

miOVISION



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:**



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



Out of Date

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



Limited

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



Under-Reported

Some roadway incidents may not be reported resulting in skewed data



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



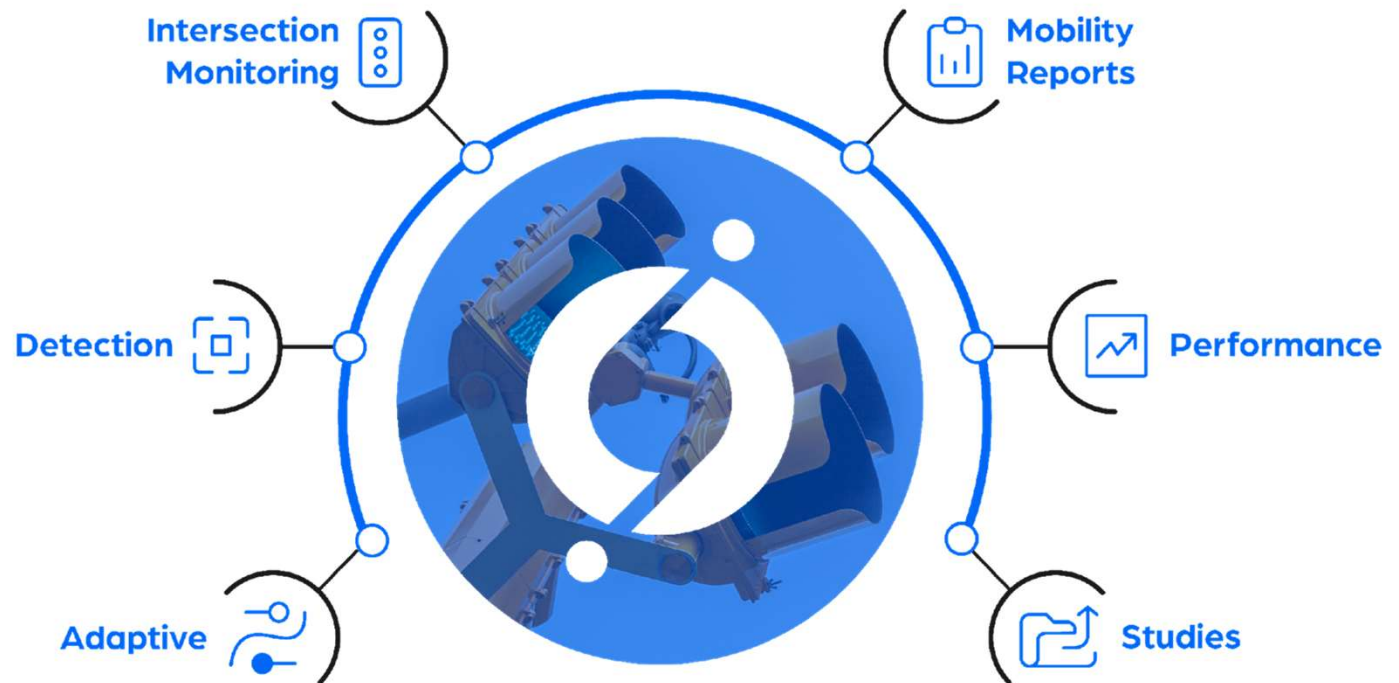
Separate contracts



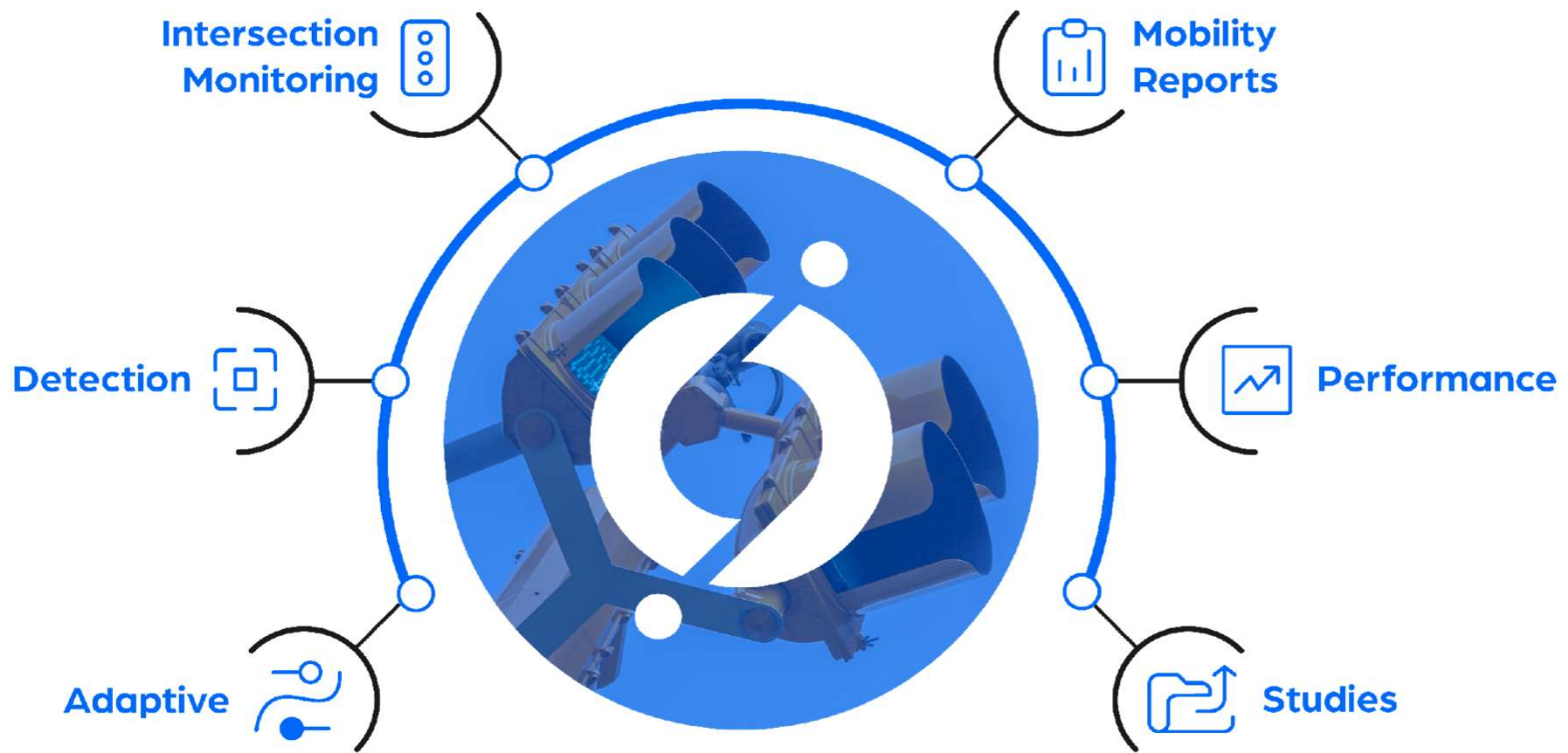
This equals a lot of unnecessary effort to get information you need to make change

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

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

Access Your Whole Network

Intersection Monitoring

Map

Telemetry

Video

Alerts

BR

Map

Region of Waterloo

Please select an intersection

Installations | **Active Alerts**

179 SmartLink devices in network

185 Cameras in network

150 SmartSense devices in network

Filters

SmartLink only

- Admin HQ
- Operations Centre - Test Smartlink Unit
- Ottawa at Hwy 7 EB Ramp
- Weber at Ottawa

SmartLink + Camera

- Courtland at Siebert
- Erbville at Laurelwood
