MIOVISION

ITS Heartland Chapter

# Empowering Cities to Design and Manage Safer Streets

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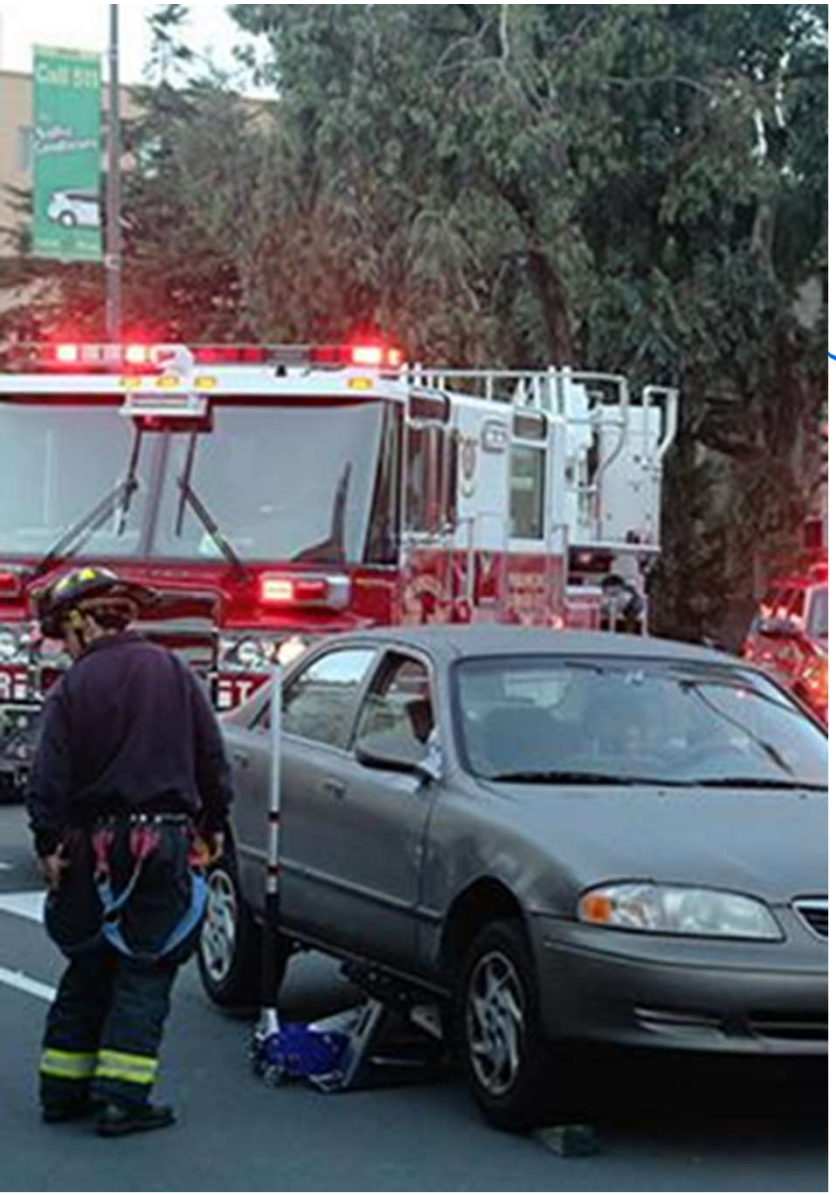
# Agenda

- Introduction
- Empowering Applications
  - Intersection Monitoring
  - Video/Stop Bar Detection
  - Performance
  - Mobility Reports
  - Adaptive Control
  - Safety Studies
- Q&A



# Traffic Crashes

Traffic crashes are a global leading cause of death

This has placed higher priority and scrutiny on building and maintaining **safer transportation networks for all modes of travel.** This has surfaced as more adoption of Vision Zero and safety initiatives.

“Over 35,000 people die in traffic crashes across the U.S. every year, by far the highest rate of any industrialized country. An increasing percentage of these deaths are of people walking and biking in urban areas.” - National Association of City Transportation Officials (NACTO)

# Current Solutions

Some existing solutions (both HW and SW) can be an unreliable and reactive approach to design and mitigation. **It may be:**

**Out of Date**

Application may be years old and doesn't reflect the current conditions

**Under-Reported**

Some roadway incidents may not be reported resulting in skewed data

**Inaccurate**

Some data reports can be error-prone depending on the hardware on the road. You are making costly decisions on what may be inaccurate data

**Limited**

It is based on small data sets and may not relate to future locations, updates or improvements.

**Reactive**

It requires an injury or death to get attention

A modern and more efficient way to design **better** and **safer** is data-driven. Crucial and quantifiable data allows you to identify your starting point and can be used to measure successes along the way. However, the quality and source of the data matters.

# As of now, the information available to manage your roads are in data ‘silos’.

Different applications

Different hardware

Different interfaces

Separate contracts

# This equals a lot of unnecessary effort to get information you need to make change

- Collect and analyze the data in all your apps
- Costly and time-consuming
- Causes delayed or **reactive** decisions to resolve issues

