



The Orlando Digital Twin

Feb 28th, 2025

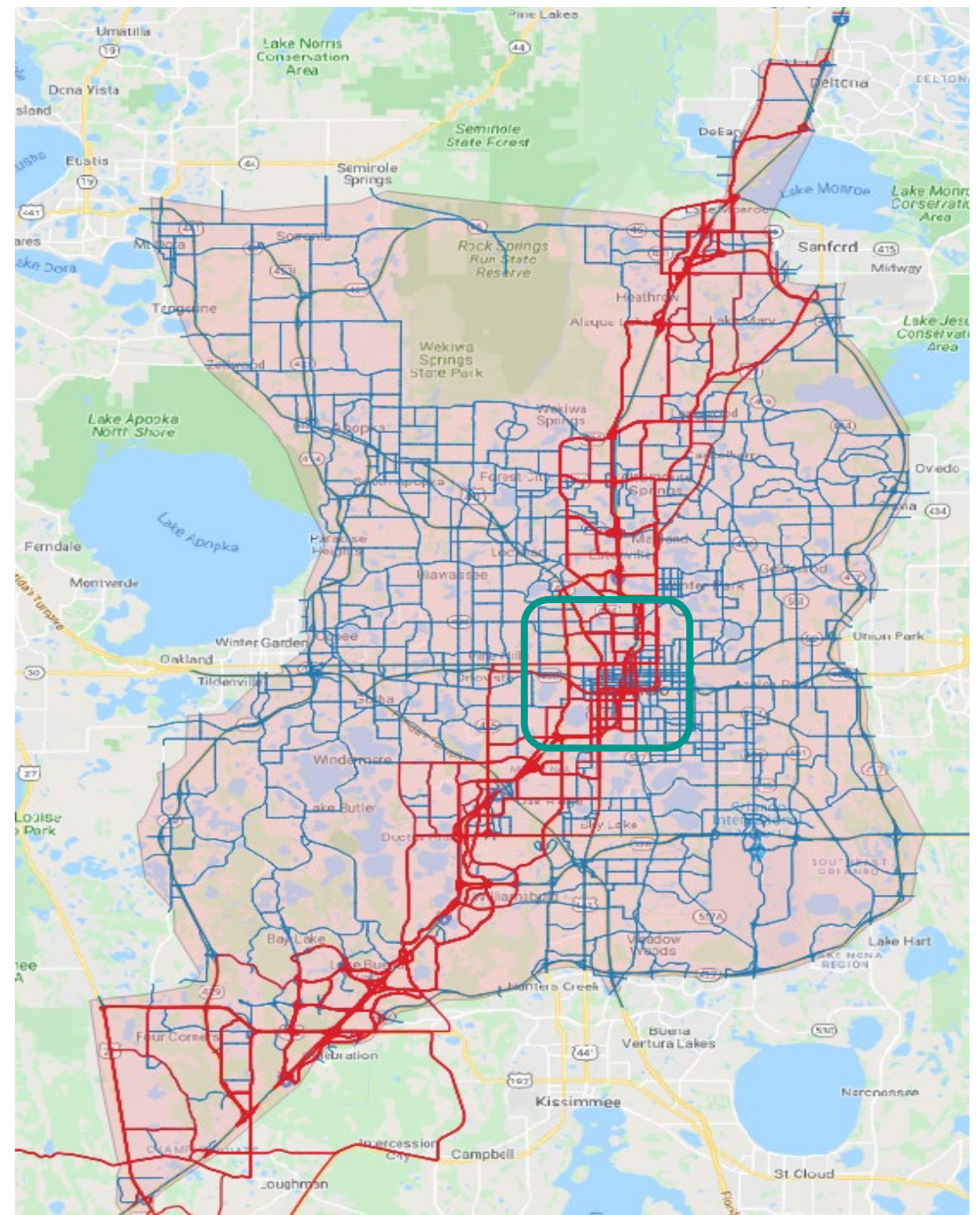
Orlando Digital Twin

Mesoscopic Simulation Modeling Engine
Transportation Network
ITS Infrastructure
Realtime Data Interfaces
Web Based User Interface



Model Boundaries

- Centered on the north-south axis along I-4 from MM 55 to MM 111.
- East ends of the model are on SR 408 at MM 20 and SR 528 at MM 16.
- SR 417 bounds the model to the east.
- West end of the model is on Florida's Turnpike at MM 267.
- SR 429 bounds the model to the west.
- Built from CFRPM Region Model



Signalized Intersections

- 1541 signalized intersections
- 606 Timing From Signal System
- 163 Synthetic Timing
- 772 Hybrid

Future Update

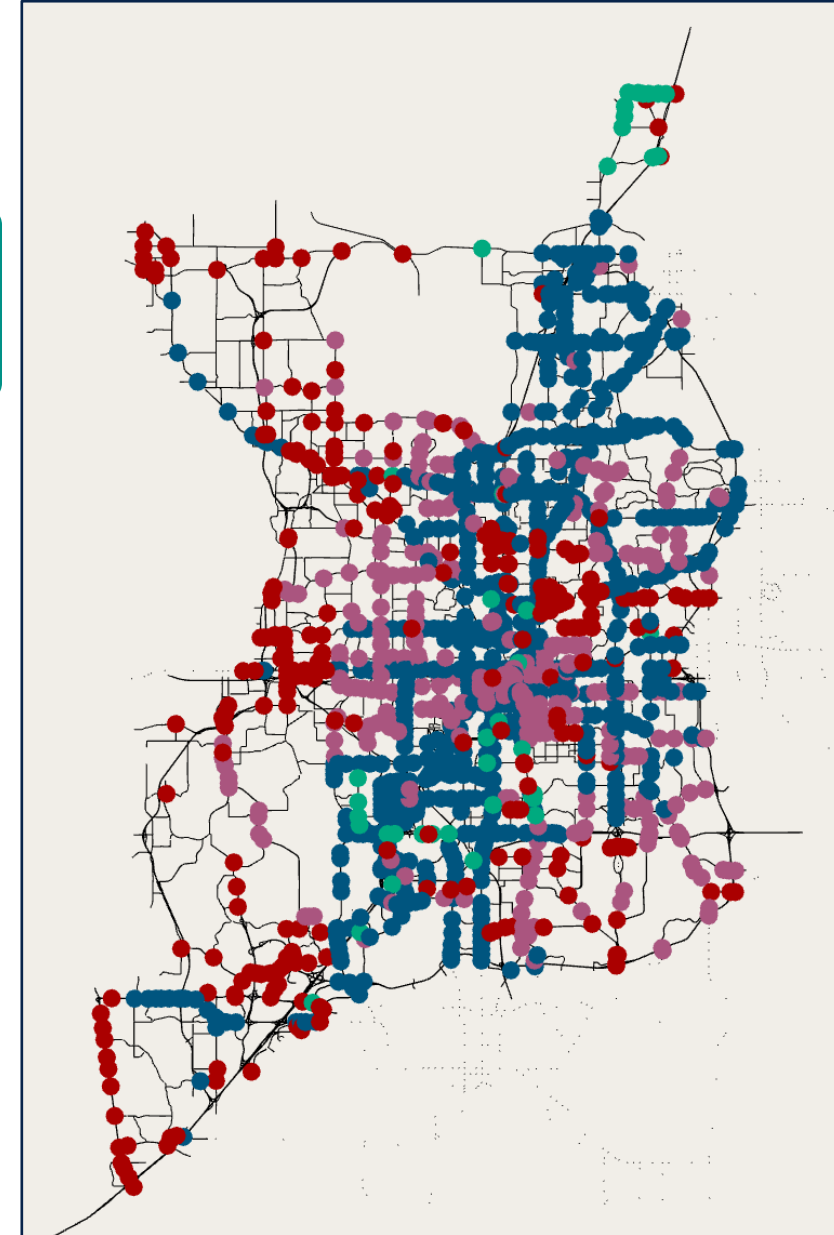
New NTCIP Data Interface to fix current issues to be integrated with the Digital Twin

