

Signal Analytics

- Probe-based signalized intersection performance measures

Rick Ayers

703.989.3221

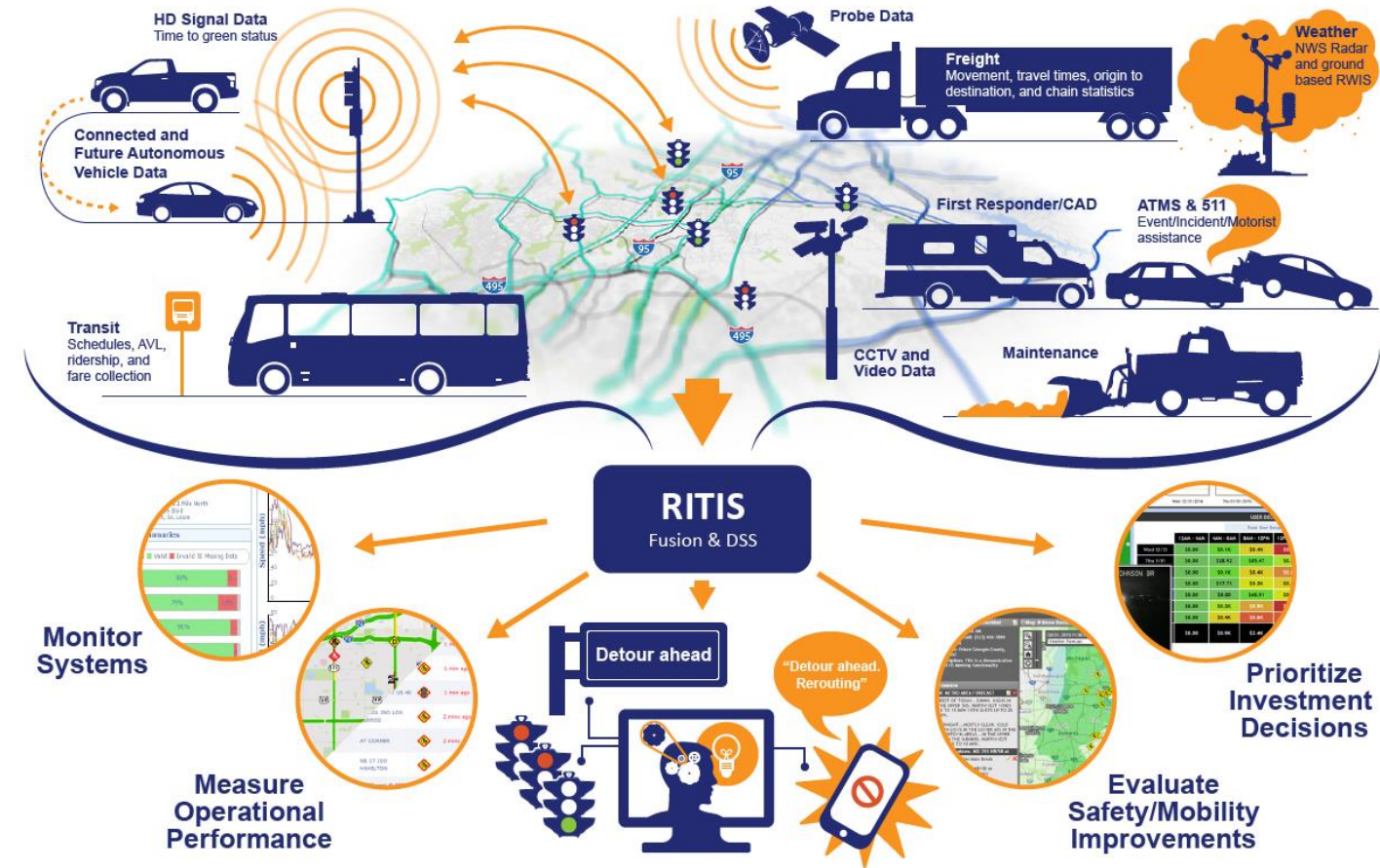
rayers@umd.edu

cattlab.umd.edu

Agenda

- Signal Analytics Background
- Corridor Analytics
- Dashboard and Deep Dive Tools
- Use Cases
- Q&A

<https://signals.ritis.org/analytics/>



What is Signal Analytics?



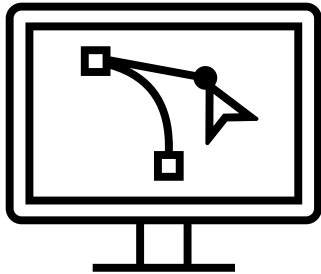
- **The Data**

- 3 to 5 second frequency vehicle waypoints collected from connected vehicles
- Snapped to a free, open, and global map



- **The Metrics**

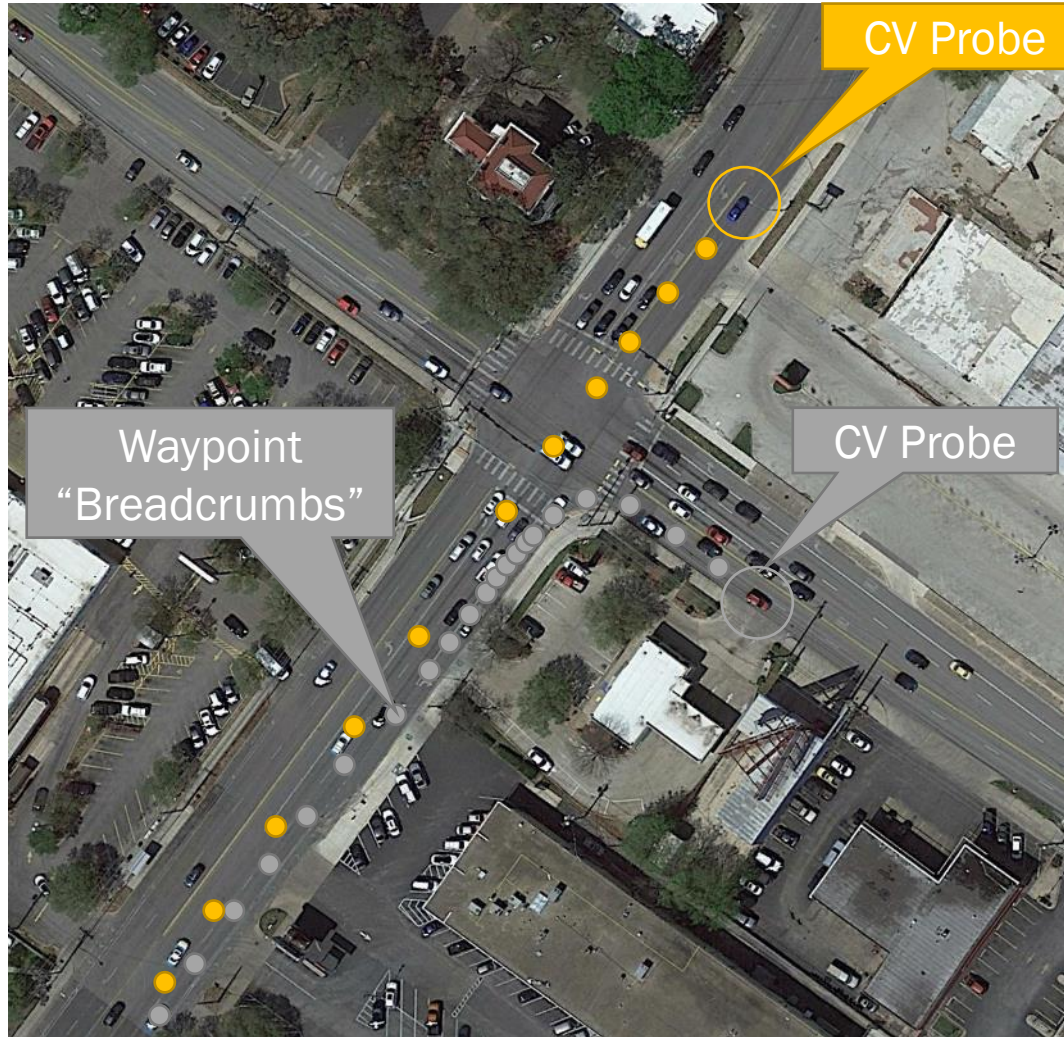
- Individual vehicle waypoints are used to determine the travel time of a vehicle moving through an intersection
- Other vehicle attributes include turning movement, vehicle stop, approach speed, or vehicle split failure and volume