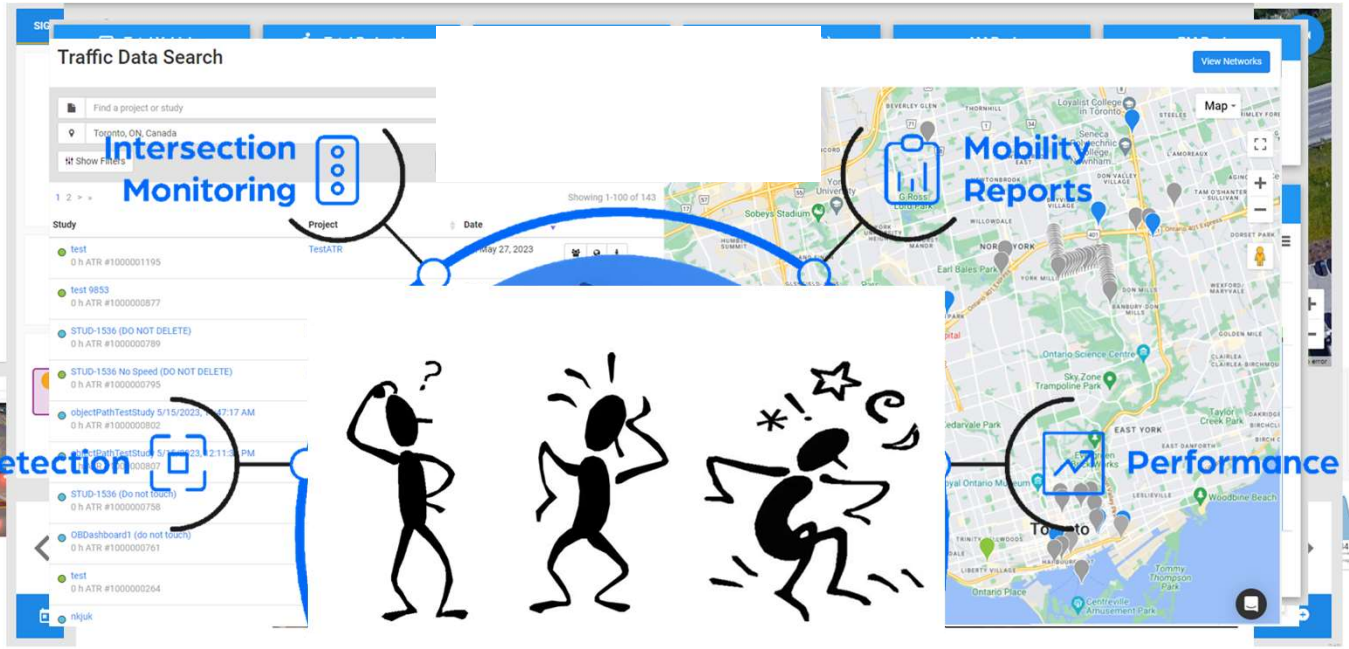




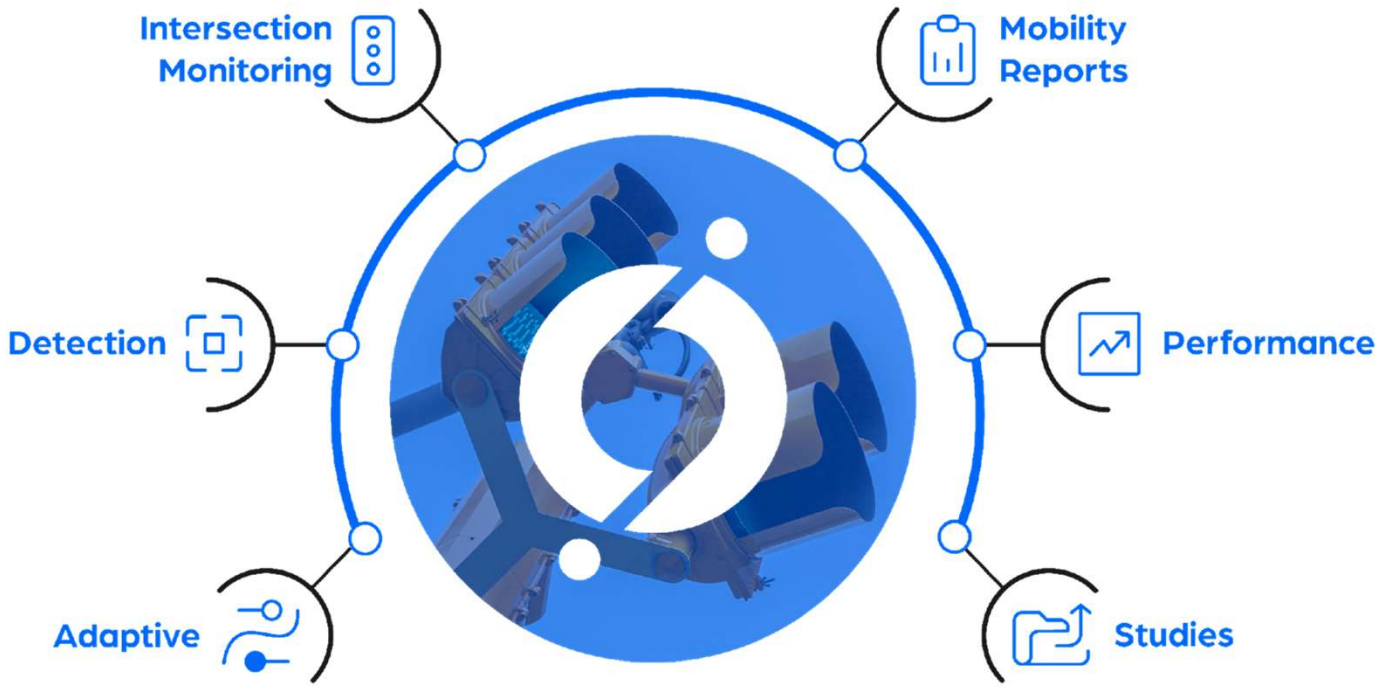




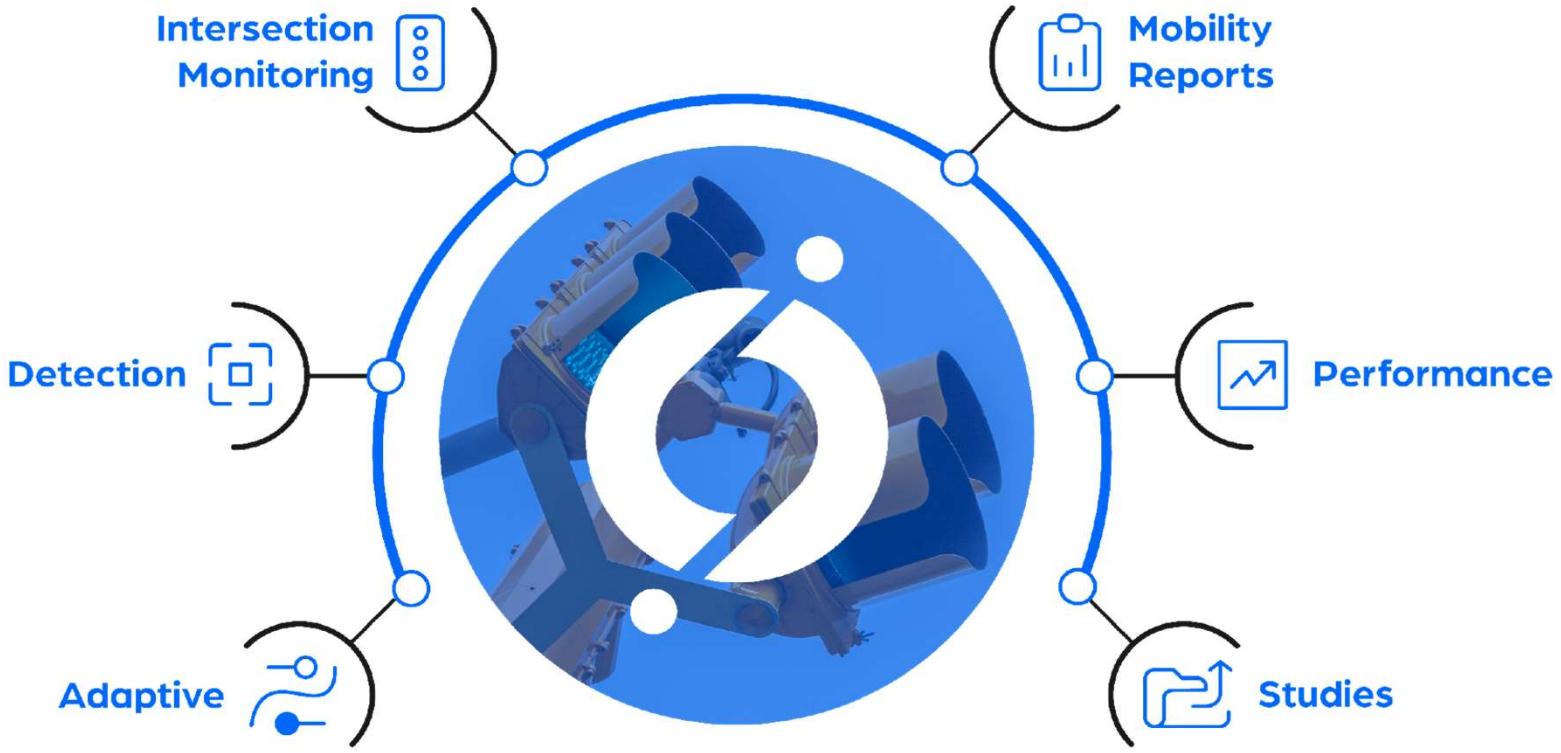




Traffic Data Search
Intersection Monitoring
Mobility Reports
Detection
Performance
Adaptive
Studies

**A more efficient method** is one platform that integrates the data in all of the applications you need to better manage traffic...and make improvements less time consuming — and less costly.