- Farmer's Market at Benjamin
- Fountain at Cherry Blossom
- Fountain at Maple Grove
- Fountain at Toyota North
- Fountain at Toyota South
- Hespeler at Dunbar
- Hespeler at Hwy 401 EB Ramp
- Homer Watson at Pioneer
- Line R6 & Herrgatt Rd
- Manitou at Wabanaki

Google Traffic

Intersection Monitoring

Intersection Monitoring

Map

MioTown Prod

Please select an intersection

Intersection Monitoring

Map

MioTown Prod

Please select an intersection

Intersection Monitoring

Map

MioTown Prod

YELLOWZZ - Sharing Cobalt with CTM0... X

SIGNAL VIEW APPROACH VIEW TIMING DIAGRAM

Traffic Signals

1 2 3 4 5 6 7 8

Detectors

1 2 3 4 5 6 7 8 Channel 17

Channel 18 Channel 19 Channel 21 Channel 22 Channel 23

Channel 25 Channel 26 Channel 49 Channel 50 Channel 51

Channel 52 Channel 53 Channel 54 Channel 55 Channel 56

Signal Alert now

New alert from King St and Erb Ave. FLASHING LIGHTS is occurring as of 4:21 pm.

slide to reply

4:21

Wednesday, October 2

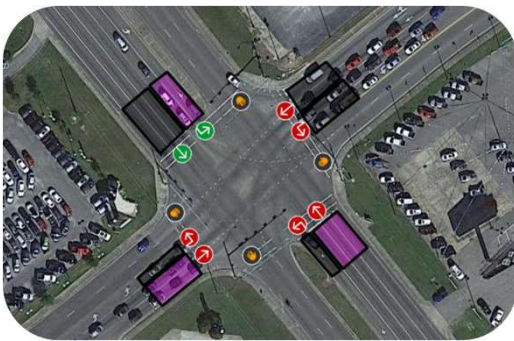
A solid Intersection Monitoring application is focused on connectivity and monitoring of cabinet equipment at an intersection, surfacing Alerts and Telemetry data.