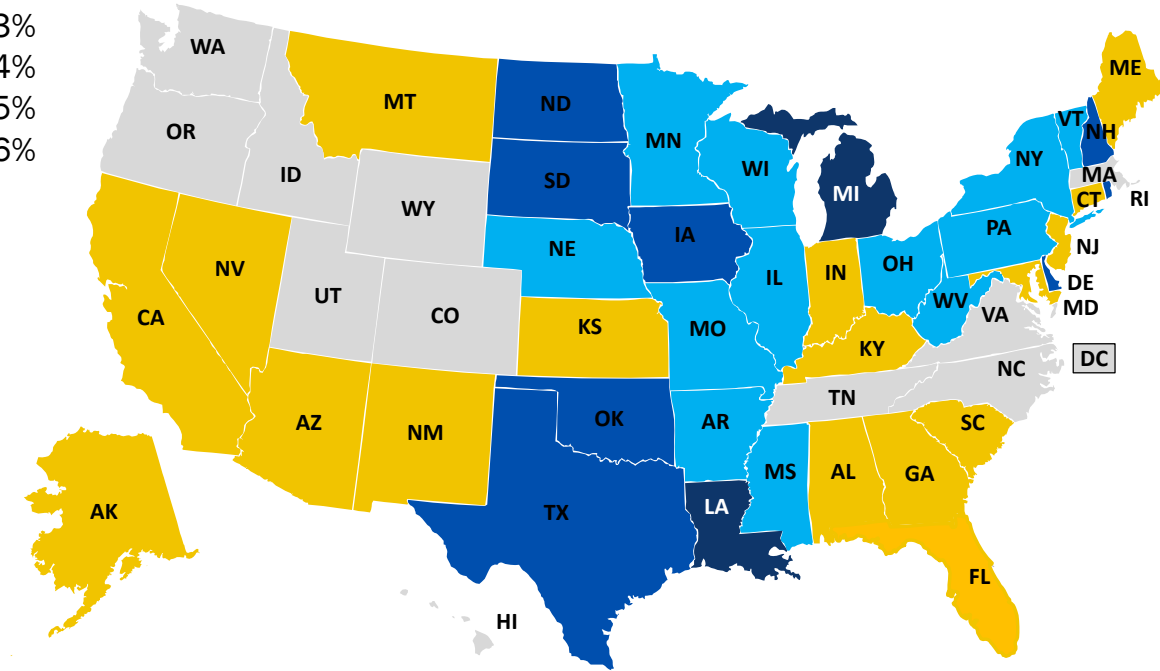
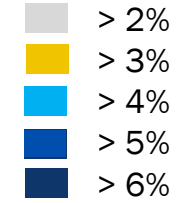
- **The Tools**

- Collaboration between CATT Lab and INRIX
- Aggregate the metrics by intersection
- Report summary metrics over various time periods

The Data



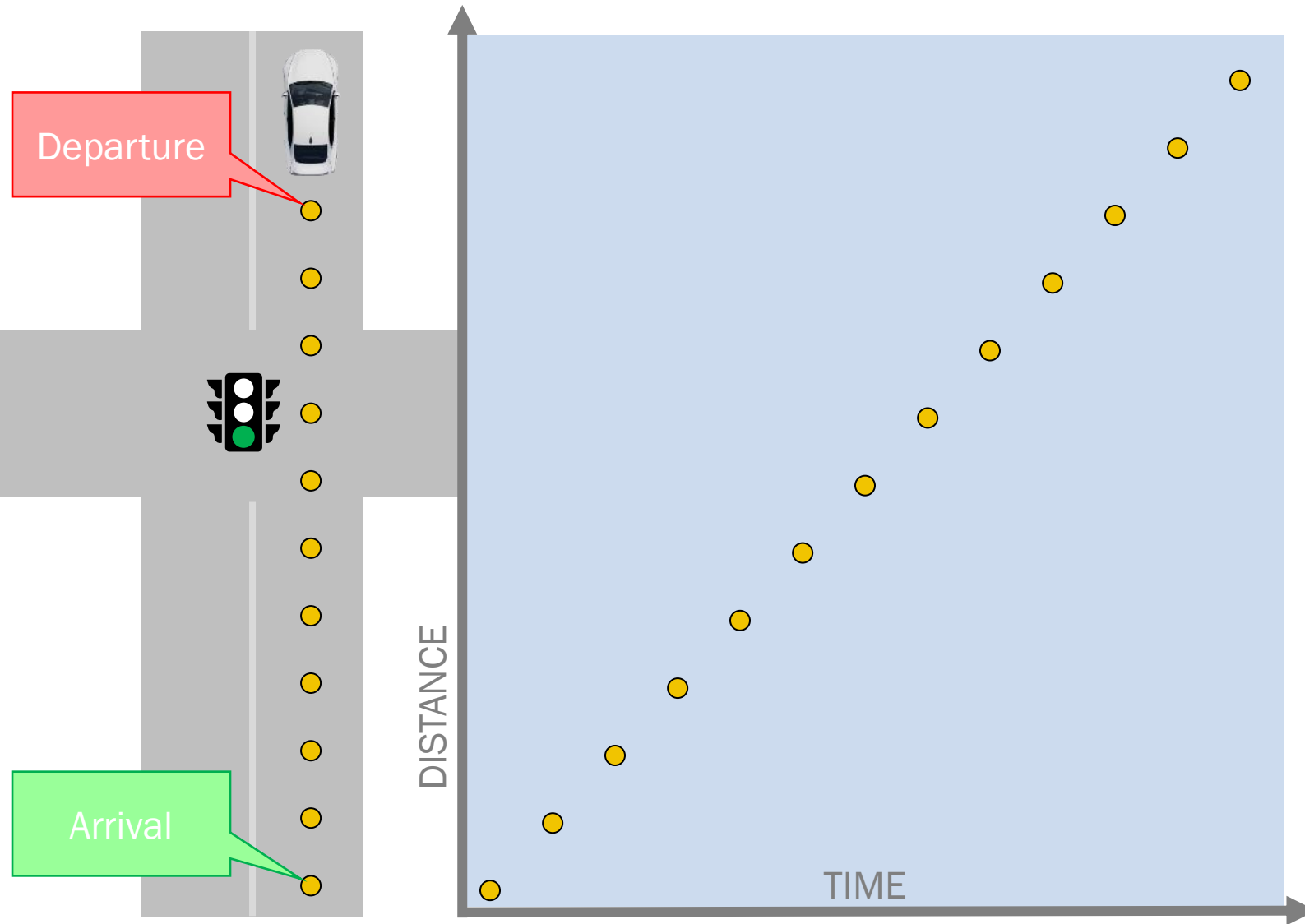
% of State VMT



- Compared to State VMT per FHWA for January 2020:

