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CONFLATION PROCESS FROM TMC NETWORK TO FLORIDA DOT'S DISTRICT 5 TDM NETWORK

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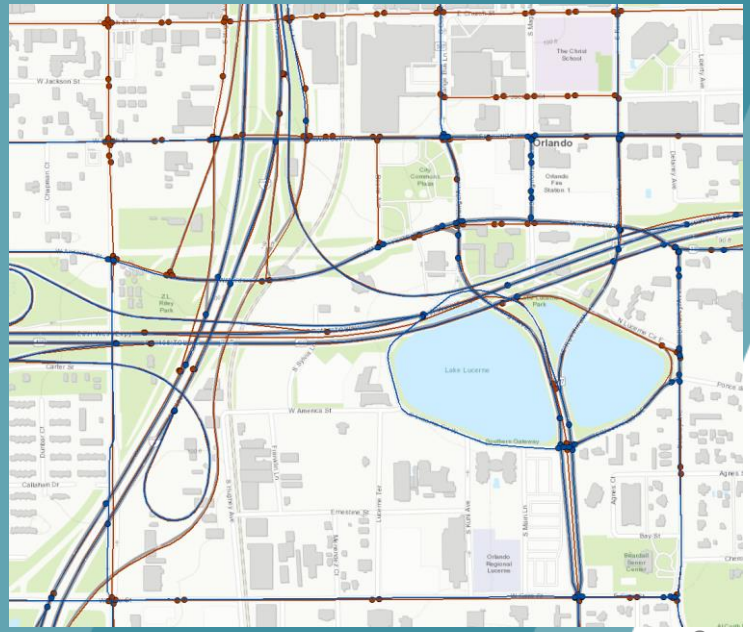
Study Objective

- “Conflation” is the process of attributes transfer from one GIS network to another GIS network.

- The study developed and transferred free flow speeds and four time periods’ probe speeds from HERE’s Traffic Message Channel (TMC) network to Florida DOT’s District 5 travel demand model network.

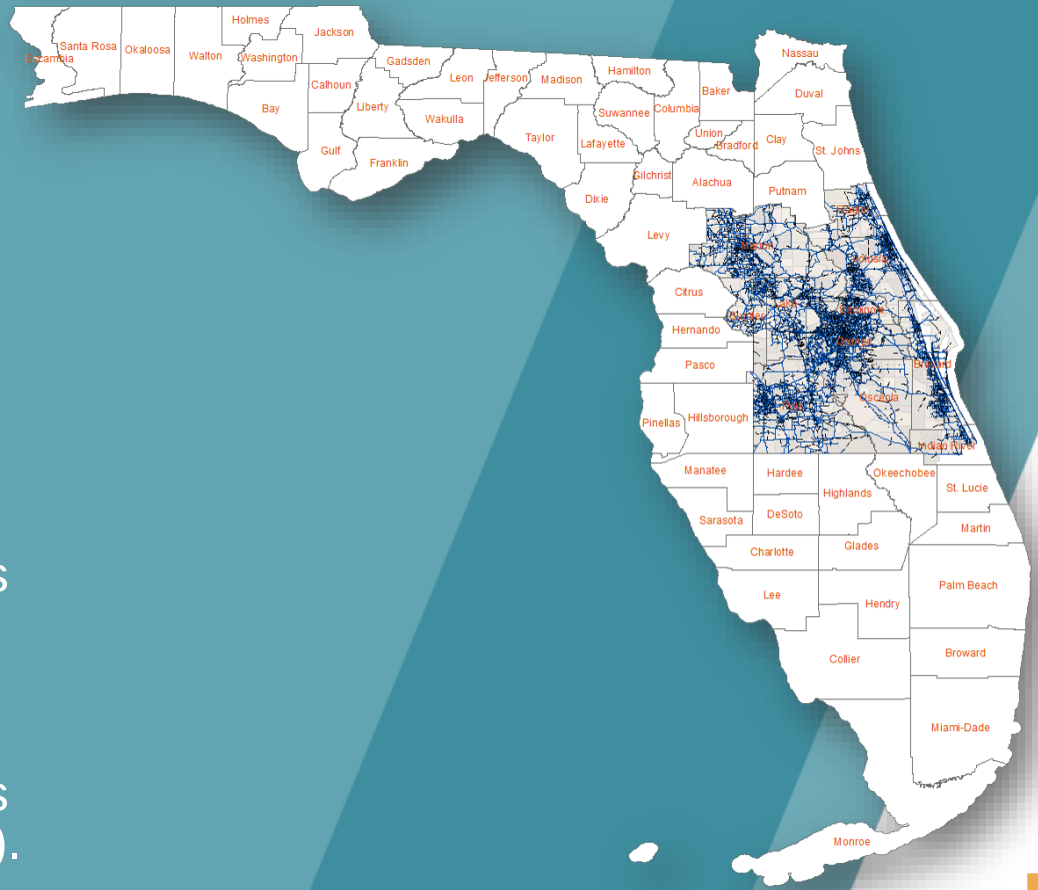
The study results may support

- Integrating volume and speeds for model development
- Model calibration and validation
- Potential “big data” analysis using model platform

