Q-FREE
SNOHOMISH COUNTY
ADAPTIVE DEPLOYMENT

HAWAII ITE TECHNICAL SOLUTIONS EVENT

Q
FREE

Introutions

Patrick Marnell, PE
Q-Free America
Senior Project Manager
Hubbard, Oregon

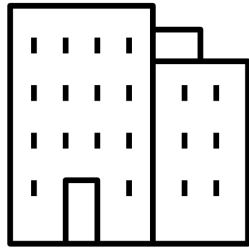Also, a Past President of OR ITE
Currently, WD ITE Tech Chair

Steve Mager
Q-Free America
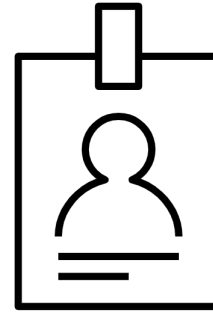Regional Sales Manager, West
Wilsonville, Oregon
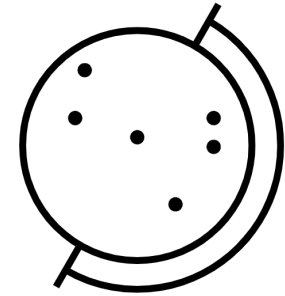
Q-Free at a glance

FOUNDED IN
1984

GLOBAL ATMS
HEADQUARTERS
CARLSBAD, CA

~ 400
EMPLOYEES
WORLDWIDE

REFERENCES IN
50+ MARKETS

Traffic trailblazers

95

Intelight MAXVIEW city traffic management systems

30k

ATC traffic signal controllers (2070 and NEMA)

10

OpenTMS freeway & statewide traffic management systems

▸ Serving more than 25 million people

▸ Managing more than 500,000 lane miles
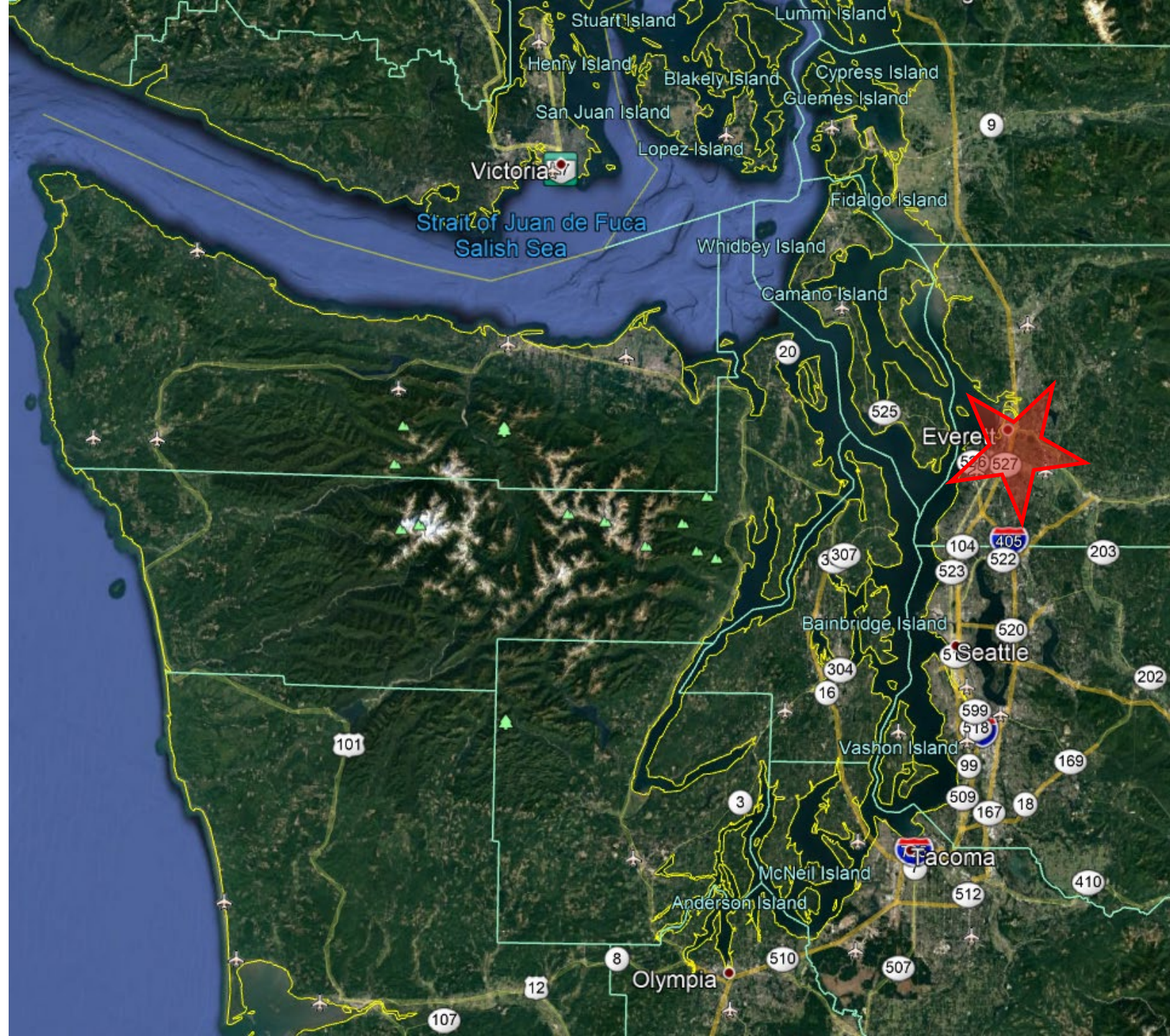
Q FREE

Snohomish County At A Glance

Snohomish County

Northern most county in Seattle-Metro Area

Population (2019): 822,083

County Seat: Everett

Named for the Snohomish People
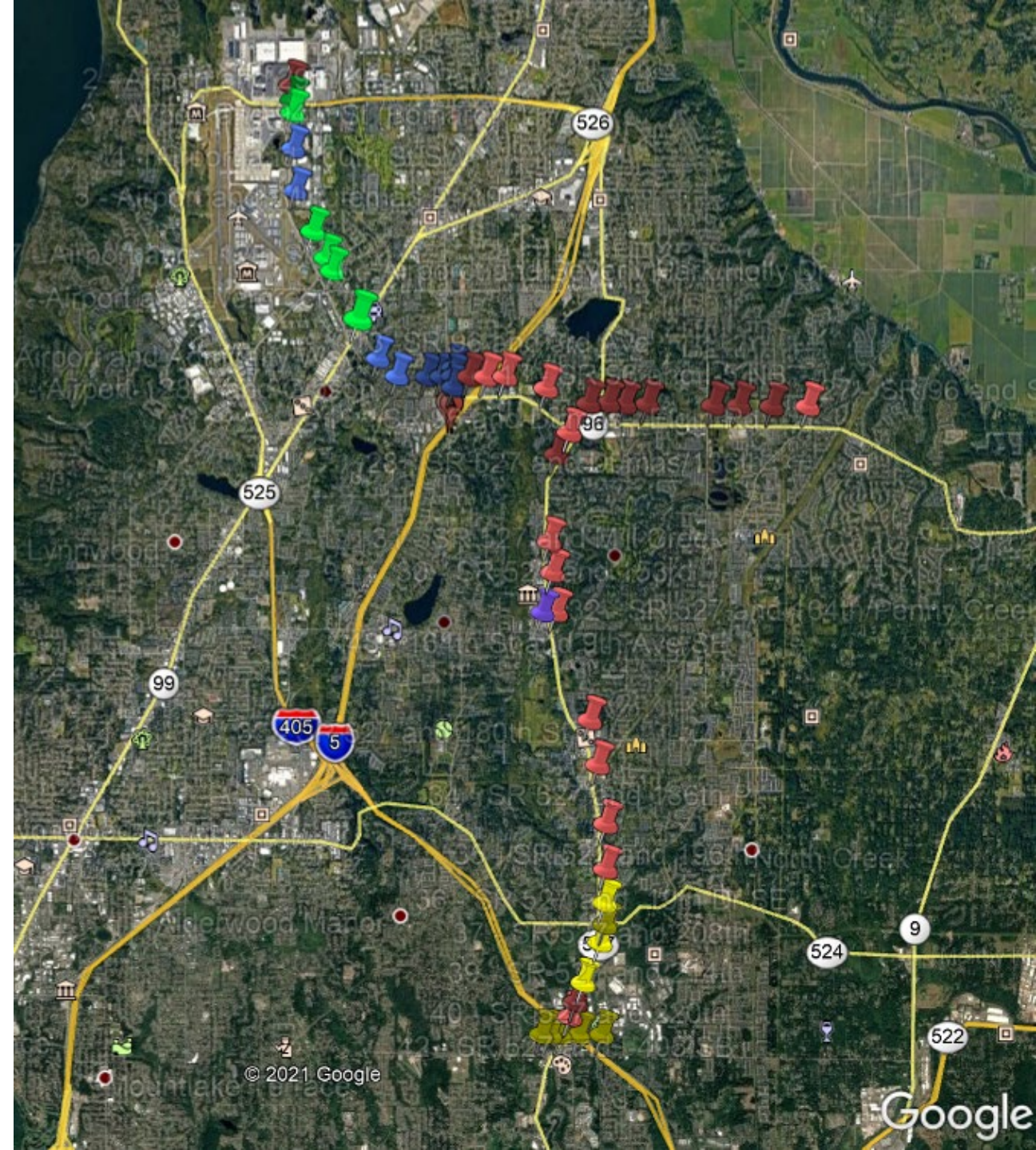
Snohomish County Adaptive At A Glance

49 Intersections

6 MAXTIME Adaptive Corridors

2 IT Networks (Snohomish County and WSDOT)

Federal Funding from FHWA STP Grant

Snohomish County Adaptive At A Glance

Jurisdictions

Snohomish County – 9 Intersections
City of Bothell – 9 Intersections
City of Mill Creek – 1 Intersection
City of Everett – 6 Intersections
WSDOT – 24 Interactions

Facilities

4 Highway to Highway Junctions
2 Freeway Interchanges
Busiest Intersection in SnoCo
Major Commuter Traffic

Major Generators

Boeing Manufacturing Plan
Pain Field Airport
2 Park and Rides
4 Schools
Multiple Bussiness Parks
Multiple Retail Centers

Transit Routes

1 BRT Line
2 Park and Rides
Multiple Commuter Routes
Multiple Local Routes
6 Planned TSP Intersections

Q FREE

Hardware use on this Project
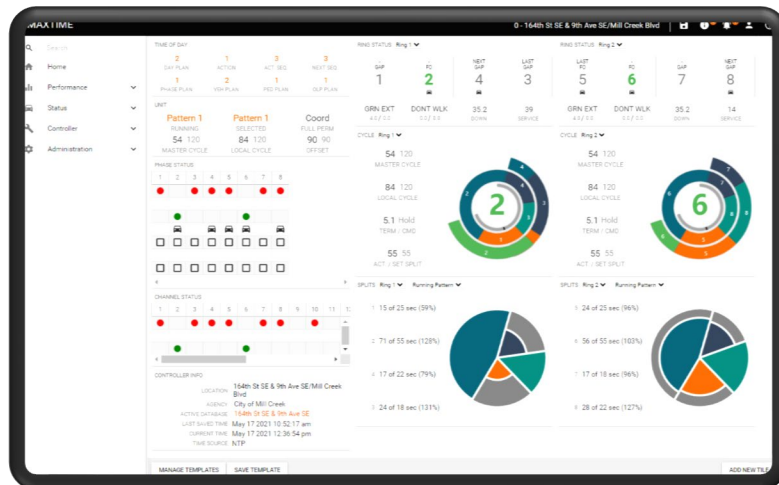
Intelight NEMA ATC
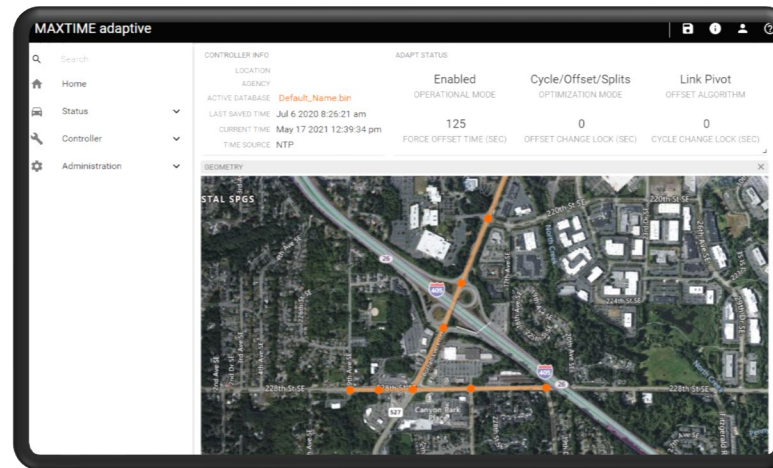
Intelight 2070 ATC