https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm

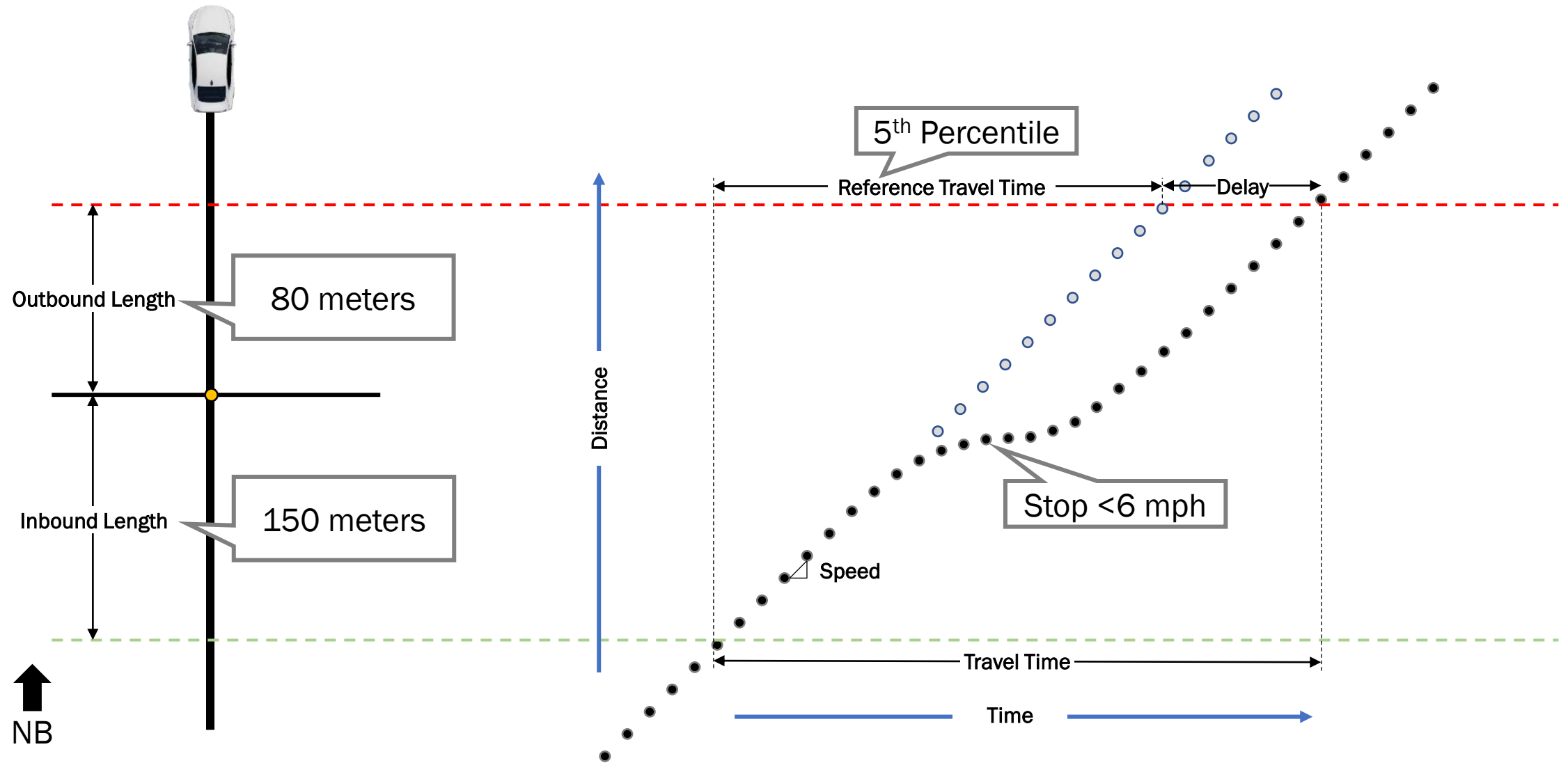
The Metrics – Each Vehicle



Metrics for each vehicle

- Travel Time
- Approach Speed
- Vehicle Stop
- Vehicle Double Stop
- Movement (Left, Thru, Right)
- Volume