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

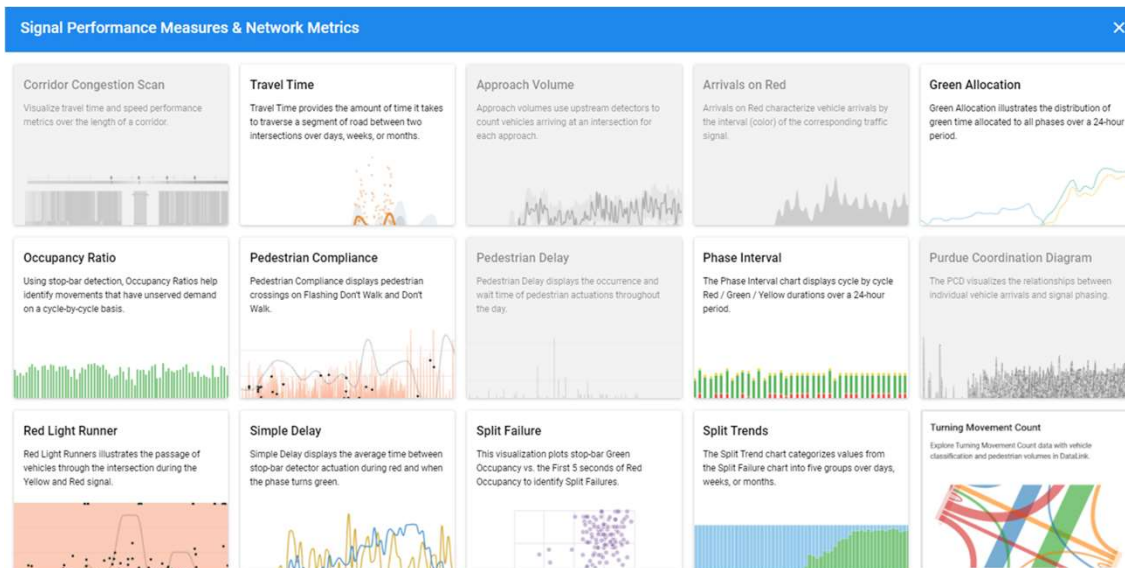
- Streamline equipment: Detect vehicles, pedestrians, and cyclists, with a single camera
- Video recall and alerts allow for quick diagnosis of problems
- Create fully actuated control plans in seconds
- Report on occupancy ratios, arrivals on red, arrivals on green, and phase intervals



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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

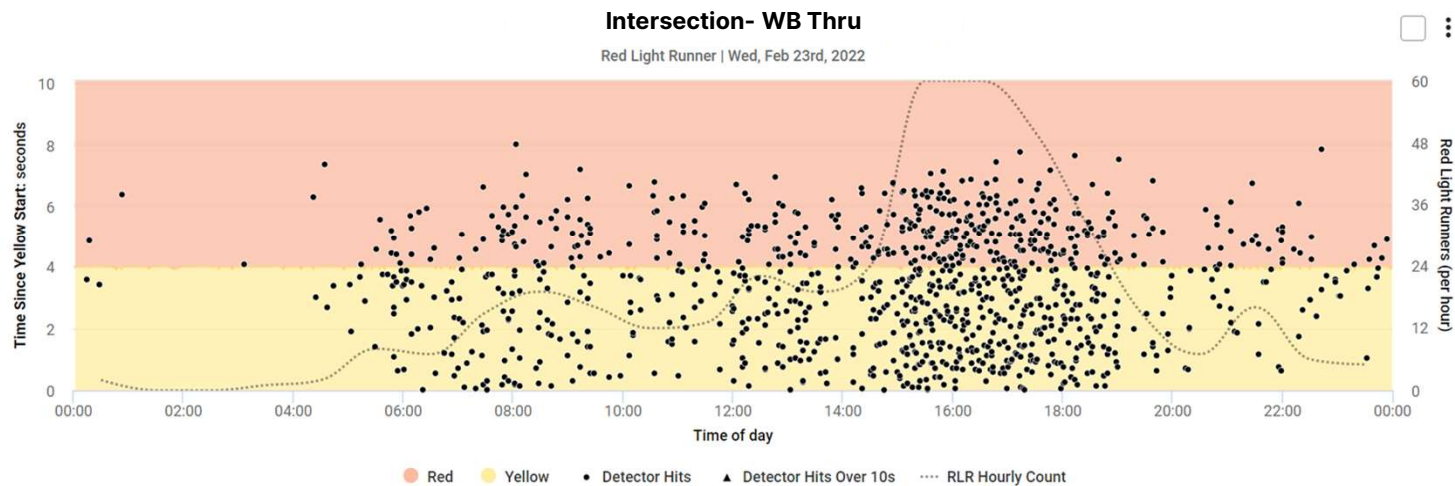
Red Light Runner Trends

Example

The Red Light Running chart shows:

