

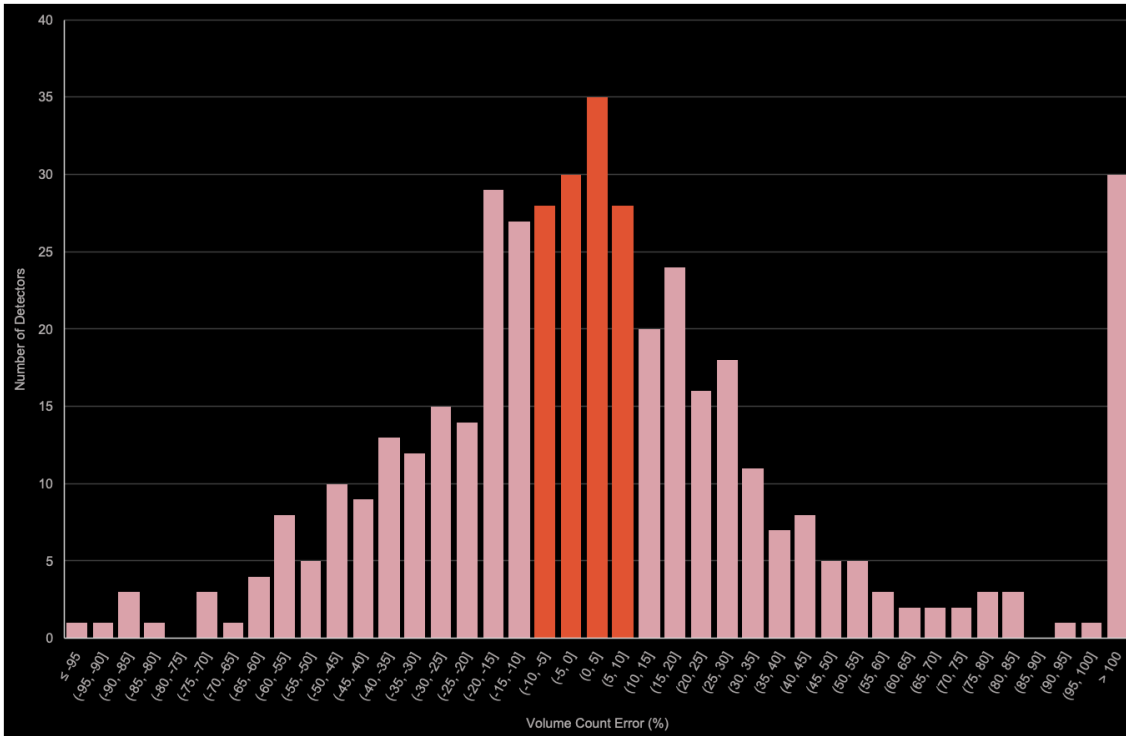


Flow Labs

Turning Reactive into Proactive: Using Better Performance Measures for Better Signal Performance

ITS Wisconsin Annual Conference, October 2024

Bad data = bad outcomes



- Over 435 detectors studied over a 1-month period
- Only **27.6% of detectors were found to be reliable** (within 10% volume count error)
- Causes false alarms, and **83% of signal issues are missed**
- Reduces trust, increases fieldwork
- Makes all the systems that use them fail

Real-World Observed Probe Vehicle Data can be the Solution to Bad Data

The Flow Labs data partner network spans OEMs, GPS device manufacturers, Location-Based Services (LBS) providers, and telematics providers - capturing data from 20-45% of vehicles on any given roadway at any given time.



OEM Data

Our network of OEM partners provides us with access to highly granular data on vehicle locations typically with penetration rates of 3-10% across the US.

Selected Examples:  **VOLVO**



Smartphone Data

Data from smartphones and Location Based Services (LBS) can provide key insights on pedestrians, and bicycles as well as vehicles.

Selected Examples:  AIRSAGE



GPS Data

We collect data from the tens of millions of GPS devices or on-board GPS systems with penetration rates of 20-35%.

