

# Utilizing Third-Party Travel Time Data for Travel Demand Model Development

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Tuesday, October 30<sup>th</sup>

North Carolina Model Users Group

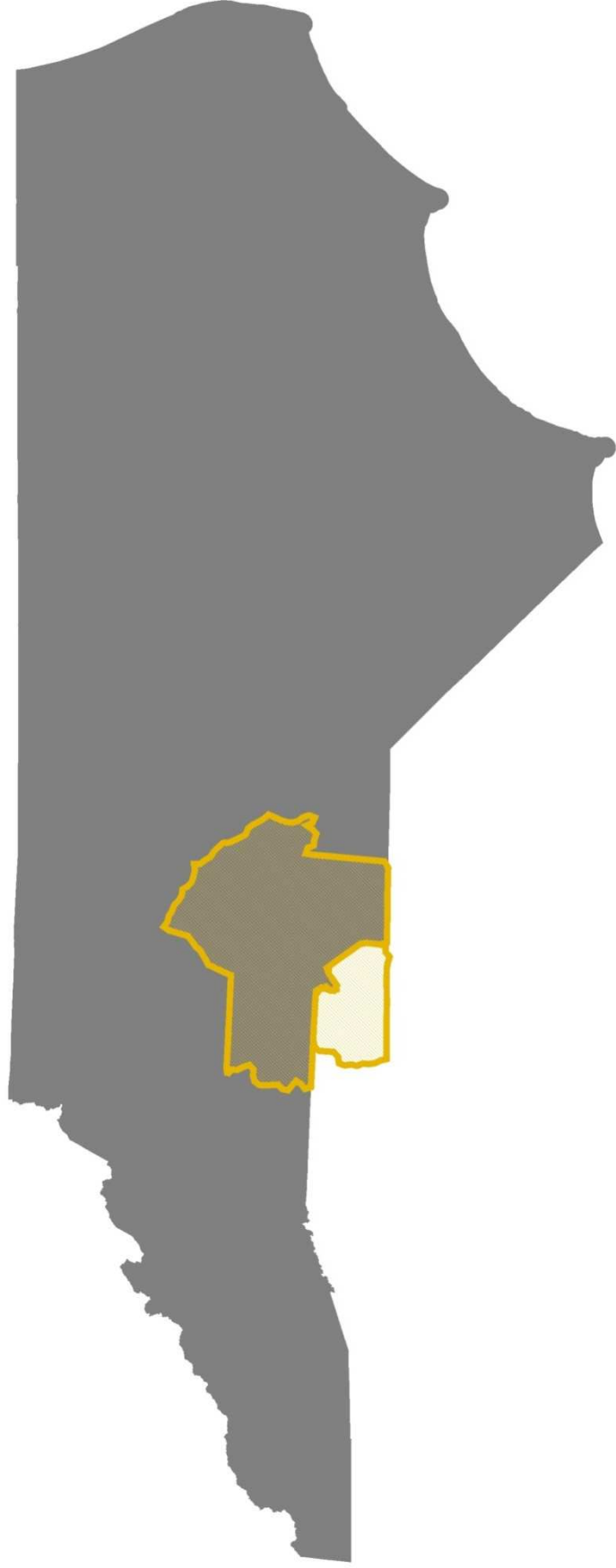
# Presentation Outline

- Background
- Sources of Travel Time Data
- Data Processing Steps
- Analysis Completed
- Issues/Limitations
- Upcoming and Potential Future Analysis