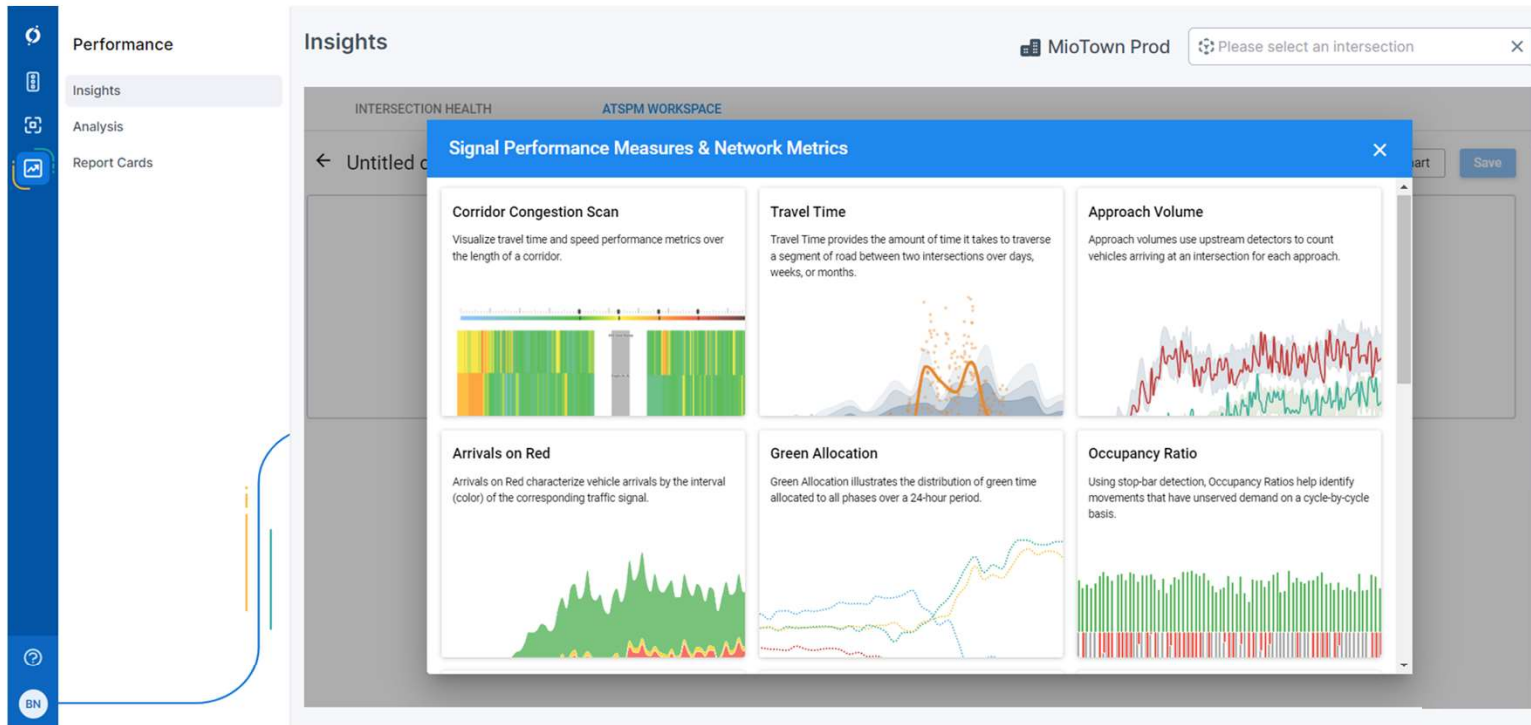
- Yellow time, red time
- Vehicles running the yellow / red

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



Performance

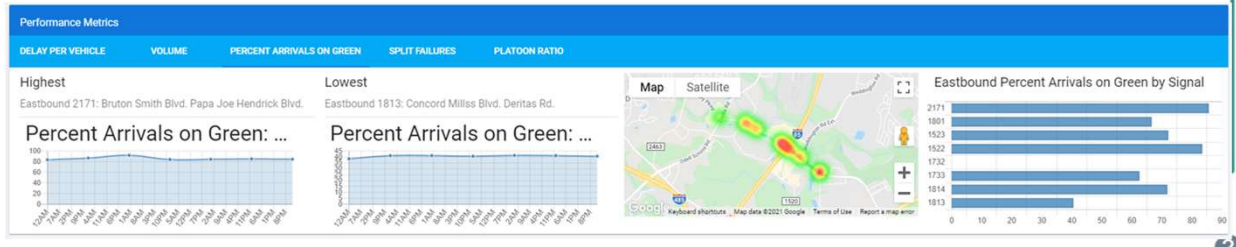
Performance



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.



Performance and ATSPMs



Select a signal Oct 5, 2021 - Oct 9, 2021

Map Satellite

Map Satellite

Hide Signal Markers

Waze Routes

Route ID	Route Name	TTI	PTI	Travel Time	Distance
15317	CMillsBlvdWB((85NB_Derita) - Derita Rd	1.94	2.86	2m 56s	1.13

Travel Time Indices

Travel Time

Congested Time

Delay Per Vehicle

Metric	Value	Unit
Travel Time (Average)	2 56	MINUTES SECONDS
Congested Time (Total)	14	MINUTES
Delay Per Vehicle (Total)	104.64	(sec)

Travel Time Indices

1.94 2.78

Travel Time Index Planning Time Index

Map Layer Insights Layer

Optimal

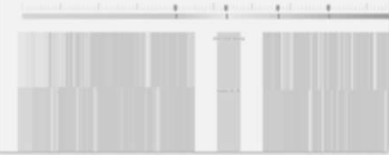
18.60% 10.47% 66.28%

You can always right click the Marker to access more metrics and items

Automated Traffic Signal Performance Measures

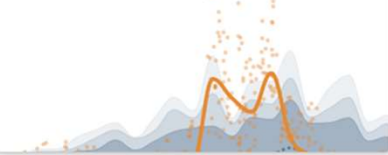
Corridor Congestion Scan

Visualize travel time and speed performance metrics over the length of a corridor.