Selected Examples:  **tomtom**

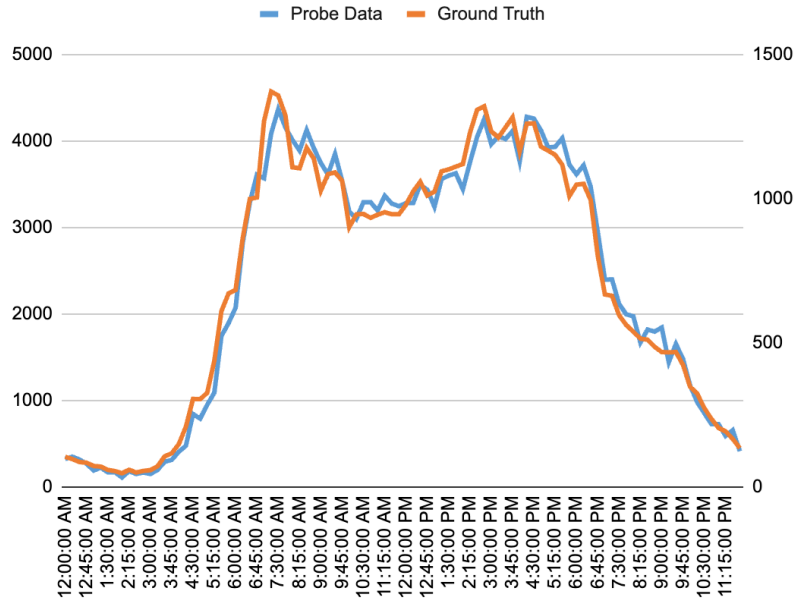


Telematics Data

We capture data from onboard telematics units which currently have penetration rates of 10-20%.

Selected Examples: **MICHELIN**  **GEOTAB** ITS

We capture data from up to 40% of all vehicles on the road at any given time

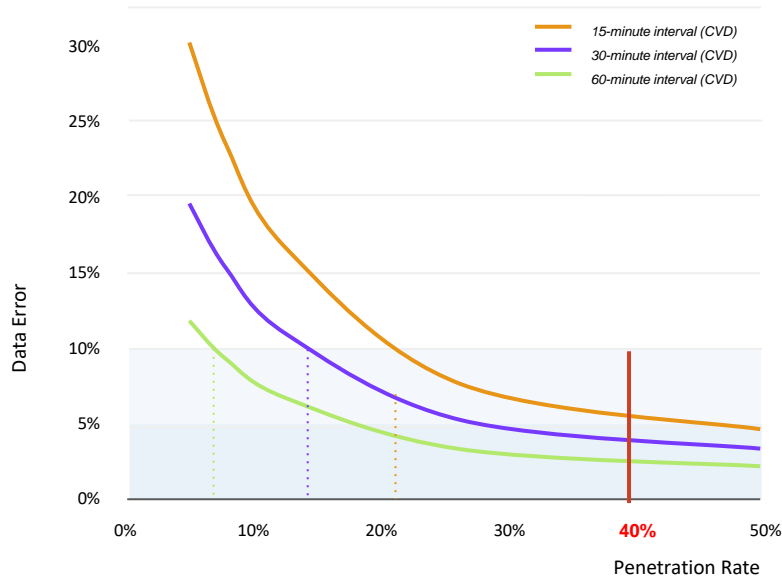


- Recently conducted validation by **Maricopa Association of Governments (MAG)**
- Comparison of Flow Platform data penetration rates comparing with **49 ground truth studies over 18 months** down to 15-minute granularity.
- **Average penetration rate of 29.1%**
- **Stable penetration rates across times of day, days of week, volumes.**
- **Average R² value of 0.97**
- **Implications:**
 - Higher accuracy data (volumes, travel times, delay)
 - Higher coverage
 - Lower latency

MAG Validation Case Study:

<https://www.flowlabs.ai/blog/maricopa-study-confirms-flow-labs-industry-leading-penetration-rates>

Market-leading Connected Vehicle Data (CVD) penetration rates maximize data accuracy



Bigger Data is Better Data

- Higher penetration rates are required to deliver the accuracy levels required for many mission-critical applications.
- Higher penetration data is necessary to achieve accuracy at 15-minute interval levels.
- The Flow platform offers penetration rates of up to 40%, enabling our users to achieve the highest levels of accuracy with connected vehicle data.