# Let’s Envision It…


Intersection Monitoring
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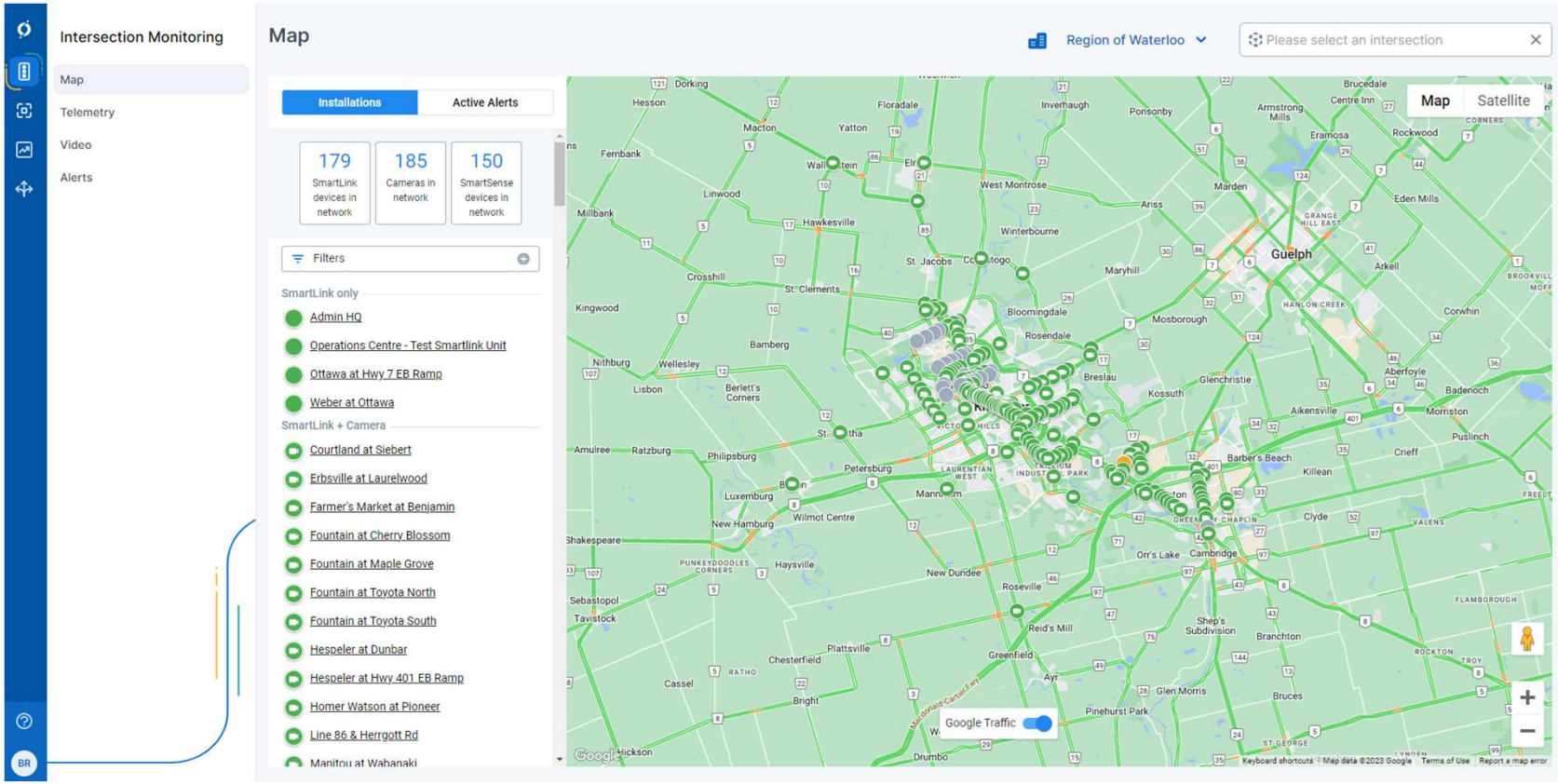
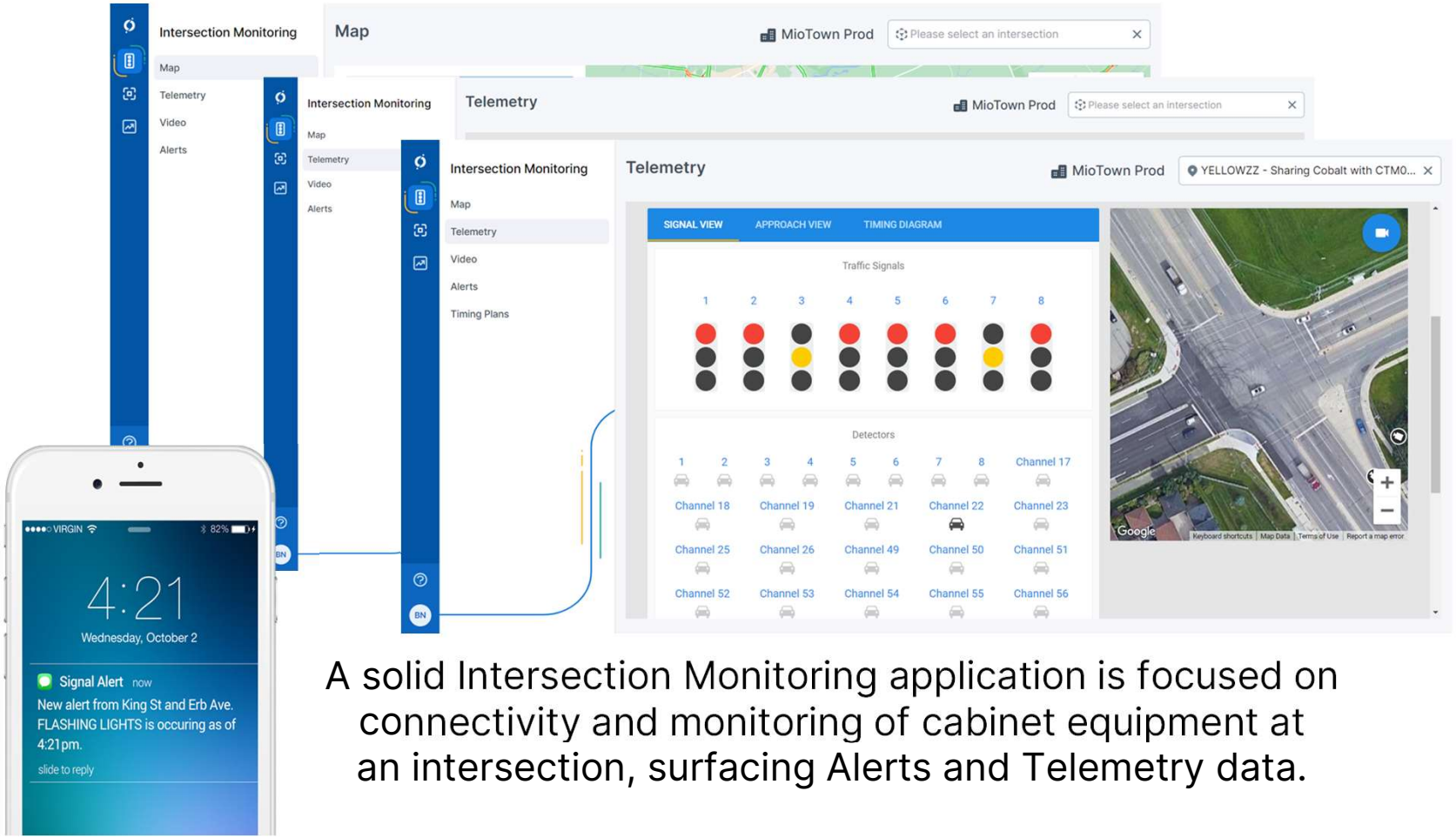
# Intersection Monitoring