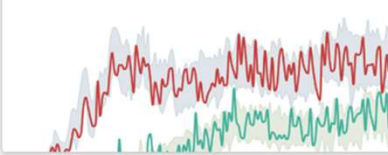
Travel Time

Travel Time provides the amount of time it takes to traverse a segment of road between two intersections over days, weeks, or months.



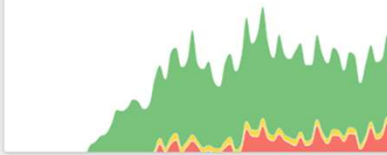
Approach Volume

Approach volumes use upstream detectors to count vehicles arriving at an intersection for each approach.



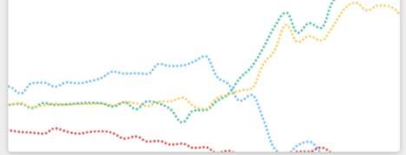
Arrivals on Red

Arrivals on Red characterize vehicle arrivals by the interval (color) of the corresponding traffic signal.



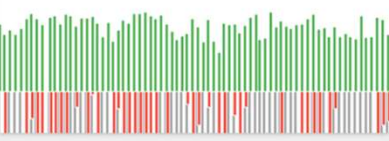
Green Allocation

Green Allocation illustrates the distribution of green time allocated to all phases over a 24-hour period.



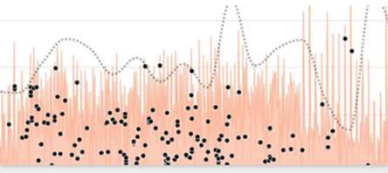
Occupancy Ratio

Using stop-bar detection, Occupancy Ratios help identify movements that have unserved demand on a cycle-by-cycle basis.



Pedestrian Compliance

Pedestrian Compliance displays pedestrian crossings on Flashing Don't Walk and Don't Walk.



Pedestrian Delay

Pedestrian Delay displays the occurrence and wait time of pedestrian actuations throughout the day.



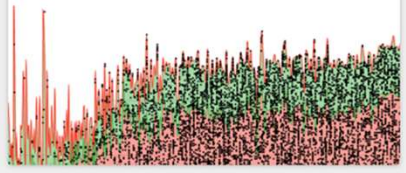
Phase Interval

The Phase Interval chart displays cycle by cycle Red / Green / Yellow durations over a 24-hour period.



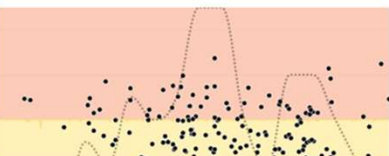
Purdue Coordination Diagram

The PCD visualizes the relationships between individual vehicle arrivals and signal phasing.



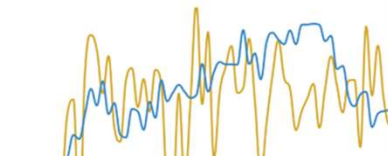
Red Light Runner

Red Light Runners illustrates the passage of vehicles through the intersection during the Yellow and Red signal.



Simple Delay

Simple Delay displays the average time between stop-bar detector actuation during red and when the phase turns green.



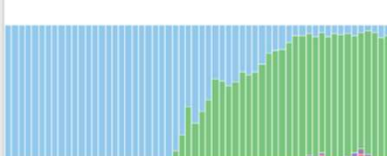
Split Failure

This visualization plots stop-bar Green Occupancy vs. the First 5 seconds of Red Occupancy to identify Split Failures.



Split Trends

The Split Trend chart categorizes values from the Split Failure chart into five groups over days, weeks, or months.



Turning Movement Count

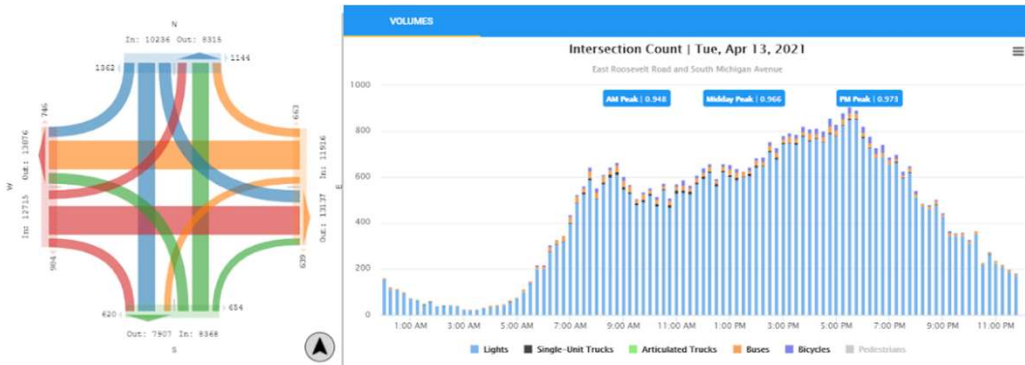
Explore Turning Movement Count data with vehicle classification and pedestrian volumes in DataLink.



