

FDOT D5: Redefining Real-Time Traffic Management

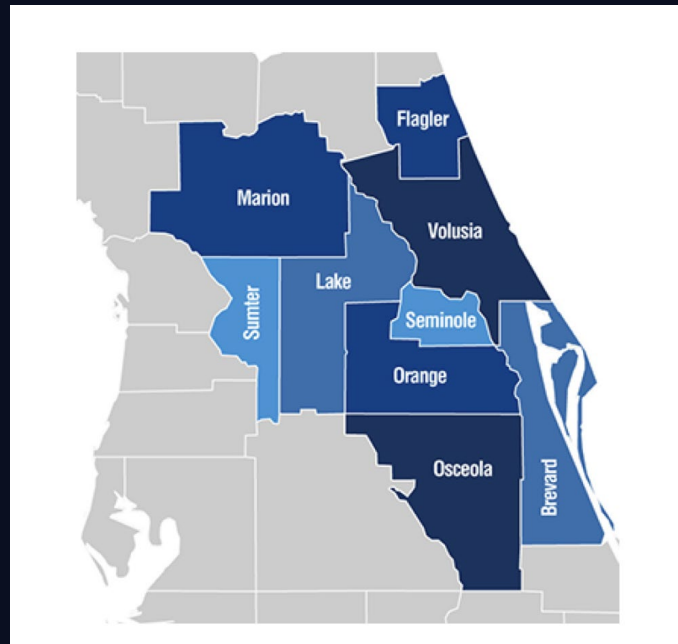
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The Challenge

Lack of reliable, high-accuracy, low-latency, scalable traffic data for signal operations and corridor management.

- Field detector inaccuracy
- Field detector operational reliability
- Lack of connectivity/hardware



FDOT D5 High-Definition Engineering Intersection Data via Integrative Modeling (HEIDI)



- Generate accurate real-time data at region scale, with and without detection.
 - **Without Detection:** Achieve <20% error
 - **With Detection:** Achieve <10% error
 - **Real-Time:** <15 minute latency
- Feed data into real-time control systems via APIs

Our Approach:

Fusing connected-vehicle and hardware data to provide higher quality, more reliable data



Zero New Hardware

Our solutions require no additional hardware to install nor maintain.



Affordable

Our software-only allows us to offer a simple, low-cost offering.