# Access Your Whole Network



# Intersection Monitoring




A solid Intersection Monitoring application is focused on connectivity and monitoring of cabinet equipment at an intersection, surfacing Alerts and Telemetry data.

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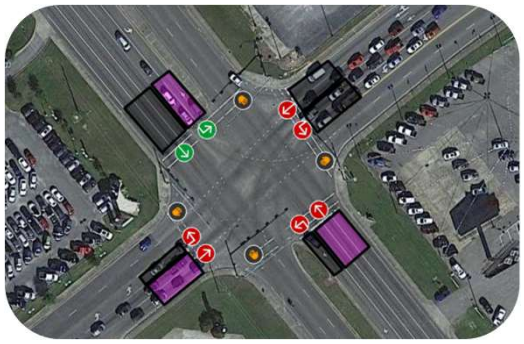
# Detection

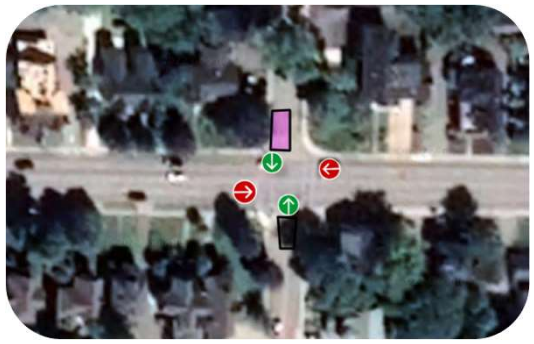
# Video Detection

Ideal Location(s)



## All intersections, all movements

- Run in any mode (free, actuated, semi-actuated)
- Understand phase utilization (occupancy) to optimize timing plans



## Intersections with low side street volumes

Semi actuated operations where the mainline rests in green unless minor is called via detection

## Left turns

- Actuated left turn movements only
- Improves efficiency as left turns only get called when there is demand.

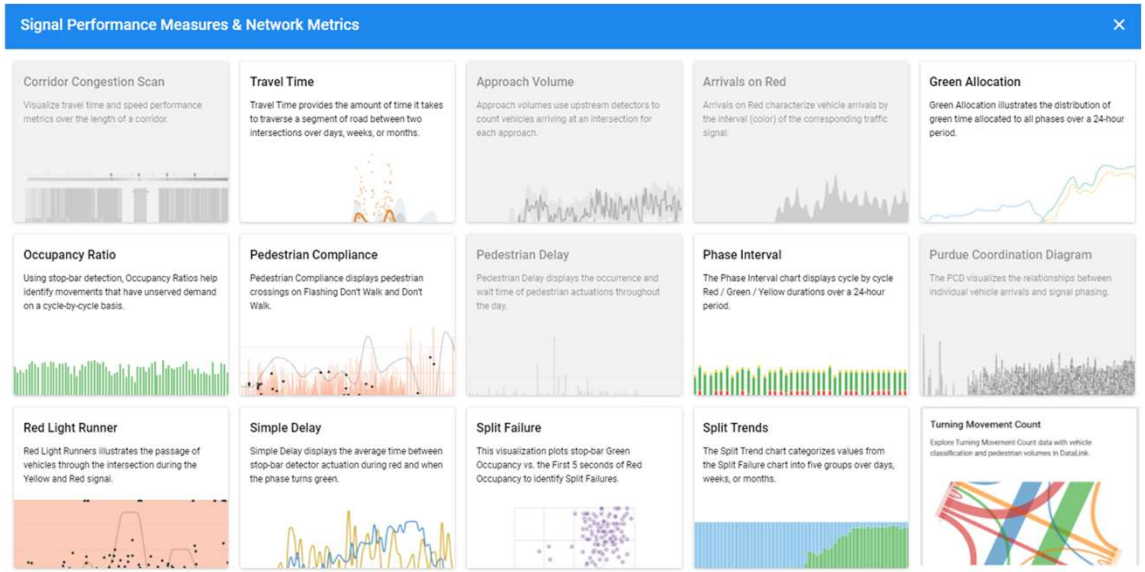
# Video Detection

## Detection for Actuation

- Streamline equipment: Detect vehicles, pedestrians, and cyclists, with a single camera
- Video recall and alerts allow for quick diagnosis of problems
- Create fully actuated control plans in seconds
- Report on occupancy ratios, arrivals on red, arrivals on green, and phase intervals

# Detection SPMs

## What SPMs are available




## How they can help

- Validate different detector malfunctions
- Evaluate the performance of the intersection from a local split allocation point of view.
- Justify the introduction of measures, such as increased police presence, installation of enforcement cameras or signal timing modifications.
- Understand volume trends
- Access Intersection Health insights