AUTOMATIC UPDATE:
Aimsun Live retrieves
TMDD data everyday.

ON-DEMAND:
Operator sends
request for evaluation.

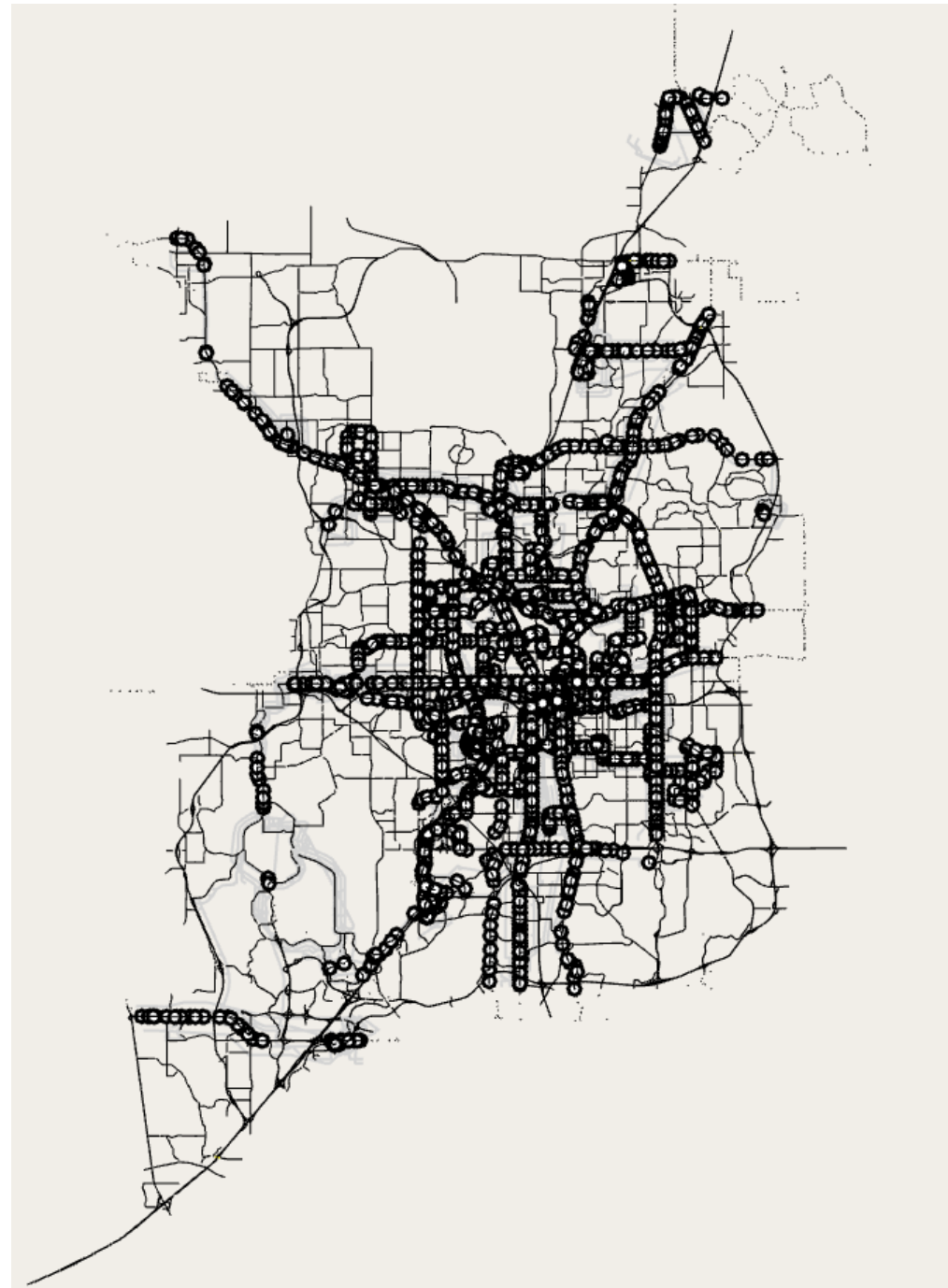
Available signal data
collected and mapped.

Latest signal data
imported to the
model.