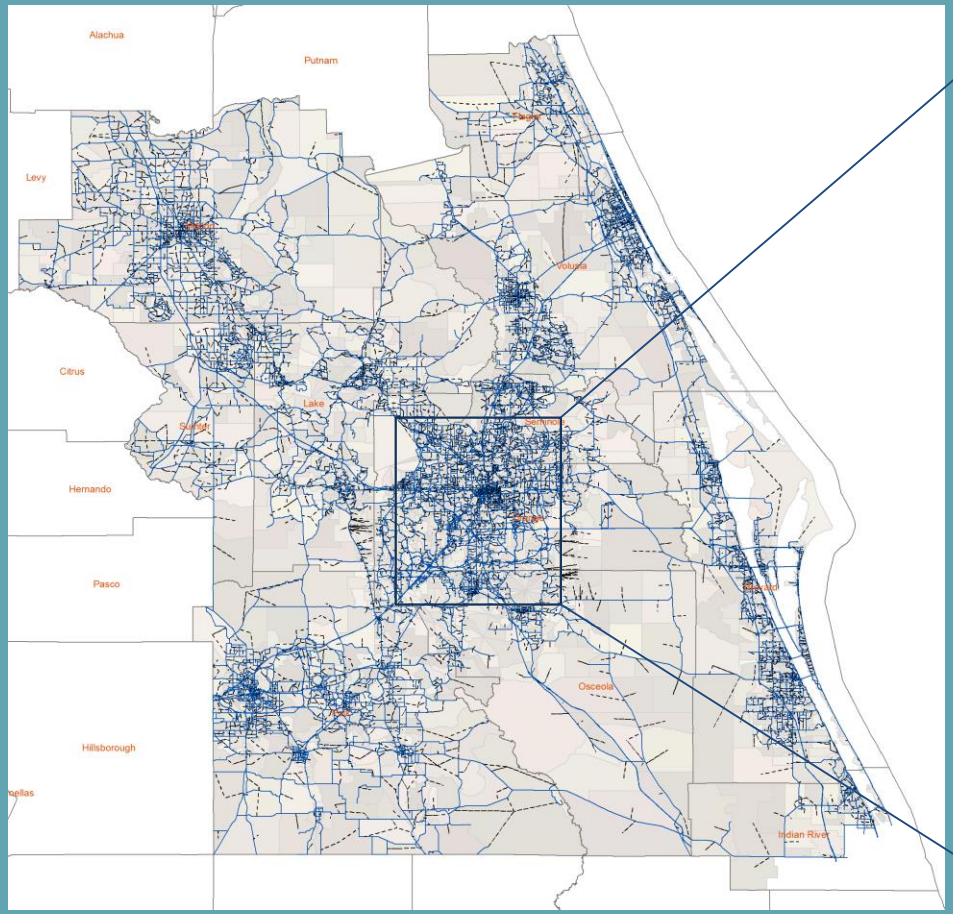


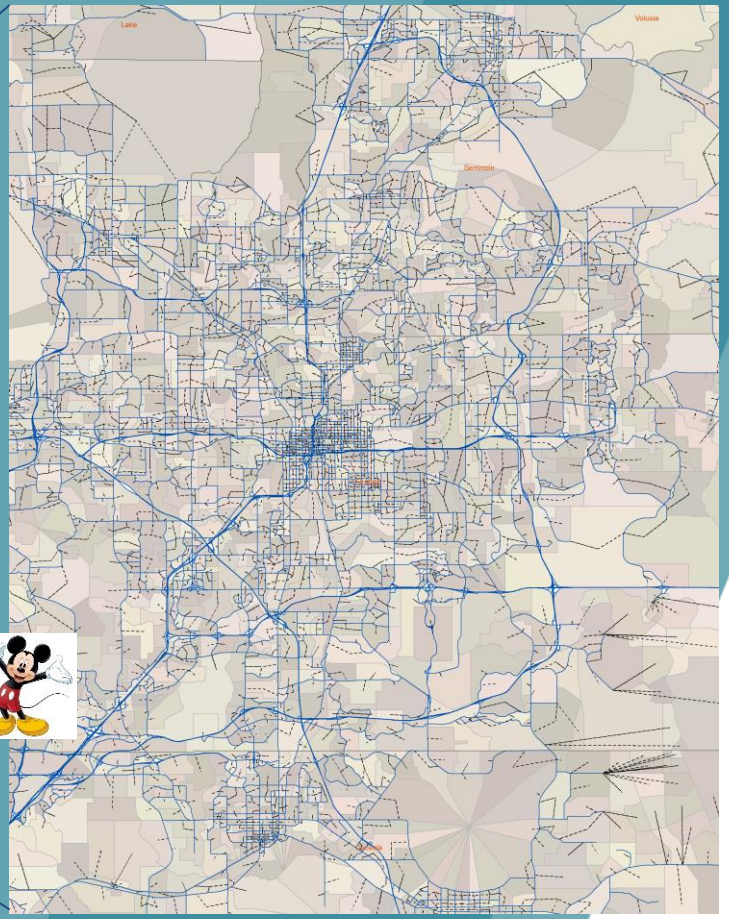
FDOT District 5 Travel Demand Model

- FDOT D5 Central Florida Regional Planning Model (CFRPM) V7 Model Update
- 11 Counties, Five MPOs
- 4.6 million population
- Around 7,000 TAZs
- 47,000 directional roadway links (not counting centroid connectors).
- 73,000 directional roadway links (if counting centroid connectors).



FDOT District 5 Travel Demand Model





Model Network

- Network was developed using FDOT GIS shape files.

- Roadways are directional in GIS with multiple attributes.

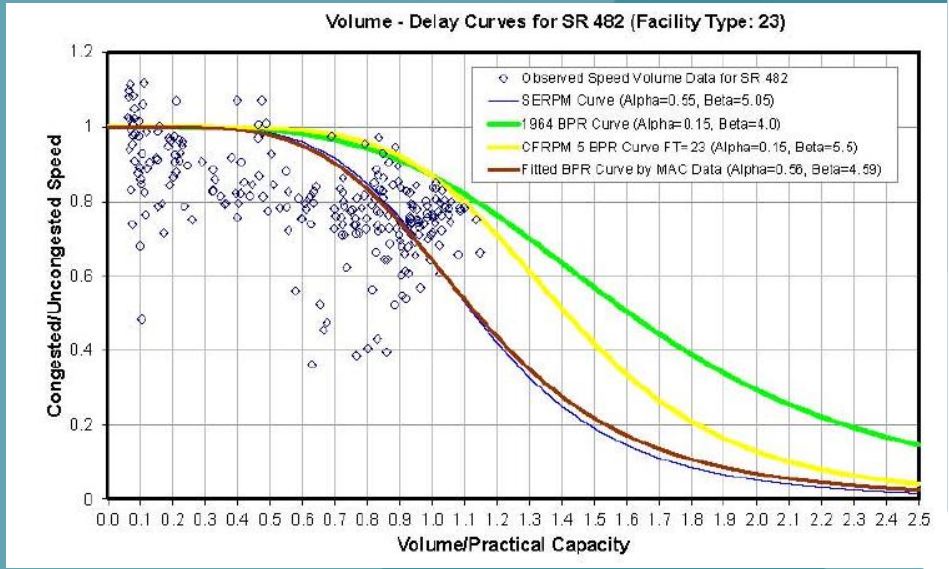
Probe Speeds Data

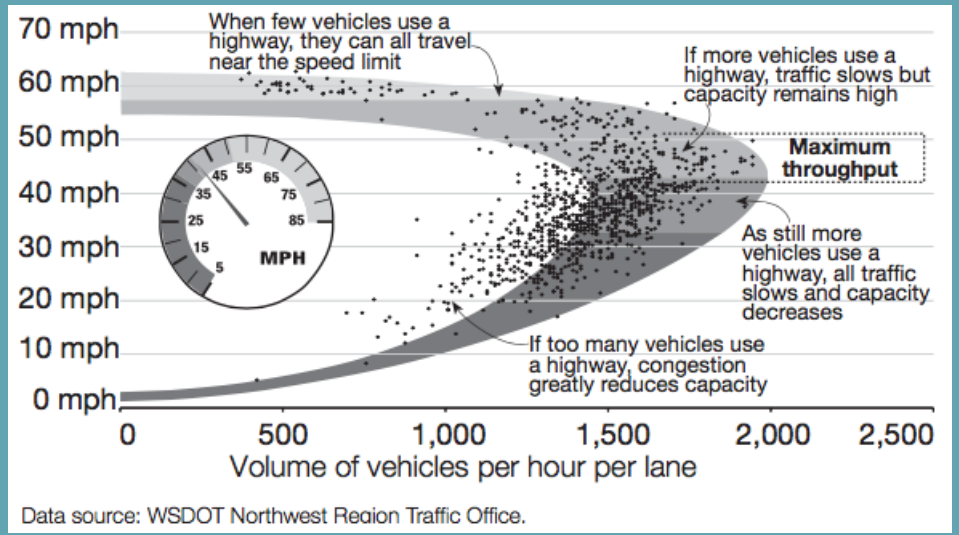
- Travel time and speed data from cell phone GPS probe data.