Intelight ATC 1C

Software use on this Project
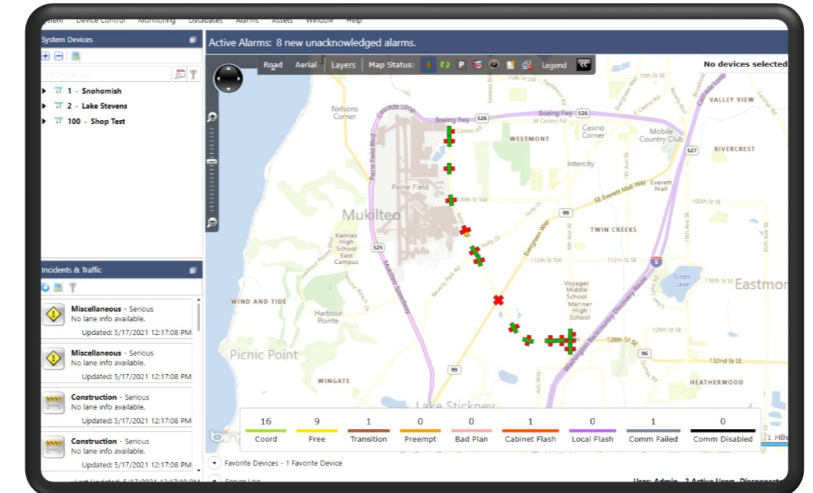
MAXTIME (Local)

MAXTIME adaptive (Local)

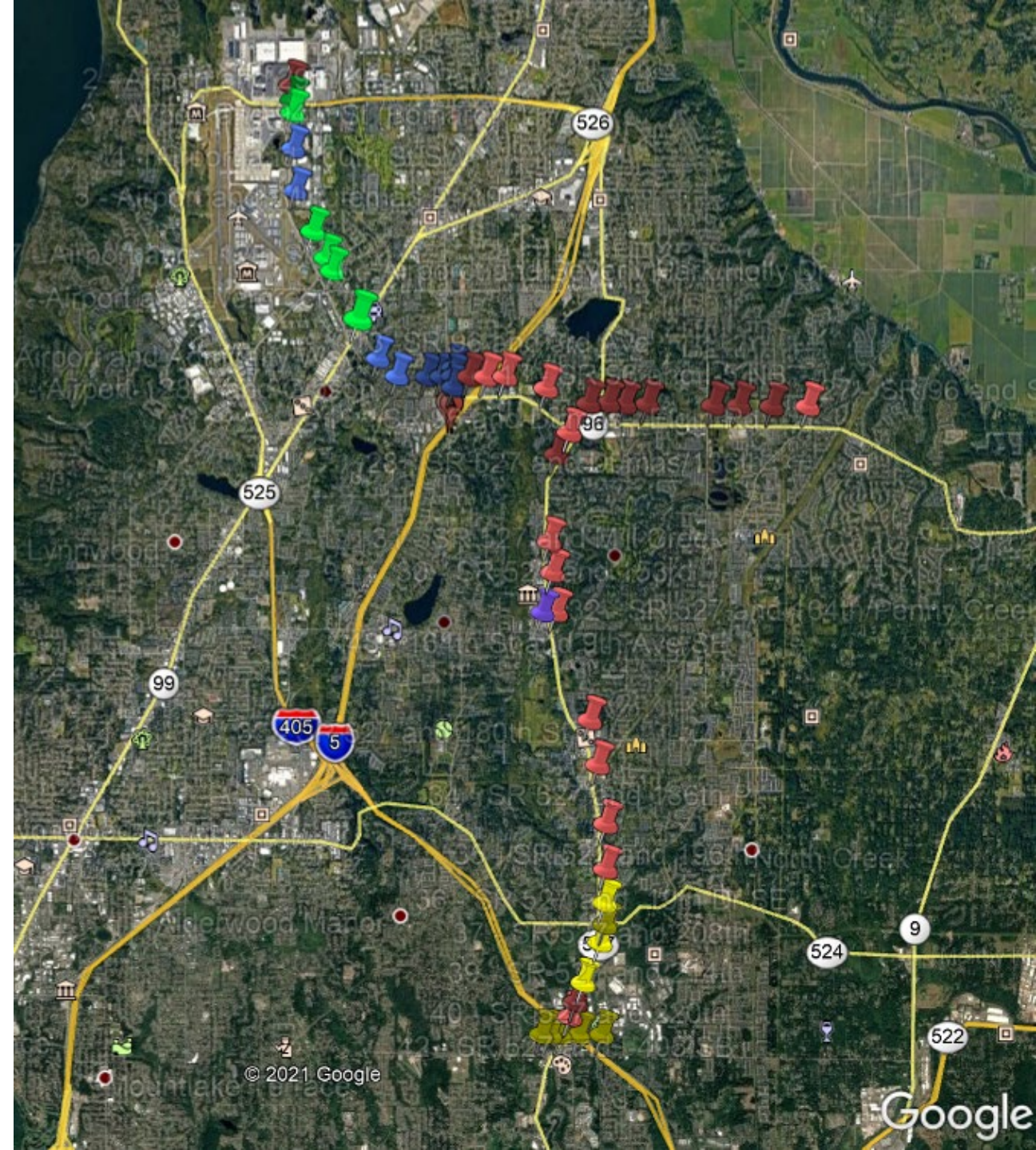## MAXVIEW (Central)

Snohomish County Adaptive At A Glance

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49 Intersections

6 MAXTIME Adaptive Corridors

2 IT Networks (Snohomish County and WSDOT)

Federal Funding from FHWA STP Grant

Why Did Snohomish Go Adaptive?

Seattle ranks 2nd worst commute time in US, report finds

by Becca Savransky, SeattlePI | Sunday, December 1st 2019

FILE - In this Sept. 24, 2014 file photo, traffic creeps along toward downtown on Interstate 5, left, and remains slowed down heading out during the rainy morning commute in Seattle. (AP Photo/Elaine Thompson)

Project Goals

Improve Transit Reliability

Reduce Emissions

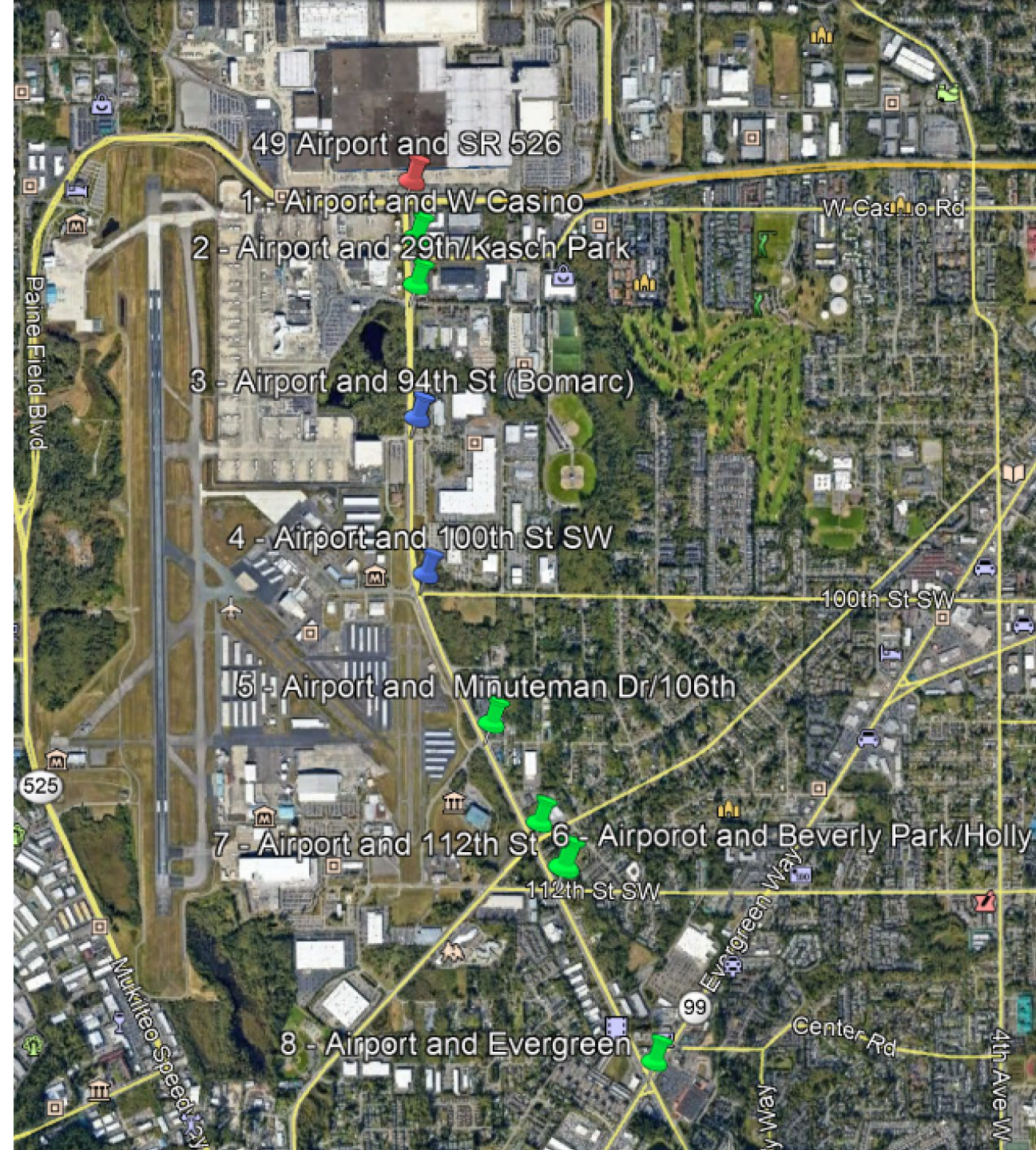**Support Regional Industrial Centers**

Reduce Congestion

Q FREE

Adaptive Networks

Airport Road Network

Boeing Manufacturing Facility
Pain Field Airport
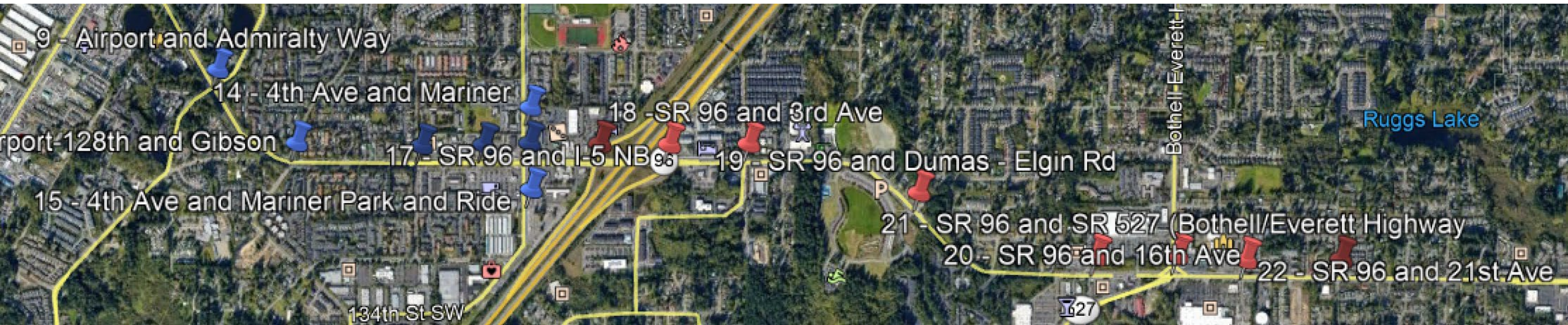**SR 99 / SR 526 Junction**
SR 96 / SR 99 Junction
Commuter Route