Probe-Based Signal Performance Measures gives insights regardless of connectivity & infrastructure

Signal Operations

Arrivals on Green

Arrivals on Red

Control Delay

Queue Length

Split Failures

Turning Movement Counts

Mobility

Travel Times

Travel Time Reliability

Control Delay

Number of Stops

Vehicle Miles Traveled

Cost of Delay

Safety

Speeding & Approach Speed

Hard Braking

Crash & Fatality Incidence

Distracted Driving

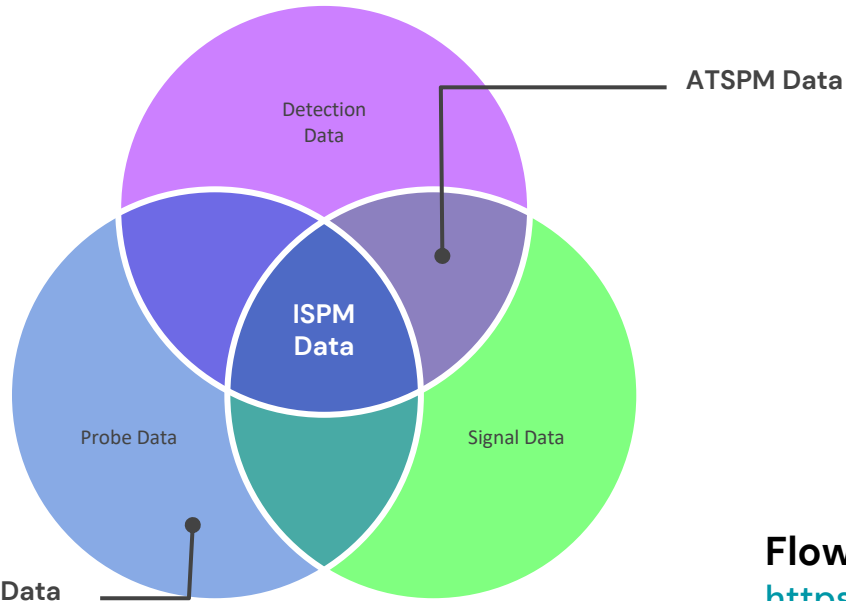
Suspected Collisions

Sustainability

Vehicle Emissions

Fuel Consumption

Integrate all roadway and signal data under a single unified platform

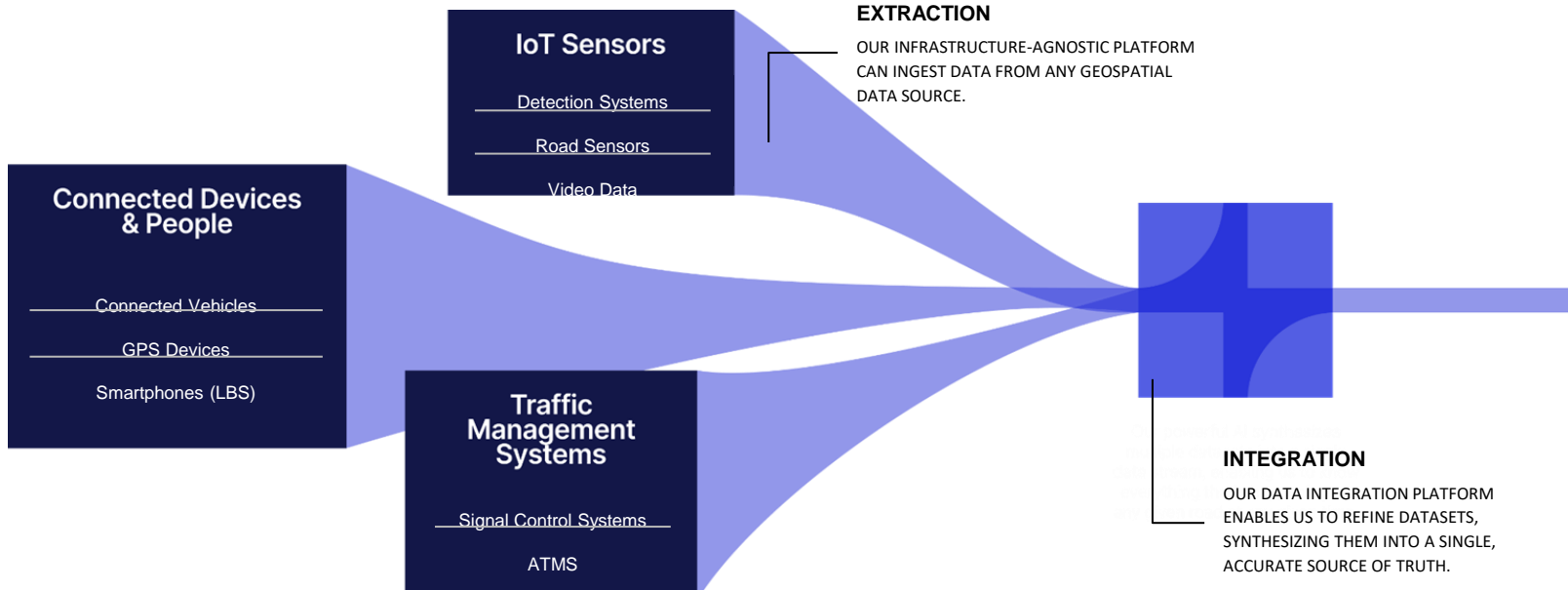


- **Probe Data:** Capture historical and real-time data directly from vehicles.
- **ATSPM Data:** Capture data from detection devices and controller logs.
