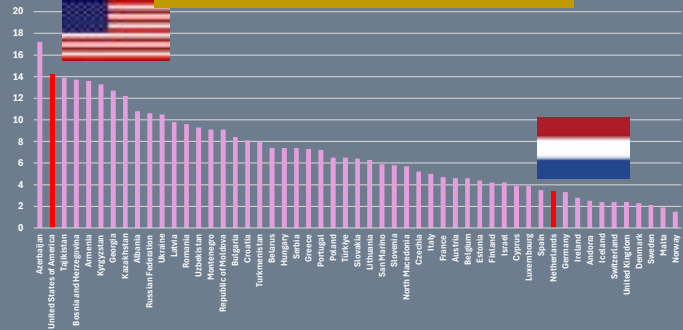




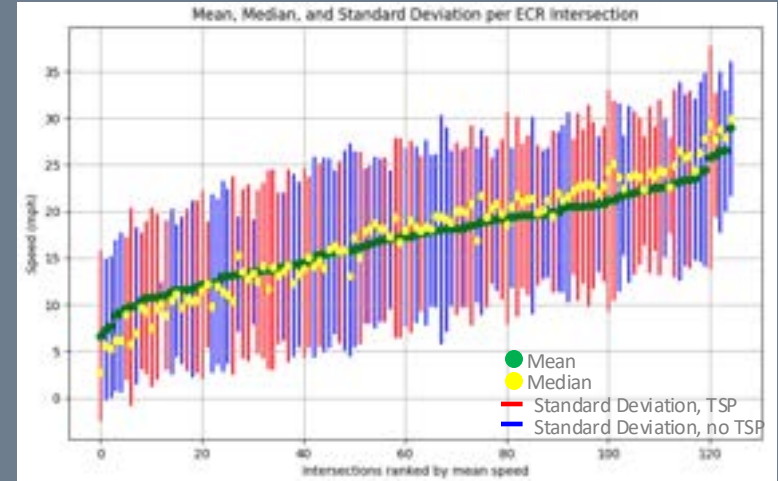
# You can't manage what you can't Measure



Fatalities USA relative to Europe, incl former USSR states



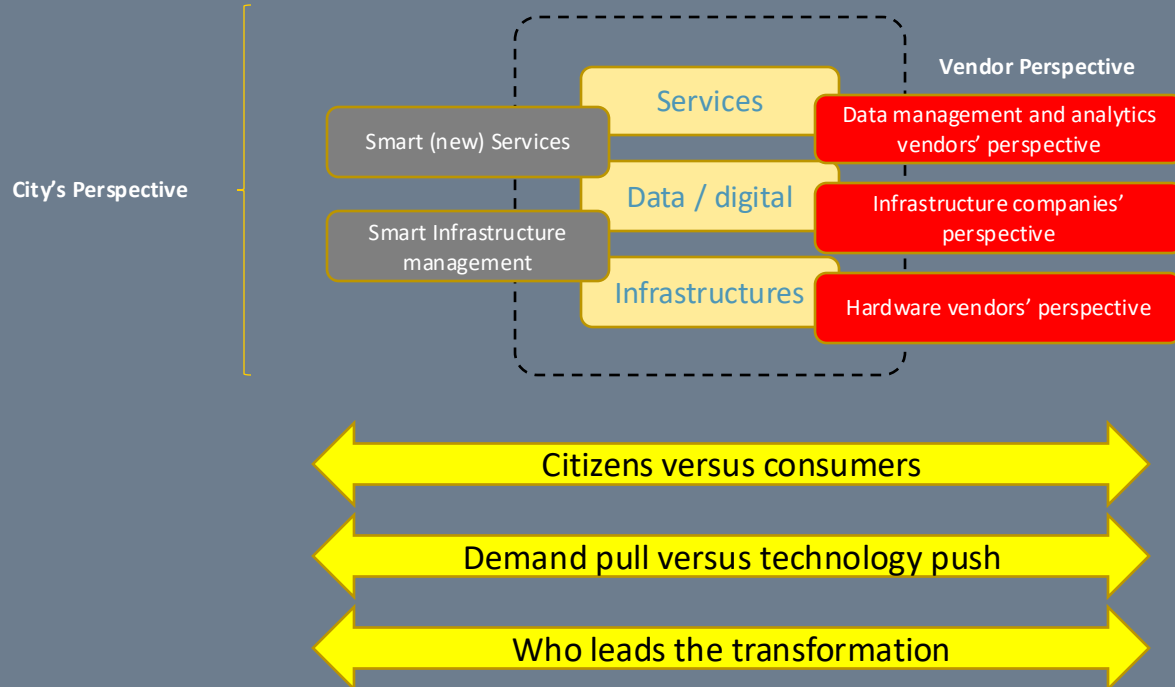
Route ECR SamTrans speed at intersections  
Red lines are intersections with TRP



USA Population: ~334 million people  
European Union Population: ~448 million people.