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## Background

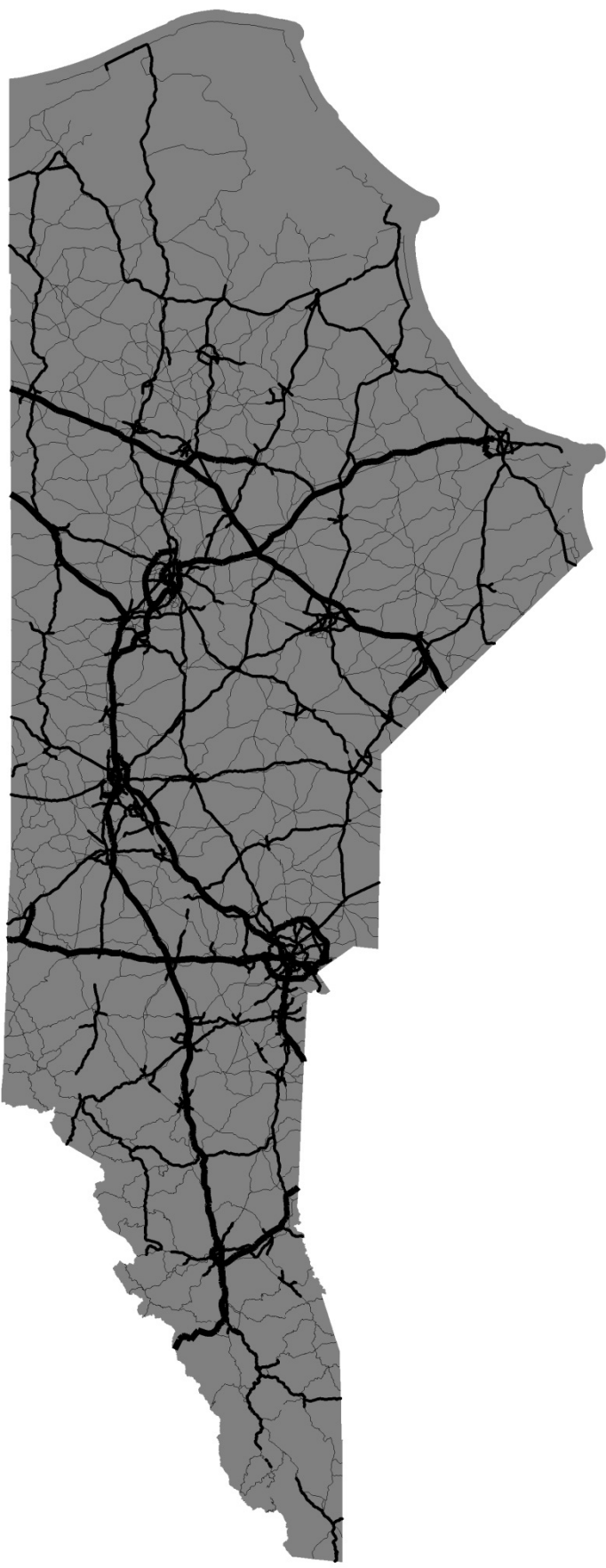
- » Two Travel Demand Models under maintenance/development
  - North Carolina Statewide Travel Model
    - Currently under development – PB, Clearbox, IEM
  - Metrolina Model – Charlotte Region
    - Maintained by CDOT and NCDOT



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# North Carolina Statewide Travel Demand Model

- » Development began in Fall of 2010
- » Currently in Calibration/Testing
- » Covers all “regionally significant” roadways in the State – Freeways, Arterials, some collectors



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## Metrolina Travel Demand Model

- » Has been going through maintenance/improvement for 10+ years
  - » Historically, travel-time run studies have been implemented to improve the travel demand model
    - Provides custom travel time data
    - Costly – typically **\$150K-300K** budgeted every **2-3** years
    - Collect data for **600 centerline** miles of freeway and arterial, during **AM and PM Peak Periods, midday**
    - **Each corridor collected for 2-3 days**
    - Floating Car/GPS Method
    - Processed internally by CDOT
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## Intent of Analysis

- » Can third-party travel time data be used to replace time-intensive, costly regional travel time studies?
  - » Can third-party travel time data be used to inform development and calibration of the statewide travel demand model?
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# Sampling of Third-Party Travel Time Data Sources

<b>Provider</b>	<b>Primary Source(s)</b>
» INRIX	Digital Sensors, GPS-Enabled Devices, Fleet
» AirSage	Cellular Data
» Traffic.com (NAVTEQ)	Digital Sensors, GPS, Fleet, Traffic Ops
» SpeedInfo	Doppler Radar
» BlueTOAD (TrafficCast)	Bluetooth Sensors
» BlueFAX (Traffax)	Bluetooth Sensors