Mobility Reports

Continuous Count Data

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



Light Vehicles



Buses



Heavy Vehicles



Bikes

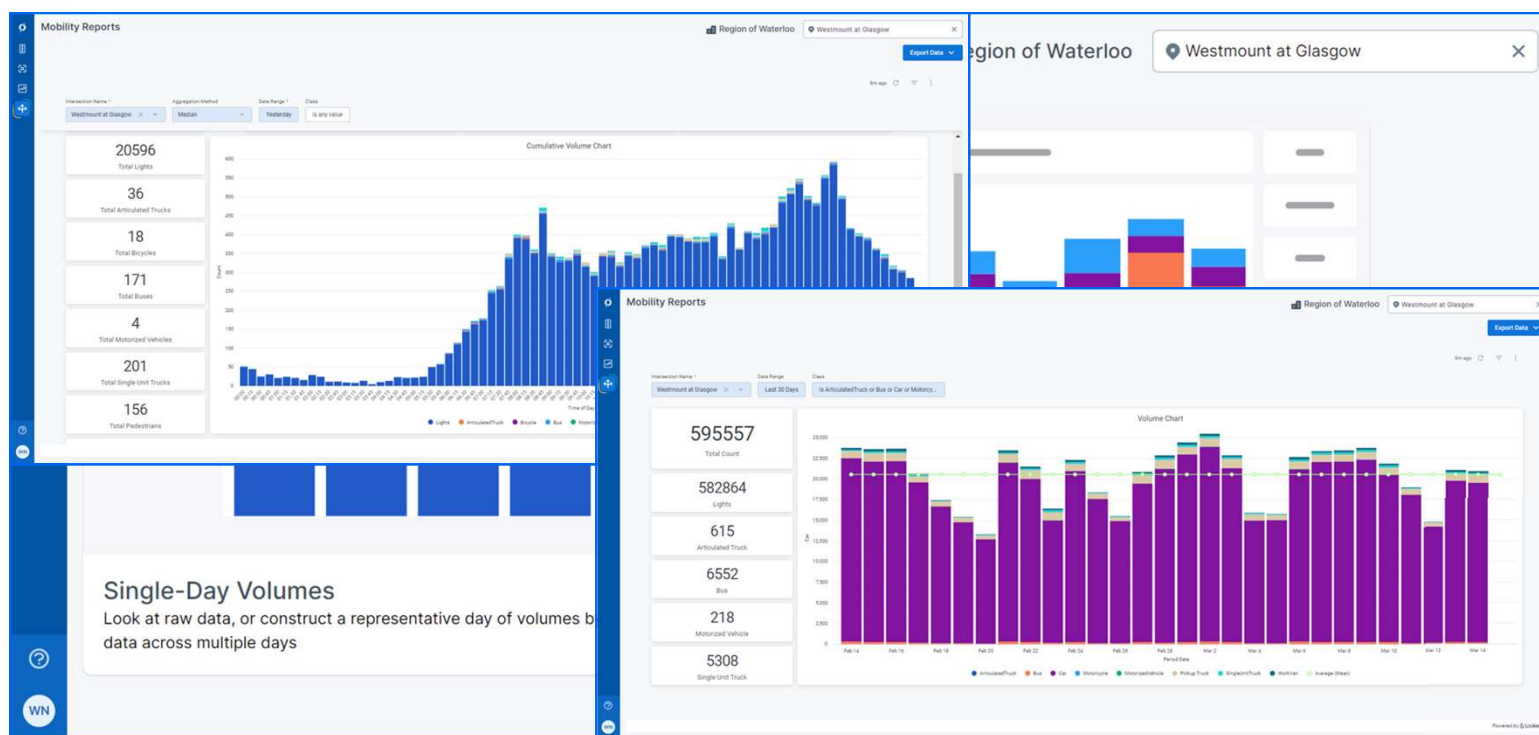


Pedestrians



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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

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

How does it work?