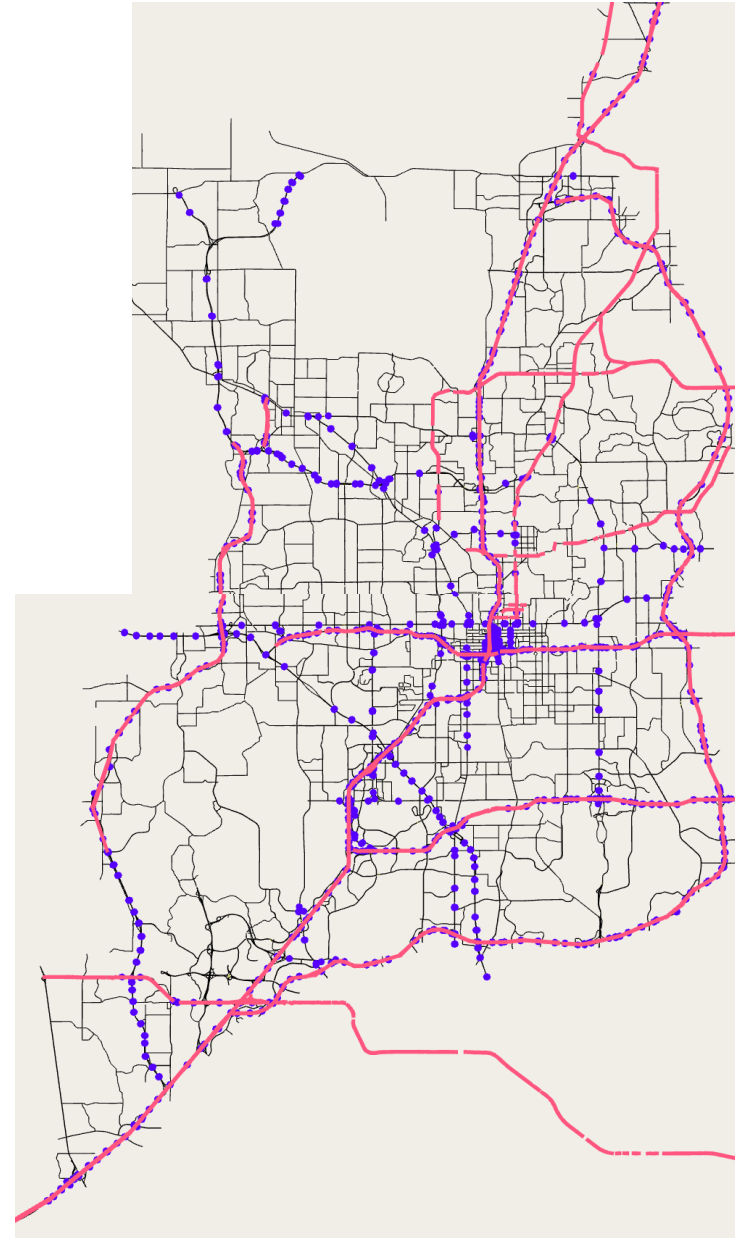
GTFS Transit Import

- 226 Transit Lines
- 4198 stops
- Importation of:
 - Routes
 - Stops
 - Schedules



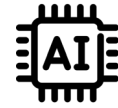
Input data

- Detectors Sources
 - RITIS (Blue)
 - ITSIIQA (Pink)
- Historical Data
 - 205 Locations with complete data for Speed, Occupancy and Volumes



Data Analytics applications

- Data comes from *multiple sources*
- Data provides *multiple pieces of information*



DATA DRIVEN MODELS



Offline applications

- Data homogenization and cleaning
- Pattern generation
- Traffic trends

Live applications

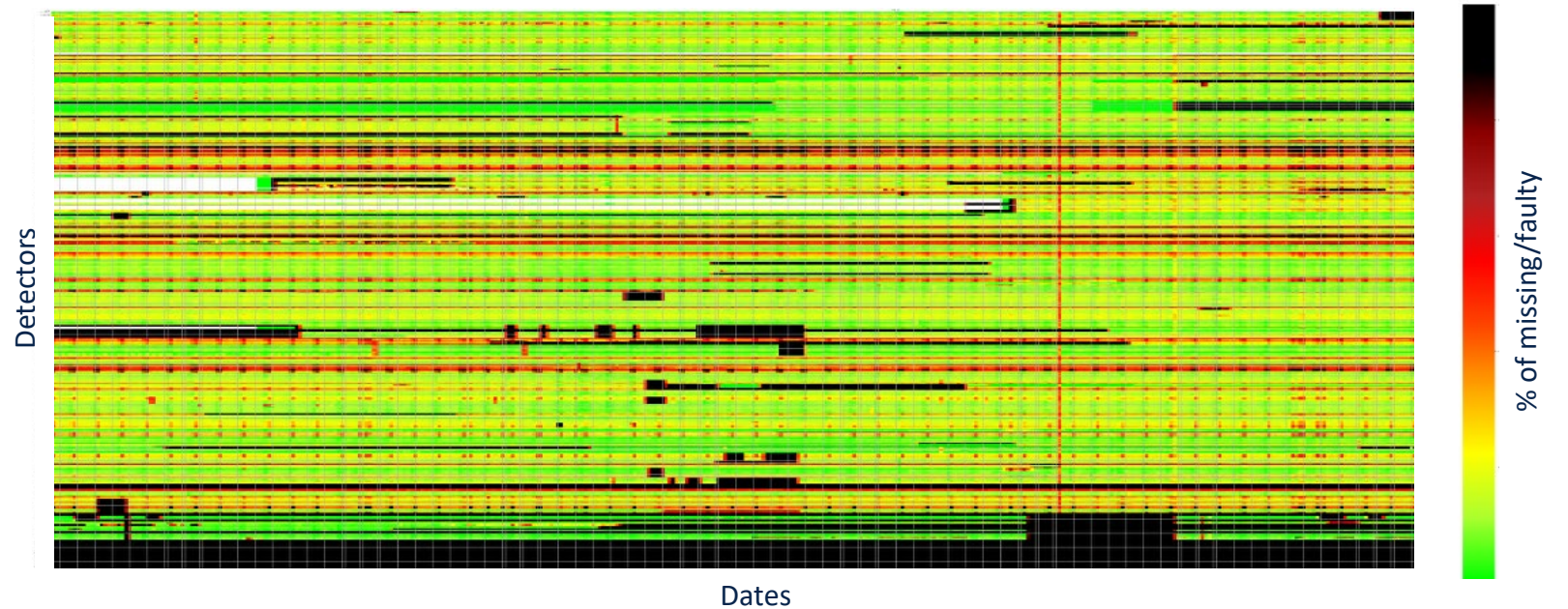
- Network state monitoring and prediction
- Incident detection and performance alarms (IDM)
- Accident risk prediction
- Parking availability monitoring and prediction
- Bus travel time prediction
- Air quality prediction

Clustering

- Data homogenization and cleaning



Analyse the number of records with "NaN" (not a number), "zero", "outlier", and "negative" values in the form of heatmaps and statistical reports