- **NTCIP Data:** Capture data from controller configurations.

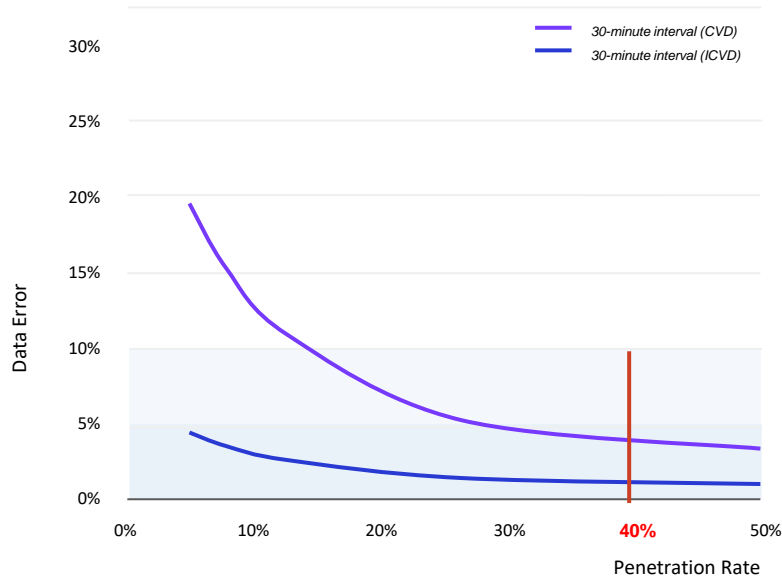
Flow Labs Integrated SPM White Paper:

<https://www.flowlabs.ai/blog/integrated-signal-performance-measures---the-next-frontier-in-signal-analytics>

Our Data Integration platform integrates data from any geospatial data source



Only Integrated Signal Performance Measures (ISPMs) offers the accuracy required for mission-critical applications



Integrated Data is Better Data

- Integrating connected vehicle data with other datasets (including from ITS devices) to generate Integrated Connected Vehicle Data (ICVD) achieves the highest levels of accuracy, reducing data error by a further 75%.
- Through generating 95%+ accurate data ICVD offers the capability to support mission-critical, real-time applications.