- GPS probe data collection is non-Intrusive from consumer smartphones.

Use of Probe Speeds

- Speed, Density and Flow/Demand Volume

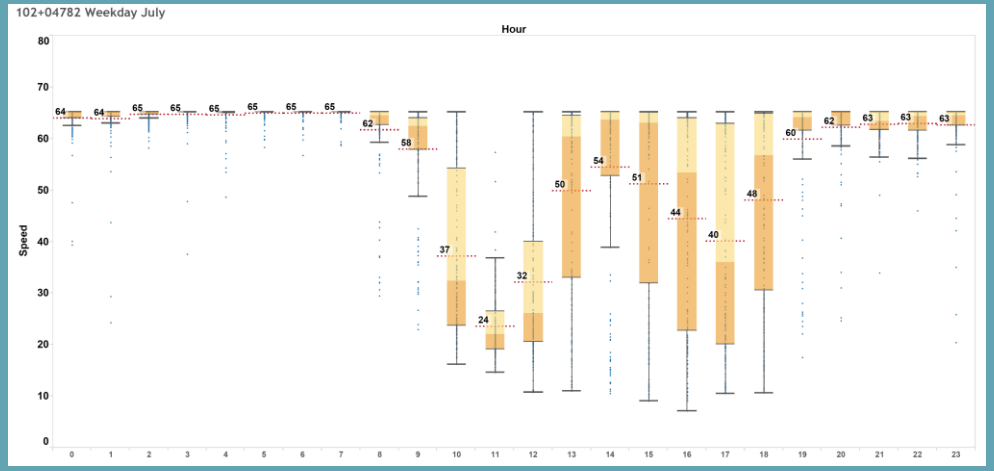




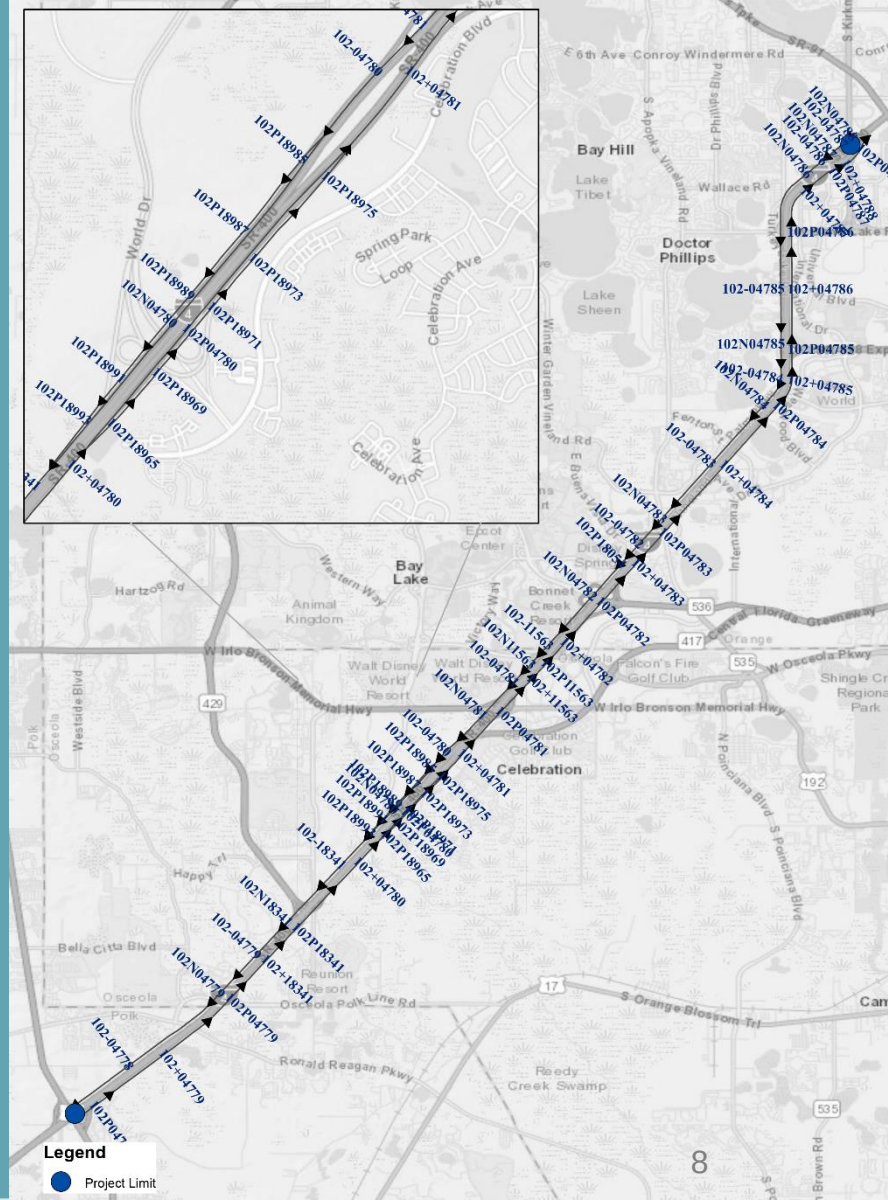
$$S = S_f / \{1 + \alpha (V/C)^{\beta}\}$$