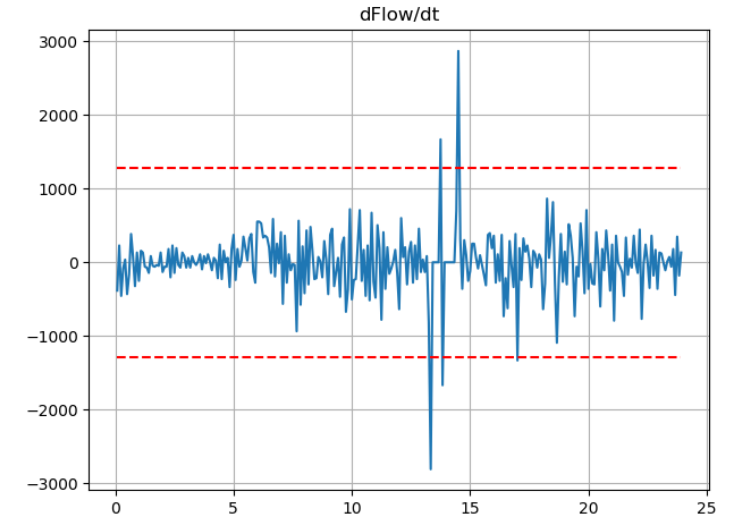
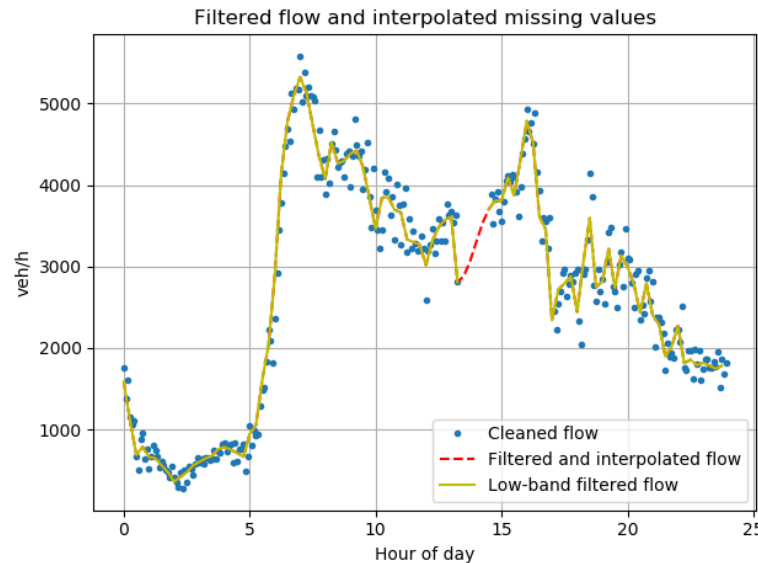


Offline applications

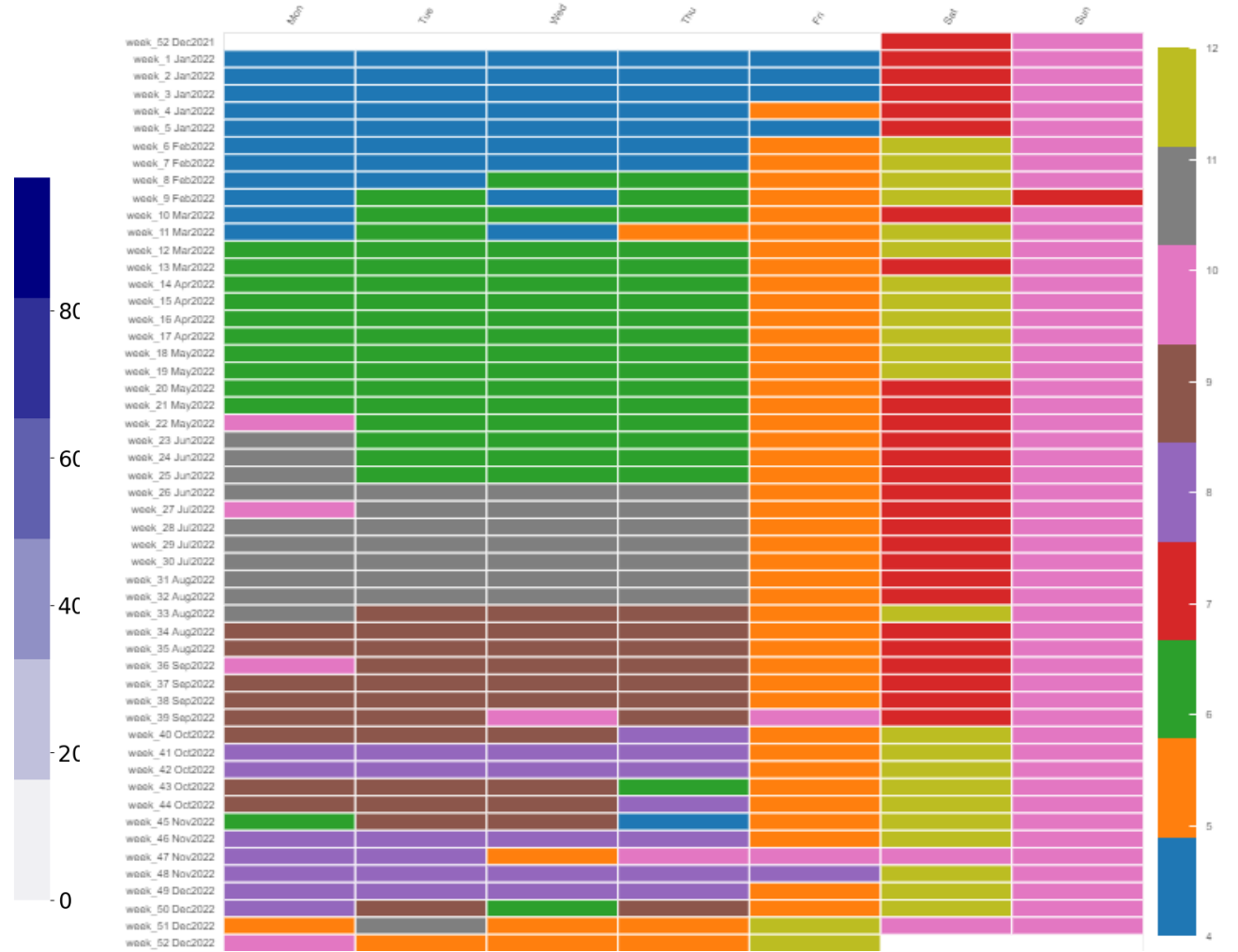
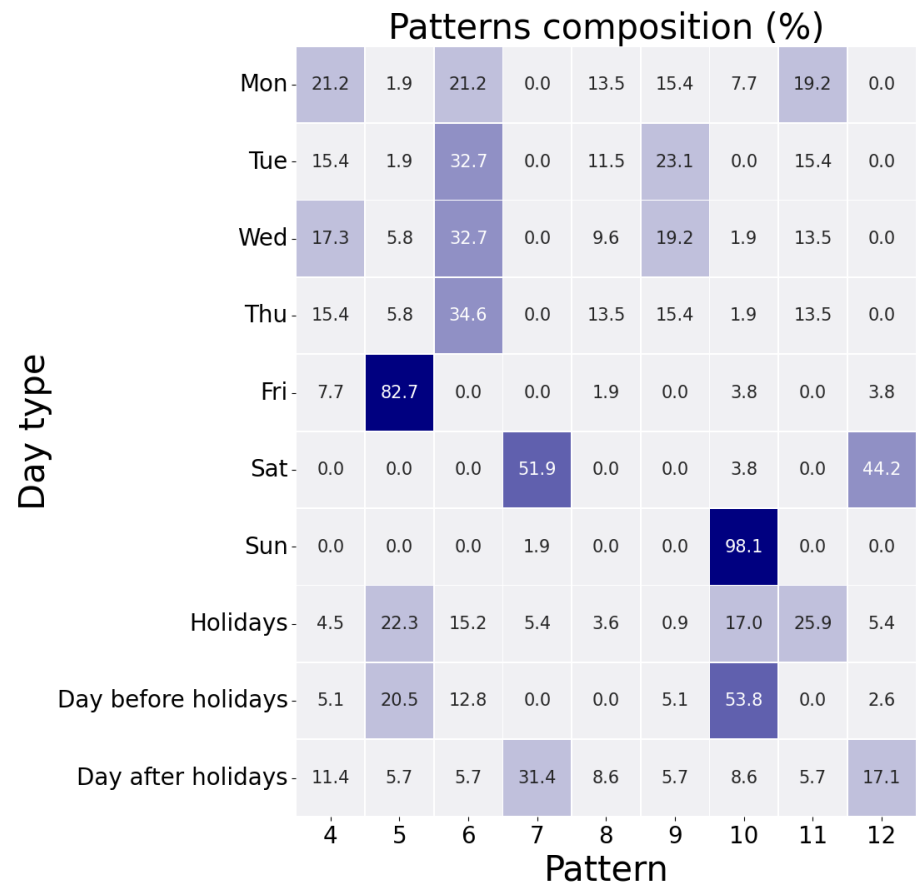
- Data homogenization and cleaning