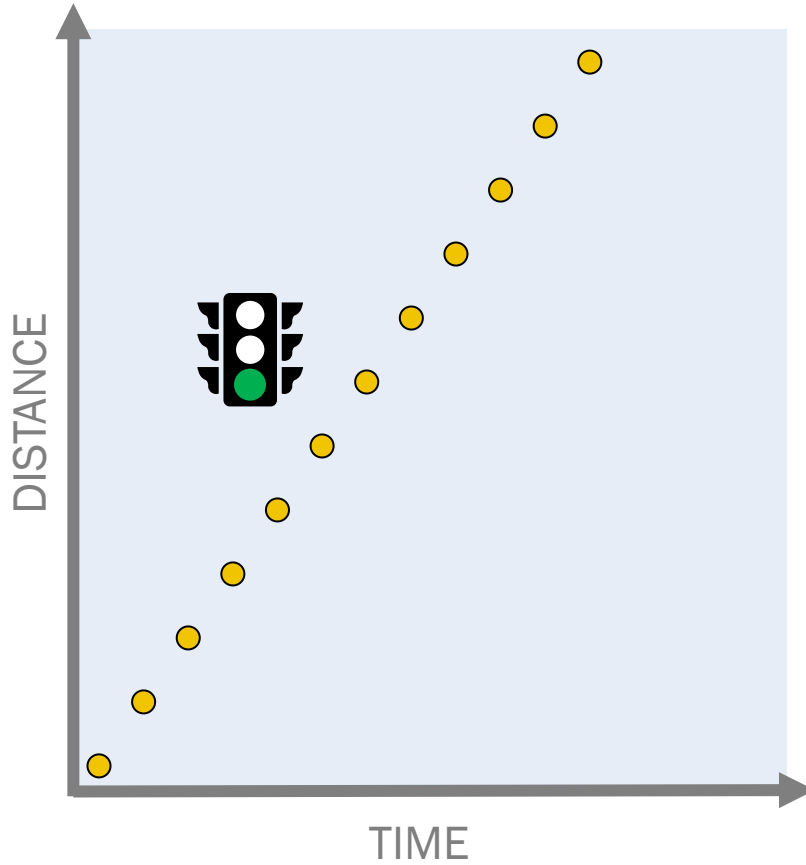
The Metrics – Assumptions



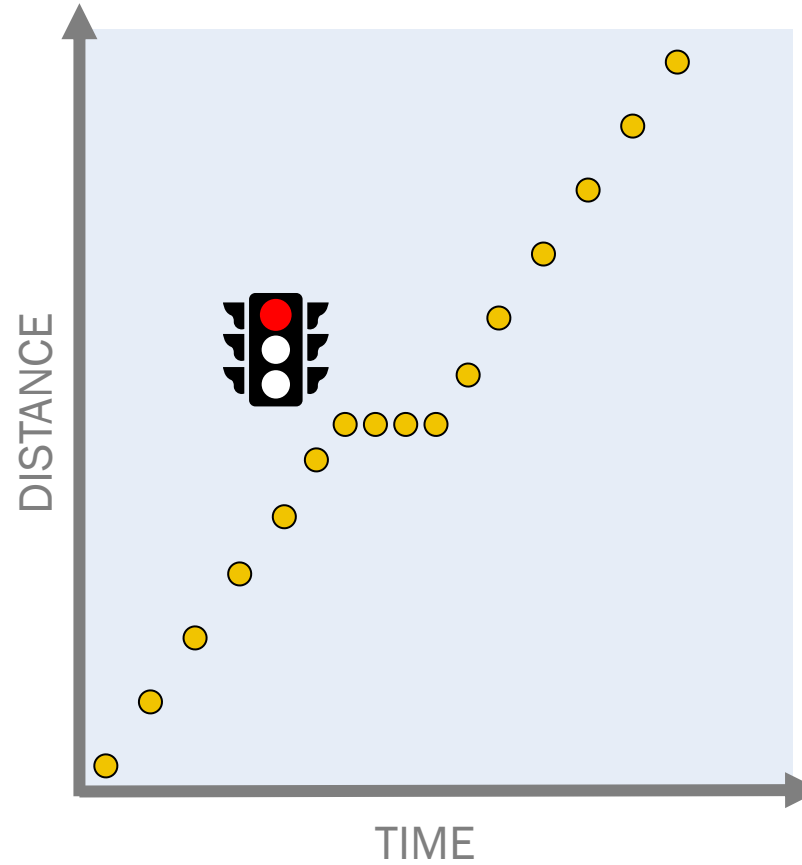
The Metrics – Assumptions



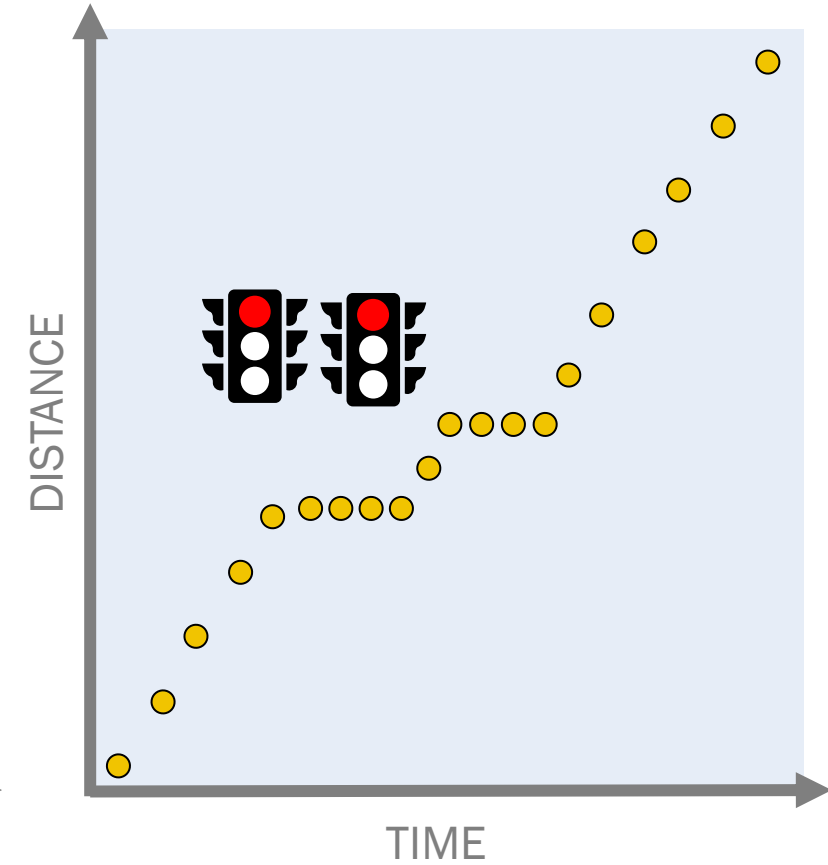
42 sec
ARRIVAL ON GREEN



61 sec
ARRIVAL ON RED



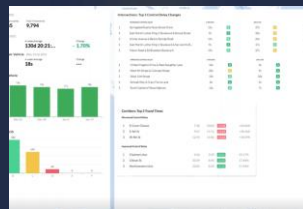
100 sec
SPLIT FAILURE



Signal Analytics - Dashboard



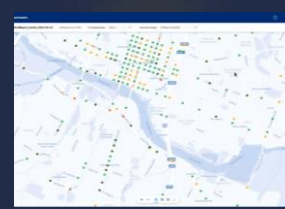
Daily Report



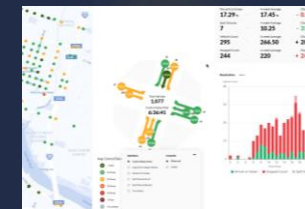
Email Summary



Systemwide Map



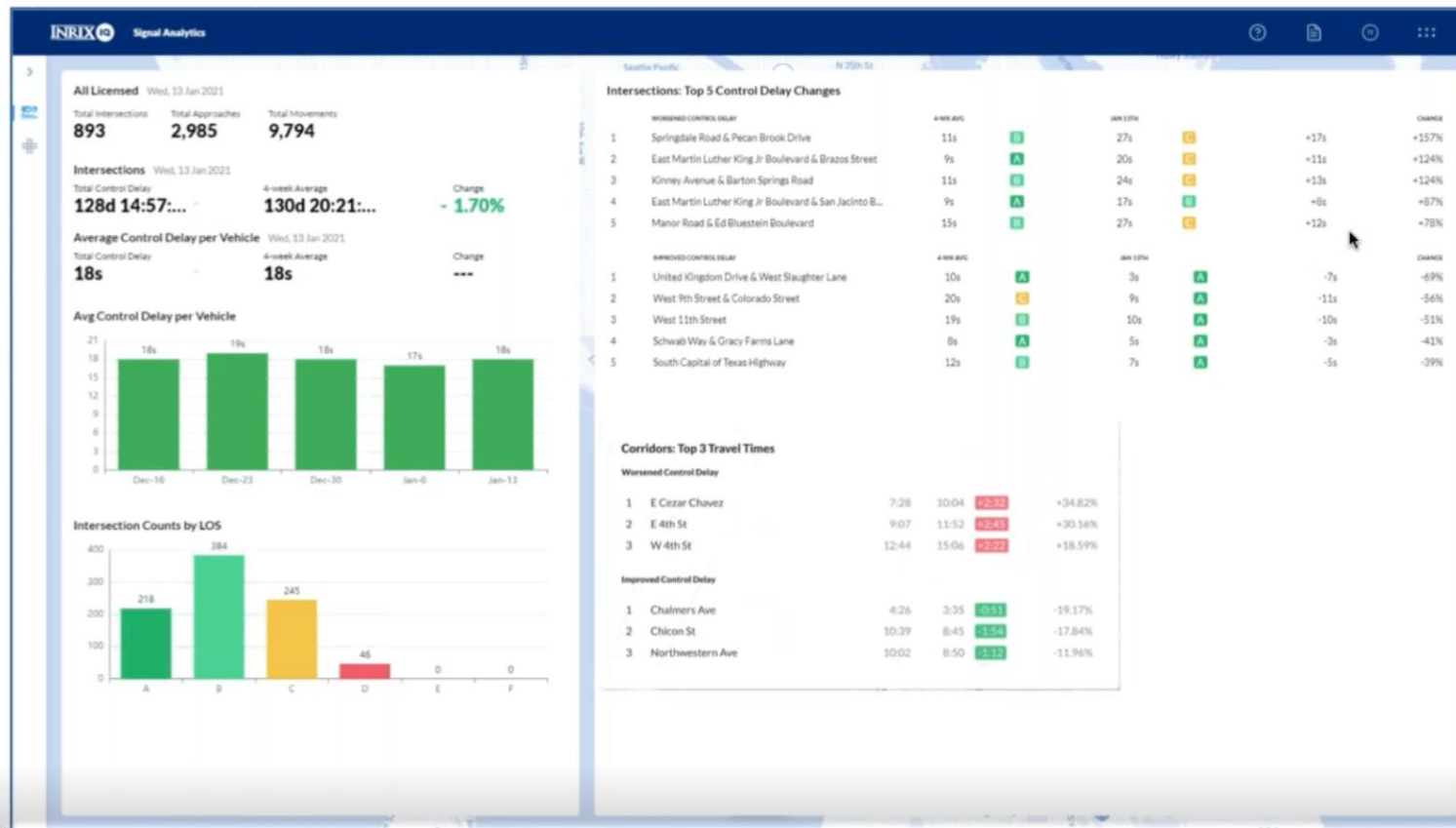
Intersection Perf Rpt



Signal Analytics – Daily Report

Daily Report – Dashboard

Updated automatically each morning



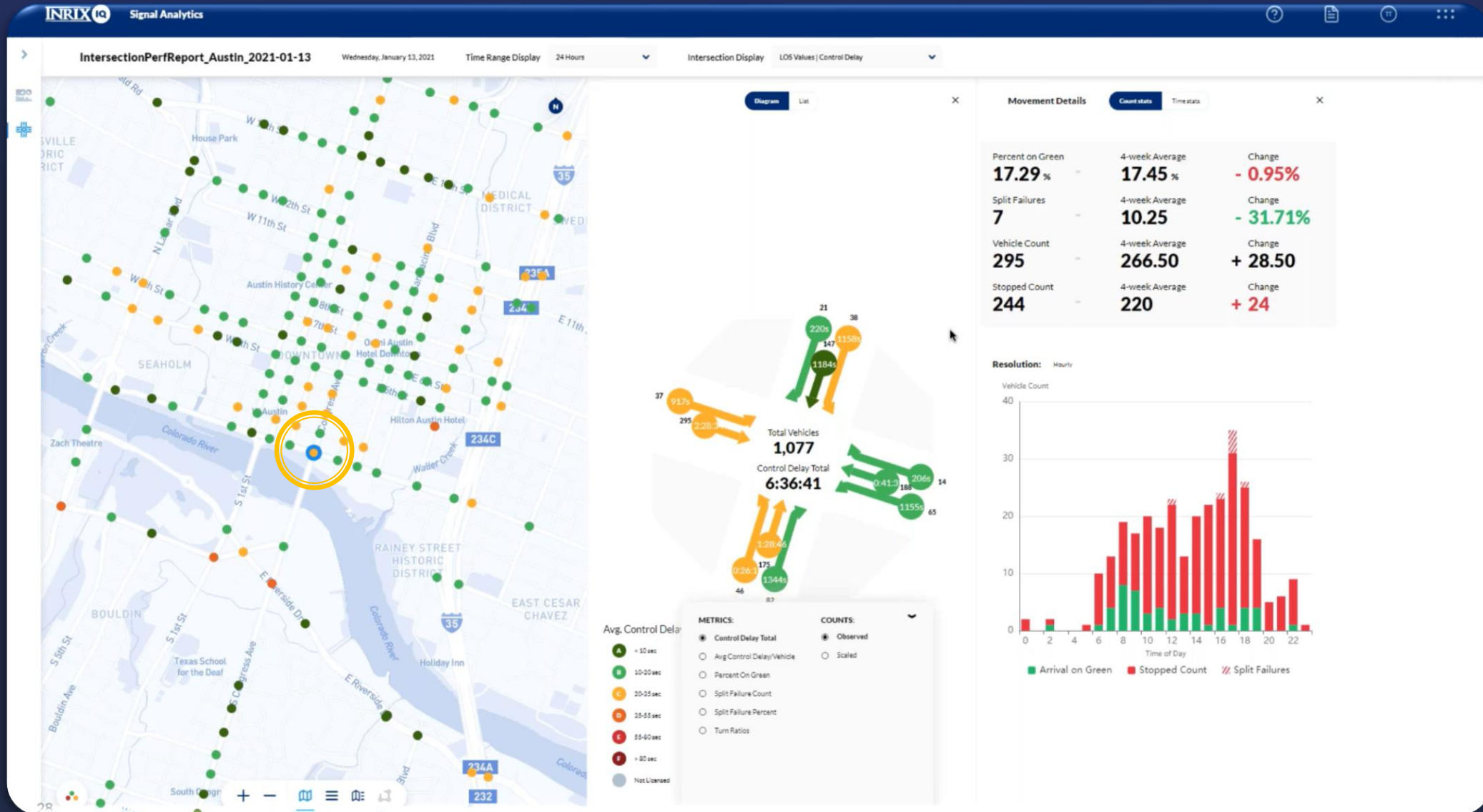
Agency defined:

- Intersections
- Peak period times

Metrics at a glance:

- Top ranked TT for corridors
- Delay per vehicle stats
- Top ranked control delay variations

Signal Analytics – Intersection Performance Report

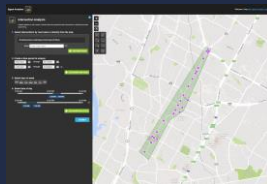


Signal Analytics – Deep Dive Intersection Analysis

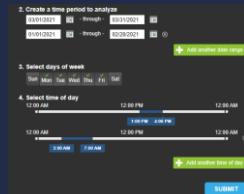
Deep Dive Analysis of Key Performance Indicators for Signalized Intersections



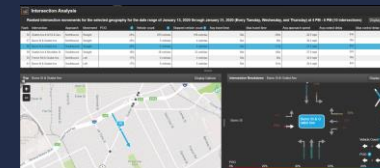
Detailed Spatial Selection



Date/Time Range Filters



Turning Movement PMs



Intersection Analysis – Advanced Historic Queries