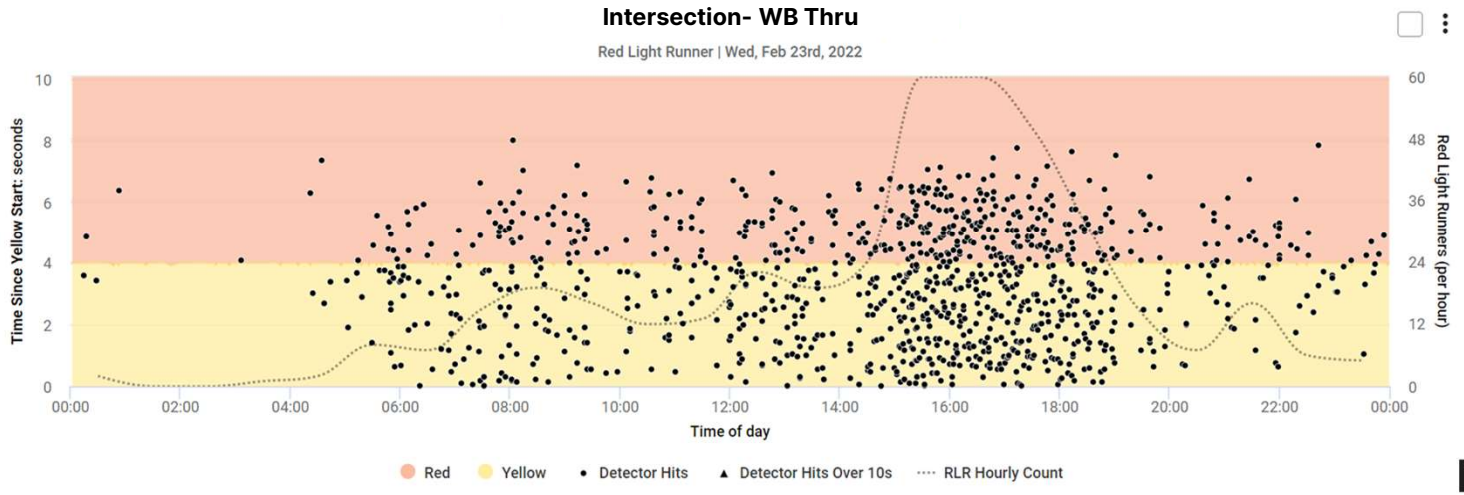
# Red Light Runner Trends

## Example

The Red Light Running chart shows:

- Yellow time, red time
- Vehicles running the yellow / red

Increase in YLR and RLR during the PM peak. Why ?



# Performance

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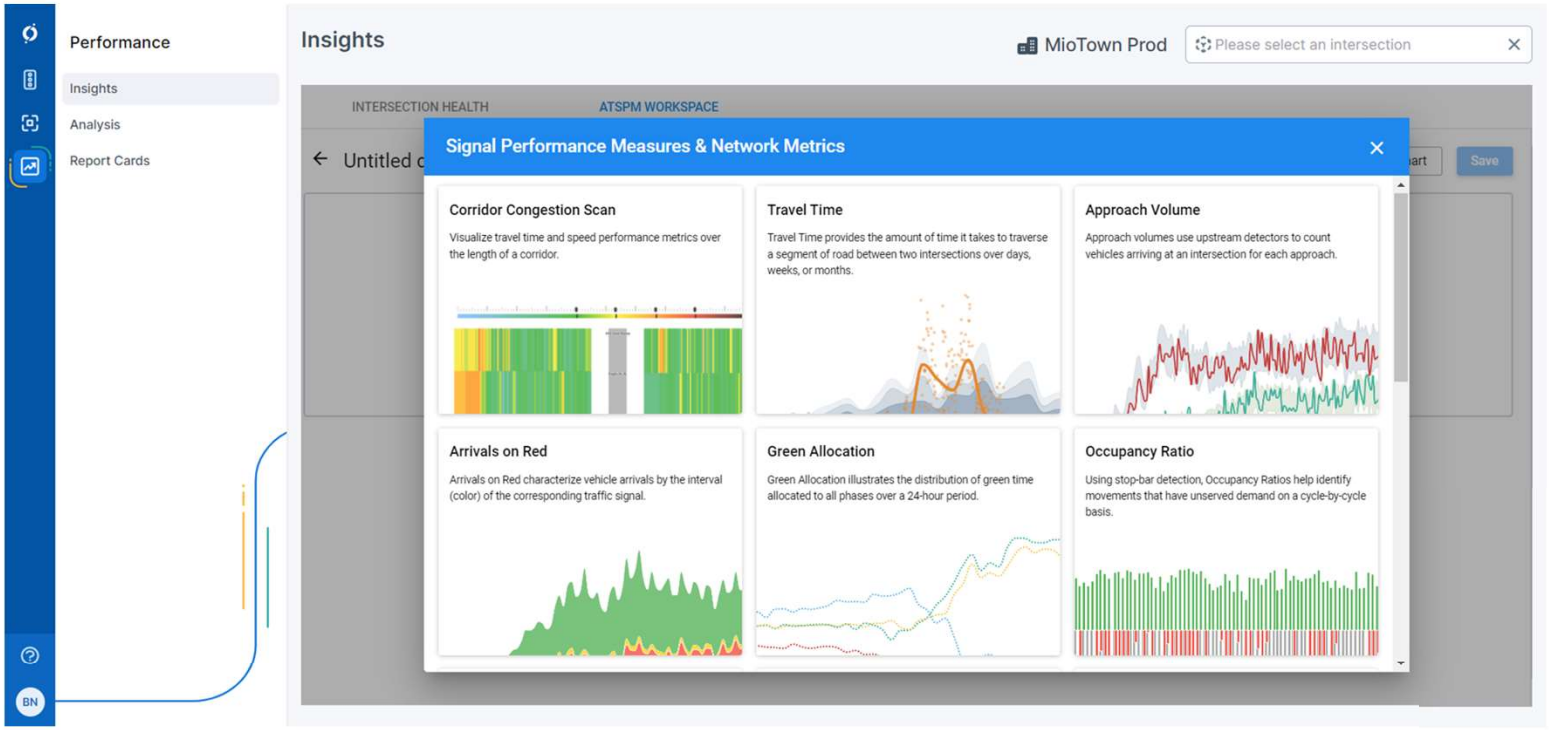


A performance application is a powerful solution for managing and optimizing traffic flow with real-time data, advanced analytics, and should include a user-friendly interface.