Adaptive Networks

Airport Road / SR 96 Network

I-5 Interchange   Big Box Commercial
Mariner Park and Ride   SR 96 / SR 527 Junction
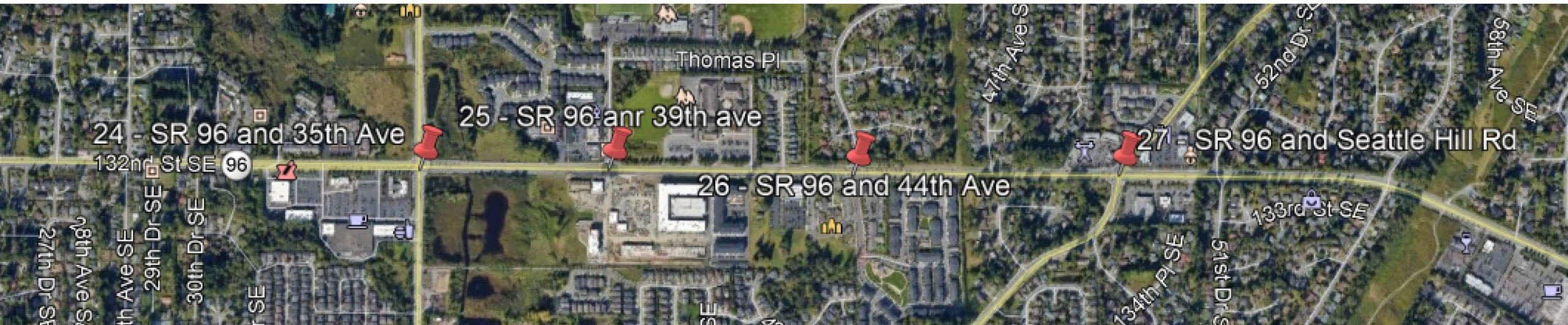McCollum Park and Ride   Commuter Route

Adaptive Networks

SR 96 East Network

Archbishop Murphy High School
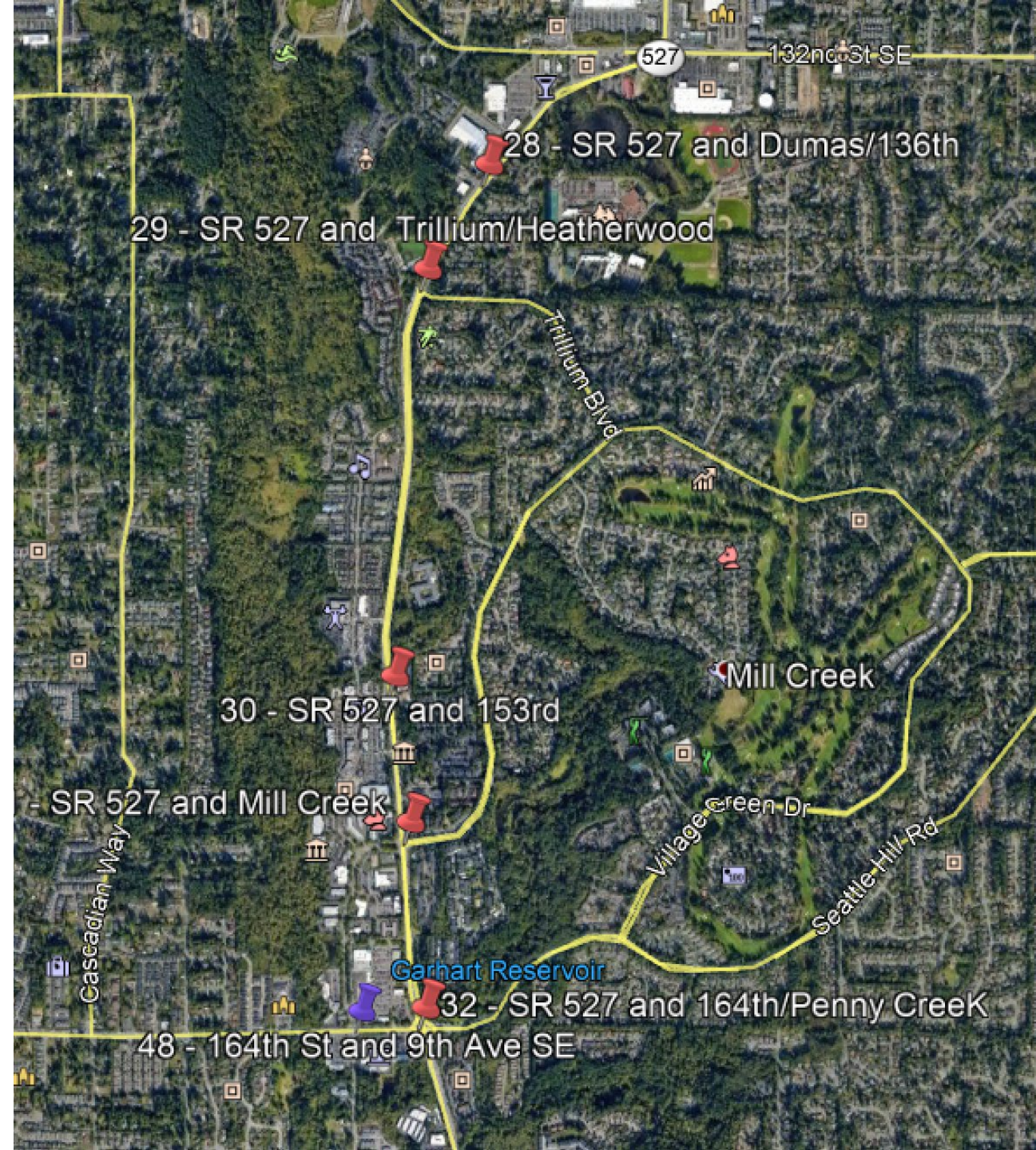**Penny Creek Elementary School**
Commuter Route

Adaptive Networks

SR 572 North Network

Henry M Jackson Highschool
Connection to I-5 west on 164th Street
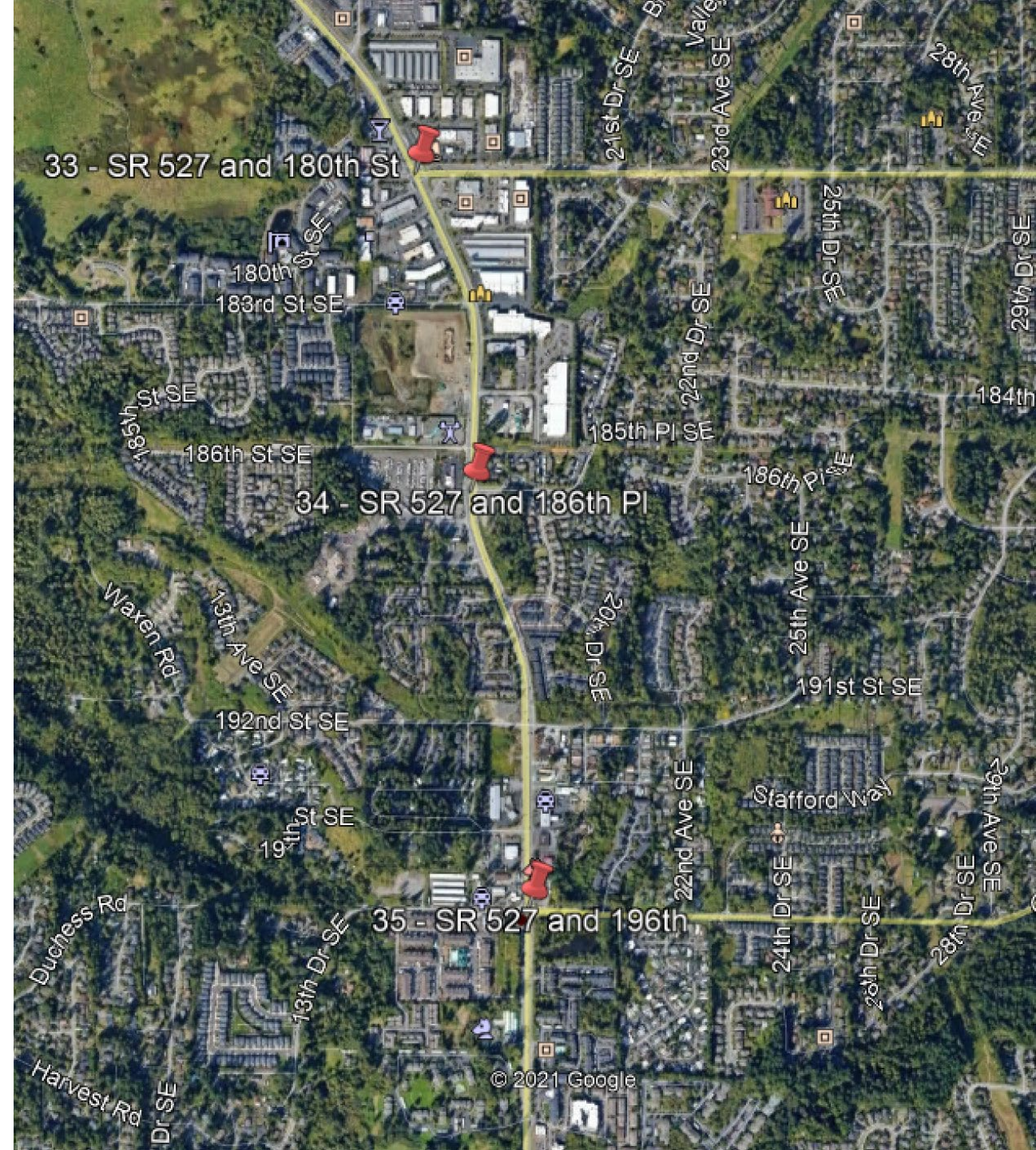**Major Retail Center**
Commuter Route

Adaptive Networks

SR 572 Mid Network

Strip Commercial
Residential
Commuter Route

Adaptive Networks
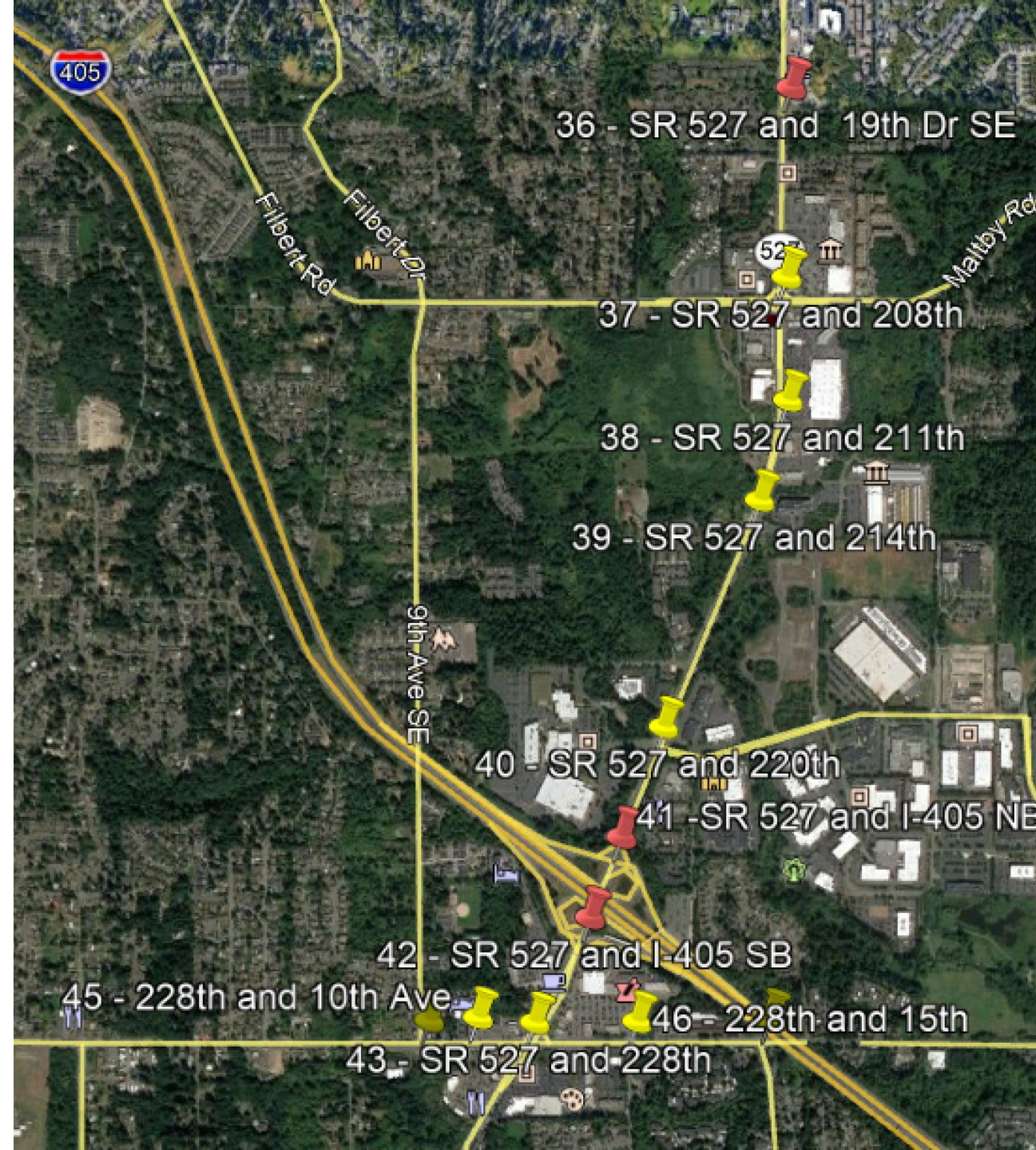
SR 572 South /228th Network