- ▶ Custom spatial selection tools
 - > Choose individual intersections
 - > Select custom corridors for analysis
- ▶ Historic comparisons
 - > Analyze historic KPIs for selected intersections
 - > Focus analysis on specific days of the week
- ▶ Custom configure peak period analysis

The screenshot shows the 'Signal Analytics' interface for 'Intersection Analysis'. The page title is 'Intersection Analysis' with a subtitle: 'Analyze statistics on the number of vehicles that have passed through intersections to identify issues with signal timing.' The interface is divided into four main steps:

- 1. Select intersections by road name or directly from the map**
 - Search results: 11 intersections matching current search filters.
 - Input field: Road [Enter road name] [Search icon]
 - Button: + Add intersections
- 2. Create a time period to analyze**
 - Start date: 03/22/2021 [Calendar icon]
 - End date: 03/26/2021 [Calendar icon]
 - Text: - through -
 - Button: + Add another date range
- 3. Select days of week**
 - Buttons: Sun, Mon, Tue, Wed, Thu, Fri, Sat
 - Checkmarks: Mon, Tue, Wed, Thu, Fri
- 4. Select time of day**
 - Time range: 12:00 AM to 12:00 PM
 - Selected range: 7:00 / 9:00 AM
 - Button: + Add another time of day

A blue 'SUBMIT' button is located at the bottom right of the form.