Use of Probe Speeds

- Support multi-resolution modeling



  - I-4 project



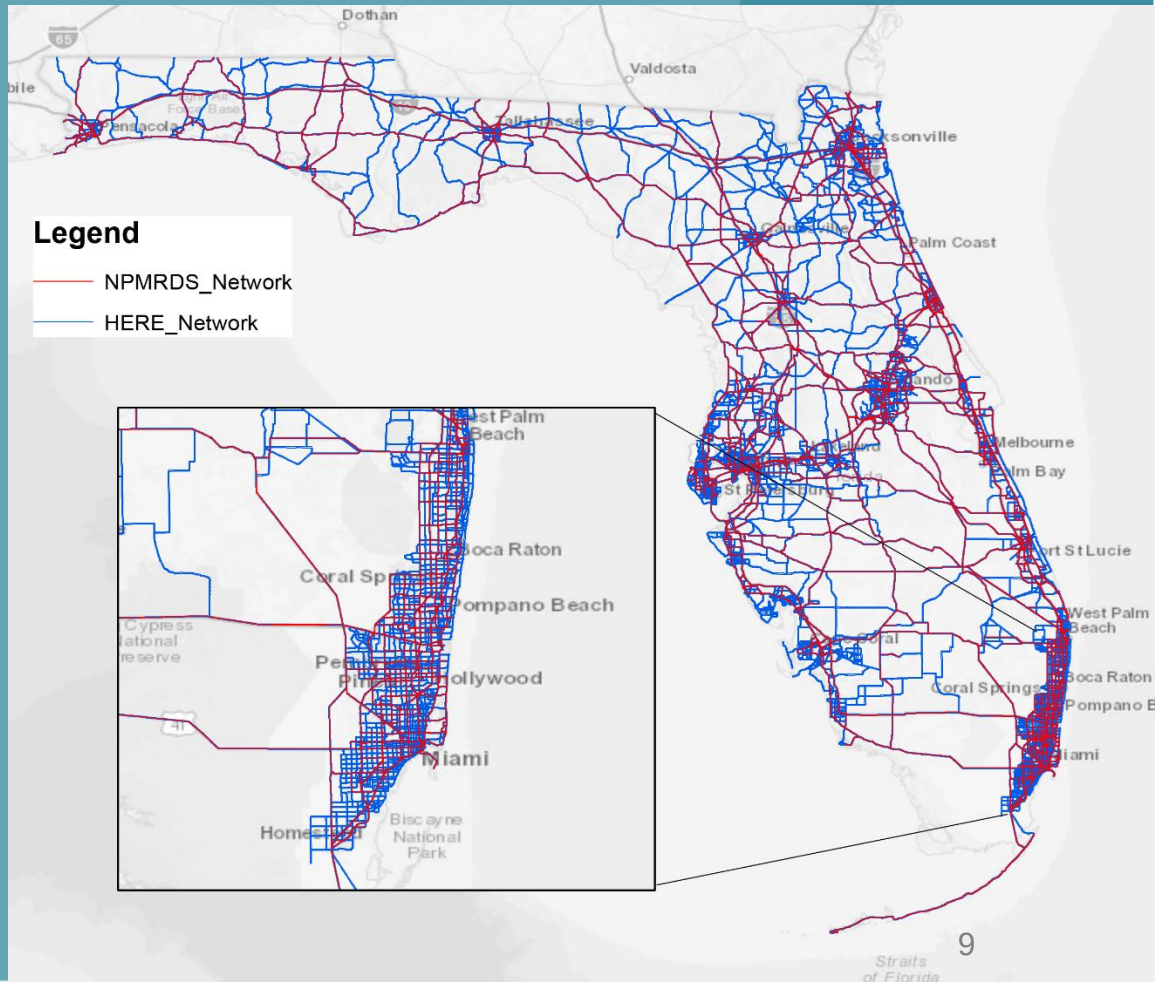
Probe Speed Data Converge

HERE Probe Speed Data

- TMC (Traffic Message Channel)
  - Unique 9-digit TMC Code
- Covers More Roads
- Mixed Flow (Passenger and Truck) Vehicles
- Speed data in Don't Average, 5 minutes, 10 minutes, 15 minutes, and 1 hour
- 46, 000 TMCs

NPMRDS Probe Speed Data

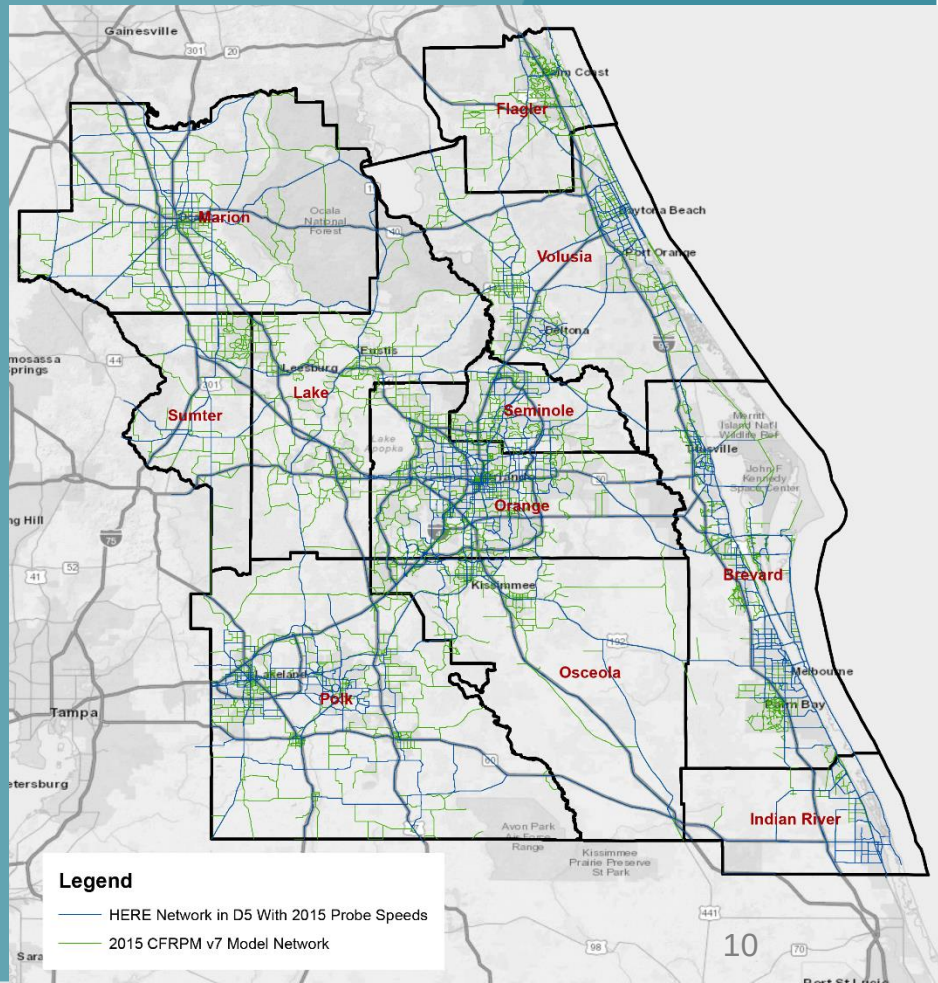
- Passenger Vehicles and Trucks
- NPMRDS v1 from HERE
  - 2011 to the end of January, 2017
- NPMRDS v2 from INRIX
  - From February, 2017 to Current
- Covers NHS roads
- 19,000 TMCs