I-405 Interchange
Busiest Intersection in County
Major Retail Center
Major Bussiness Parks
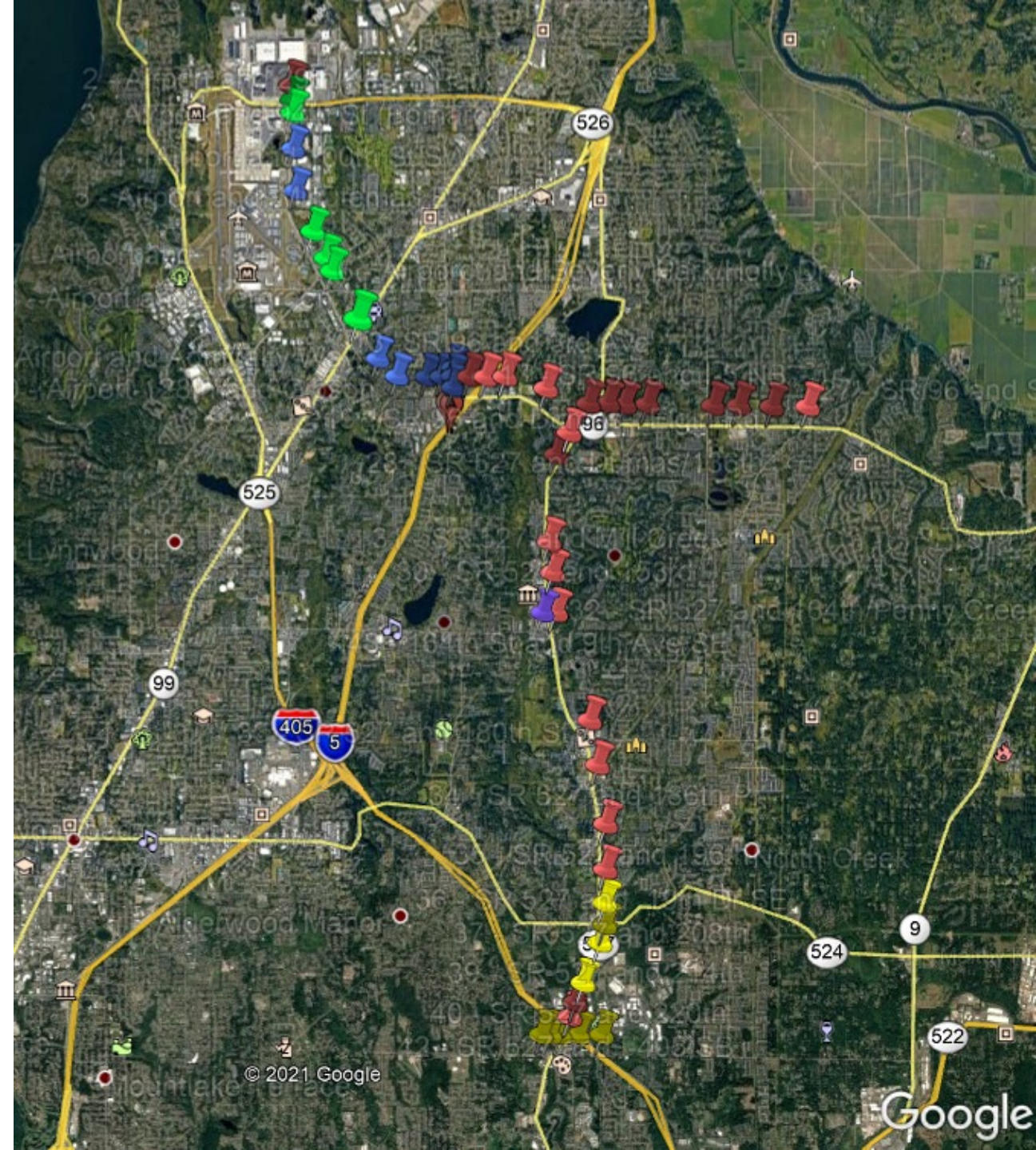**Commuter Routes**

Regional System

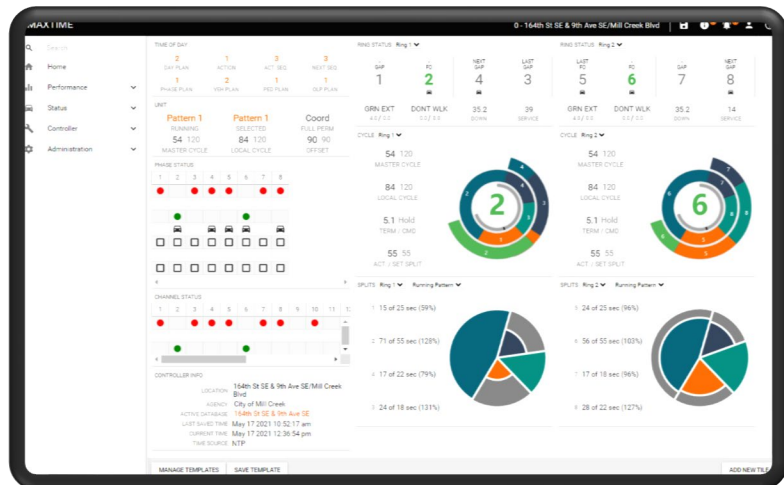**Multiple north south and east west routes**

Traffic incidents on one route will create impact on other routes
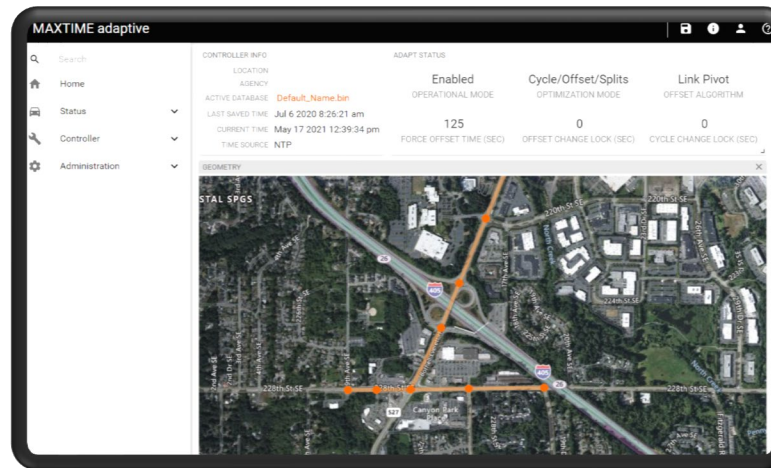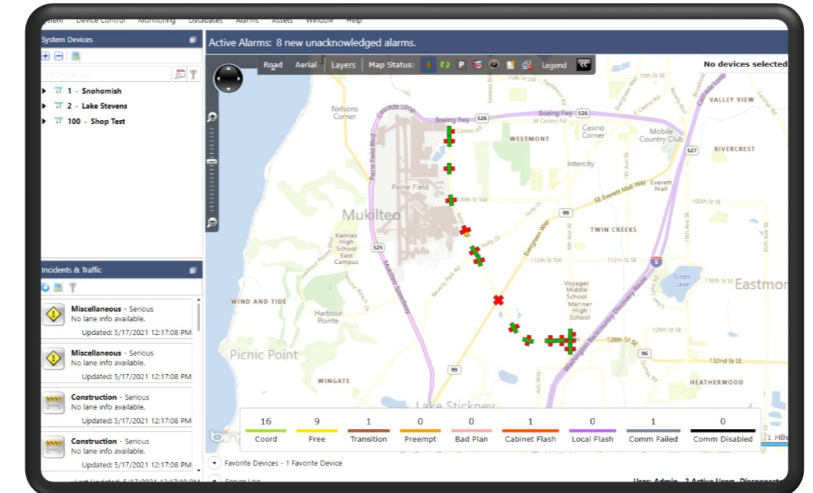
Software use on this Project
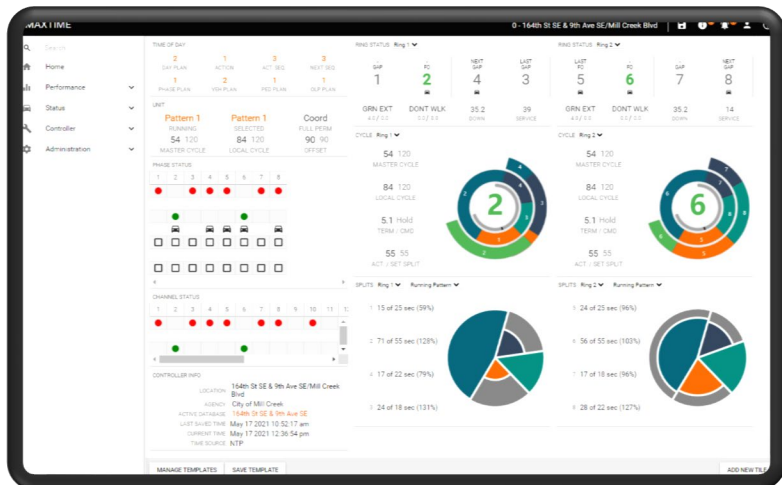
MAXTIME (Local)
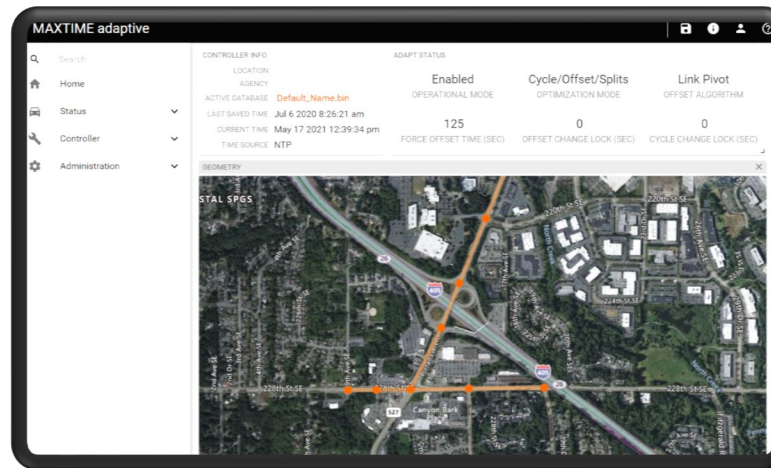
MAXTIME adaptive (Local)
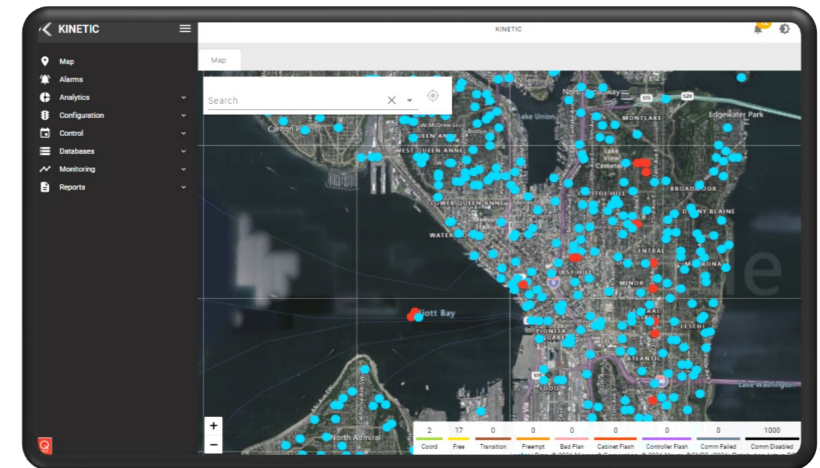
MAXVIEW (Central)