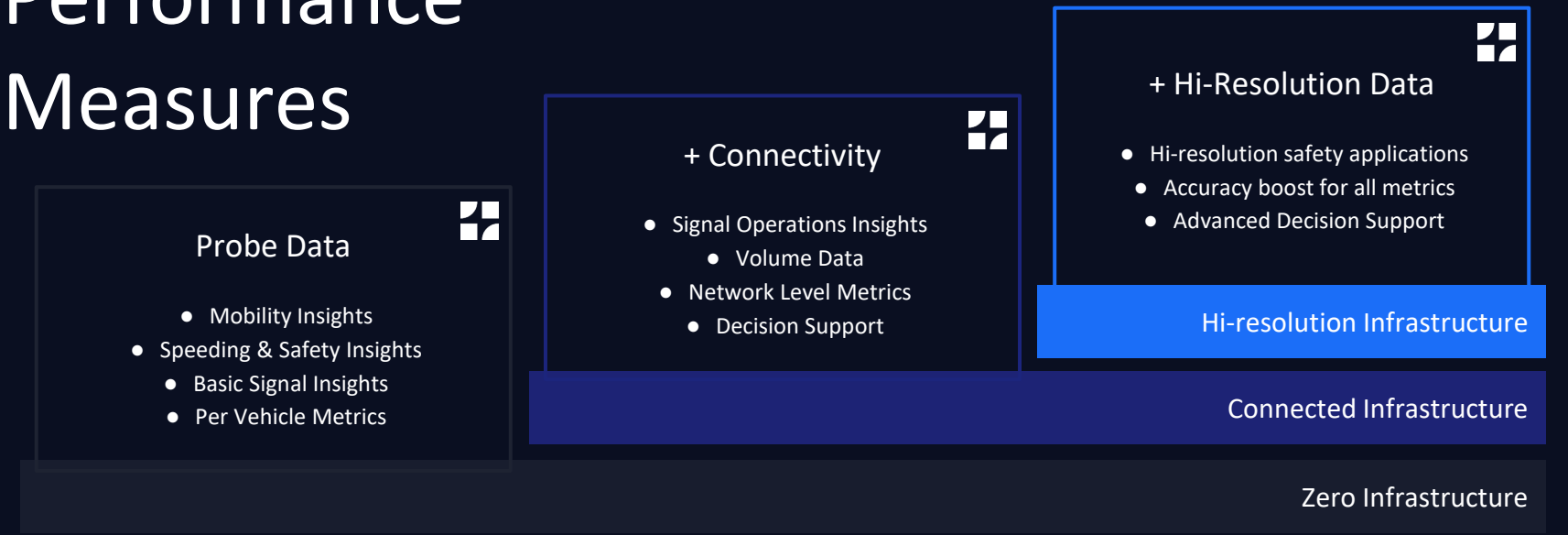


Future-proofed Connected vehicle enabled technology lets you build for the future.



High-performance Artificial Intelligence allows you to measure and optimize roadway performance.

Integrated Signal Performance Measures



0%

100%

Infrastructure

Phase 1

Small-scale ISPMs

- Evaluation & Proof of Concept
- 18 intersections in two corridors, 1 urban and 1 rural
- Connected to FDOT data infrastructure to pull in hi-resolution data

Network Operations • **Mobility** Environmental

EB Travel Time ⓘ

348.4 s

EB Total Control Delay ⓘ

183.1 s

WB Travel Time ⓘ

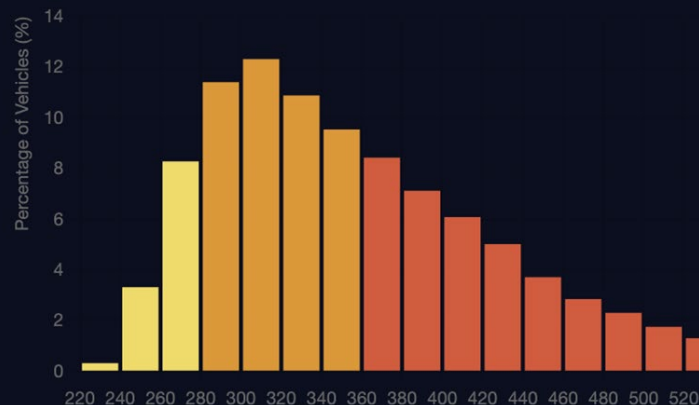
331.8 s

WB Total Control Delay ⓘ

163.1 s

Diagnostic ▾

Mainline Travel Time



Phase 2

Real-time API

- Using data fusion to provide lane-level volume estimates
- Latency ranging from 1-minute to 1-hour, with increasing levels of accuracy
- Feeding data straight back into FDOT D5 ITS data integration system