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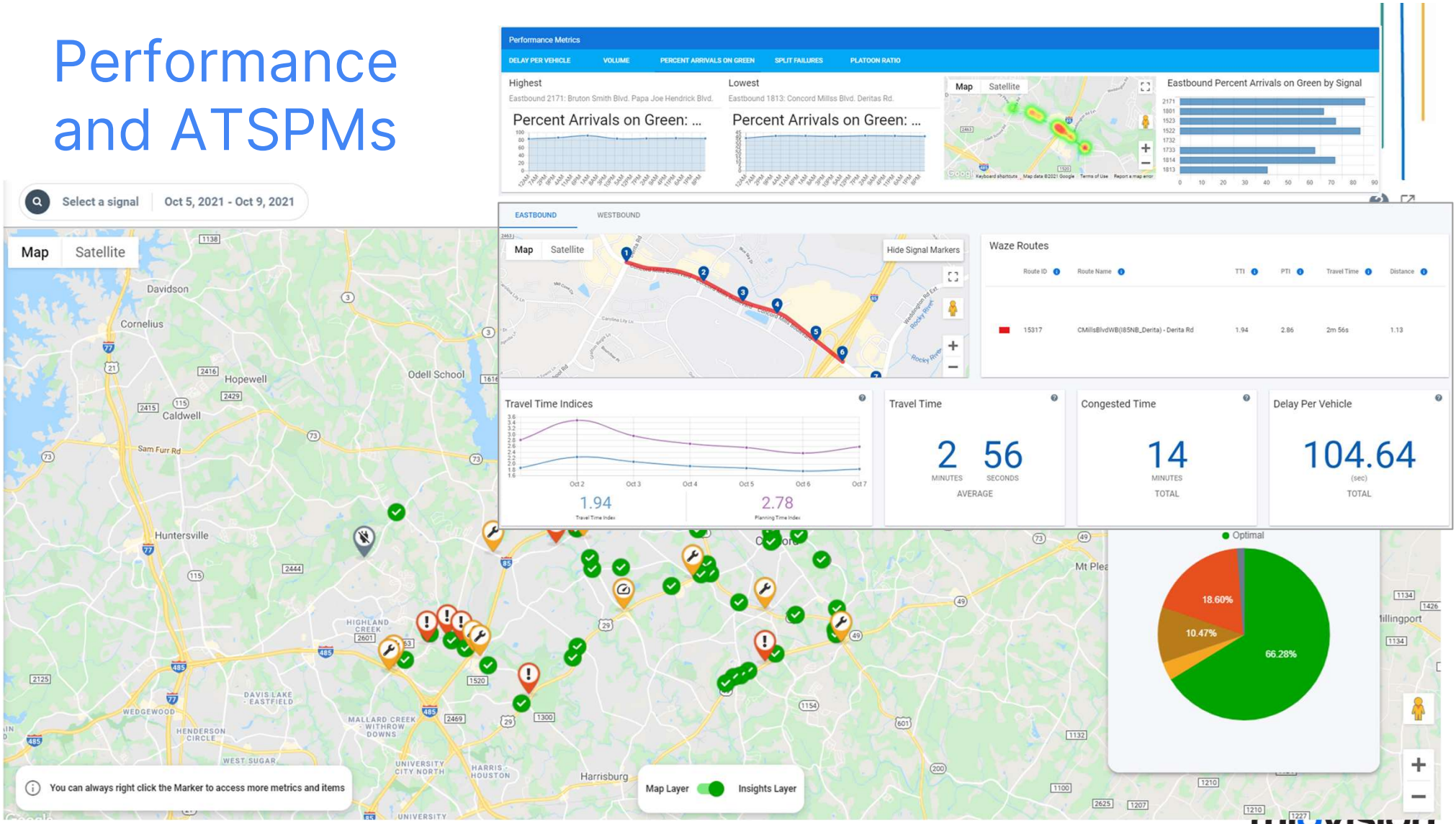
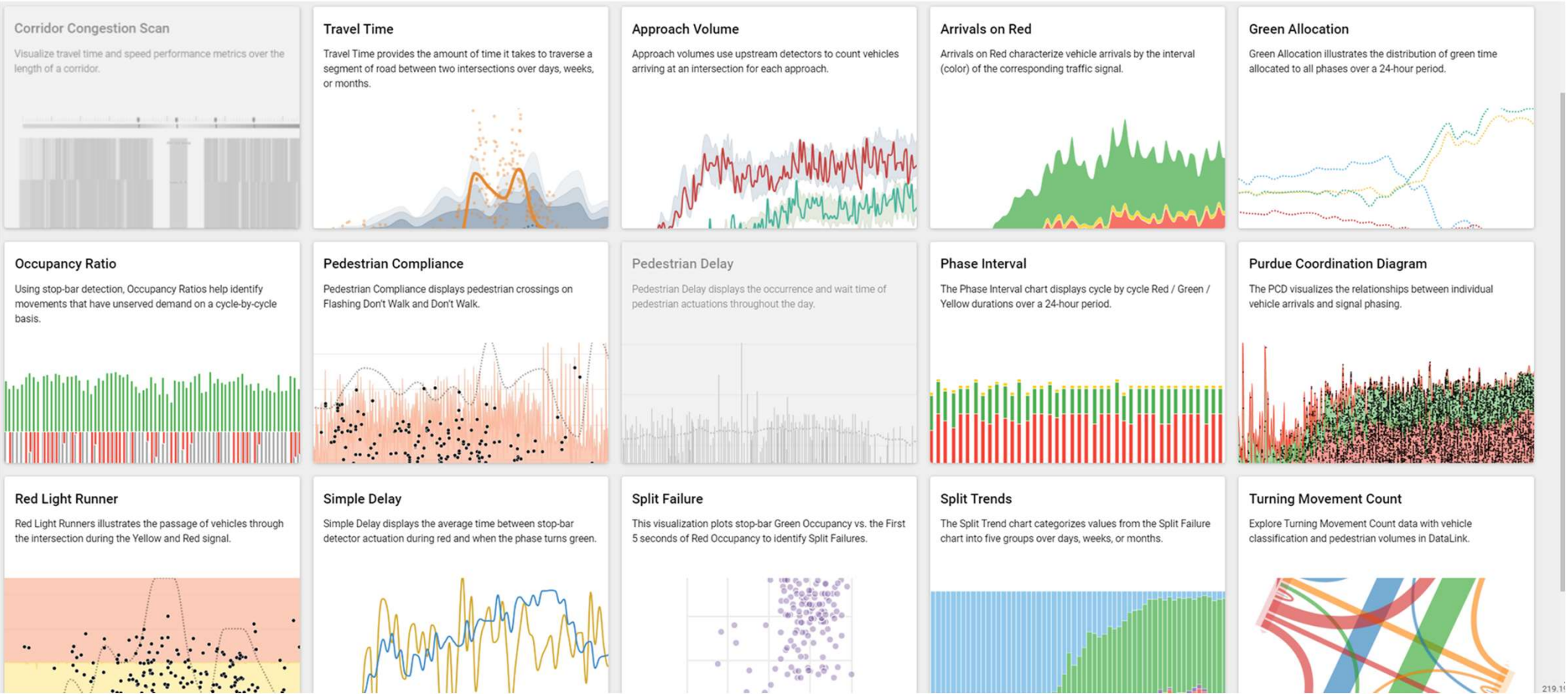
# Performance and ATSPMs



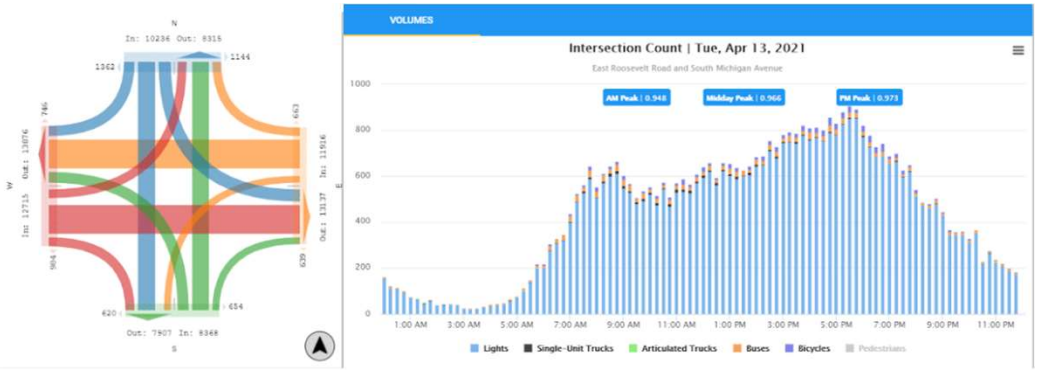
# Automated Traffic Signal Performance Measures



# Mobility Reports

# Continuous Count Data

- Being able to access and analyze count data from your intersection 24/7





# Mobility Reports


A Mobility Report is a comprehensive tool for visualizing and analyzing traffic counts data.