Software use on this Project
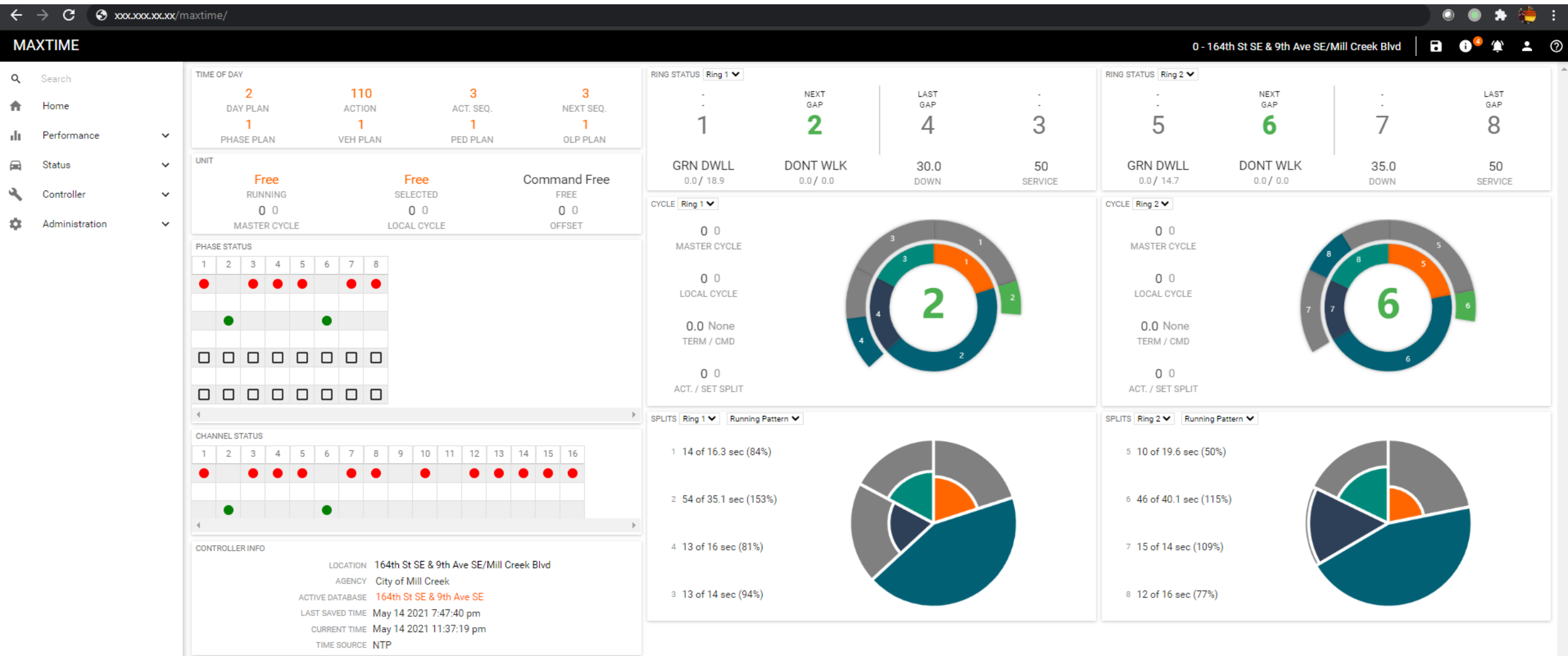
MAXTIME (Local)

MAXTIME adaptive (Local)

Kinetic Signals (New Central)

MAXTIME

MAXTIME

LOCAL INTERSECTION CONTROLLER SOFTWARE

State of the Art ATC Software

Runs on 2070 or NEMA

HTML5 Thin Client Interface

Simple Licensing, No Add on Modals

xx.xxx.xx.xxx/maxtime/Status/UnitAndPhaseStatus

MAXTIME

0 - 164th St SE & 9th Ave SE/Mill Creek Blvd

Search

Home

Performance

Status

Unit, Ring & Phase Status

Coordination Status

Detector Status

Overlap Status

Recorded Splits

Preempt Status

Prioritor Status

Alarm Status

Channel Status

Input Status

Output Status

Special Function Status

Cabinet Status

Peer Status

Master Status

EDI SMU Status

Configuration Validation

Queue Responsive Plans Status

Front Panel Emulator

Controller

Administration

Main Control

| Timebase CONTROL SOURCE | Free SELECT MODE | Free ACTIVE | 2 DAY PLAN | 110 ACTION STATUS | 1 PH PLAN | 1 VEH PLAN | 1 PED PLAN | 1 OVLP PLAN | 1 PRI PLAN | 3 SEL SEQ | 3 SEQ |

Coord & Extended Status

| Free MODE | 0 LOCAL CYCLE | 0 MASTER CYCLE | 0 SET OFFSET | 0 ACT. OFFSET | Command Free FREE STATE | Off FLASH STATE | None COORD MAX | Off PRI STATUS | Inactive PRI QUEUE STATUS |

Ring Status

Show All Rings

Ring	Active	Phs Interval	Up Time	Down	Term Time	Term	Coord Cmd	Ped Interval	Ped Up
1	2	Grn Ext	1.1	2.9	30.0	Max 1		Dont Wlk	0.0
2	6	Grn Ext	0.0	4.0	35.0	Max 1		Dont Wlk	0.0

Phase & Call Status

Show All Phases

Phase	1	2	3	4	5	6	7	8
Reds	●		●	●	●		●	●
Yellows								
Greens		●				●		
Veh Calls						🚗		
Min Calls	☐	☐	☐	☐	☐	☐	☐	☐
Max Calls	☐	☐	☐	☐	☐	☐	☐	☐
Ped Calls								
Ped Call	☐	☐	☐	☐	☐	☐	☐	☐
Alt Ped Calls								
Dont Walks		✋		✋		✋		✋
Ped Clears								
Walks								

MAXTIME

LOCAL INTERSECTION CONTROLLER SOFTWARE

MAXTIME Controller Always in controller of intersection operations

All feature available during adaptive operations
- – Advanced Coord Modes
- – TSP
- – Peer to Peer
- – User Logic

MAXTIME + MAXTIME adaptive
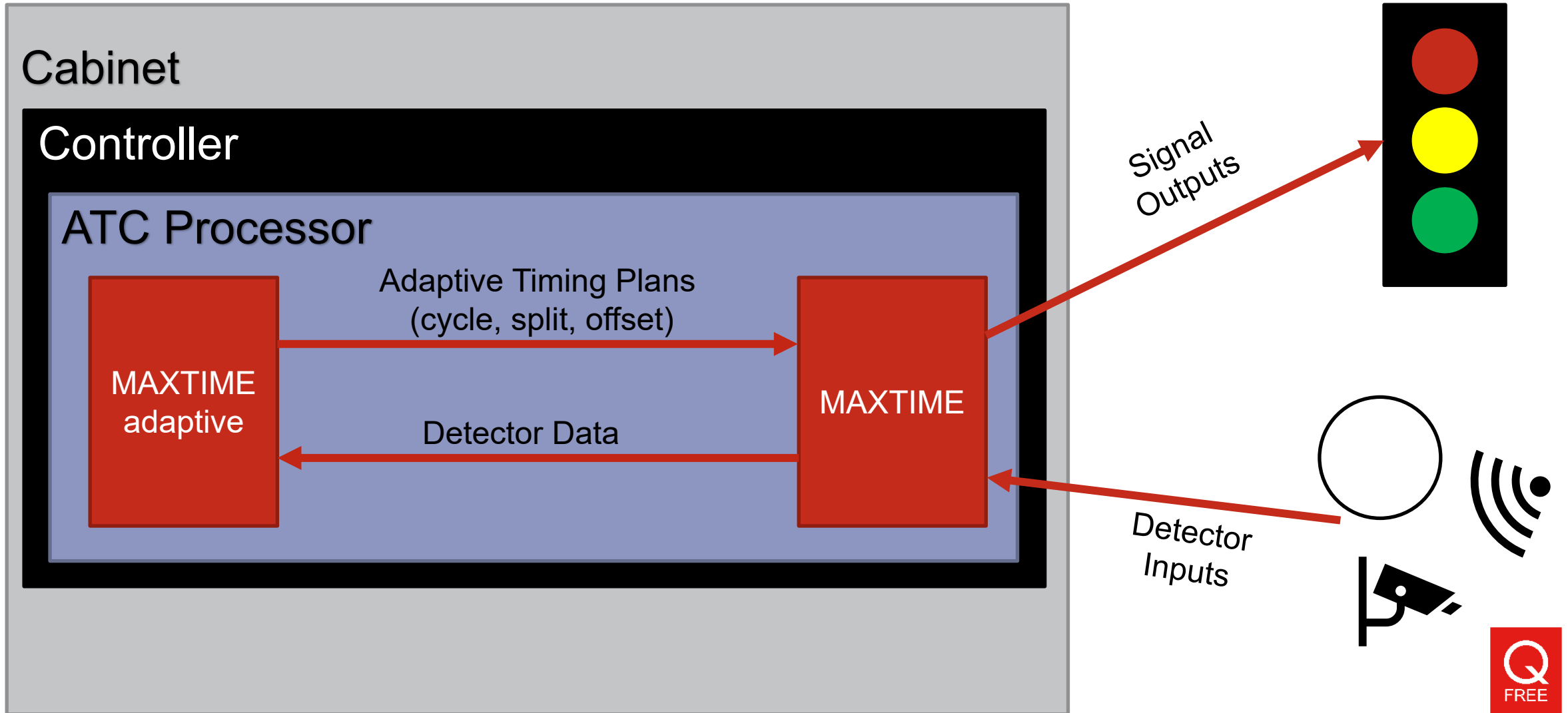
MAXTIME adaptive to MAXTIME adaptive

Cabinet

Controller

ATC Processor

MT

MT adaptive

MAXTIME adaptive communicates over local Ethernet connection to share network parameters

No central connection is needed for adaptive operations, but one may be useful

Cabinet

Controller

ATC Processor

MT adaptive

MT

Q FREE
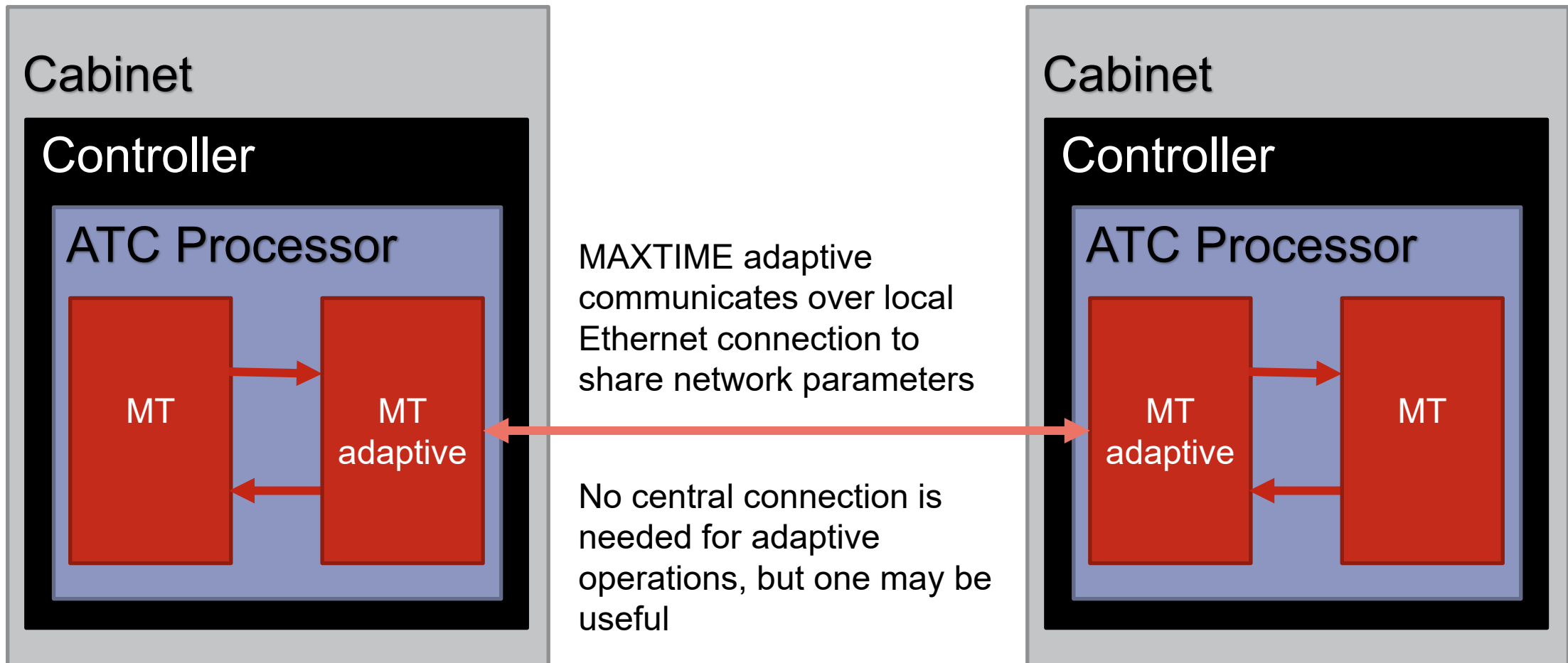
MAXTIME adaptive

LOCALLY DISTRIBUTED ADAPTIVE SOFTWARE

Requires intersection communicate locally, central comm not necessary

Detection requirements based on ATSPM configuration

Geometry programmed in Kinetic Signals central software

MAXTIME adaptive

LOCALLY DISTRIBUTED ADAPTIVE SOFTWARE

Cycle Length Algorithm based on:

