Flow Labs

Seattle Department of Transportation

Proving the Value of Smarter Signals

Using multi-modal signal performance measures to validate federally funded projects, improve daily operations, and unlock new funding opportunities

Executive Summary

The Seattle Department of Transportation (SDOT) partnered with Flow Labs to modernize signal operations in the University District — one of the city's most complex mobility hubs. Using Flow Labs' Luminus Plus Integrated Signal Performance Measures (ISPM) platform, SDOT was able to:

- Continuously monitor performance across 40 intersections, including high-priority areas near Husky Stadium.
- Validate federally funded signal improvements with defensible before–after analytics.
- Detect and resolve inefficiencies like split failures before they reach the public.
- Measure multimodal outcomes, including pedestrian delay and ped time allocation.
- Unlock new funding opportunities with data-backed evidence of success.

Background & Challenge

Seattle's University District is a hub of constant motion. Anchored by the University of Washington, the district blends academic life, residential neighborhoods, small businesses, and one of the region's largest venues — Husky Stadium, seating more than 70,000. The area also contends with heavy transit use, two light rail stations, a movable bridge, and converging interstate corridors.

This made the district one of the city's most challenging environments to manage — and until recently, one of the most outdated. While the University District's historic charm is a point of pride, its aging traffic infrastructure has become a liability. Key challenges include:

- **Aging ITS Equipment:** Inflexible, outdated controllers limited adaptability.
- **Network Complexity:** Interstate corridors, a movable bridge, and stadium events made traffic unpredictable.
- **Limited Visibility:** Engineers often had to rely on gut instinct or public complaints to identify issues, with no defensible data to guide decisions.

> "It's a complex area to manage, and it had some of our oldest ITS equipment which was highly inflexible."
>
> — **Jason Cambridge**, Technology & Innovation Team Lead, Seattle Department of Transportation

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To effectively modernize the University District's signal operations, SDOT required a solution that could deliver:

- **Real-time visibility** into system performance without costly hardware upgrades.
- **Defensible before-and-after evaluations** to validate federally funded projects.
- A **proactive monitoring framework** that would flag problems before they reached the public.
- **Multimodal insights** to balance the needs of pedestrians, cyclists, transit, and vehicles during daily activity and major events.

The Solution: Integrated Signal Performance with Flow Labs

Traditional systems depend solely on either controller or probe-based data, providing only a fraction of the data needed to generate the comprehensive analytics required by SDOT. After reviewing options, SDOT selected Flow Labs' Luminus Plus — the only platform that integrates probe-based data and controller data into one unified set of performance measures.

With this, SDOT could:

- Monitor **40 intersections** continuously across the district.
- Generate **before-and-after evaluations in seconds** to validate project outcomes.
- Receive **automated alerts** when problems arose, from split failures to detection faults.
- Gain **multimodal insights**, balancing needs of pedestrians, cyclists, transit, and vehicles.
- Deploy in weeks — with **no new hardware required**.

"We went with Flow Labs because they were the only system we knew of that integrated probe-based and controller-based data in one platform."

— **Jeffrey Conor**, Data Analytics Supervisor, Seattle Department of Transportation

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Luminus Plus

Integrated Signal Performance Measures (ISPMs)

- **High-Penetration Probe Data:** Leverages anonymized movement data from 16–32% of vehicles.
- **Real-Time Insights:** Monitors multiple measures including queue lengths, travel time reliability, and arrivals on green to assess system health instantly.
- **Proactive Monitoring:** Automated alerts and health scores flag issues like excessive delay or poor progression.
- **Diagnostics:** Identifies timing faults, detection errors, and unusual volume changes for rapid troubleshooting.
- **Before–After Reporting:** Produces defensible impact evaluations in seconds.
- **Zero Hardware:** No new equipment or infrastructure required.

Deployment: Quick, Seamless, and Supported

In a simple process that lasted just a matter of weeks, Flow Labs deployed Luminus Plus to monitor 40 intersections across the University District and around Husky Stadium. The process was far faster than traditional hardware-heavy upgrades and once live, provided Seattle DOT unprecedented visibility into how signals were performing in real time. At the same time, SDOT was replacing outdated signal controllers and piloting a new adaptive system. Flow Labs coordinated closely to ensure uninterrupted visibility, integrating seamlessly across multiple controller and firmware types. This gave SDOT a single platform to monitor both conventional and adaptive intersections side by side.

Results: Data-Driven Visibility with Flow Labs

Luminus Plus gave SDOT what it lacked: a complete, defensible, multimodal set of performance measures. The platform generated corridor travel times, reliability indices, vehicle delay, arrivals on green, split failures, stops, speed violation rates, pedestrian delay, and intersection health scores — all in a single system.

These measures delivered value on multiple fronts:

- **Validating Outcomes:** SDOT was required to demonstrate the impact of its federally funded adaptive and multimodal improvements. Flow Labs made this possible by generating continuous before–after data that became the backbone of the official evaluation — without costly manual studies. With Luminus Plus, SDOT could tell a compelling story of project success. Instead of relying on anecdotes or snapshots, the agency had rigorous evidence that its investments were delivering real improvements for drivers, transit riders, pedestrians, and cyclists alike.

  With the Flow Platform, SDOT was able to generate the core performance measures needed to evaluate the project. The system **quantified reductions in corridor travel times of 6% northbound (9.2 seconds) and 11% southbound (19.8 seconds)**, an **11% reduction in vehicle control delay**, improvements in travel time reliability with a **15–20% improvement in the Planning Time Index**, and improvements in multimodal measures such as pedestrian delay and green time allocation.

  These metrics formed the basis for calculating broader impacts, including a benefit-to-cost ratio of 30:1 over five years and 40:1 over ten years. In total, the analysis showed $12–24 million in net benefits, with costs recouped within just 1–2 months.

  By generating the defensible data behind these outcomes, Flow Labs provided SDOT with the evidence it needed to demonstrate project success and secure future funding.
- **Proactive Operations:** Beyond the evaluation, the same measures powered daily operations. Automated alerts, health scores, and diagnostics allowed engineers to detect split failures, poor progression, or detection faults before they reached the public.

- **Multimodal Performance Measures** Flow Labs captured both vehicle and pedestrian metrics in one platform, including pedestrian delay and green time allocation. This gave SDOT visibility into how projects affected all travelers — not just drivers — and ensured that improvements balanced multimodal needs.
- **Streamlined Data Collection** Continuous digital feeds replaced field visits, floating car runs, and tube counters. Flow Labs turned what was once days of staff effort into data that could be accessed instantly, freeing engineers to focus on solutions instead of data gathering.

Conclusion

Seattle DOT's partnership with Flow Labs shows what's possible when advanced analytics are paired with targeted infrastructure investments. In one of the city's most complex corridors, Flow Labs enabled SDOT to validate federally funded improvements, operate proactively, and streamline multimodal data collection.

By generating the performance measures that underpinned SDOT's evaluation, Flow Labs provided the performance measures the agency needed to demonstrate project success and secure future funding opportunities.

> "Flow Labs allows us to be more analytical and more descriptive of the issues we're dealing with. We can get away from gut feelings and talk more about numbers."
>
> — **Jeffrey Conor**, Data Analytics Supervisor, Seattle Department of Transportation

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