Probe Speed Data Converge

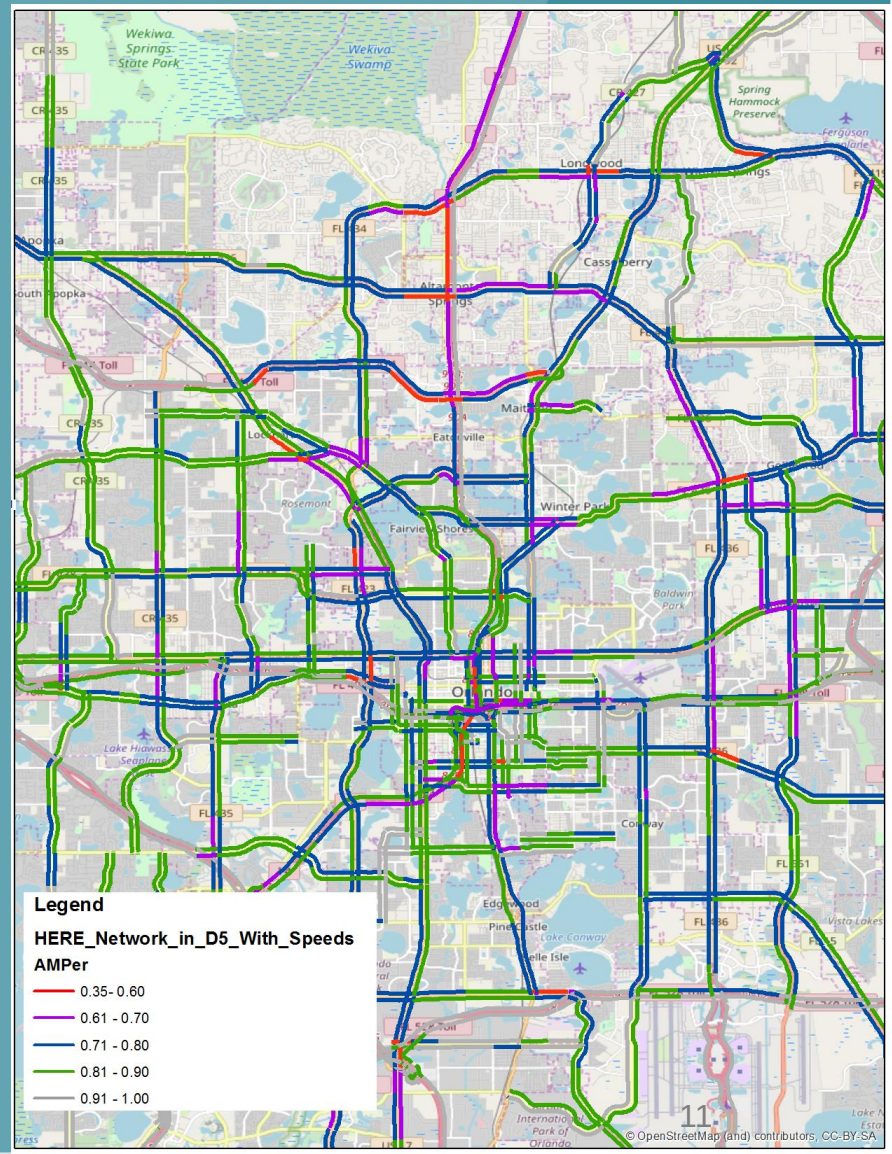
- Directional Miles

HERE Network	CFRPM V7 Network (Without Centroid Connectors)	Coverage
8,238	28,745	29%