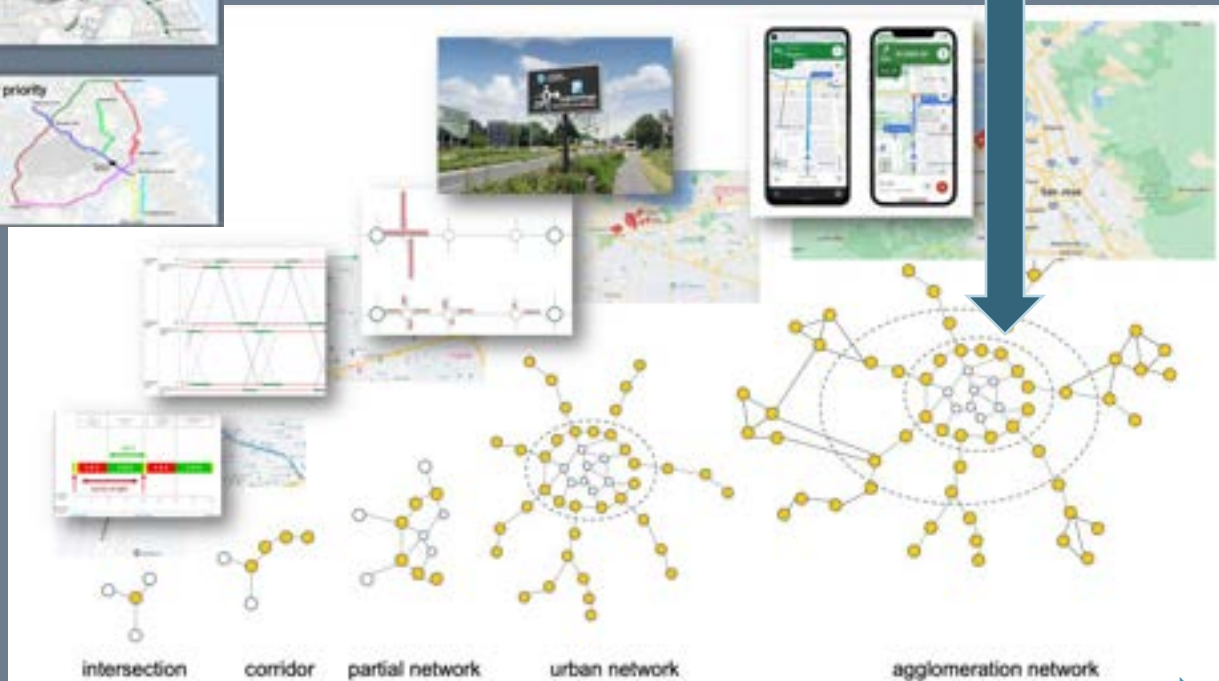
# You need to Control your Destiny



# It took over 50 years for the Dutch to become world-class



**Why not just start here?**



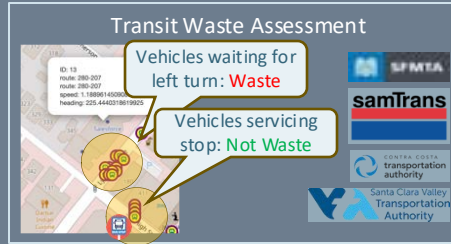
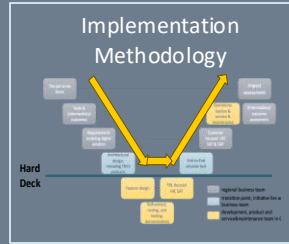
1960s

1980s

2000s

>2010s

# From PoC to Service – Empowering Traffic Engineering

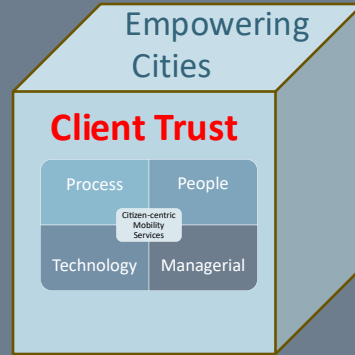


**Liveable City and Mobility Maturity Workshop**

“Intersection in a Box”



Operationalize and harden the algorithms and technology



TNL AI Edge Sensor *FlowCubes*  
24/7 Support and Maintenance



Cyber Security Audit Trail  
Multi-sensor object detection

Paper ID: 1226690



Use Case Engine

**Visit to The Netherlands**

Endorsed by: [Logos of endorsing organizations]

Participants: [Logos of participating organizations]








Speakers: [Logos of speakers]

*“As we rethink transit and transportation, this trip provided not only a great overview of proven approaches but also real-world examples and conversations with practitioners. It brought a valuable perspective to the conversation in California,” Mark Tollefson, Under Secretary Transportation California State*



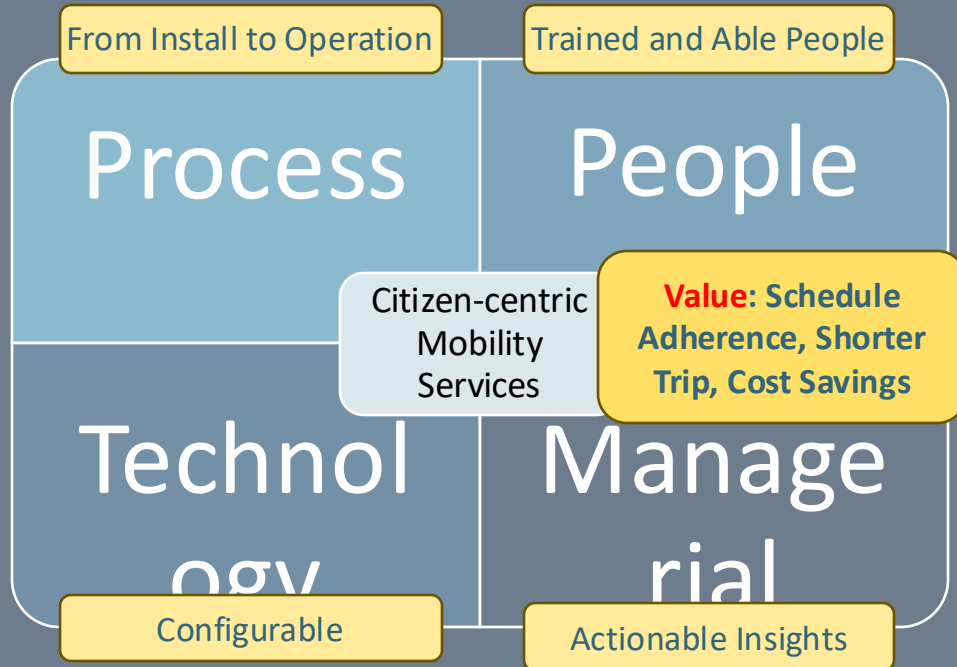
# Integrated Tooling to Deliver Dynamic Multi-Mode Traffic Flow Optimization

## *Enabling Traffic Engineering*

- Eliminate the need for studies and adjustment of signal timing and schedules 
- Prioritize by mode at network, corridor, intersection, approach level 
- Transit  
- Emergency Vehicle Route Clearing and Intersection Prioritization 
- ADA Support: Request Boarding and Extent Crossing Time App 
- Para Transit and School Bus 
- Event Support
- Freight Route and Waste Management
- Parking Guidance and Reservation
- School and Hospital Zones
- Dynamic Streets
- Freeway-arterial transition
- Dynamic Street Lights, Variable Message Boards
- Apple CarPlay and Android Auto integration
- Drones – Operational Management Airspace
- ITS Asset Management

## SFMTA Connected Corridor PoC Mission

Build a Service to improve the flow, safety, and climate for the people in the streets and in all vehicles



### Design Principles

#### Scale

- Multi-jurisdiction
- Continuous optimization
- Leverage existing infrastructure
- Phased deployment

#### Transit

- Significant service level increase
- Cost reduction

#### Traffic Engineering

- Micro-management multi-mode and next generation Adaptive Flow Management
- Scenarios and rules
- The client owns all data

#### Technical Architecture

- All Connected Signal Controllers
- Open architecture
- Military-grade cyber security

