



TAMC

TRANSPORTATION AGENCY FOR MONTEREY COUNTY



Caltrans

Adaptive Signals

TAMC BOARD

OCTOBER 23, 2024

Traffic Signal Overview

1. Signals typically used to control intersections with heavy movements in several conflicting directions
2. Lower volume intersections typically are served with STOP control
3. Higher volume intersections may become freeways or have overpasses
4. Roundabouts are an alternative to signals in most cases

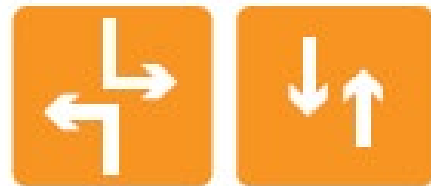


Fig.1 States (phase pairs)

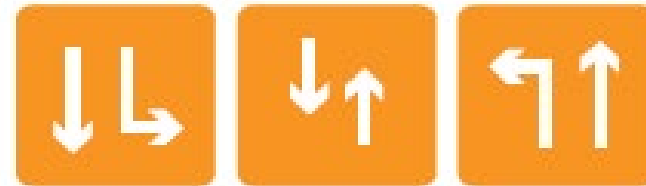


Fig.2 Sequence of phases

Types of Signal Operation



Free (uncoordinated)

First come first served

Serve in a very well-defined sequence

Flexible and treats everyone the same

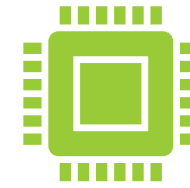


Coordinated

Set a specific cycle length for a specific time of day

Serve all minor movements then “rest” on mainline green for remainder of cycle

Rigid and unbending to benefit mainline travel



Adaptive (AI)

Hybrid of Free and Coordinated modes

Switches as needed to best serve current conditions

Uses real-time information to quickly adapt to conditions in the field

Traffic Signals: Comparing Modes of Operations

Condition	Free (uncoordinated)	Coordinated	Adaptive
Off-Peak / Light Traffic	Good	Poor	Great
Peak Hour / Heavy Traffic	Poor	Great	Great
Incident	Good	Poor	Great
Special Event	Fair	Poor	Great
Close Intersections	Poor	Good	Great
Intersections Spaced Far Apart	Fair	Poor	Good

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

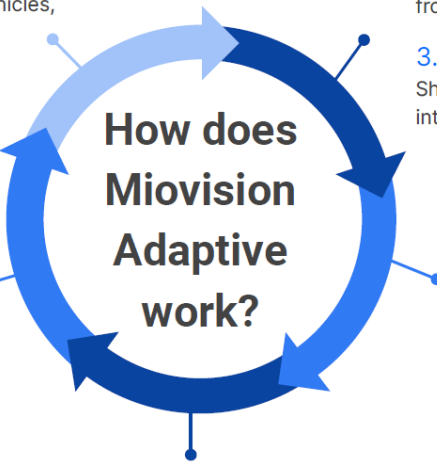
Create aggregate representation of traffic flows from sensed traffic

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



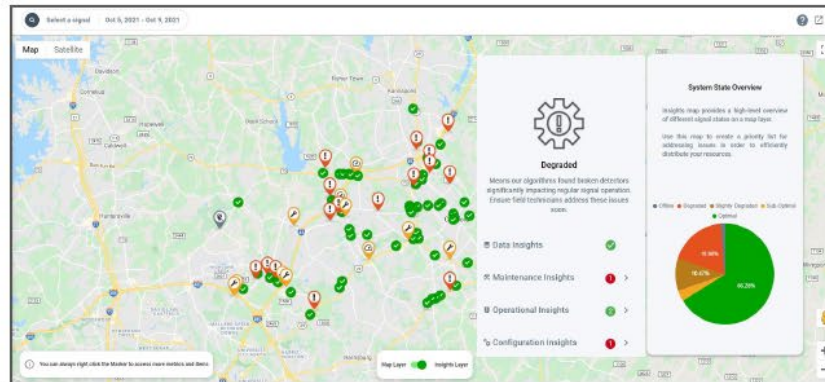
Why is Adaptive So Much Better



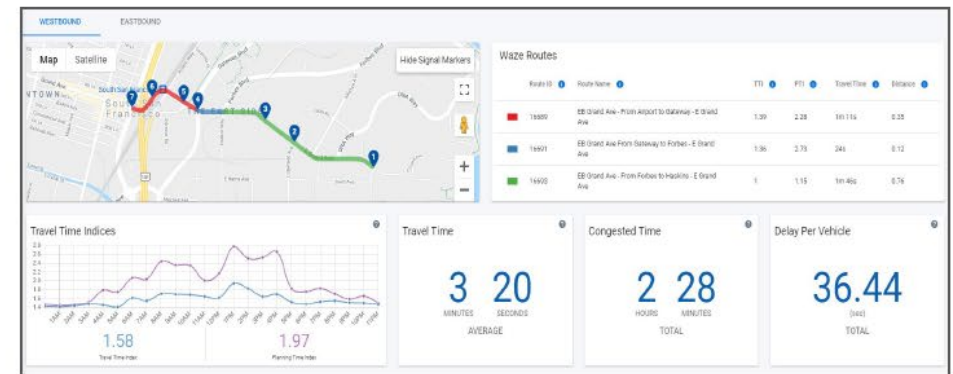
If you can't measure something, you can't understand it.
 If you can't understand it, you can't control it.
 If you can't control it, you can't improve it.

H. James Harrington

Maintenance Insights



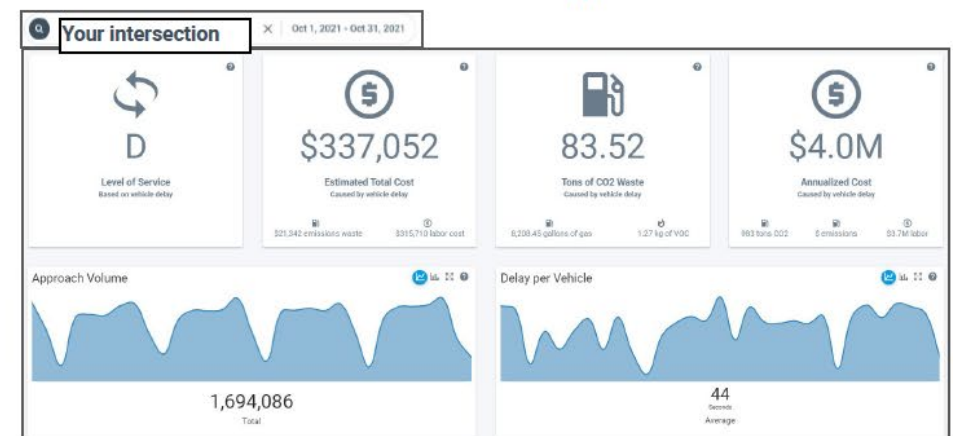
Travel Time & Corridor



Signal Performance



Executive Reports



Proposed Benefits

Adaptive Traffic Signal Control



40%*
Less time
spent idling



25%*
Lower travel
times



30%-40%*
Fewer stops



20%*
Lower
emissions



-60%

**Stops
Reduction**



-57%

**Delay
Reduction**



-24%

**Travel Time
Reduction**



-23%

**Emissions
Reduction**



-17%

**Fuel Consumption
Reduction**



-23%

**Crash
Reduction**

Proposal

- Caltrans pilot project update
- TAMC offer to fund Phase I (Pilot Project)
- Phase I cost estimate = \$250,000
- 4 intersections (east side)
- Phase II once Phase I results validated