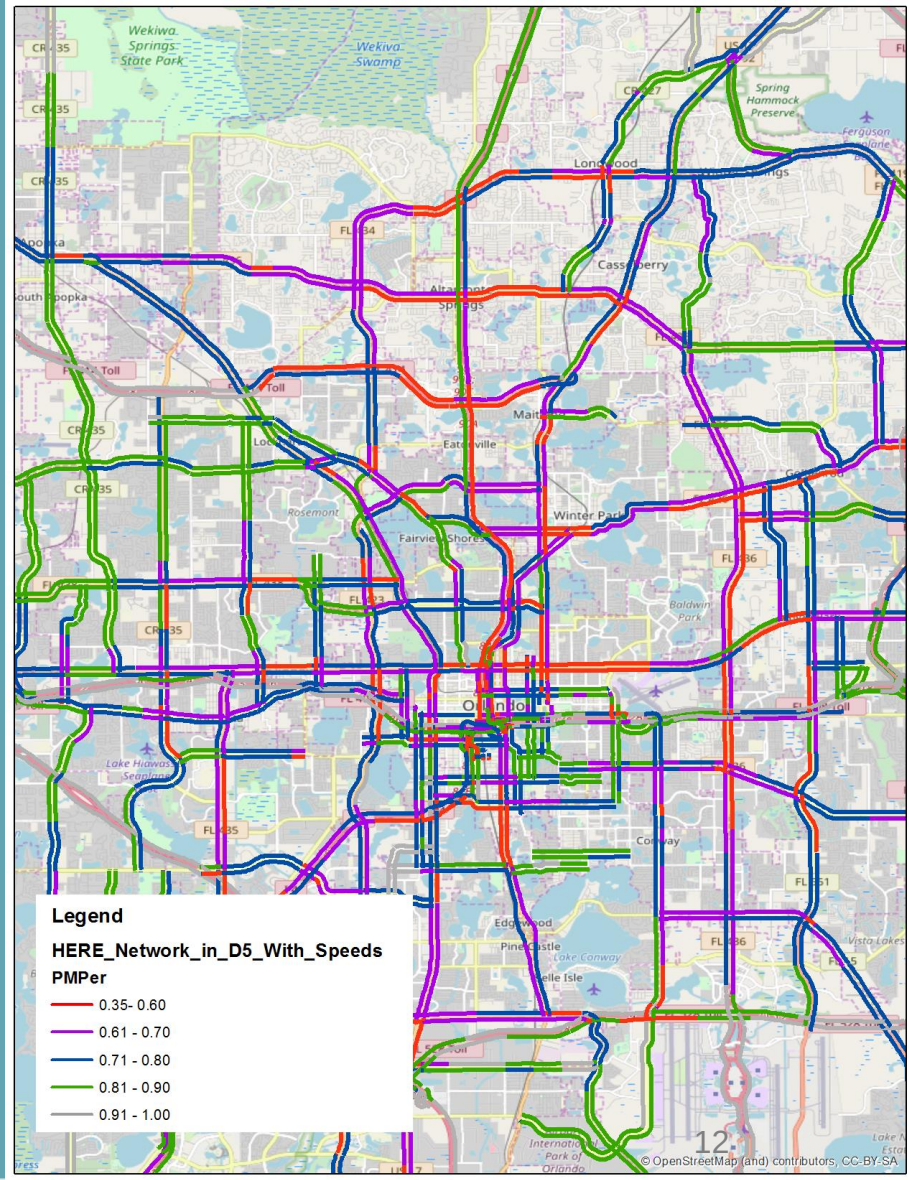
D5 Probe Speed Data

- AM Peak
  - 7:00-10:00AM
  - Percentage of AM speeds over free flow speeds



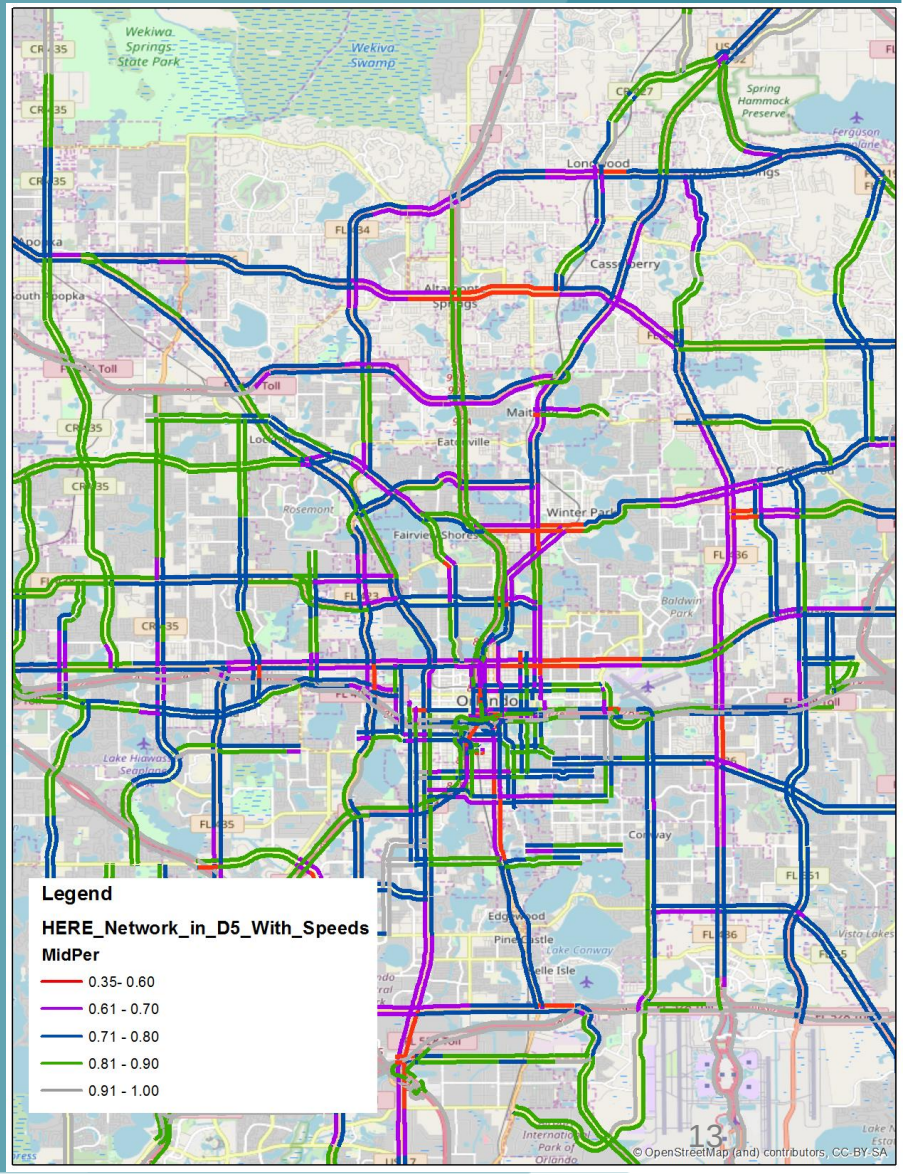
D5 Probe Speed Data

- PM Peak
  - 3:30-6:30PM
  - Percentage of PM speeds over free flow speeds



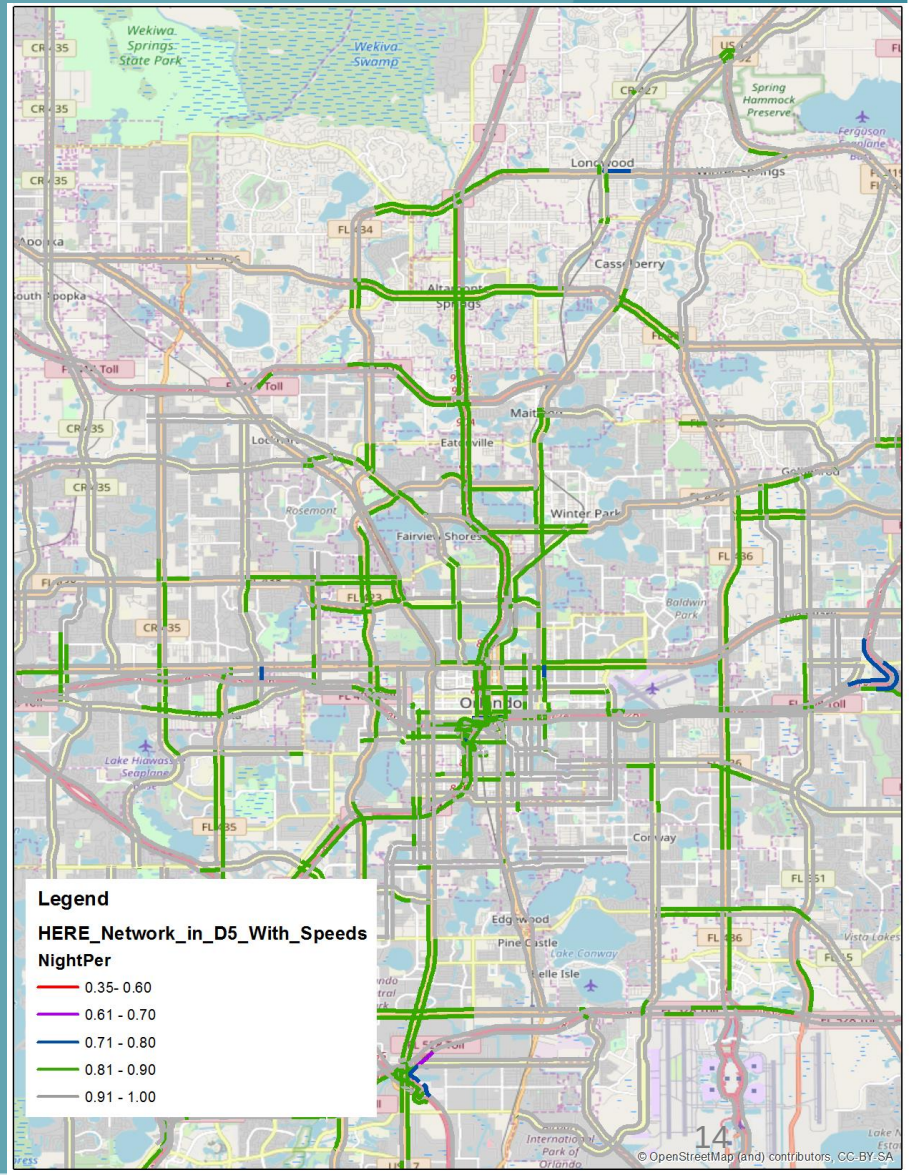
D5 Probe Speed Data

- Midday
  - 10:00AM-3:30PM
  - Percentage of Midday speeds over free flow speeds



D5 Probe Speed Data

- Night
  - 6:30PM-7:00AM
  - Percentage of Night speeds over free flow speeds



Discuss Conflation Process

- Three logical steps:
  - Establish spatial positional match
  - Determine direction match
  - Transfer “speed” weighted by matched TMC segments “shape length”

Positional Relationship Establishment

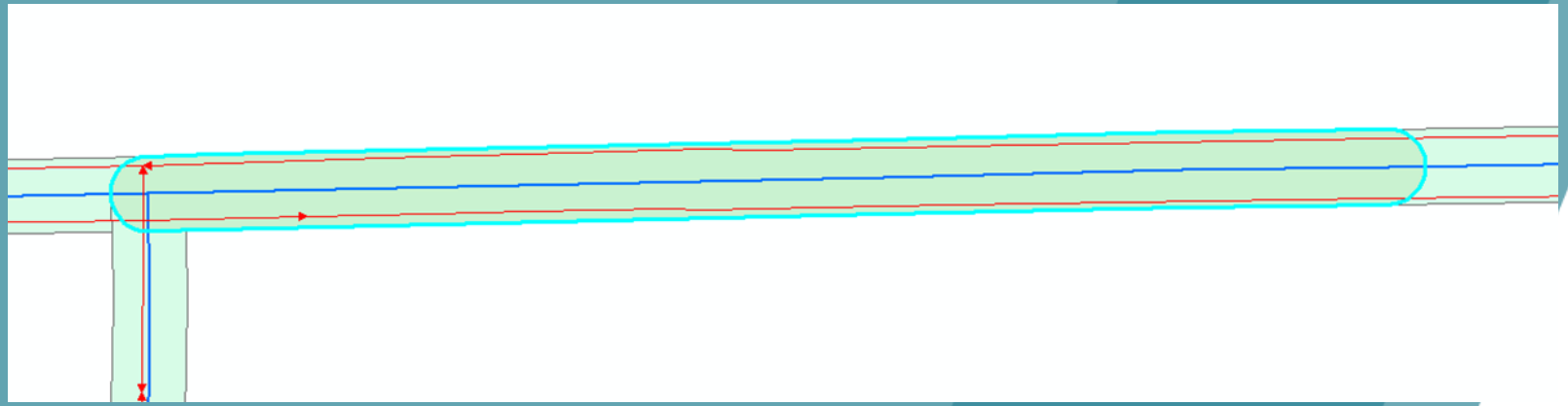
- Spatial match – by buffering /clipping