Filter outliers and incoherent (not realistic) measurements
Impute missing data and estimate the reliability of the imputed data
Aggregate/interpolate data into the desired sampling period
Permit data-preprocess without information of the network
Aggregate data in stations



Cluster Analysis - Patterns & Calendar



Demand Calibration

- Period Based

R2	4	5	6	7	8	9	10	11	12
0000-0600	0.98	0.98	0.99	0.98	0.98	0.98	0.98	0.98	0.98
0600-1000	0.96	0.96	0.94	0.95	0.94	0.92	0.96	0.94	0.95
1000-1500	0.96	0.91	0.92	0.94	0.89	0.93	0.93	0.93	0.92
1500-1900	0.87	0.84	0.89	0.88	0.88	0.89	0.84	0.86	0.92
1900-2400	0.98	0.96	0.97	0.97	0.95	0.96	0.97	0.97	0.95

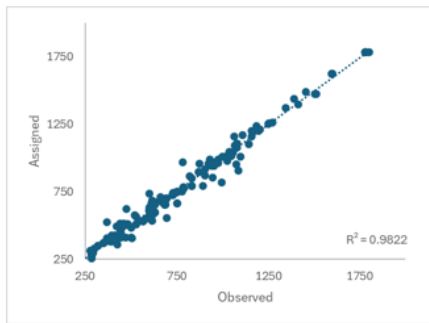


Figure 23. Overnight result regression plot.

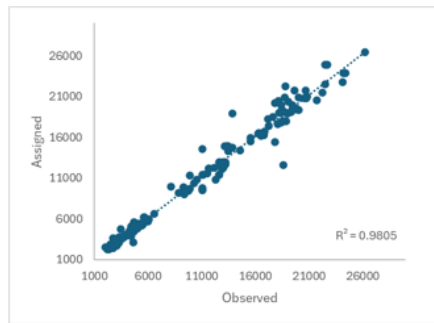


Figure 24. AM Peak result regression plot.

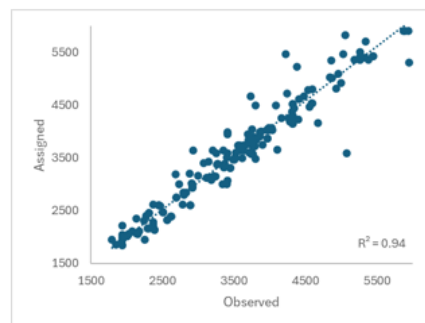


Figure 25. Interpeak regression plot.

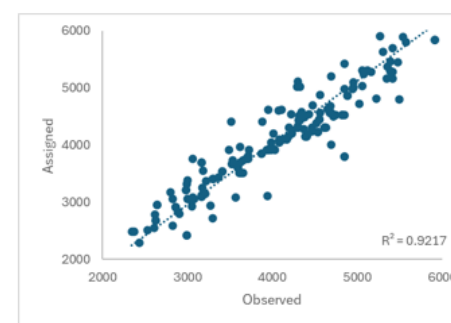


Figure 26. PM Peak result regression plot.