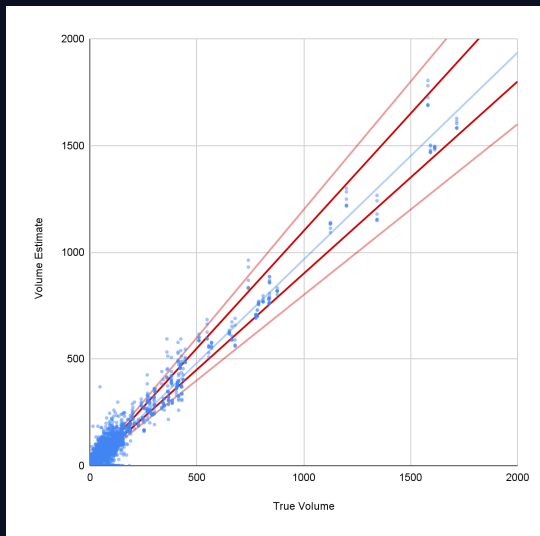
```

1  [
2  {
3    "lane_id": "D5I-5004-N1-3",
4    "turning_movement": "through",
5    "start_time": "2025-02-18T18:00:00.000Z",
6    "bucket_length_seconds": 900,
7    "volume_estimate": 144.54878,
8    "volume_estimate_uncertainty": 3.967644
9  },
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12   "turning_movement": "right",
13   "start_time": "2025-02-18T18:00:00.000Z",
14   "bucket_length_seconds": 900,
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16   "volume_estimate_uncertainty": 11.074003
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20   "turning_movement": "through",
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22   "bucket_length_seconds": 900,
23   "volume_estimate": 144.54878,
24   "volume_estimate_uncertainty": 3.967644
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49 },
50 ]

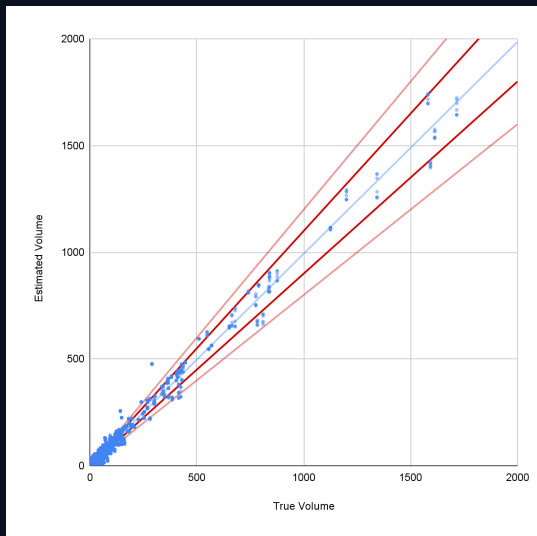
```

RESULTS

HEIDI was able to achieve high accuracy with and without detection



Probe Only Correlation Analysis
 $0.970 \cdot x + -3.59$ $R^2 = 0.960$



Integrated Correlation Analysis
 $0.993 \cdot x + 0.699$ $R^2 = 0.985$

- Extremely high correlations between estimated and actual volumes
- Substantially outperformed FHWA accuracy benchmarks

RESULTS

HEIDI was able to achieve high accuracy at a variety of data buckets and latencies

		Time Interval (minutes)					
		1	3	5	15	30	60
Latency (minutes)	1	100.00%	107.27%	89.49%	24.68%	10.59%	7.28%
	3	103.22%	96.23%	62.61%	24.33%	9.79%	7.63%
	5	94.84%	73.28%	46.12%	19.25%	9.86%	7.87%
	10	89.17%	44.64%	26.87%	15.11%	8.93%	7.50%
	15	32.74%	21.72%	18.15%	13.33%	8.58%	7.46%
	30	32.18%	21.33%	18.25%	13.25%	8.36%	7.29%
	60	32.22%	21.34%	18.31%	13.29%	8.37%	7.29%

- Probe Data achieved high accuracy levels at target latency levels.
- Integrated approaches yielded the highest accuracy

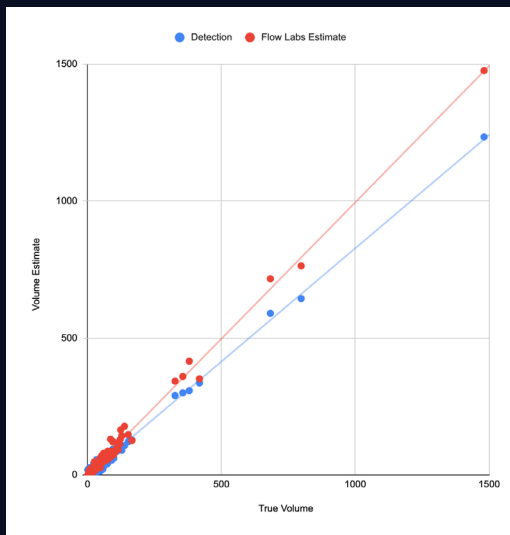
Probe Only - MAPE

		Time Interval (minutes)					
		1	3	5	15	30	60
Latency (minutes)	1	35.09%	16.61%	13.82%	9.84%	7.71%	5.80%
	3	35.09%	16.61%	13.81%	9.57%	7.52%	5.95%
	5	35.09%	16.59%	13.62%	9.35%	7.08%	5.87%
	10	35.04%	16.48%	13.48%	8.53%	5.88%	6.14%
	15	34.07%	15.61%	11.93%	7.83%	6.07%	6.36%
	30	34.08%	15.54%	11.94%	7.90%	5.96%	6.27%
	60	34.08%	15.54%	11.95%	7.90%	5.97%	6.28%