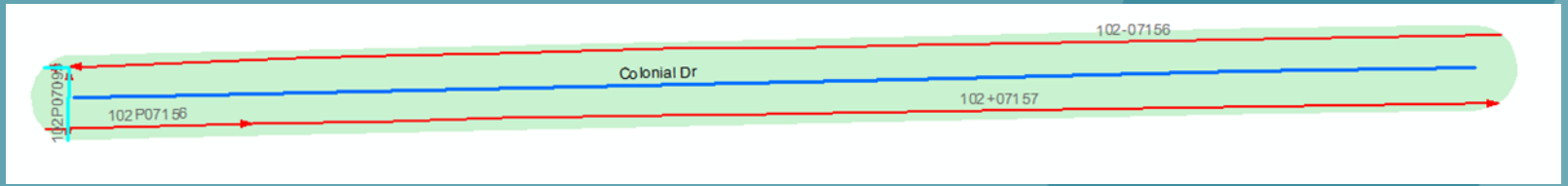
- Assumption:

  Line segments of the same “actual road” in both layers (of different sources) will be close enough and fall within a reasonable sized buffer around the road.

Spatial Match: Buffering / Clipping

- Buffering: 50 feet buffer from Street Network
- For each street segment buffer, search matching TMC line segment by clipping on the TMC layer

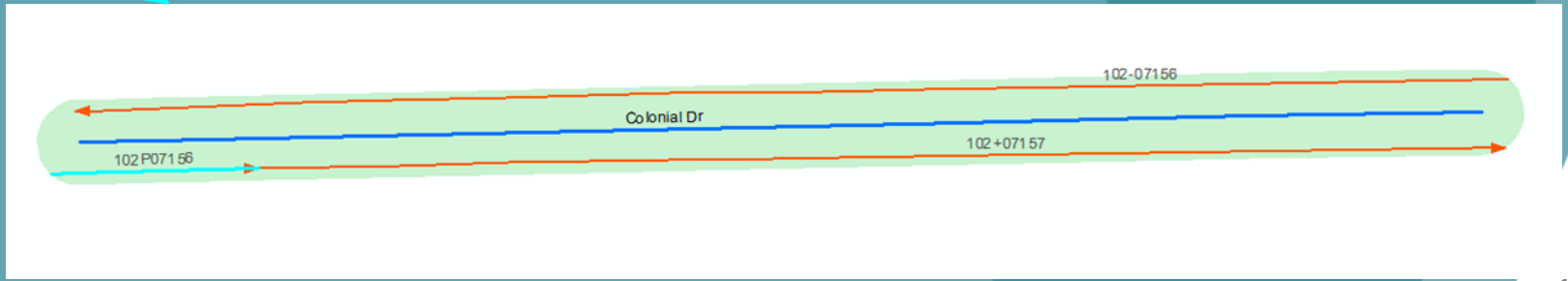




Spatial Match: Filtering

- Filter out “noise” type short segments clipped for the buffer

Discard tiny segments per tolerance distance – 200 feet



Spatial Match: Output

ONE SINGLE
street segment/feature

ONE SET
two-direction TMC segments

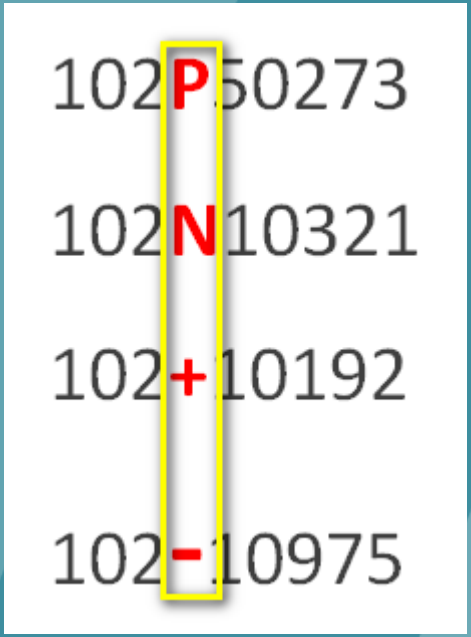
Direction Match

- TMC layer line segment direction:
  - Indicator within the TMC code - use the 4th character
  - Code convention