# Adaptive Control

# Actual Traffic

Adapt in real-time to changing traffic conditions

## Decentralized

Your ideal system is decentralized and scalable to networks of any size and shape

## Multimodal

Optimize for multiple modes of travel, keeping vehicles, cyclists, pedestrians, and transit moving and safe

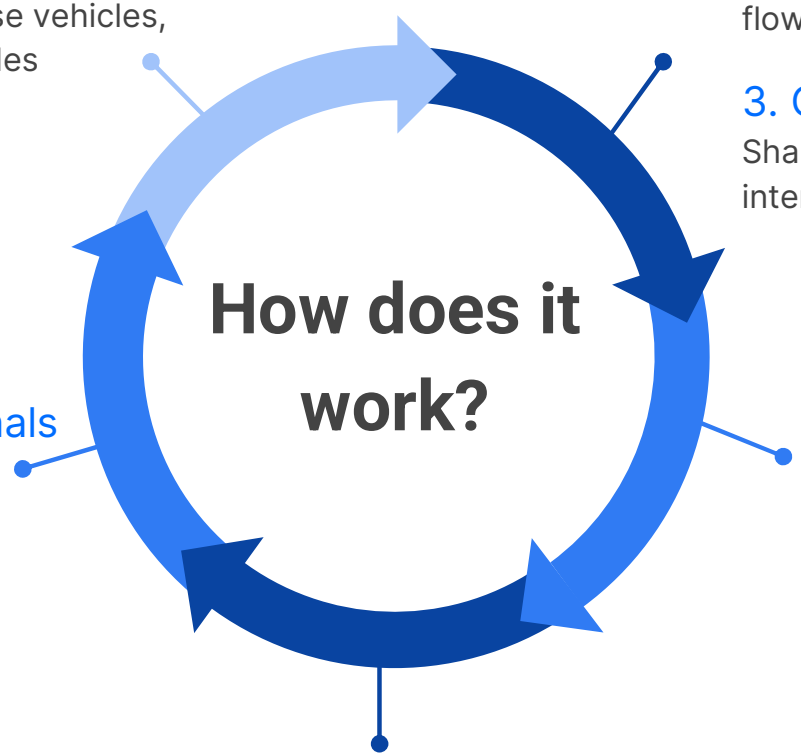
## Optimized

Coordinate traffic flow on complex grids, not just on arterials or corridors

## Real World

Your ideal system focuses on real world traffic rather than historical data for the largest impact

# How does it work?



### 1. Sense Traffic
Uses traffic detection systems (e.g. video or radar) to sense vehicles, pedestrians, and other modes

### 2. Build Predictive Model of Traffic
Create aggregate representation of traffic flows from sensed traffic

### 3. Communicate With Neighbors
Share predicted outflows with neighboring intersections, extending the planning horizon

### 4. Optimize Schedule (Timing Plan)
Optimize over the predictive model of traffic to minimize overall delay

### 5. Send Commands to Controller
Execute only the first few seconds of the plan by sending commands to the traffic signal controller, typically using NTCIP

### 6. Controller Manages Signals
Traffic signal controller continues to enforce safety and operational constraints

# Adapts For Your Network

Behavior automatically adapts based on traffic flow levels

## Light Traffic

The system focuses on moving platoons through the network without stopping and is very responsive to current traffic flow.

## Shoulder Periods

The focus shifts to queue management so the coordination is more defined and the goal is avoiding saturation in the network.

## Saturation

The focus becomes queue management, so the system will be less responsive to individual vehicles and will focus on the dominant flow of traffic.

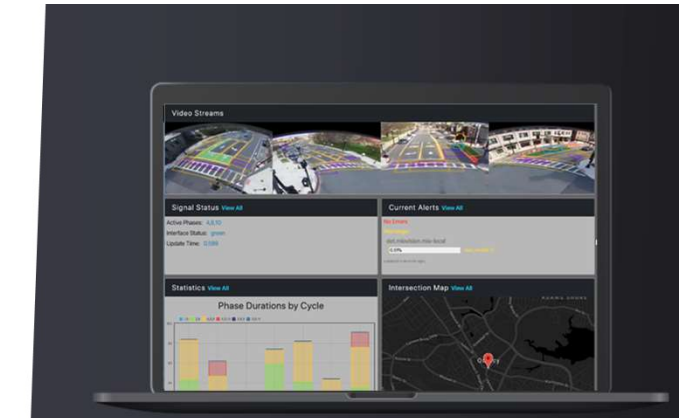
# User Interface

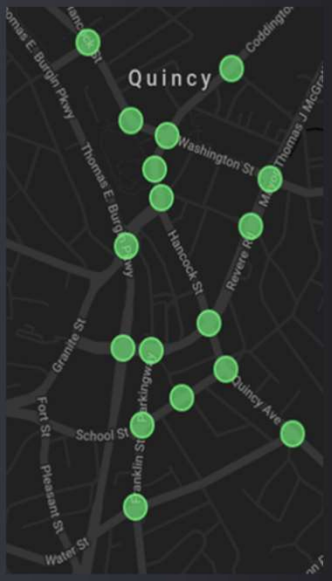
## Browser Based
Easily access your information remotely with no software to install

## Remote Access
Quickly configure Surtrac, and analyze and monitor your network from anywhere

## Live View of Traffic
Access live video and live view of Surtrac optimization  to see how the system in working in real time

## Alerts
Flexible alerts that cater to your needs



# Safety Studies

# Safety Assessments

Using historical crash data can be an unreliable and reactive approach to safety risk measurement and mitigation. **It may be:**

**Out of Date**

Data may be years old and doesn't reflect the current conditions

**Under-Reported**

Not all crashes are reported resulting in skewed data

**Inaccurate**

Police crash reports are notoriously error-prone. You are making costly decisions on what may be inaccurate data

**Limited**

It is based on small data sets and may not relate to future crash locations

**Reactive**

It requires an injury or death to get attention

# Preventative Solution

Proactive diagnostics using computer vision

## Proactive

This approach focuses on preventing accidents **before** they happen

## Injury Focused

Using kinetic energy we can focus on crashes that will cause injury or death, rather than property damage