# Let's Race!

Simulation generated with SFMTA  
PoC Connected Corridor Data  
11am - 12pm



## Reference Day

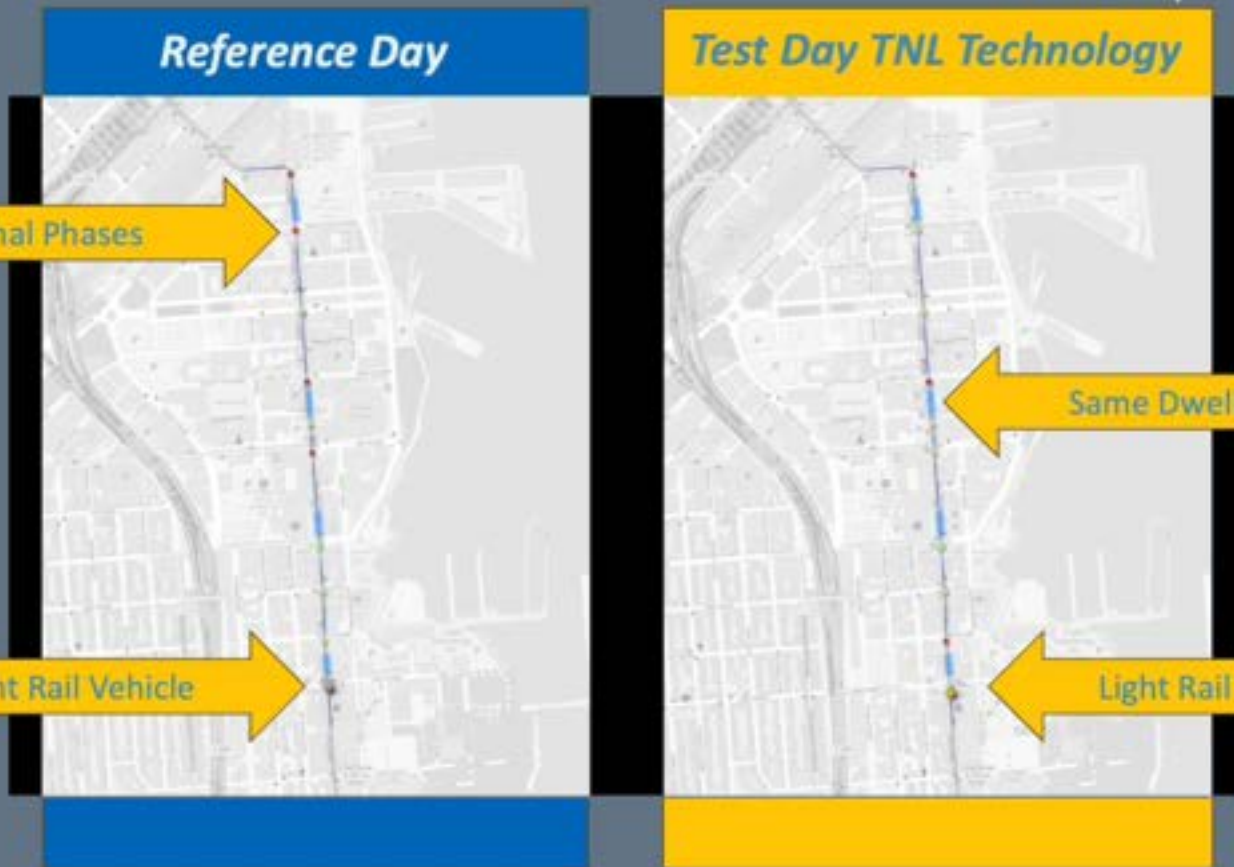
Signal Phases

Light Rail Vehicle

## Test Day TNL Technology

Same Dwelling

Light Rail Vehicle





✓ Small Teams signed off the dashboards to enable actions to be identified and prioritized with after-project benefit determination.

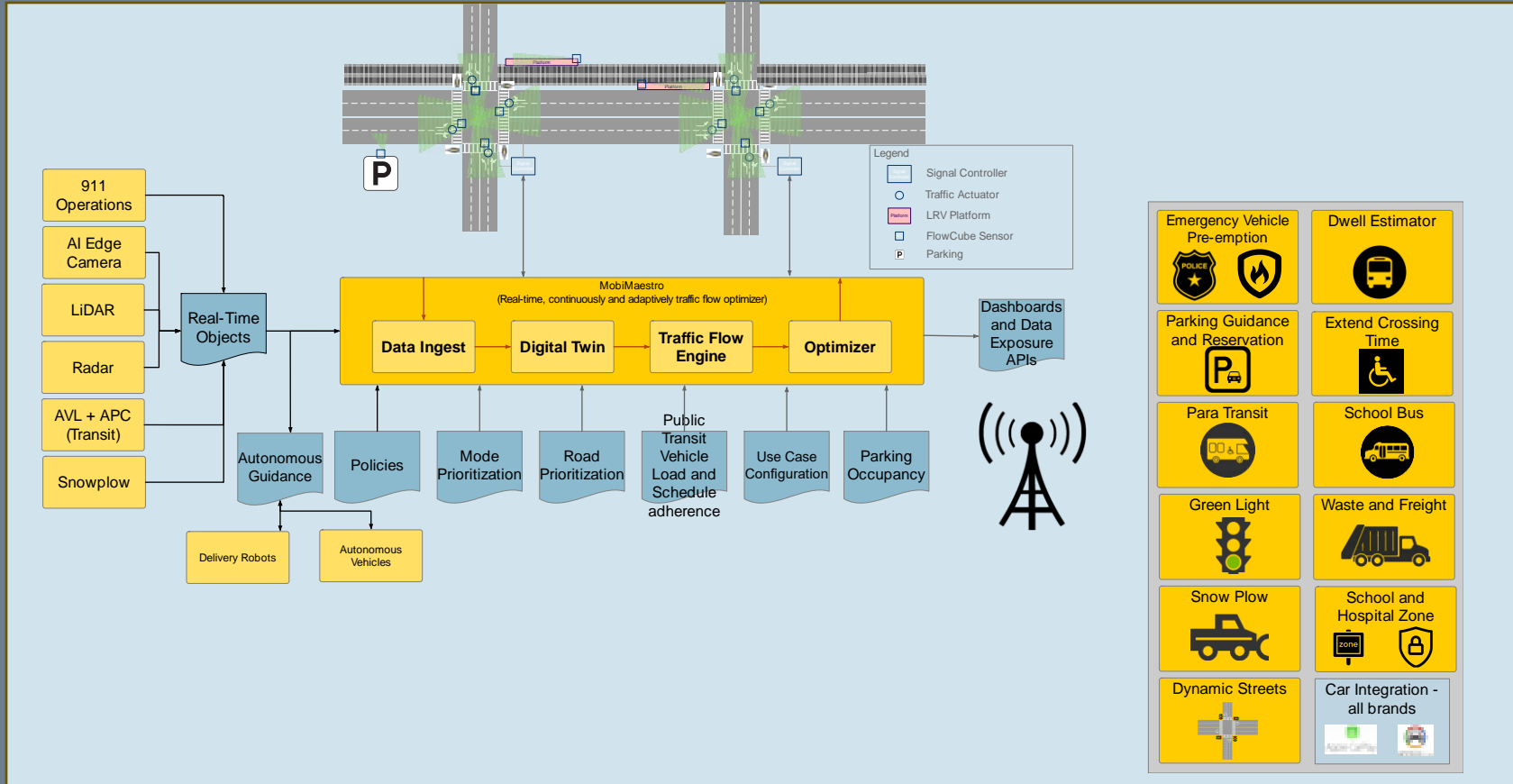
Livable Streets, Transit, Curb Usage, Traffic Engineering, Autonomous Vehicles, Taxis & Accessible Services and Vision Zero Teams