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



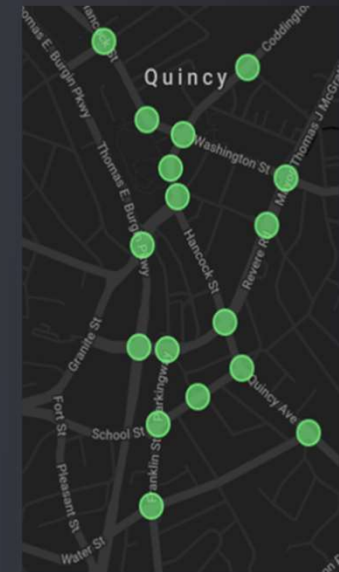
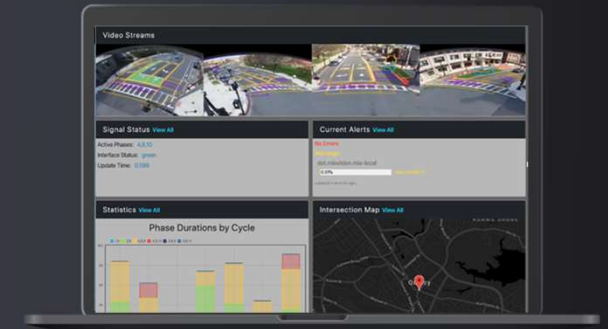
Live View of Traffic

Access live video and live view of Surtrac optimization to see how the system is 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:**



Inaccurate

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



Out of Date

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



Limited

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



Under-Reported

Not all crashes are reported resulting in skewed data



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



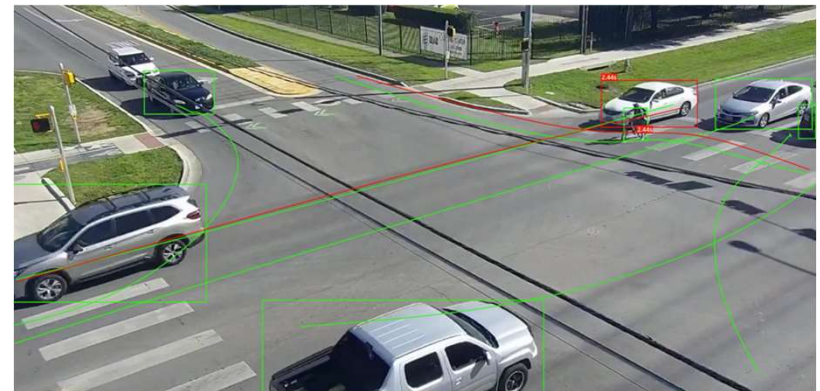
Reduction

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



Action Plan

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



Gather Video

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



Implement Changes

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



Risk Identification

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

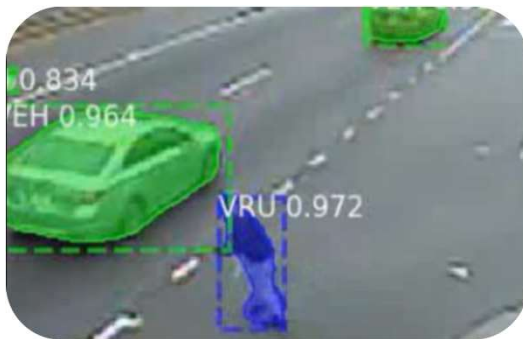


Monitoring

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

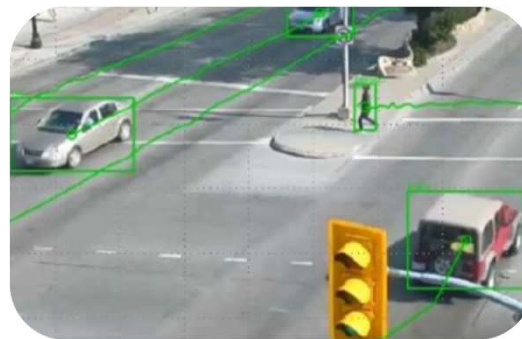
How It Works

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



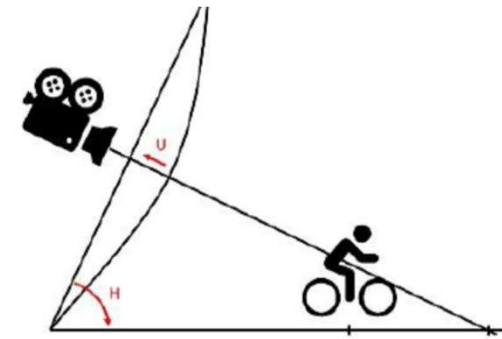
Detection

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

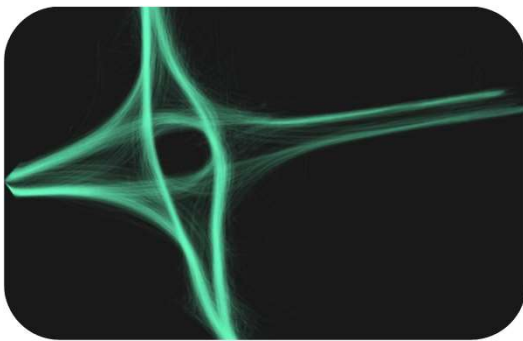


Mapping

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

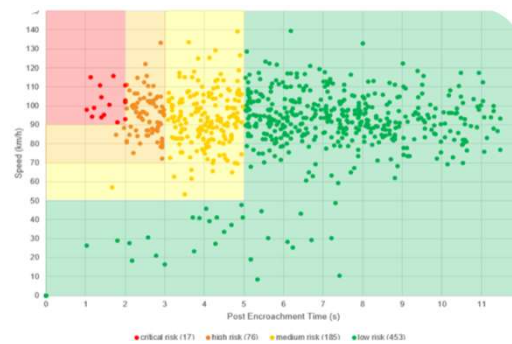
How It Works (cont)