- Webster Cycles
- Condition Plans Trigger Changes

Two Offset Optimization Algorithms:

- Geometric
- Link Pivot

Split Optimization based on:

- Detector Occupancy
- Configurable split equity plans
- Adaptive Min and Max Splits
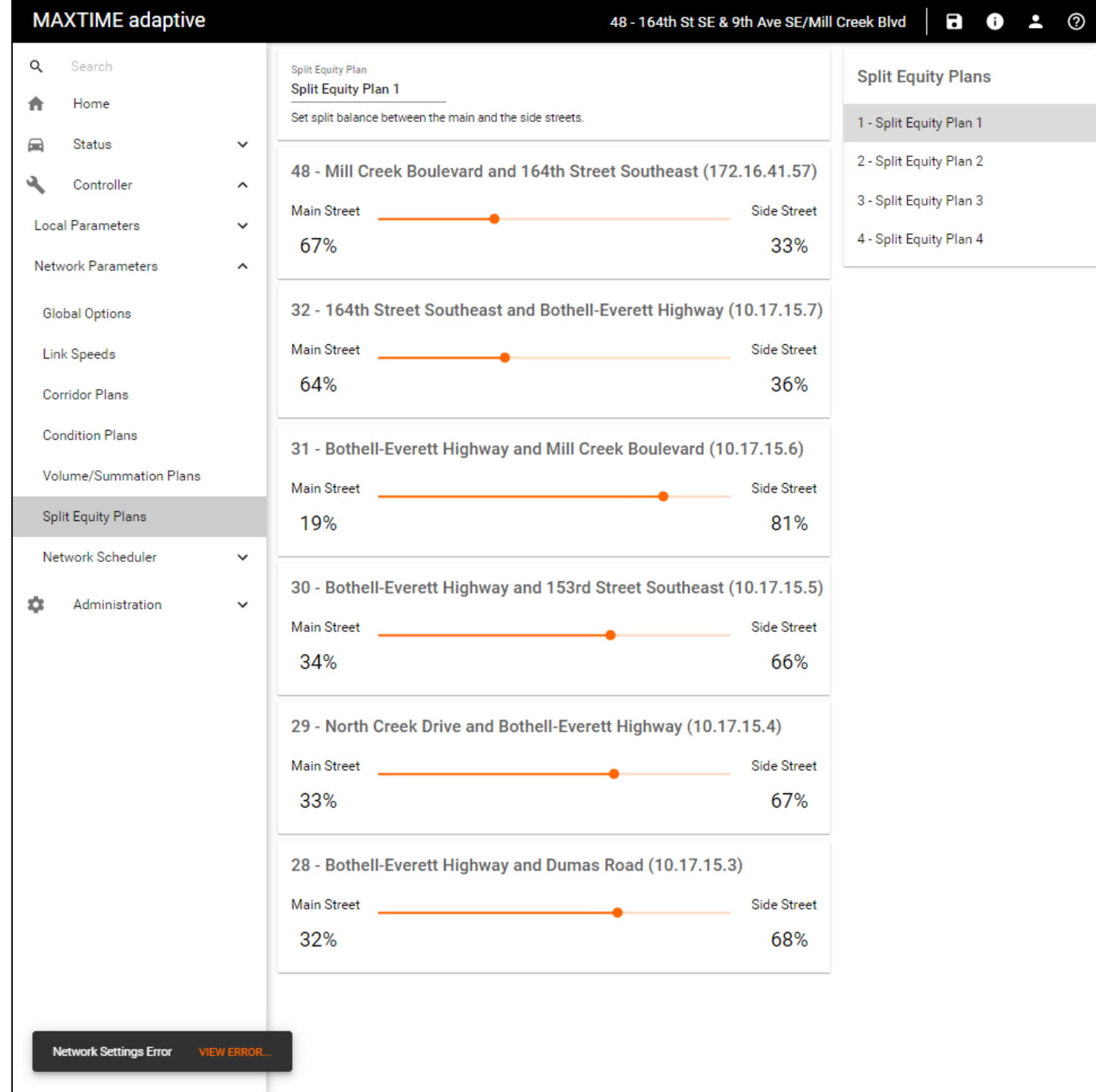
Cycle Length Optimization
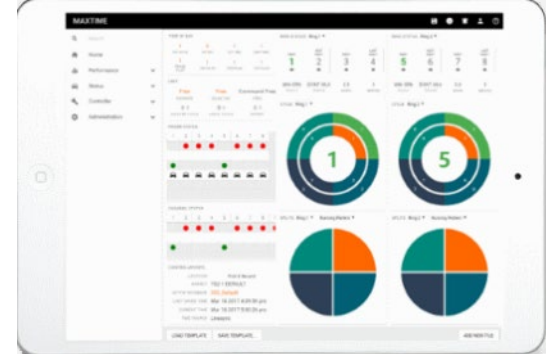
WEBSTER'S FORMULA

Establish System Lower Bound

Compare with User Defined Cycle Limits

CYCLE LENGTH RANKING

Evaluated in 5 sec Increments

Processed through Offset Models

CYCLE LENGTH SELECTION

Utilizes Time Space Diagrams

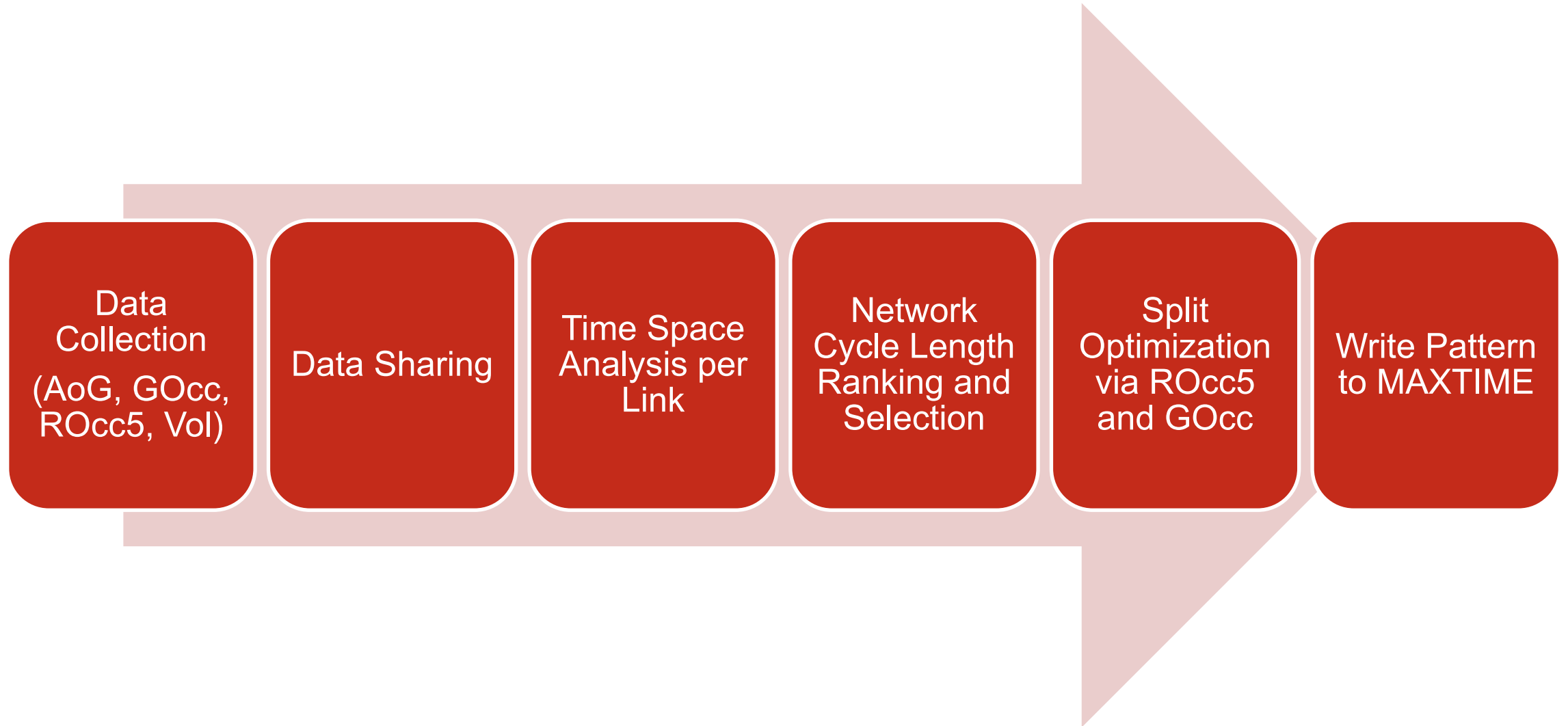Selects Largest Green Band(s)

TWO WAY CORRIDORS
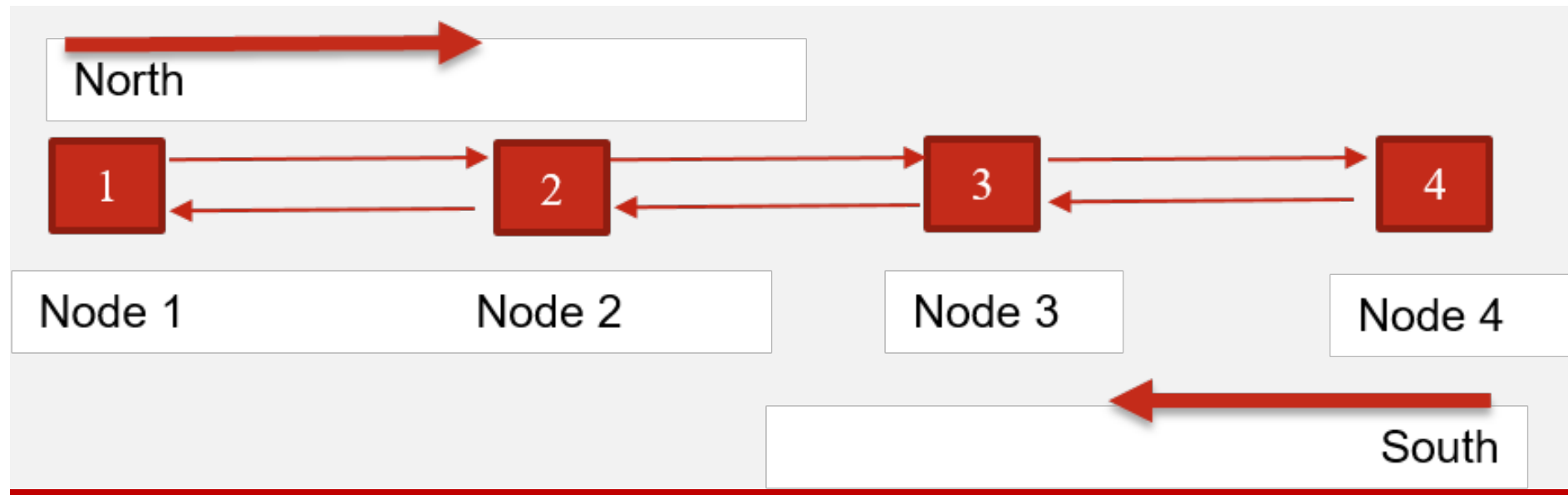
Weights Directionality of Green Bands

User Definable

How It Works

The link pivot algorithm computes the optimal offset for each node independently, given the past N cycles of data

Offset Optimization

Link Pivot Offset Calculations

Calculates Bi-Directional Arrival Data for First Link

Calculates Mainline Green Probabilities (per cycle length)

Scores Each Offset Based on AoG

Repeats for Remaining Links, in Order

Q
FREE

Split Optimization

1.