The system stores a complete digital twin – rich high-resolution data set to analyze mode, signal phase, speed, emission, safety, etc.

Counts, averages, durations, filters, comparisons, graphs, data downloads



# Technology as Enabler



A close-up photograph of Tom Cruise from the movie 'Mission: Impossible - The Final Reckoning'. He is wearing a white dress shirt and is shouting with his mouth wide open while holding a black mobile phone to his ear. The background is a blurred office or public space.

**SHOW ME**

**THE MONEY!**



# Transit Waste Index

Assessing the Service Level Transportation Agencies provide Transit



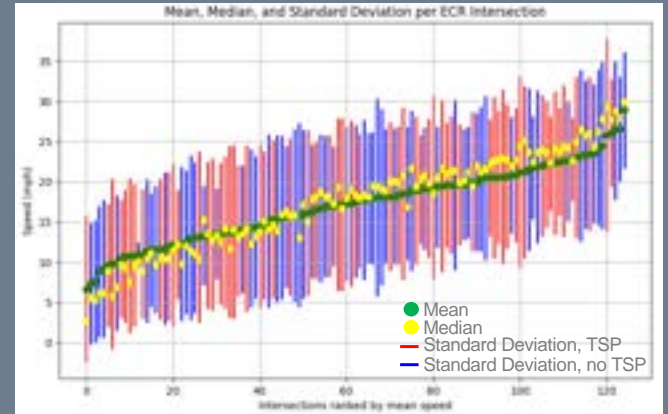
Score: TWI for SamTrans is **Poor: 43.2% Waste**

Route ECR SamTrans speed at intersections  
Red lines are intersections with TRP



Percentage Operational State  
ECR Field Measurement

	Northbound	Southbound
Signal Delay,	39.6%	33.7%
Transit Stop,	32.7%	35.4%
In Transit,	27.7%	30.9%



# How Ample is the Opportunity?

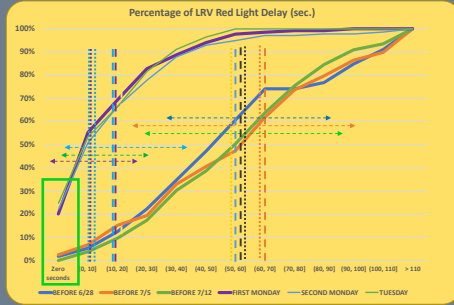
The benefits are large enough to **create self-funding programs**



## T-Line Current

- 12-14 LRVs
  - 80 min travel
- ## Projected
- 8-11 LRVs
  - 60 min travel

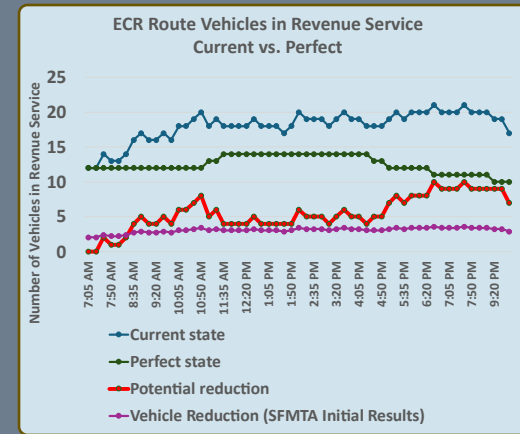
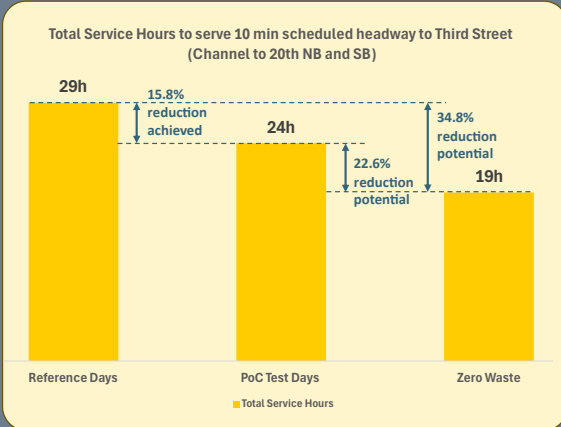
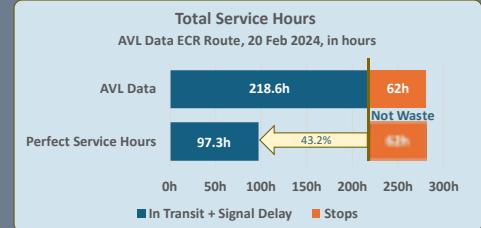
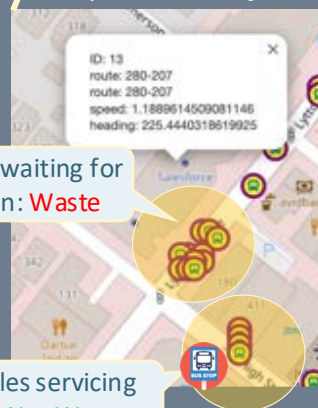
**OpEx: \$1.4M / vehicle**