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



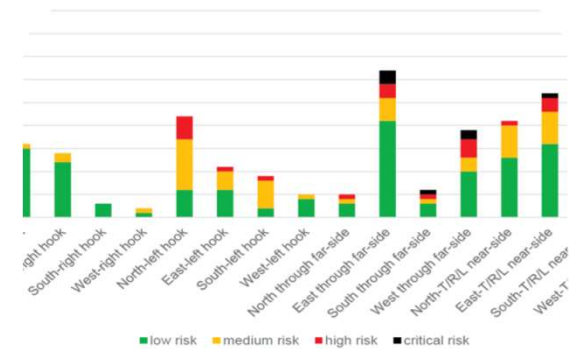
Trajectory

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



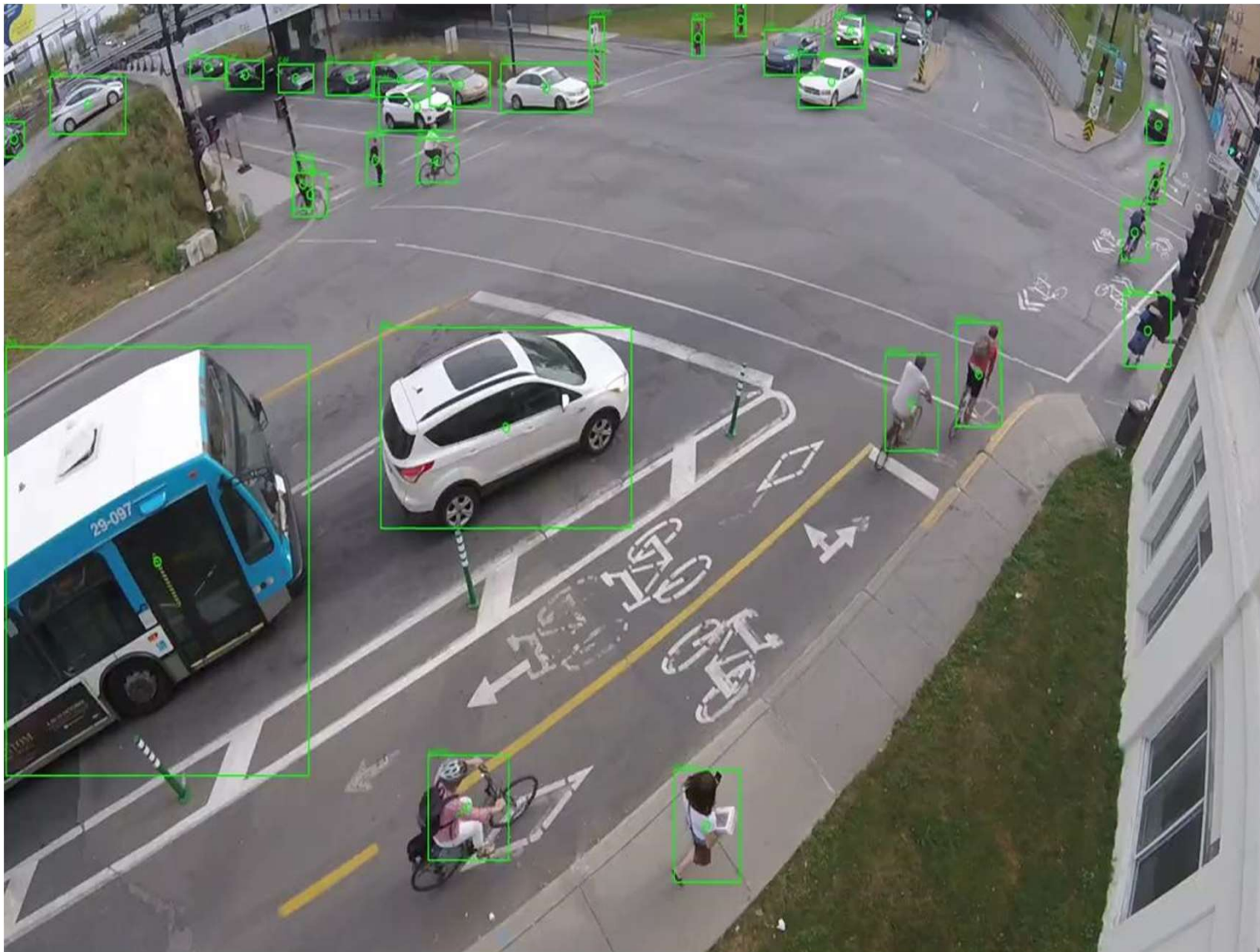
Near Miss

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



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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