Signal Analytics – Advanced Input Query Options

Signal Analytics  Welcome, Greg | [My History](#) | [Help](#) | [Logout](#)

Intersection Analysis

Analyze statistics on the number of vehicles that have passed through intersections to identify issues with signal timing.

- Select intersections by road name or directly from the map**

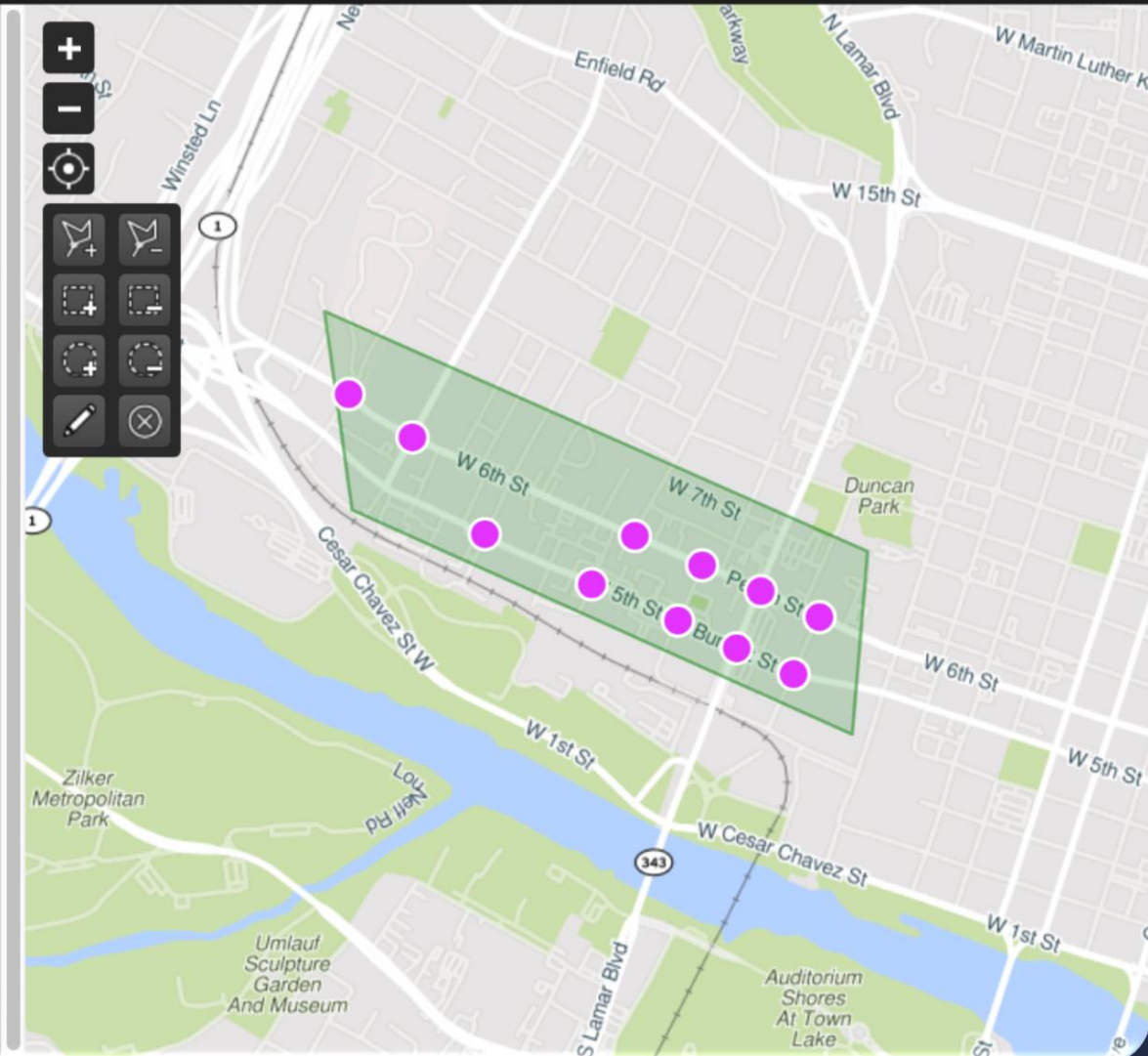
11 intersections matching current search filters