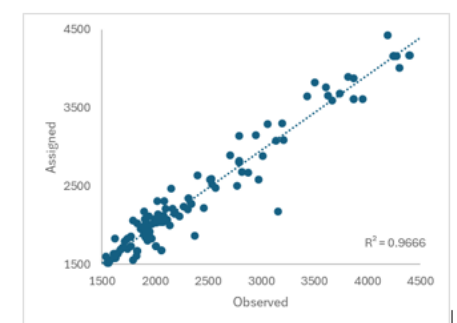


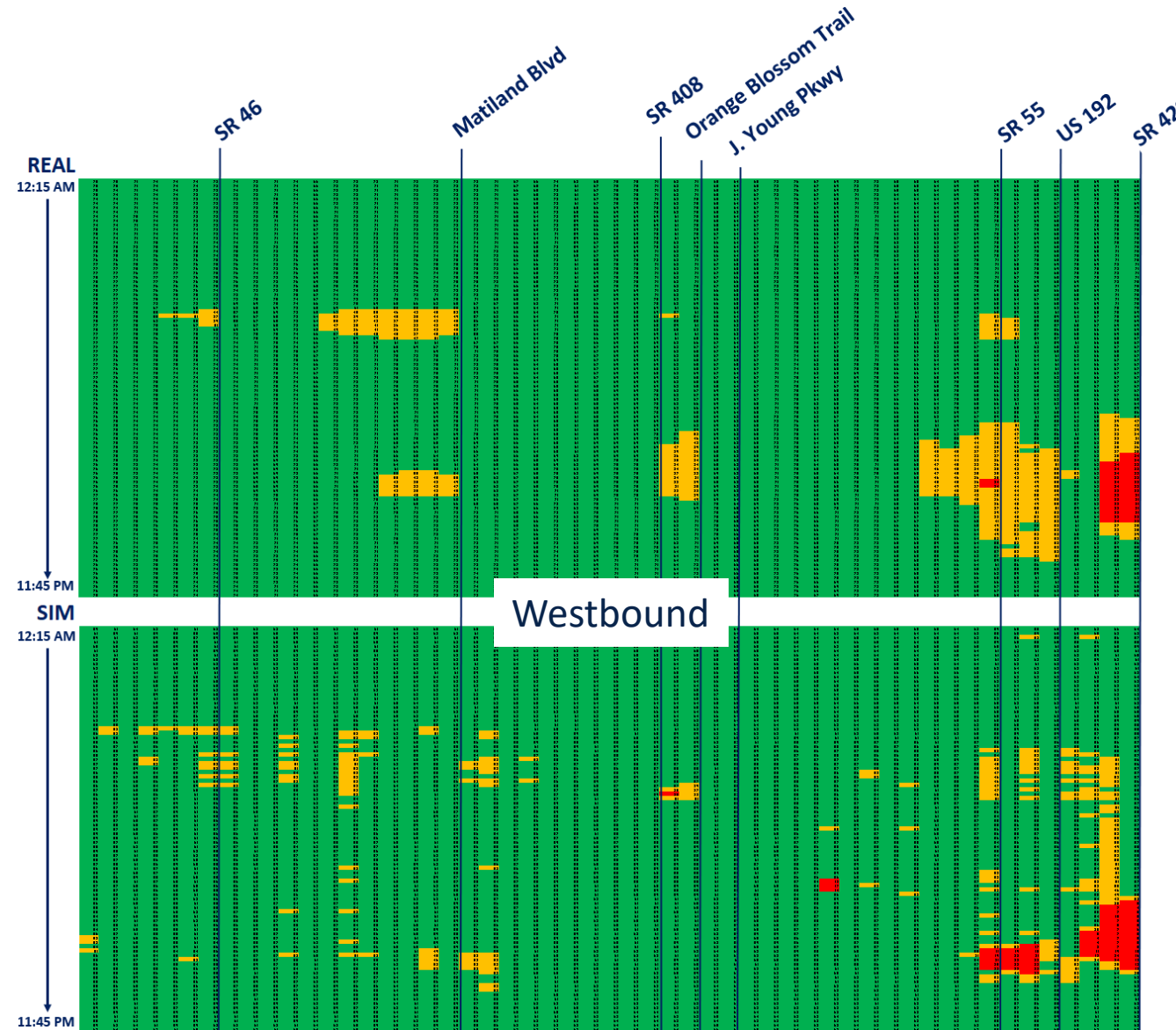
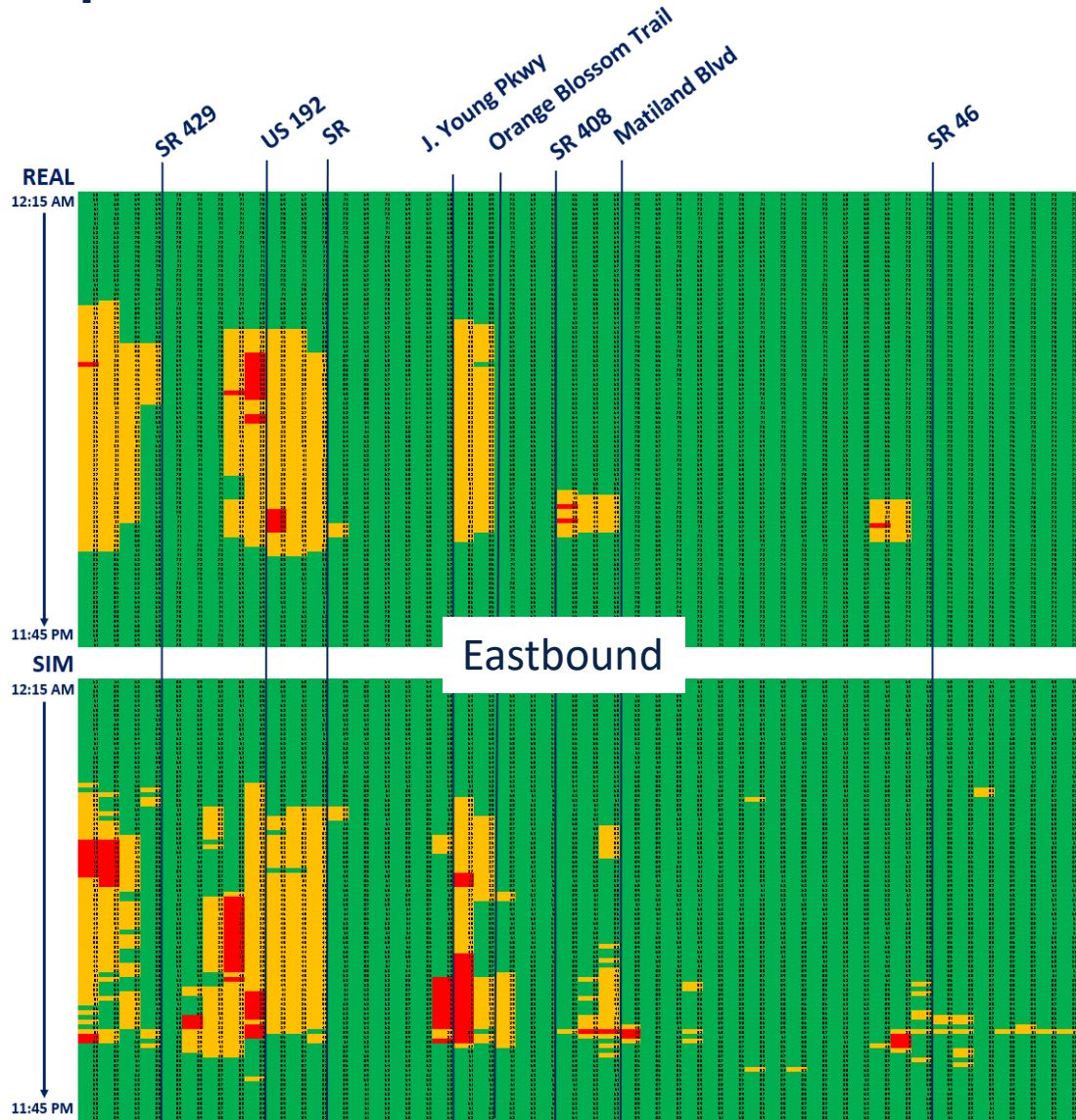
Figure 27. Evening ODME result regression plot.