Integrated Signal Performance Measures offers the most insights available today

Signal Operations

- Arrivals on Green
- Arrivals on Red
- Control Delay
- Queue Length
- Split Failures
- Turning Movement Counts
- Signal Timing
- Phase Terminations

Mobility

- Travel Times
- Travel Time Reliability
- Control Delay
- Number of Stops
- Vehicle Miles Traveled
- Cost of Delay

Safety

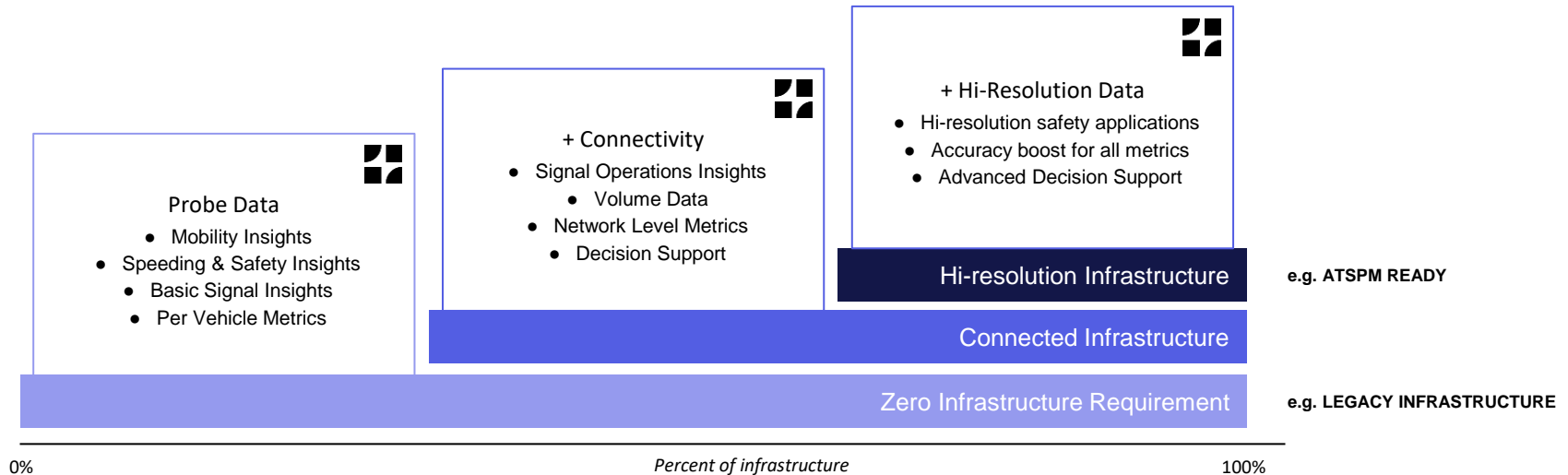
- Speeding & Approach Speed
- Hard Braking
- Crash & Fatality Incidence
- Distracted Driving
- Suspected Collisions
- Pedestrian Safety
- Dilemma Zone Entry
- Red Light Running

Sustainability

- Vehicle Emissions
- Fuel Consumption

Integrate all roadway and signal data under a single platform, regardless of existing infrastructure

Every transportation agency has a mix of infrastructure that is constantly evolving. With an infrastructure-agnostic architecture, the Flow Labs platform creates a single digital layer that allows transportation agencies to future-proof their infrastructure.



A full end-to-end SPM platform for all traffic signal management needs

Our Traffic Signal Management solutions enable engineering teams to monitor, analyze, and optimize traffic signals with ease.

- **Combine Probe-Based SPMs & ATSPMs all in one place.** Use probe data to validate the accuracy of ATSPMs or supplement where ATSPMs aren't available or fall short.
- **Traffic Signal Monitoring & Prioritization.** Proactively identify major signal issues and prioritize retimings.
- **Data Collection & Analysis.** Leverage connected vehicle data and SPMs to analyze and diagnose signal issues. Generate health scores to prioritize intersection issues across corridors or the whole region.
- **Before-After Analysis & Reporting.** Quickly quantify retiming impacts and generate customizable reports instantly.
- **Signal Optimization.** Instantly optimize splits, cycles, and offsets for even the most complex corridors.



Proactive Signal Health Monitoring & Corridor Prioritization



- **Customizable Health Scoring Algorithms:** Cerberus enables engineers to set scoring criteria and performance thresholds.
- **Regionwide Corridor Prioritization:** Health scores can be used to instantly prioritize corridors and identify candidates for retiming.
- **Alerting & Notifications:** Users are alerted to major performance changes triggering further investigation and retiming.
- **Asset Monitoring:** Users can quickly identify poorly performing assets including controllers and detection.