Vehicle speed <15mph



Unprotected Left

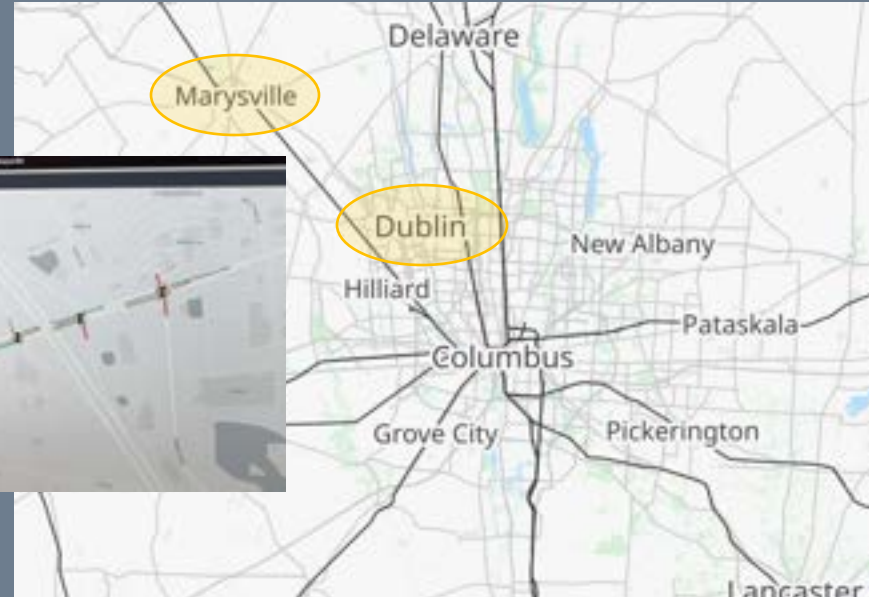


3 Vehicles reduction  
**OpEx: \$728k / vehicle**

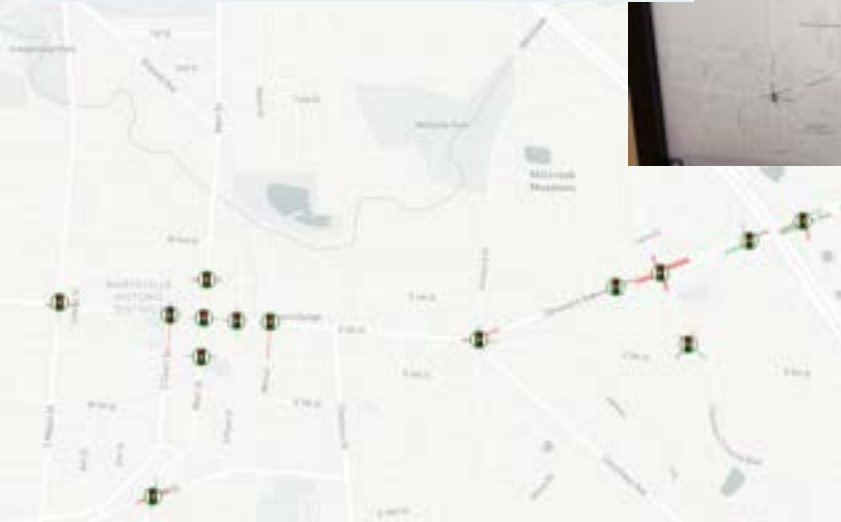


**YEAH**

**SHOW ME THE MONEY**



NETWORK Optimization of five modalities  
Emergency, Snowplows, Trucks, Pedestrians,  
cars



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# THANKS!

## We're Here to Help!



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- Public Works Director for 20 years Centennial and Colorado Springs
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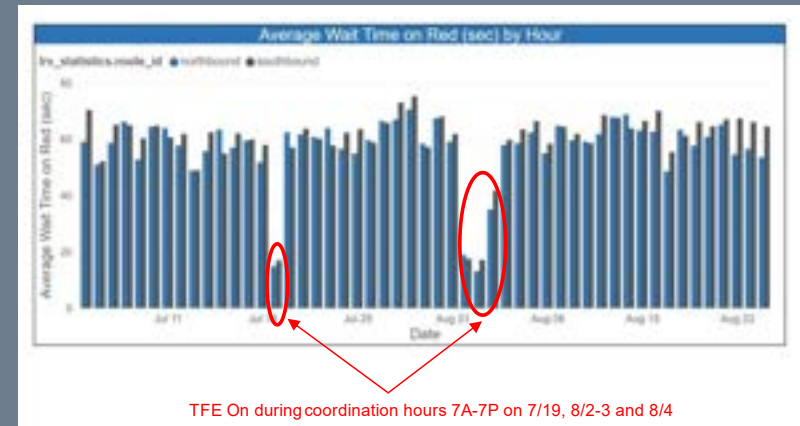


# SFMTA Proof of Concept

## By the Numbers



Mode	Metric	Before	After	Avg. Results
LRVs	Red Light Delay	60.3 sec	16.2 sec	73% reduced
	Travel Time	424.2 sec	358.2 sec	16% reduced
	Approach on Green	62.1%	85.8%	24% increased
	Average Speed	8.2 mph	9.9 mph	21% increased
Vehicles	Approach on Red	27.3%	26.3%	1% reduced
	CO <sub>2</sub> Emissions (Channel + WW)	2.79 tons	2.06 tons	26.1% reduced
Pedestrians	Approach on Walk Symbol	76.4%	75.5%	0.9% reduced



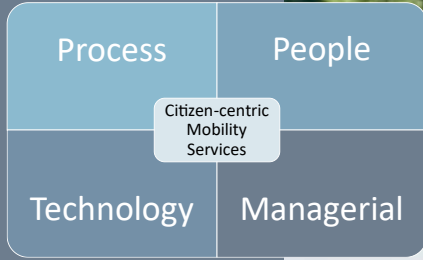
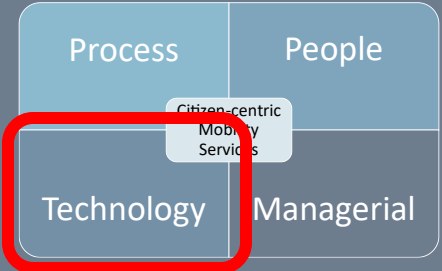


# Schedule and Headway adherence are key drivers of customer satisfaction

Transit Agencies are highly dependent on Transportation Agencies

*Transportation Agency*

*Transit Agency*



Dutch Traffic Engineers have significantly better tooling



# People and Process - Capacity Building

## *Invest in people*



*"Exploring each of the mobility maturity factors provided valuable insights, revealing where we currently stand and the possibilities ahead. This process also facilitated a unique and productive conversation among group members about our opportunities."*

Jamie Gaskill, Associate Director of Active Transportation,  
Colorado State University



# Self-Funding Programs

*Re-invest Operational Expenditure (OpEx) savings*

*Effective*

**Optimize Main Route**

**People**

- Capacity Building with Transit and Transportation Agencies

**Processes**

- Daily Operations
- Incident handling
- Problem identification
- Optimization route (Quarterly Infra Review)

**Technology**

- Deploy Technology enabler
- Dashboards
- Multi-modal platform

**Managerial**

- Fund initial deployment
- Establish governance model

*Efficient*

**Realize benefits**

**Positively Impact riders**

- Adjust schedule / go to headway
- Shorter trips
- Higher schedule adherence

**Climate impact**

- ~1400 kg CO<sub>2</sub> per service day

**OpEx**

- Reduce vehicles at \$728k/y

More riders?