Volume Calibration

- Mesoscopic Simulation
 - Not typical Micro Calibration

Hourly Meso GEH	Whole Network	
	GEH<7	GEH<10
0000-0100	89%	96%
0100-0200	93%	98%
0200-0300	92%	99%
0300-0400	98%	99%
0400-0500	93%	98%
0500-0600	89%	94%
0600-0700	82%	86%
0700-0800	89%	96%
0800-0900	83%	88%
0900-1000	80%	88%
1000-1100	77%	84%
1100-1200	86%	93%
1200-1300	81%	94%
1300-1400	82%	92%
1400-1500	83%	94%
1500-1600	80%	86%
1600-1700	81%	93%
1700-1800	75%	85%
1800-1900	82%	89%
1900-2000	73%	89%
2000-2100	82%	88%
2100-2200	87%	93%
2200-2300	85%	95%
2300-2400	82%	88%

Speed Contours I-4

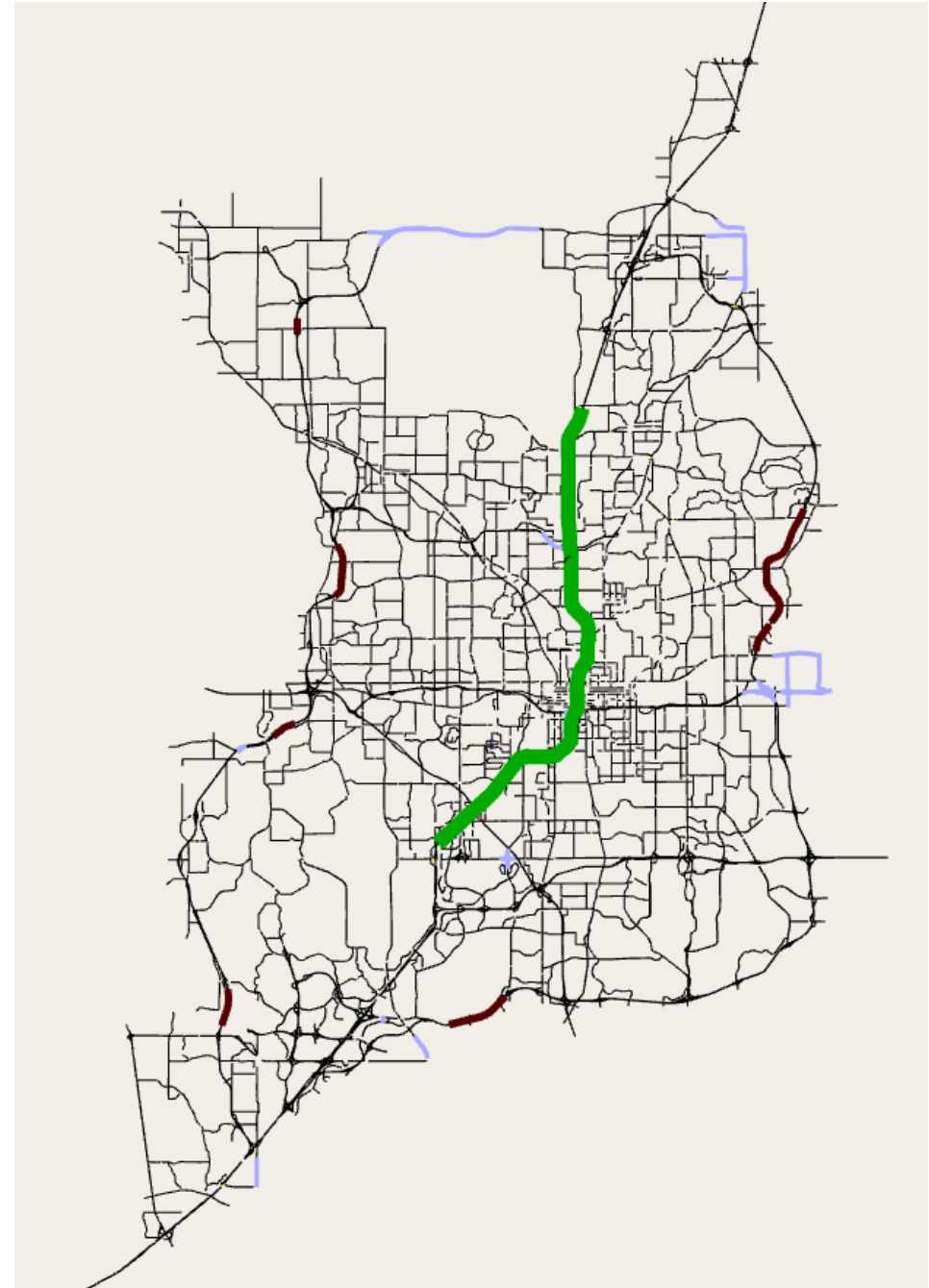


Twin Maintenance and Updates

- Geometry
 - Construction Projects
 - Major
 - Minor
 - Local
 - Signal Timing Plans
 - Transit
 - Demands/Traffic Conditions