Road
- Create a time period to analyze**

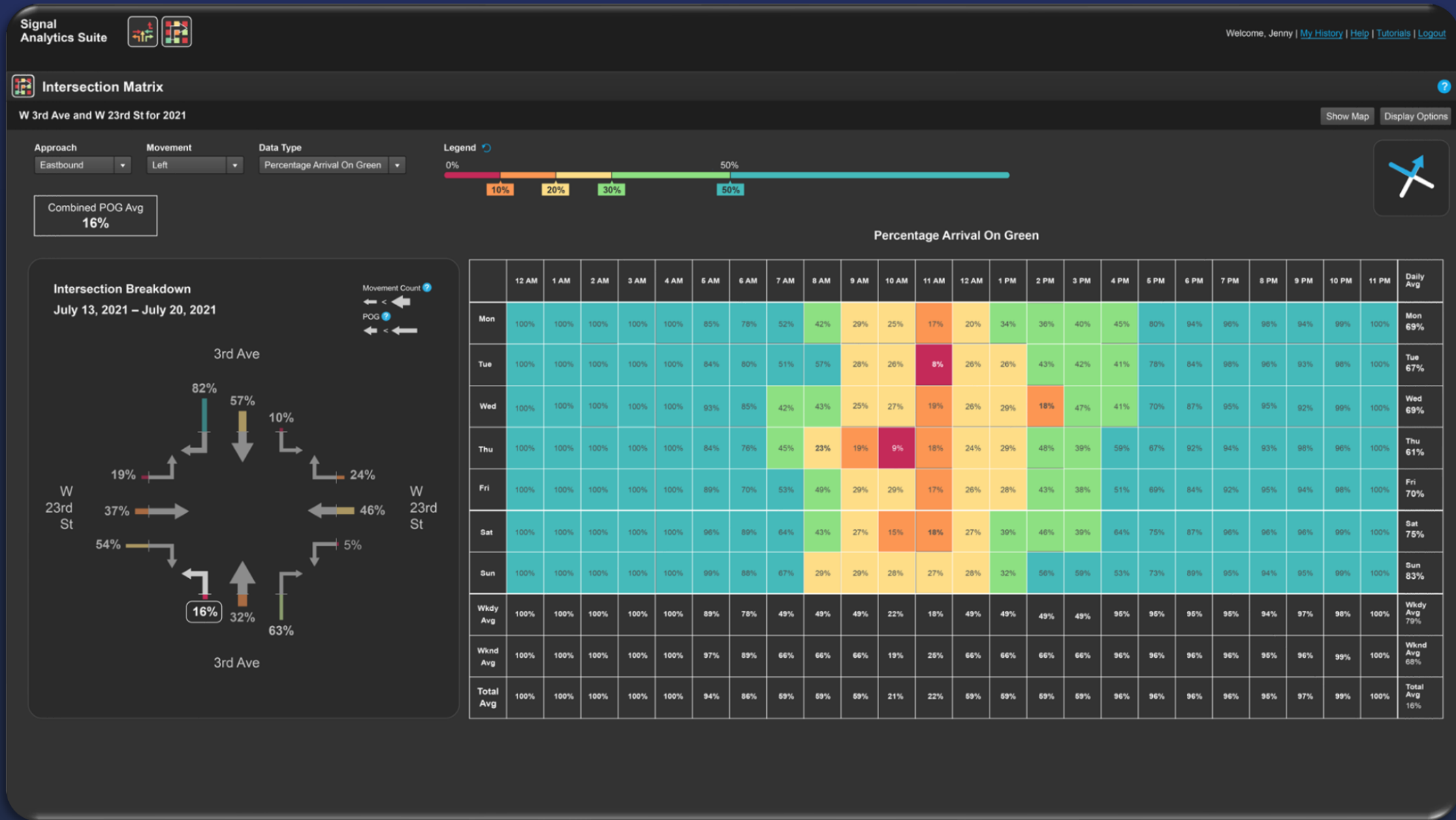
- through -
- Select days of week**

Sun Mon Tue Wed Thu Fri Sat
- Select time of day**

12:00 AM 12:00 PM 12:00 AM



Signal Analytics – New Content under Development

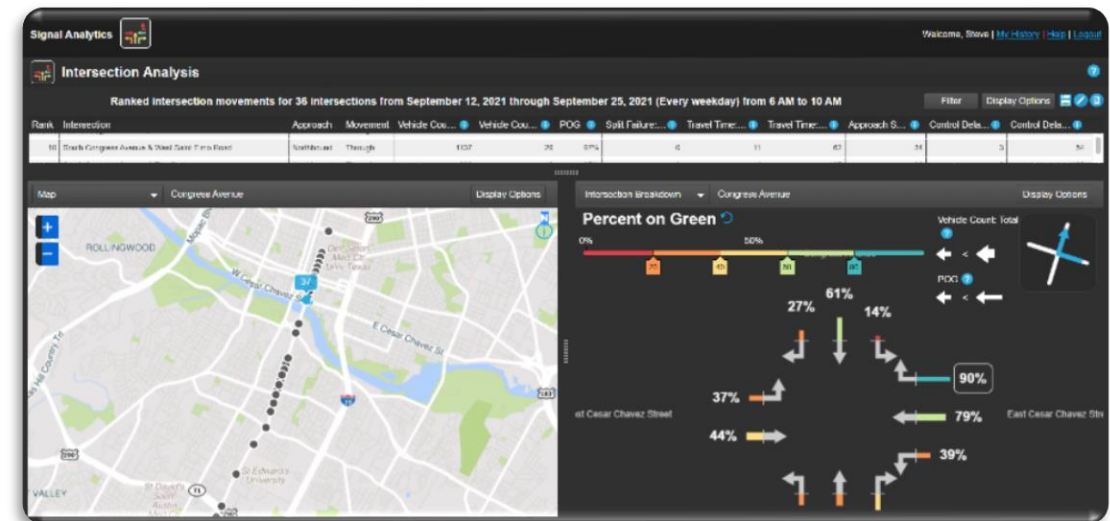
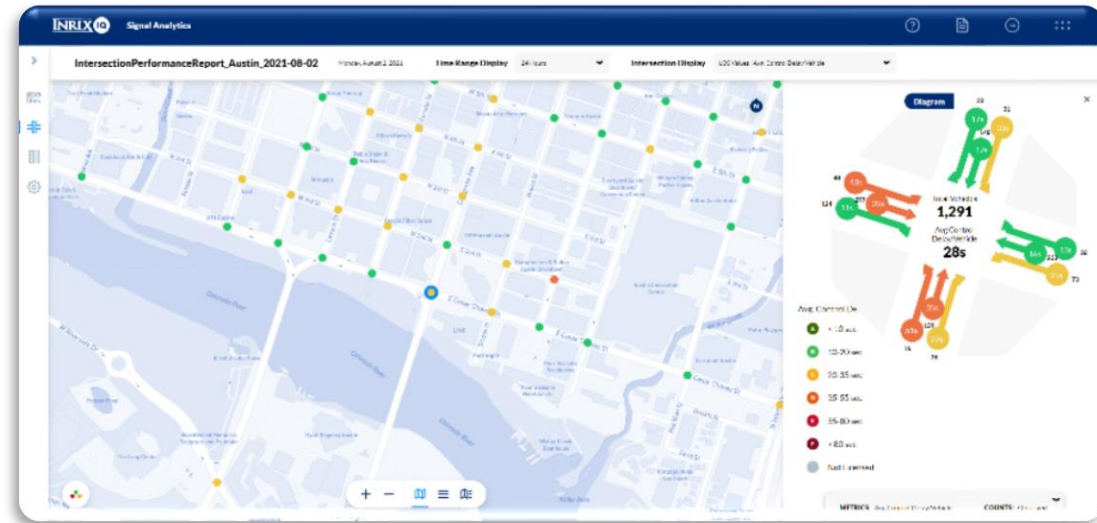


Signal Analytics – Use Cases



Core Use Cases – Signal Analytics

- ▶▶ Scanning the entire traffic signal network and prioritize intersections for further investigation
- ▶▶ Identify intersections where performance has degraded
- ▶▶ Discover, deploy, and measure small iterative changes to signal timings
- ▶▶ Perform systematic before and after studies
- ▶▶ Verify the results of traffic modeling or simulation software



Use Case – Austin, TX

➤ Leveraged Signal Analytics to investigate before and after a signal retiming project

Before & After Analysis

Riverside Drive - 2021

Intersection: All

Day: Weekday Weekend

Vehicle count: 5 (slider) 3981

Approach: All

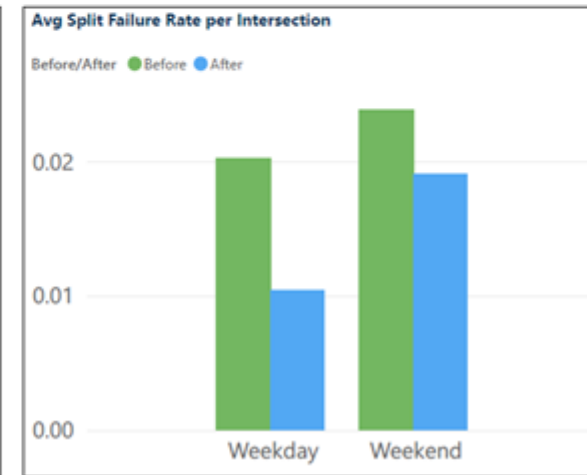
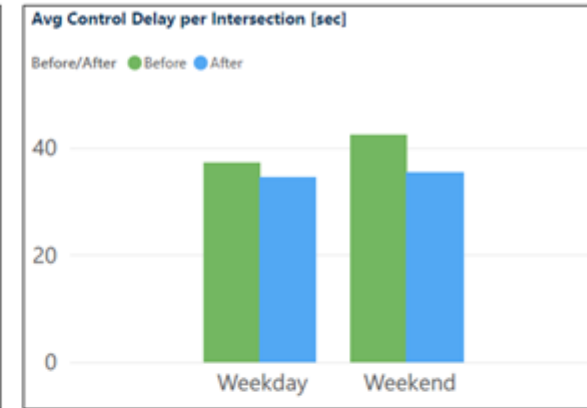
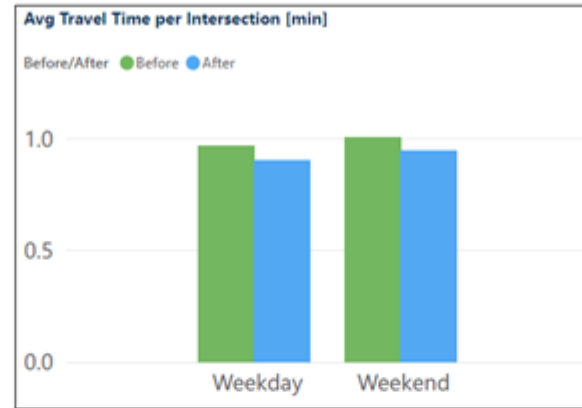
Maneuver: All