Retire older fleet sooner?

Reduce operator shortage?



*Scale*

**Roll-out to all routes**

**Multi-mode optimization**

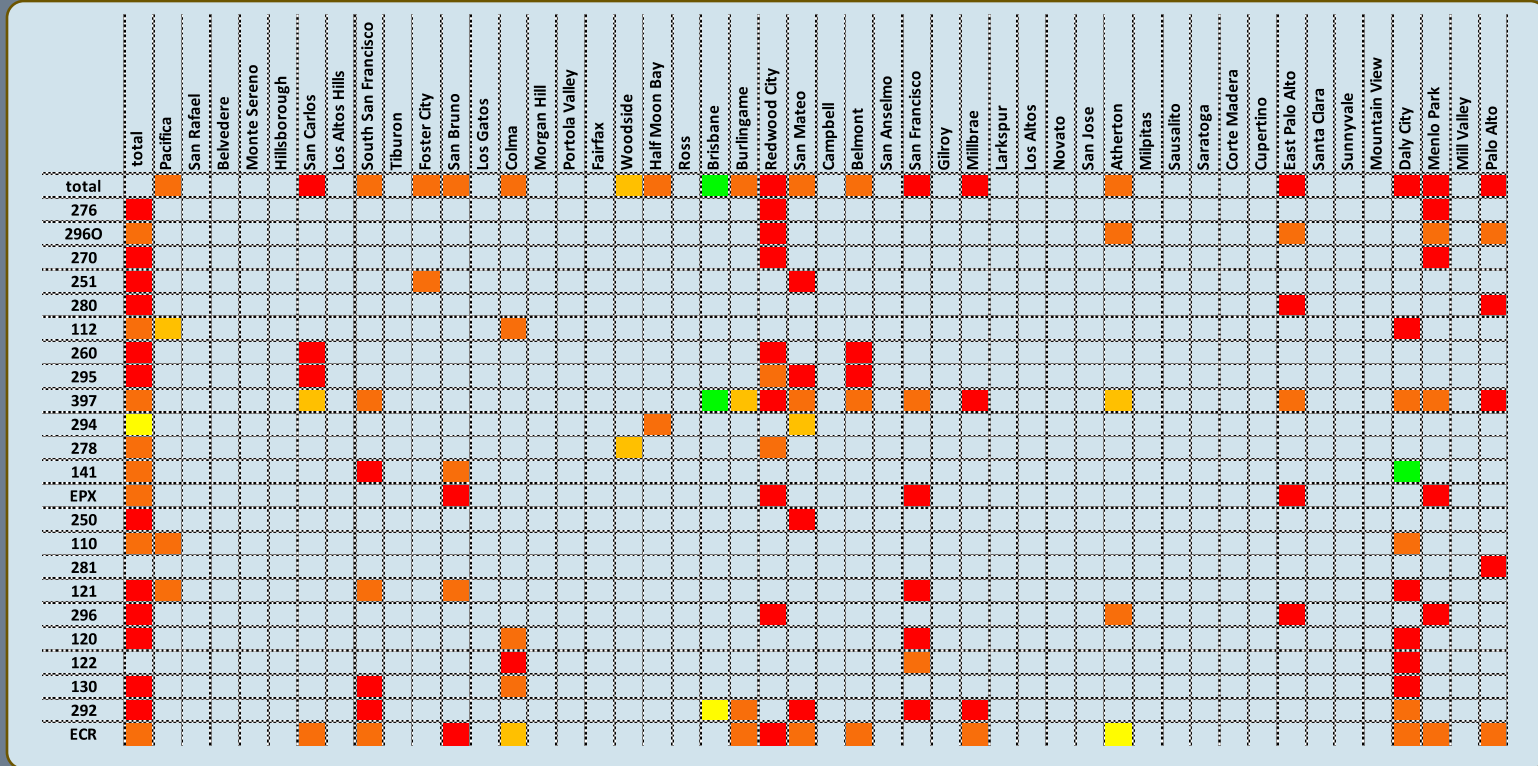
**Make available to all CA  
Transit Agencies**

**Operational Mobility  
Framework**



# TWI Scores by Route by City

Routes with over 5000 data points in AVL data from Tuesday, 20 February 2024



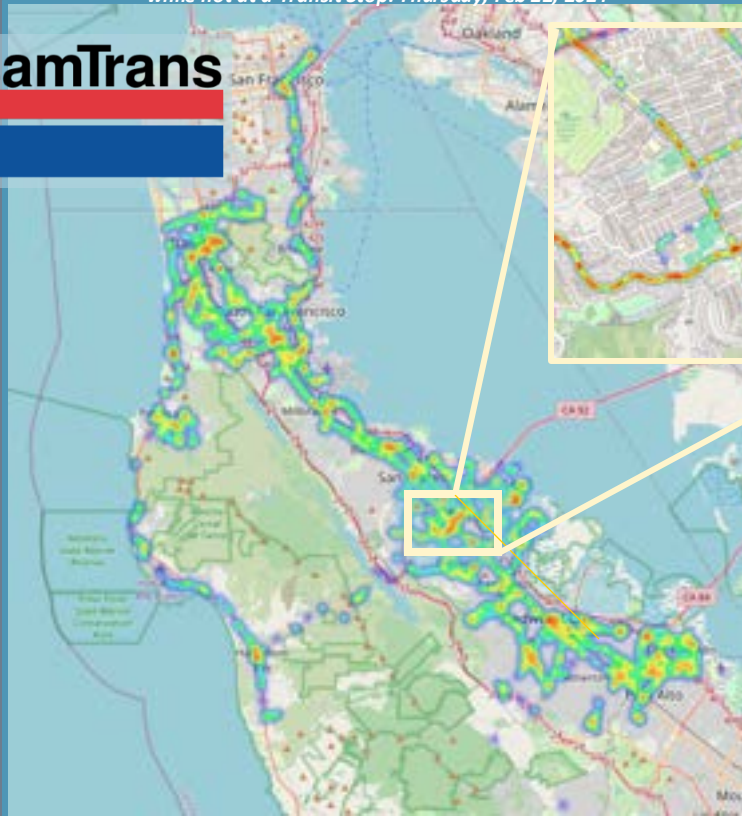
City	Waste %
Palo Alto	57.25%
San Francisco	55.01%
Redwood City	54.53%
East Palo Alto	53.69%
Daly City	53.11%
San Carlos	51.24%
Menlo Park	50.83%
Millbrae	50.20%
Foster City	48.33%
San Bruno	48.33%
San Mateo	46.54%
South San Francisco	43.55%
Belmont	41.38%
Colma	41.04%
Burlingame	37.40%
Atherton	36.31%
Half Moon Bay	34.75%
Pacifica	33.77%
Woodside	27.33%
Brisbane	5.35%