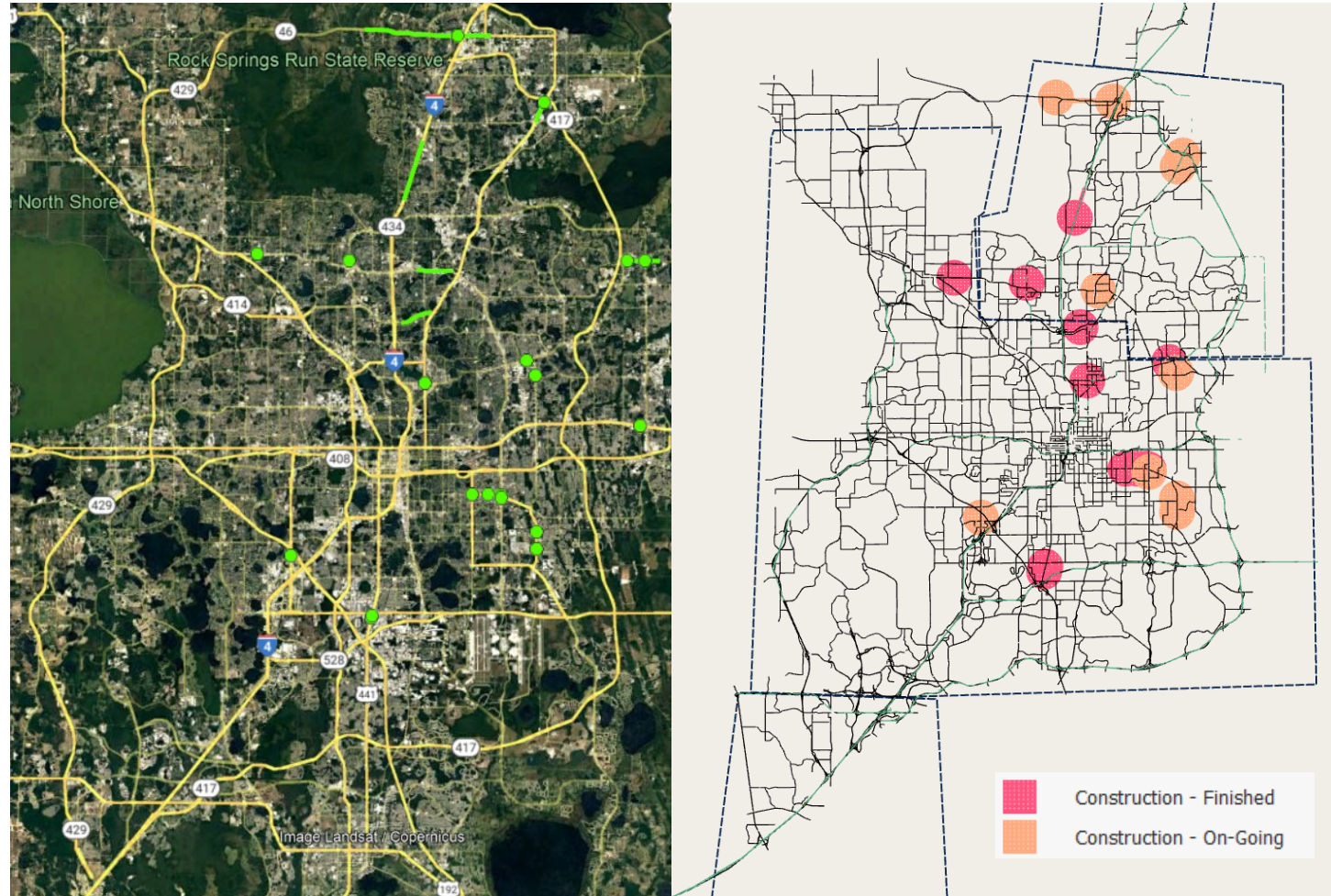
Geometric updates

- I-4 Express Lanes



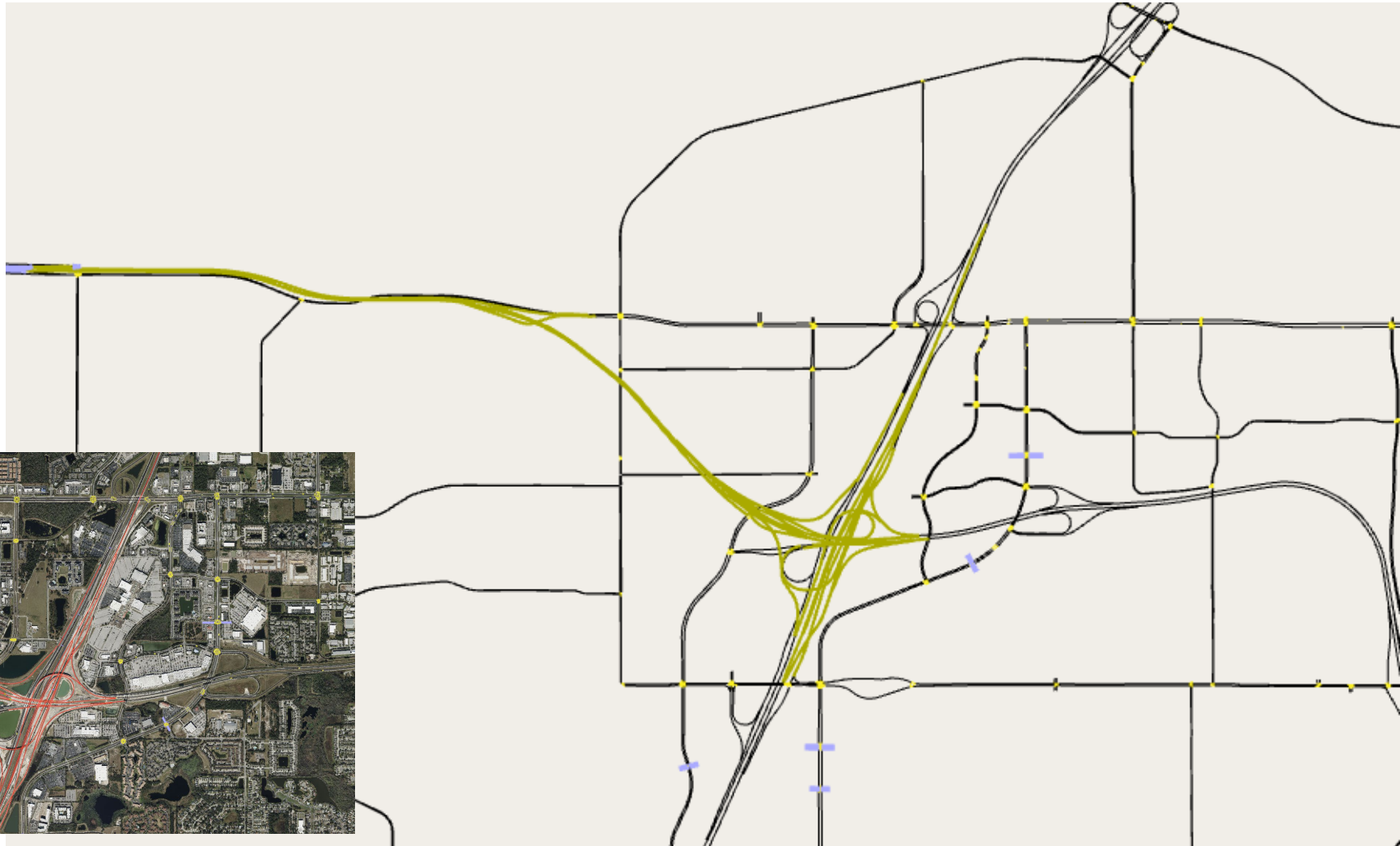
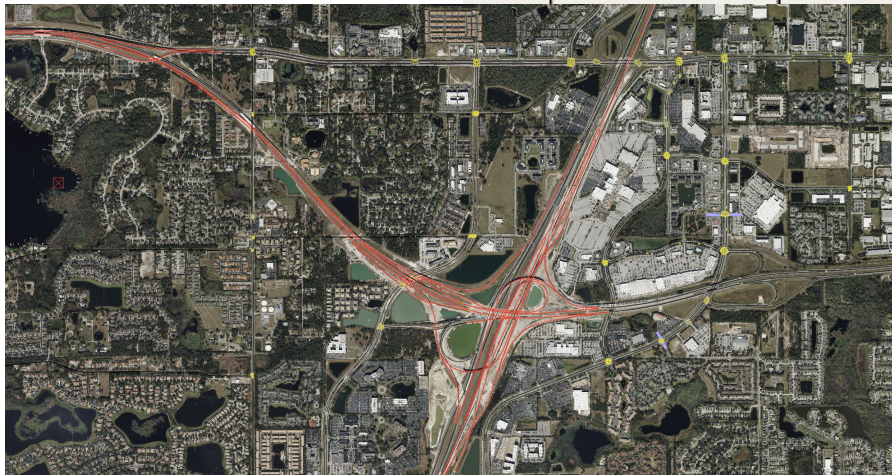
Geometric updates

- Local Construction Projects
- One-Network Data integration on-going to import permit data



Geometric updates

- Wekiva



User Interface



Benefits of Transportation Systems Management and Operation (TSMO)

The benefits to TSMO can include:

- Improved quality of life
- Smoother and more reliable traffic flow
- Improved safety
- Reduced congestion
- Less wasted fuel
- Cleaner air
- Increased economic vitality
- More efficient use of resources (facilities, funding)





Thank You

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