-6%
Change in Travel Time

-12%
Change in Control Delay

6%
Change in AOG

-34%
Change in Split Failure Rate



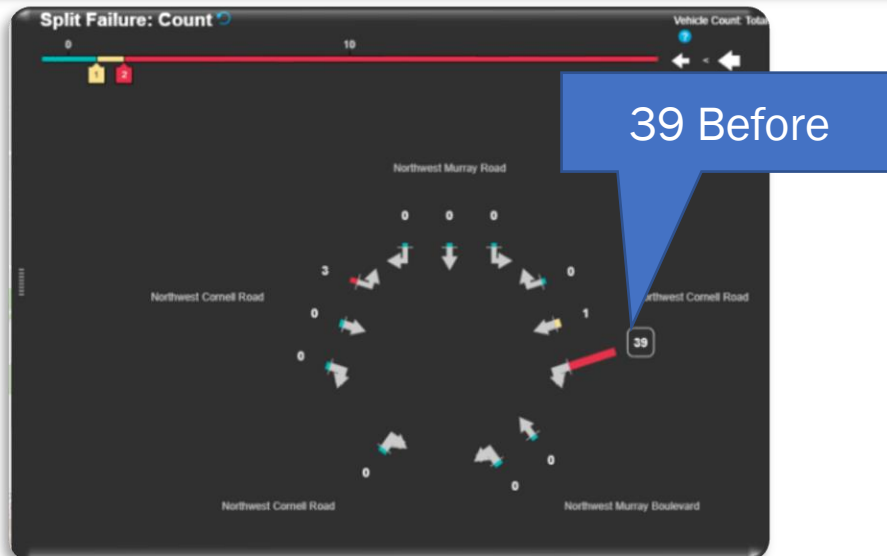
Use Case – Washington County, OR

▶▶ Leveraged Signal Analytics to investigate citizen complaint

NW Cornell Rd at NW Murray Blvd 7/22-8/11/21 5am-9pm

Ranked intersection movements for 1 intersection from July 22, 2021 through August 11, 2021 from 5 AM to 9 PM

Rank	Intersection	Approach	Movement	Vehicle Count: Total	Vehicle Count: Stopped	POG	Split Failure: Count	Travel Time: Avg (sec)	Travel Time: Max (sec)	Approach Speed: Avg (...)	Control Delay: Avg (sec)	Control Delay: Max (sec)
1	Northwest Cornell Road	Westbound	Left	1183	1038	12%	39	74	239	27	57	222
2	Northwest Cornell Road	Eastbound	Left	75	71	5%	3	80	157	28	64	141
3	Northwest Cornell Road	Westbound	Through	1390	702	49%	1	37	118	31	24	105
4	Northwest Cornell Road	Eastbound	Right	974	365	33%	0	27	88	32	12	71
5	Northwest Cornell Road	Westbound	Right	239	95	40%	0	33	95	31	15	77
6	Northwest Cornell Road	Eastbound	Right	1509	711	47%	0	37	105	27	20	148
7	Northwest Cornell Road	Northbound	Through	557	346	62%	0	47	118	30	33	104
8	Northwest Cornell Road	Southbound	Right	15	11	73%	0	49	94	29	28	73
9	Northwest Cornell Road	Northbound	Left	1401	1057	75%	0	59	147	30	44	132



Impact of Well-Timed Signals

Reduce Delay

- Recent estimates indicate that traffic signals account for roughly 329 million vehicle hours of delay per year
- Institute of Transportation Engineers shows signal retiming projects reduce motorist delay by between 15 and 37 percent

Reduce Fuel Consumption

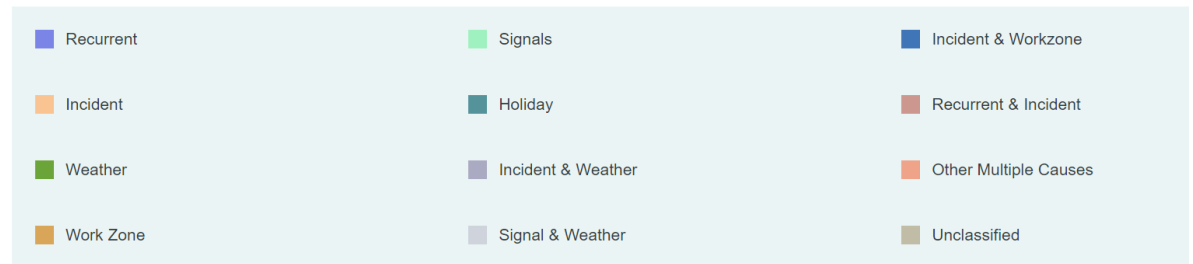
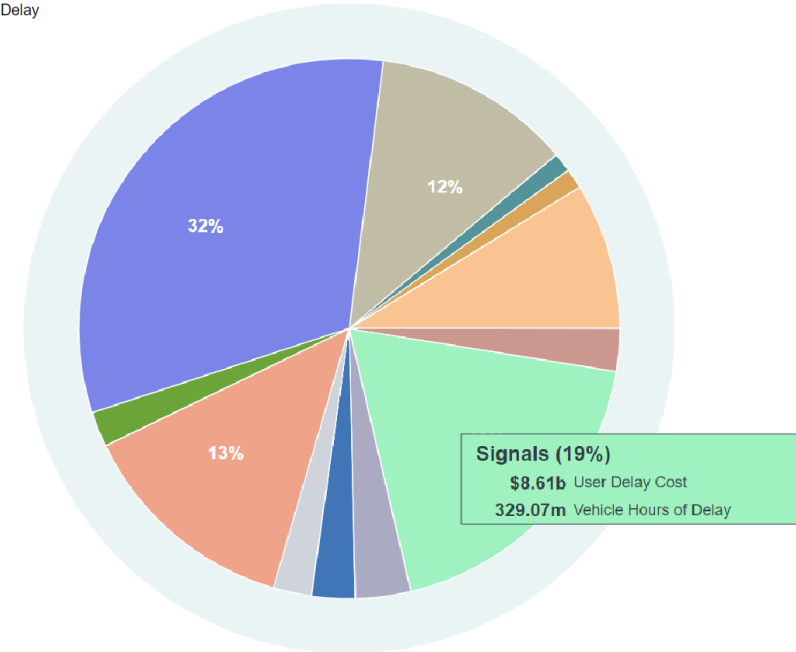
- ITE estimates that proper timed signals decrease fuel consumption by 6 to 9 percent

Reduce GHG Emissions

- 1 gallon of fuel = ~20 pounds of CO2

Sources of Disruption Nationwide 2019
No weather radar data was included for the states of AK and HI

\$45.84b User Delay Cost
1.75b Vehicle Hours of Delay



Visit: <https://congestion-causes.ritis.org/>

SOURCE: <https://www.hrg-inc.com/benefits-of-traffic-signal-retiming-outweigh-costs-401/>



REGIONAL INTEGRATED TRANSPORTATION INFORMATION SYSTEM

Thank You!



Rick Ayers



703.989.3221



rayers@umd.edu



cattlab.umd.edu