Stop-bar detector data used to track occupancy during green (GOcc) and occupancy in 1st five-seconds of red (ROcc5) and plotted with a best-fit straight line.

2.

Split methodology is first impended across the sequence to share among barriers.

3.

Then it is applied across each phase within the ring and barrier group.

Q
FREE

Split: Barrier Balancing

Node 1

Barrier 1
Barrier 2

15
11
27
12
26
15

Red Occupancy

Green Occupancy

ROcc5 vs GOcc Plot
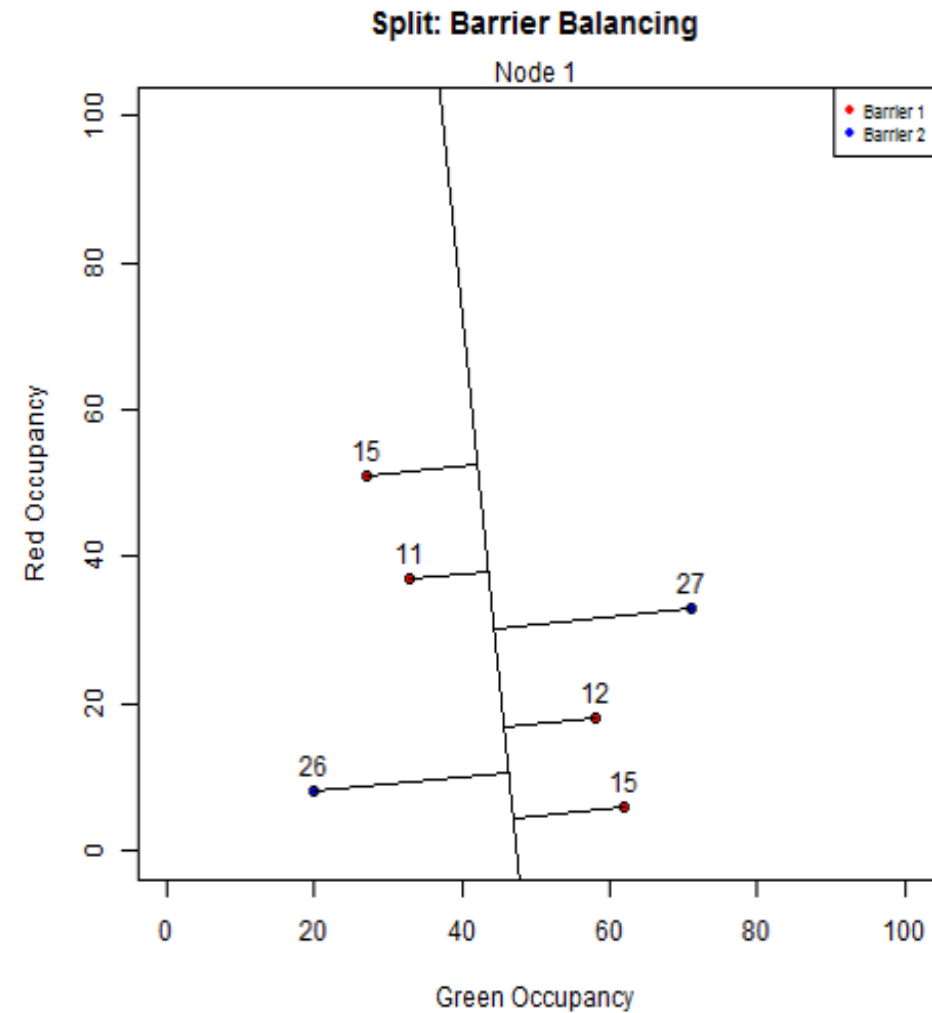
The plot represents split utilization.

The perpendicular lines give a % value of how much time each split can absorb or give.

Values are used to rebalance splits to achieve equal utilization.

Q FREE

MAXVIEW atms (advance traffic management system)

- True thin-client
- Standards-based
- Open API
- 3rd party controllers and devices
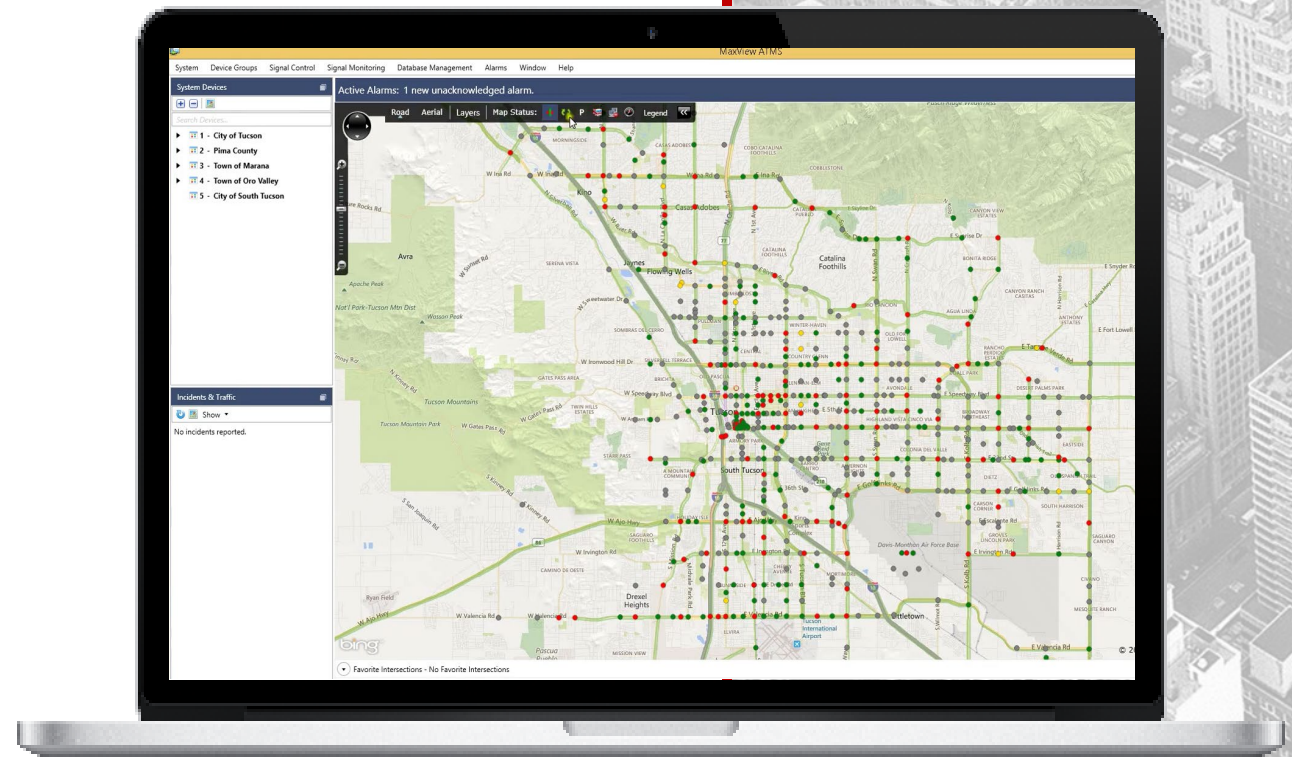
Advanced ATMS Functionality

ATSPM REPORTS

- Included at no cost
- No ATSPM server
- MAXVIEW event log data

INNOVATIVE DATABASE EDITOR

- "Live Front Panel"
- All changes logged
- Copy-and-Paste

DYNAMIC GROUP PLAN VIEW

- Groups of intersections
- Group manual control

CALENDAR BASED SCHEDULER

- Outlook-style calendar
- Quick Commands
- Control hierarchies

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Hi-Res Data
Logging

PERFORMANCE

Signal Performance Metrics (ATSPM)

- No extra cost
- No extra server
- No extra SQL Server
- Uses MAXVIEW data

REPORTS

Graphical Reporting

- Event data over time
- Drag-and-drop time slice
- Line, bar, scatter, etc.

ANALYTICS

Analysis Tools

- Split monitor
- Time space diagram
- Device event detail

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ATSPM – Purdue Coordination Diagram

ATSPM – Purdue Coordination Diagram

Purdue Split Failure

Airport @ Kasch - SIG#3
Monday, May 17, 2021 6:00 AM - Monday, May 17, 2021 1:01 PM

Phase 1: SBL-1

Total Split Failures = 4

MAXVIEW 1.9 → Kinetic™ Signals
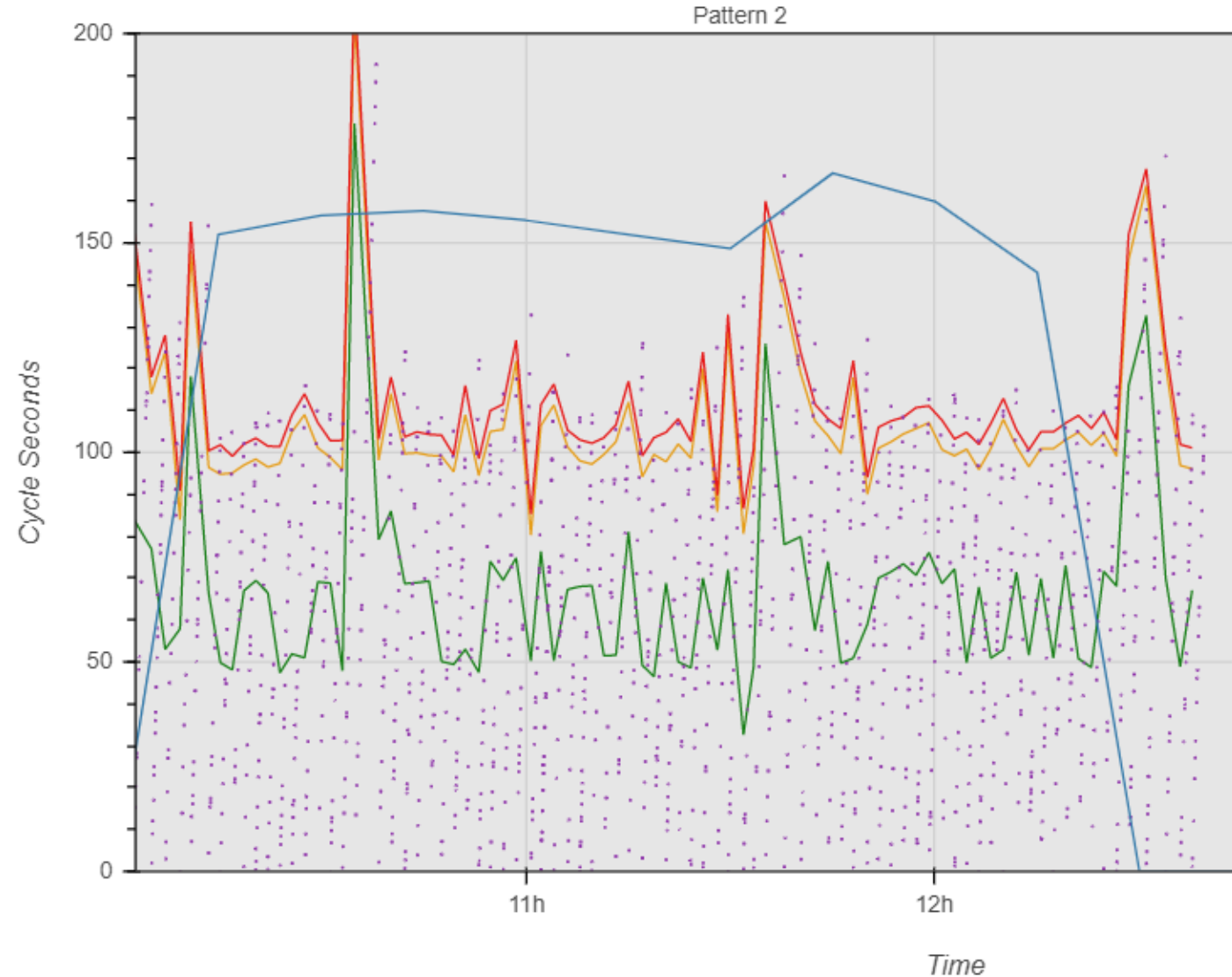
MAXVIEW 1.9 → Kinetic™ Signals