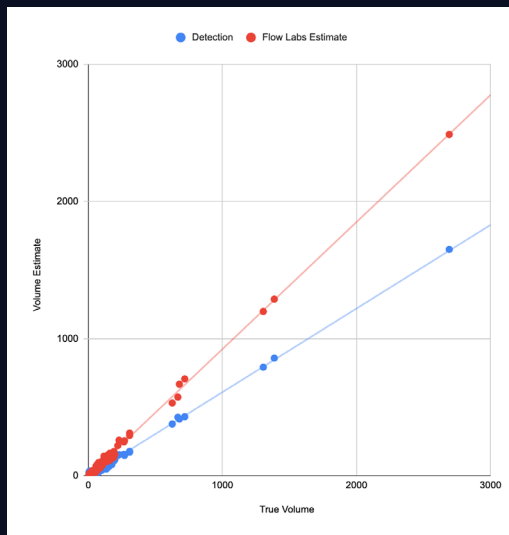
Integrated - MAPE

RESULTS

HEIDI was able to turn bad detection data into good detection data



Probe Only Correlation Analysis
 $R^2 = 0.992$



Integrated Correlation Analysis
 $R^2 = 0.997$

- Detection error was reduced by up to ~90%
- HEIDI provides a scalable approach to correct detector drift and error

Additional Use Cases

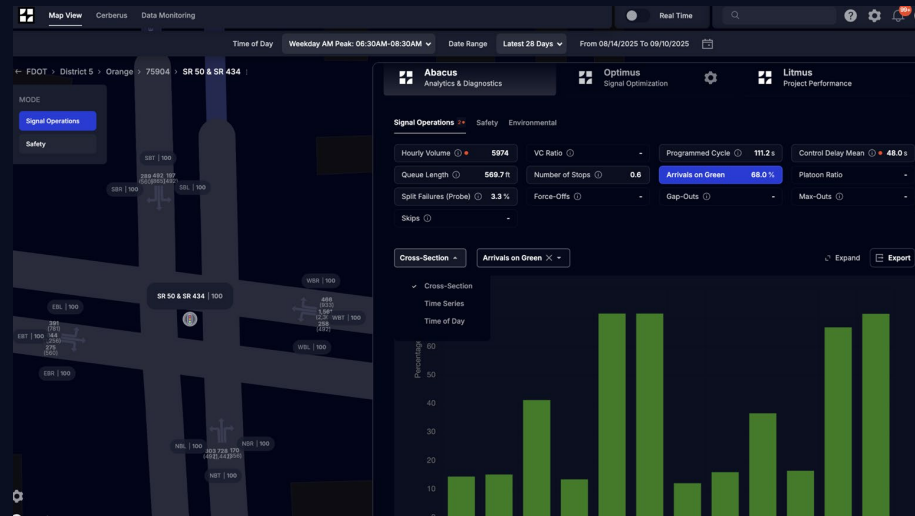
- Real-time SPM information available at scale
- Active detector health monitoring using correlation between detector and probe data

MOVEMENT	DETECTOR TYPE	STATUS ?	CORRELATION INDEX ?
SWBTR	Advanced Count	ACTIVE	23.6%
SWBTR	Advanced Count	ACTIVE	23.6%
SWBTR	Advanced Count	ACTIVE	23.6%
NEBTR	Advanced Count	ACTIVE	24.1%
NEBTR	Advanced Count	ACTIVE	24.1%
NEBTR	Advanced Count	ACTIVE	24.1%
SWBTR	Advanced Count	ACTIVE	25.3%
SWBTR	Advanced Count	ACTIVE	25.3%
SWBTR	Advanced Count	ACTIVE	25.3%
NBTR	Advanced Count	ACTIVE	25.9%