## Recommend

Assigned road safety engineers can diagnose the data and provide a road safety improvement plan

## Reduction

After executing the plan, monitor the risk reductions achieved

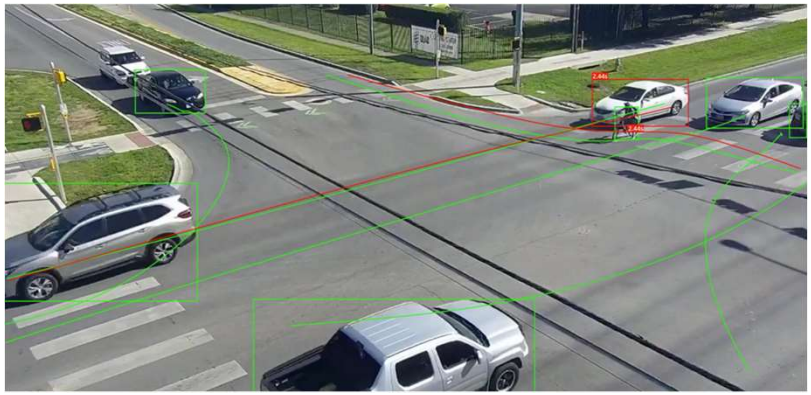
# Impacts

## Making a real impact on your network safety

**94%** Validated accuracy of Safety Studies risk indicators for predicting injury collisions*

**80%** Typical risk reduction achieved when responding to diagnostics

**36X** Faster measurement of safety improvement compared to crash data



*Anarkooli, Persaud, Milligan, et. Al (2021). Transportation Research Record.

# Safety Studies Process - Full Intersection

### Gather Video

Video is captured on location for 3 days or longer by agency or contractor.

### Risk Identification

Produce a risk diagnostic report by measuring near-misses with AI.

### Action Plan

A road safety plan is developed by the agency or consultant, or, optionally, by in house experts.

### Implement Changes

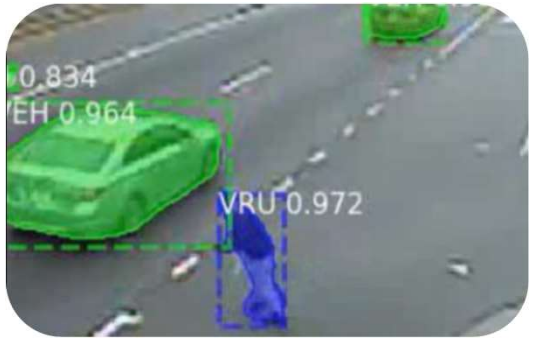
The recommended changes are approved and implemented to the network by the agency.

### Monitoring

Optional: Another report can be run afterwards to measure the risk reduction achieved

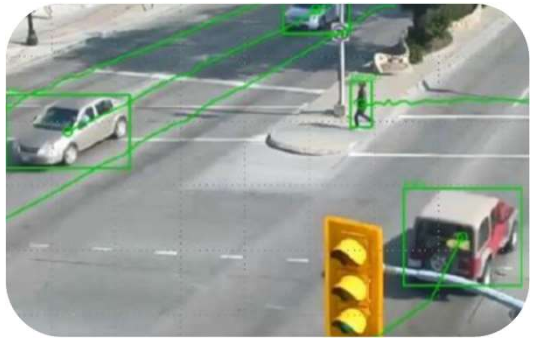
# How It Works

There are 6 components to Safety Studies for every pair of potentially interacting movements



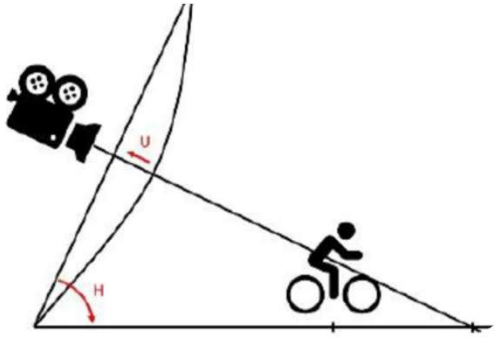

## Detection

Road users are detected and classified in every frame using AI



## Tracking

The tracking systems links together the detected users in adjacent frames to create green tracks

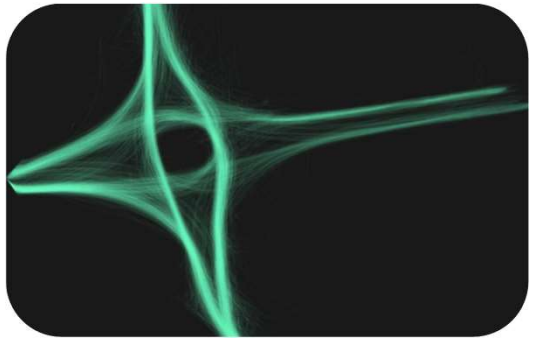



## Mapping

Spatial mapping is completed to translate the locations of the road user to their location in the intersection

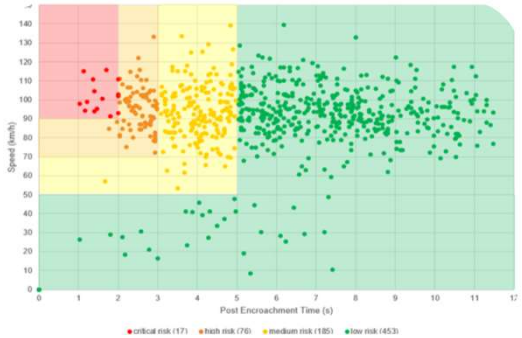
# How It Works (cont)

There are 6 components to Safety Studies for every pair of potentially interacting movements



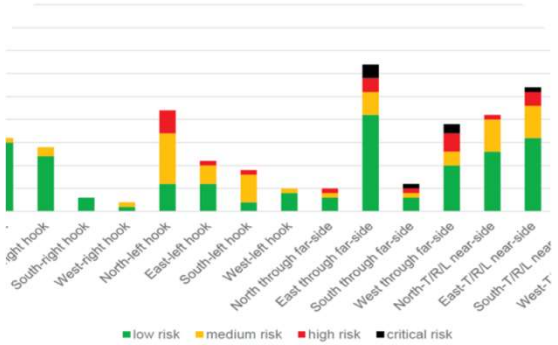
## Trajectory

Trajectories are developed and intersecting trajectories are filtered by near-miss criteria




## Near Miss

Near miss interactions and risk models are used to develop scatterplots for each encounter coloured by severity




## Report

We then output the results for every possible conflict configuration at an intersection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Having access to one toolkit with the right data needed to design and manage safer streets will increase output and productivity while reducing redundancy and overall cost - long term.

Learn more about how our data is being used in other cities:

Examples include:

- Quincy MA: Empowering Cities to Protect their Most Vulnerable Road Users
- Chicago, IL: Becoming the best cycling city in America
- MassDOT: Measuring Arterial Operations and Performance with Miovision Hardware

# Thank You!

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