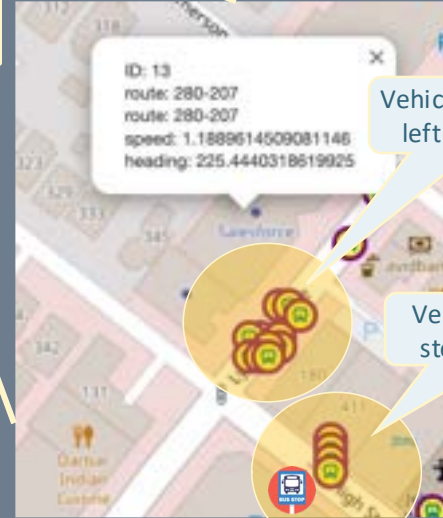
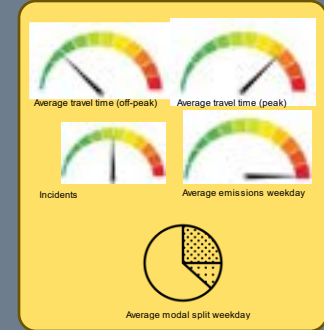
# Continue till there is no Red left

Count of buses travel with speeds <15mph while not at a Transit Stop. Thursday, Feb 22, 2024

samTrans



Quarterly Infrastructure Review

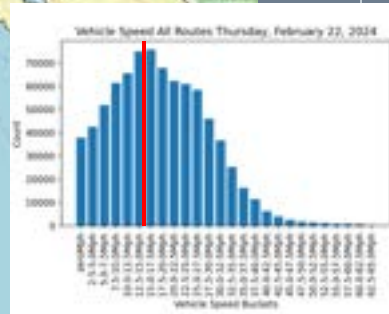
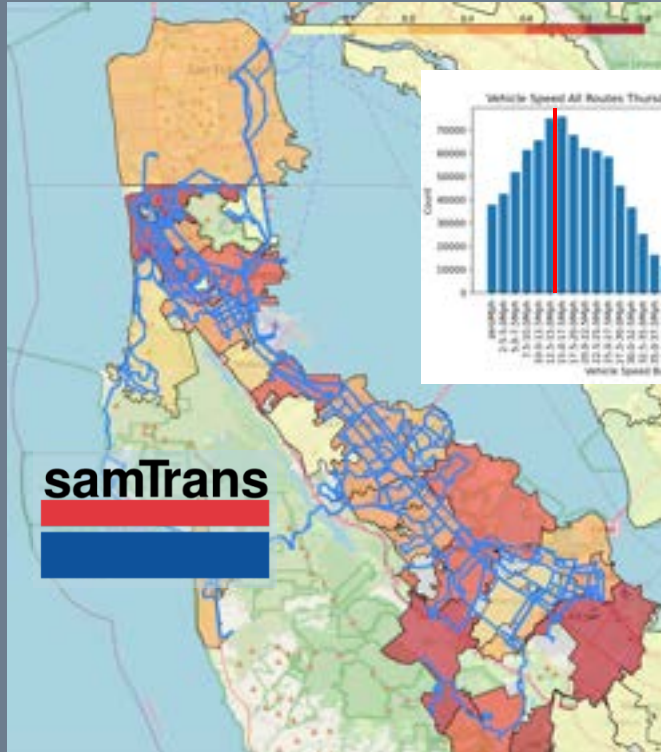


# Rely on benefit to fund the next project, not external

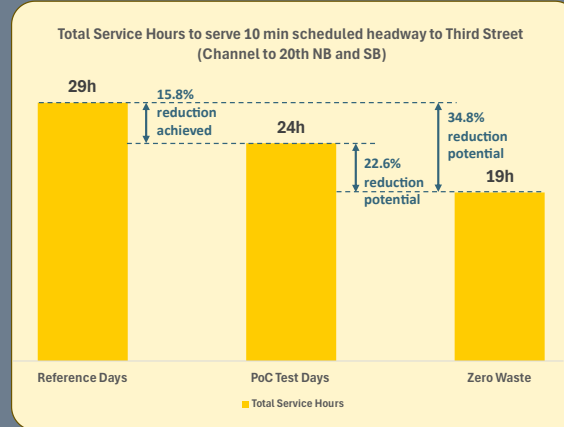
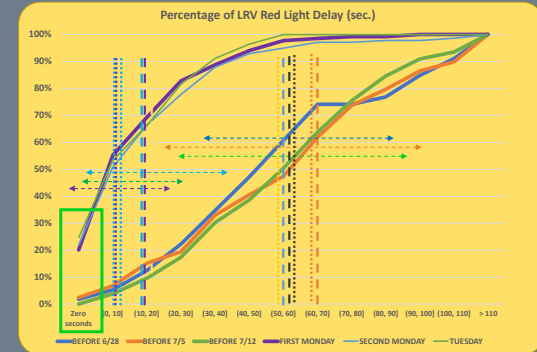
## Operational Expenditure