Rapid before-and-after analyses for internal and external reporting



- **Instant Before-and-After Analysis:** Litmus empowers engineers to generate a performance analysis for a signal timing project in seconds without any fieldwork.
- **Simplified Reporting:** Export feature enables users to create shareable reports and charts instantly.
- **Attribution:** Identify which specific changes drove the biggest performance changes.

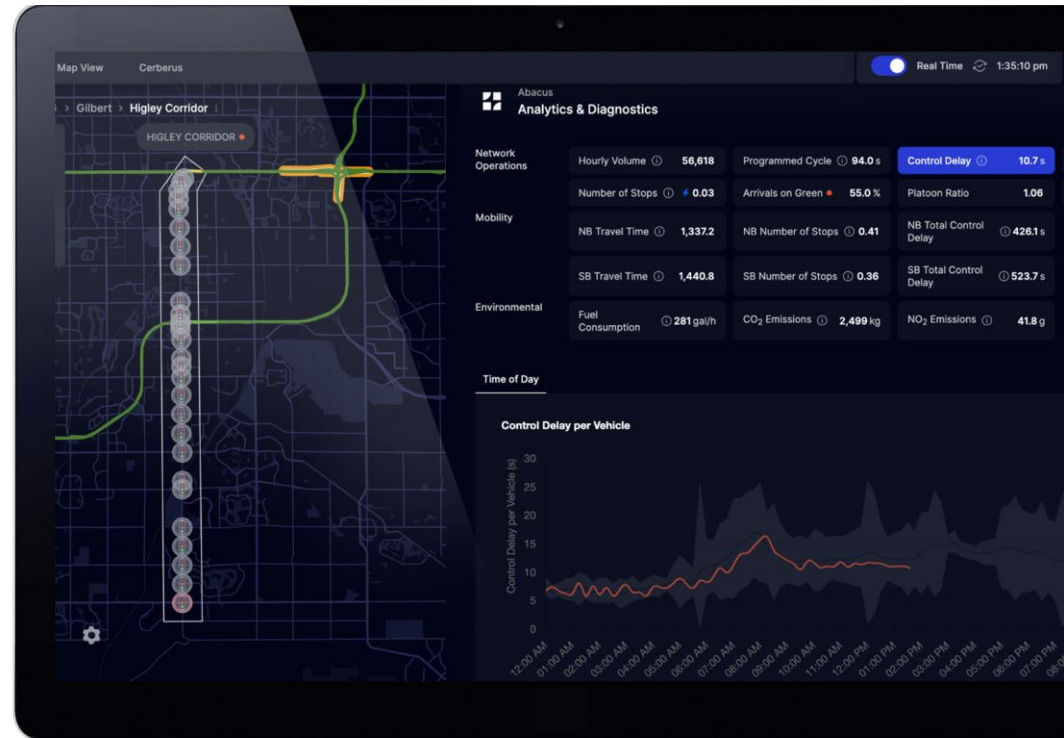
Advanced decision support capabilities for engineering teams across the region



- **Flexible User-Driven Optimization:** Optimus enables engineers to easily set key objectives and constraints for optimization.
- **Accurate Performance Predictions:** Each timing plan comes with an accurate performance prediction.
- **Safety Optimization:** Optimus enables users to optimize timing plans for safety including establishing corridor speed targets, minimizing Red Light Running and Dilemma Zone Entry, and maximizing pedestrian safety.

Probe Data unlocks Real Time Signal Performance Measures

- **Deploy** real time SPMs to get minute-by-minute data on signal performance without any connectivity to the signals.
- **Prioritize** resolving abnormal traffic issues by getting real time alerts when congestion is outside the threshold of normal.
- **Visualize** real time conditions compared to historical trends without needing to change systems or screens.



Summary

- **Avoid garbage in, garbage out!**
- High-penetration probe data can be used by agencies to ensure better coverage, accuracy, and redundancy.
- Integrated data can ensure the highest quality of data for mission-critical applications, including real-time operations.
- Use Probe-Based and Integrated Signal Performance Measures for project prioritization, before-and-after analysis, and decision support to accelerate engineering productivity.





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