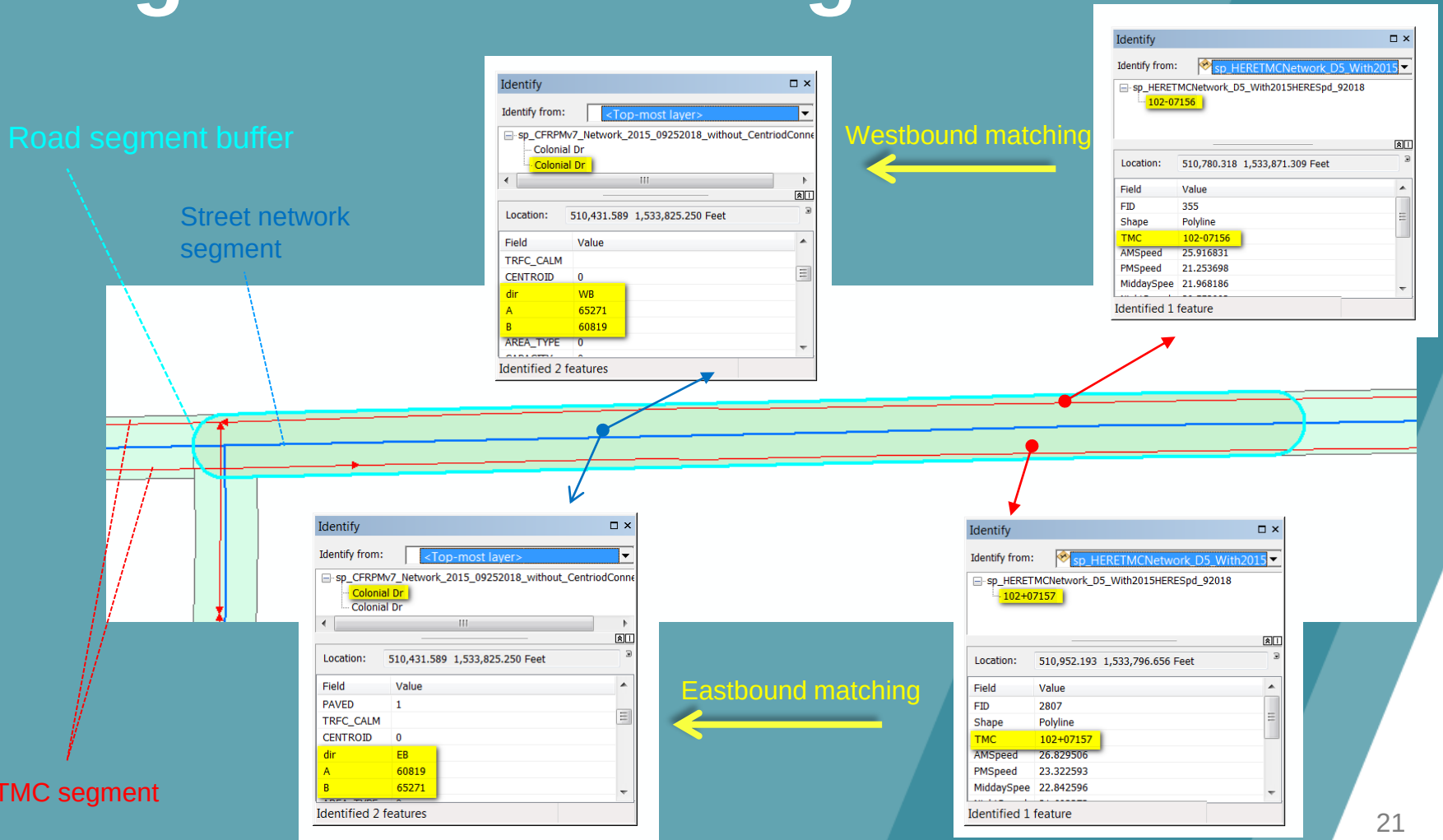
    Either characters P/N or signs + / -

- + / P (positive): North / East

  - / N (Negative): South / West



Segments matching



“Speed” attribute transfer

- One TMC segment matched

  Use the “speed” attribute(s) from TMC segment directly

- Multiple TMC segments matched
  - Compute the “speed” attributes from all matched TMC segments by weighting each TMC segment based on shape length

TMC segment #1 to be weighted for EB speed

TMC segment #2 to be weighted for EB speed

“Speed” attribute transfer

- Weighting approach to get attribute from multiple TMC segments:

Speed of Street layer = (speed1 x len1 + speed2 x len2) / (len1+len2)

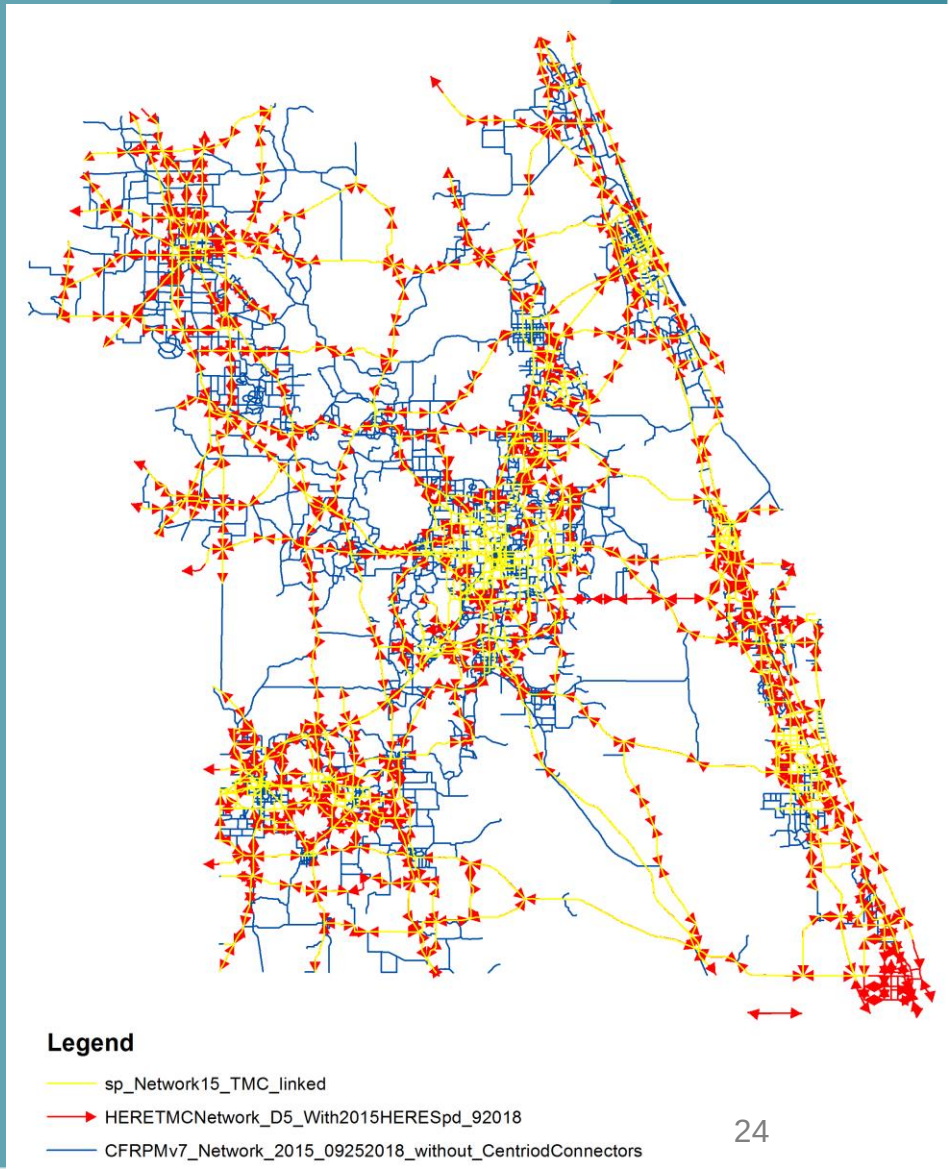
Where
len1: shape length of TMC segment #1
len2: shape length of TMC segment #2
Speed1: speed attribute of TMC segment #1
Speed2: speed attribute of TMC segment #2

TMC segment #1 to be weighted for EB speed

TMC segment #2 to be weighted for EB speed

Conflation result

- More than 90% street network segments obtained “speed” attributes from TMC layer where these two layers have consistent coverage



Implementation of Conflation

- Automation of the conflation (“attribute transfer”) processing
  - ArcPy code developed for this specific process
  - Use “in-memory” for intermediate geo-processing outputs to significantly improve computation performance;
  - Able to handle tens of thousands of features in tens of minutes

Summary

- This study conflated the probe speed data from the HERE TMC network to the model network. The probe speed data will support model development, assignment, calibration and validation.

- The probe speed data in this study are in 15 minutes interval across whole year. The connection between model and probe speeds will support “big data” analysis using model platform such as corridor analysis, reliability analysis, bottleneck analysis, freight analysis, etc.

THANKS. QUESTIONS?