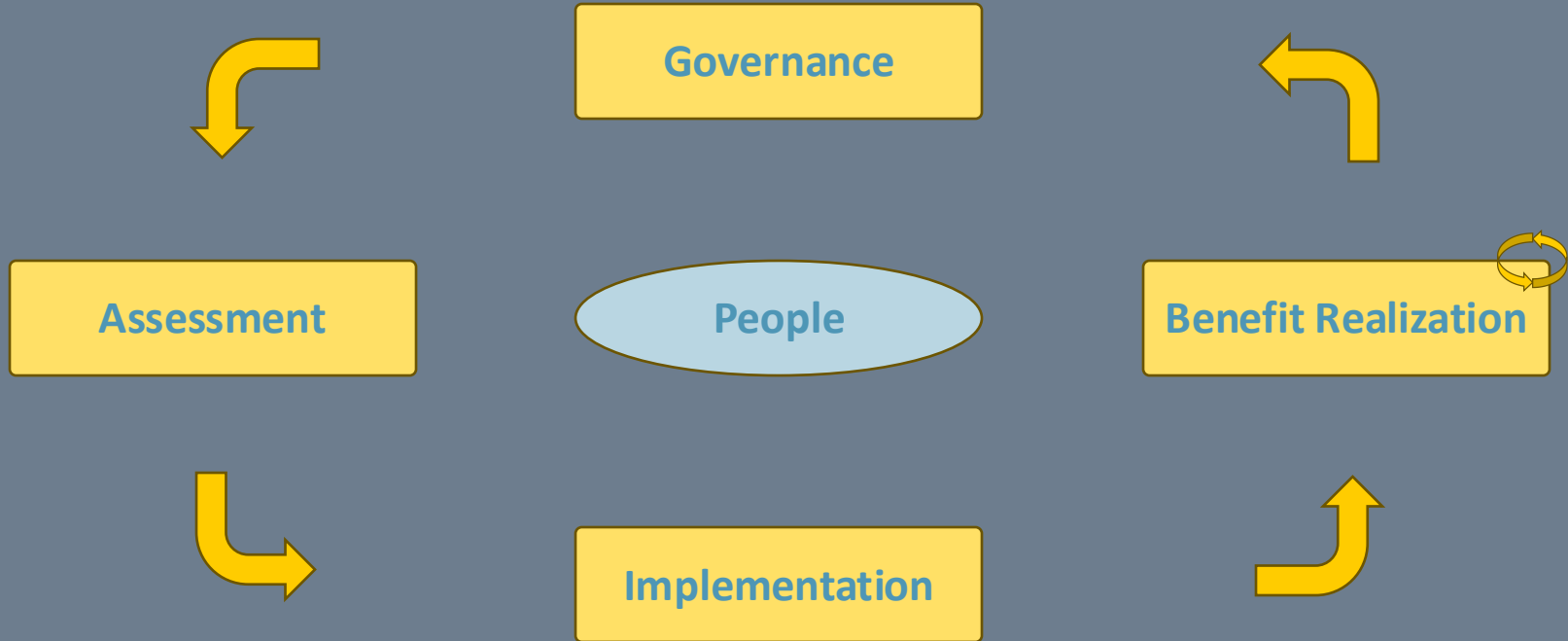
47.4% of buses travel with speeds <15mph while not at a Transit Stop. Thursday, Feb 22, 2024



- ### T-Line Current
- 12-14 LRVs
  - 80 min travel
- ### Projected
- 8-11 LRVs
  - 60 min travel



# Service Improvement Framework







# Bridging the Financials

## *One of the options besides Grants, etc. - PPP*



### Sponsors



- Institutional investment vehicle that enables cities to unlock financial and societal benefits and a rapid transition towards low-carbon, resource-efficient, and inclusive communities.
- Smart City Infrastructure Fund is backed by a leading European pension fund to invest in the scale-up of integrated Smart City infrastructure projects.

Investment size >\$10million  
 Investment term 10-year minimum  
 Structure Public private partnerships (PPP/P3), concessions sale & lease back  
 Eligible Funding Common equity in individual assets, preferred equity, and acquisition of receivables

#### Contact Information

**ERIN AUSTIN** | COO  
[erin.austin@smartcityinfrafund.com](mailto:erin.austin@smartcityinfrafund.com)  
 T: +1 207 400 5662  
[www.smartcityinfrafund.com](http://www.smartcityinfrafund.com)

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[katie.collins@smartcityinfrafund.com](mailto:katie.collins@smartcityinfrafund.com)  
 T: +1 970 294 5170  
[www.smartcityinfrafund.com](http://www.smartcityinfrafund.com)



#### Physical Layer of Digital Infrastructure

Target back-end infrastructure investments for the development of digital networks and smart city use cases in the energy, transportation and environmental services.



#### Long Term Equity Investments

Investment in a broad arrangement of infrastructure assets with public and private entities. Project risk transfer to private sector and environmental (public) budget.



#### Global Scale Up Strategy

Partnership approach with best-in-class industry players offering scale-up support for their smart city program. Minimum investment size is at least \$5.000 million, where there are expected to be (scale-replicable) opportunities.



#### Competitive Funding Cost and Upside Sharing

Attractive risk-adjusted returns to meet the low-risk profile of the infrastructure fund. Revenue sharing on the development of future smart city use cases and PPPs.

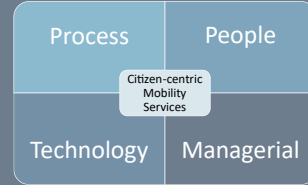
### US Investment Portfolio\*

City	Investment Date	Population Size	Invested Amount
Fullerton, CA	April 2019	135k	US \$72m
Salem, MA	October 2020	41k	US \$31m
Placentia, CA	April 2021	51k	US \$39m
Simi Valley, CA	October 2021	131k	US \$85m
Rancho Cordova, CA	January 2022	75k	US \$64m
Kenosha, WI	October 2023	99k	US \$98m

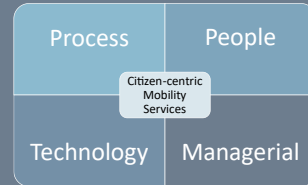
\*Investments are for open access fiber network build-outs



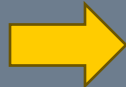
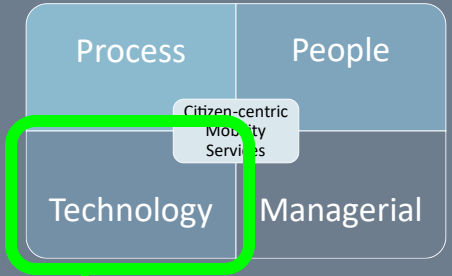
### Transit Agency



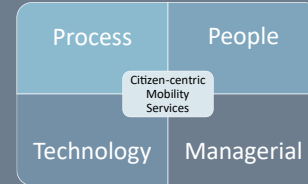
### Vulnerable Road Users



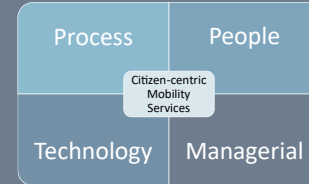
### Transportation Agency



### Emergency Service

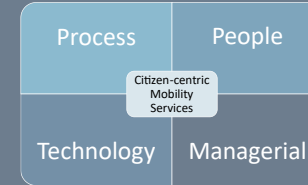


### Vision Zero

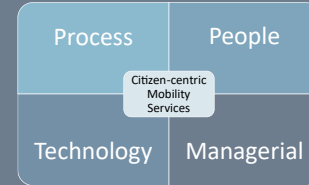


Traffic Engineering empowered to deliver world-class services

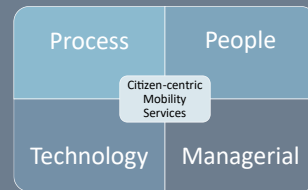
### Parking



### Autonomous Vehicles



### Micro-Mobility



### School buses, Para, Waste, etc.