Phase 3

Scale

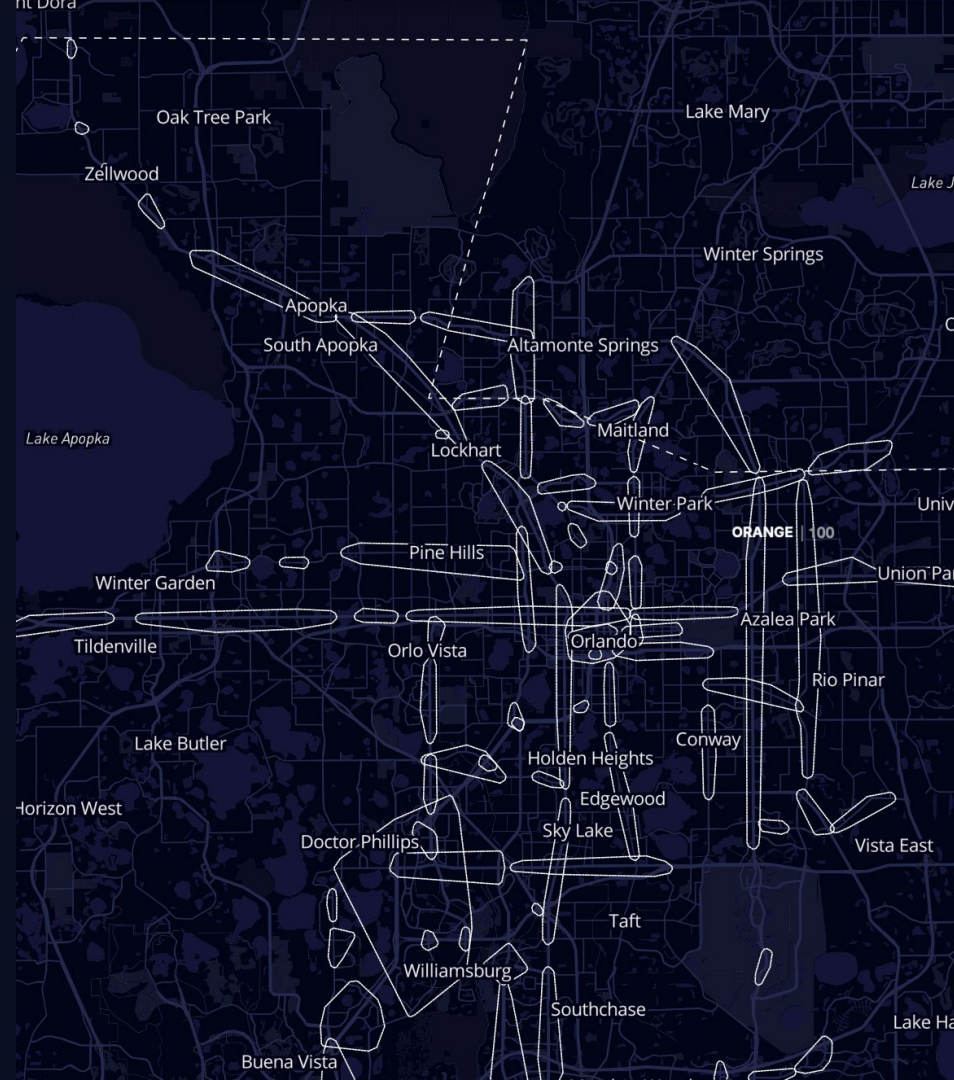
- Now deployed to 1,998 signals across District 5
- ~1,400 of these currently enabled to provide integrated data
- Version2 of real-time API to enable additional data volume



Looking Forward

+Lessons Learned

- Parsing signal configuration information
- Volume calibration efforts
- Collaboration with surrounding MPOs and local agencies



Connected vehicles and new data infrastructure can enable scalable, real-time insights and a new way of managing traffic. Get in touch:

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HEIDI Case Study