ATSPMS

- Dynamic Time Scaling

- Active Data Filtering

- User Friendly Exports

- Popular Reports:

  – Purdue Coordination Diagram
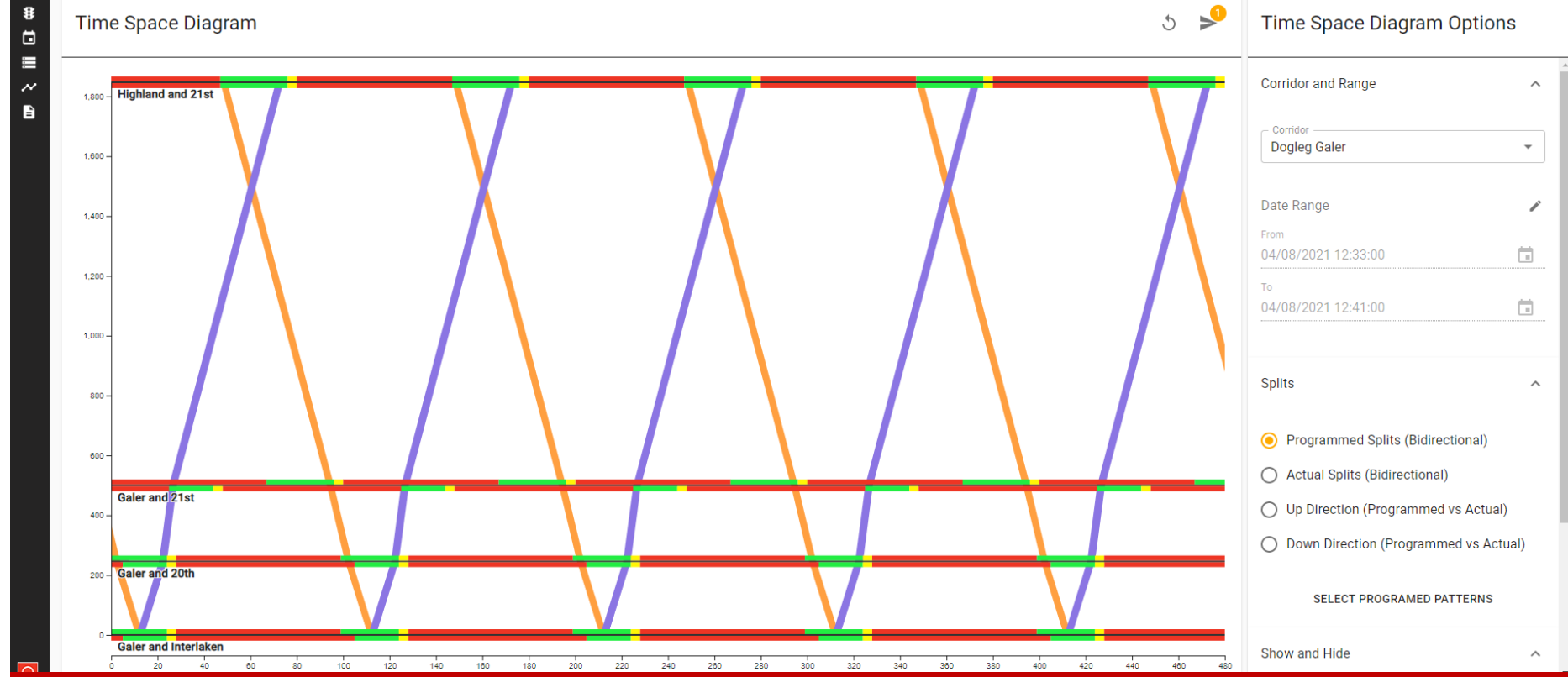 – Split Failures
  – Turning Movement Counts

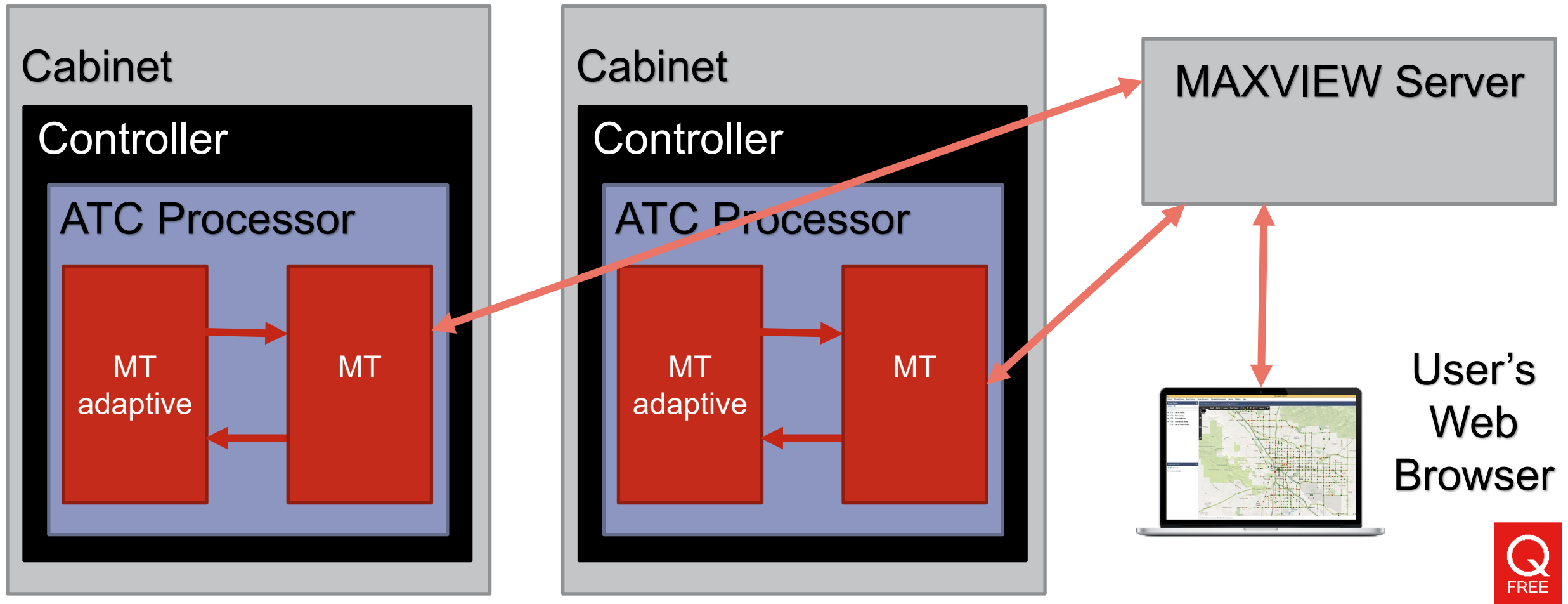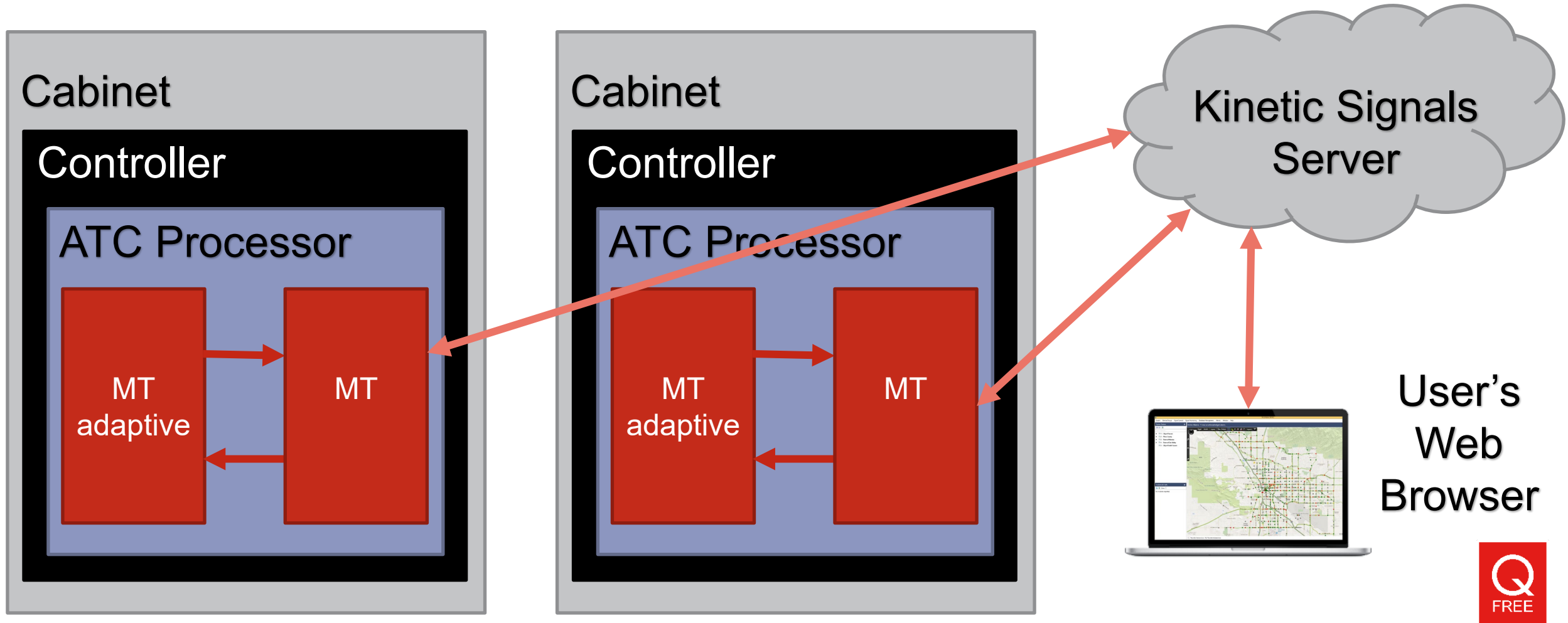**Interactive Reports**

Time Space Diagrams

- Historical and near Real Time relationships

- View Programmed and Actual Splits

- Interactive offset adjustments

MAXTIME + MAXTIME adaptive + MAXVIEW

Cabinet

Controller

ATC Processor

MT adaptive

MT

Cabinet

Controller

ATC Processor

MT adaptive

MT

MAXVIEW Server

User's Web Browser

MAXTIME + MAXTIME adaptive + Kinetic Signals

Deployment Challenges

Large Stakeholder Group

– **Frequent Coordination**

– **Reserved Longer Meeting Times**

Multiple IT Networks

– **Interagency Coordination**

– **NAT IP Addresses**

Federal, State, and County Contracting

– **Flexibility in Scheduling**

– **Building on Existing Relationships**

Deployment Challenges

Covid-19

- Wrote a Covid-19 safety plan for last deployment trip
- Delayed before and after study over a year

Software Improvements

- Scheduled devlopment resources on stand-by
- Multiple builds in the first week of deployment.

Concerned Citizens

- A good sense of humor

Notable MAXTIME adaptive Deployments

CURRENTLY INSTALLED

Snohomish County, WA (49 signals)

Lincoln City, OR (7 intersections)

Omaha, NE (4 Systems)

- Dodge Street (15 intersections)

- 84th Street (25 intersections)

- 144th Street (7 Intersections)

- 132nd Street (6 Intersections)

Olathe, KS (3 Intersection)

Waterloo, IA (9 intersections)

Orange County, FL (3 Signal Pilot)

COMING SOON

Snohomish County, WA (Additional 32 intersections)

Union City, CA

Waterloo, IA

Clive, IA

Oregon Department of Transportation (ODOT)

- Sandy, OR

- Salem, OR

Washington County, OR

- Tualatin-Sherwood Highway (joint with ODOT)

- Durham Road

Q FREE

Thanks *for* **joining us**