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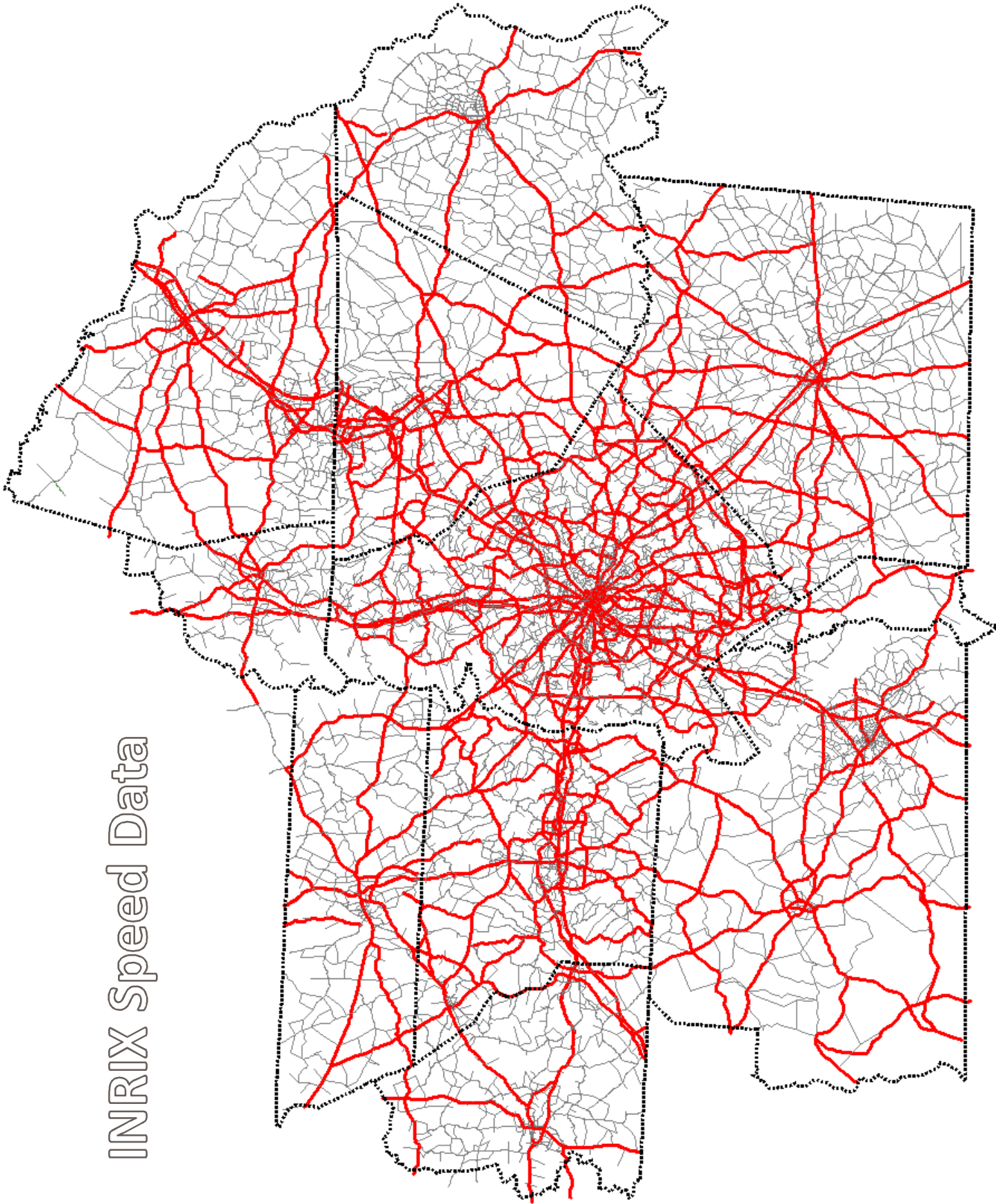
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## INRIX Travel Time Data

- » Selected for purchase by the Metrolina Regional Model Team
  - » Chosen for several reasons:
    - Familiarity with data – already implemented in NC (I-95 Corridor, NCDOT ITS Operations/511)
    - Data available – historical, average weekday, specific day, annual dataset
    - Cost – significant savings over travel time study (per centerline mile)
  - » Purchased over 2500 centerline miles of data for entire region at **80-90%** less per centerline mile for travel time data
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# INRIX Speed Data



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## Processing Travel Time Data

- » Utilized 2010 Average Weekday data from INRIX
  - Available by data of week
  - Reported in 15-minute increments over 24-hr period by “TMC” ID
- » Matched to approximately 130 locations in region where detailed traffic counts were available
  - Counts reported on an hourly basis
  - Counts reported by direction
- » Matched to travel demand model capacity data

*Only locations with speed data, hourly counts, and model capacity data carried through for analysis*

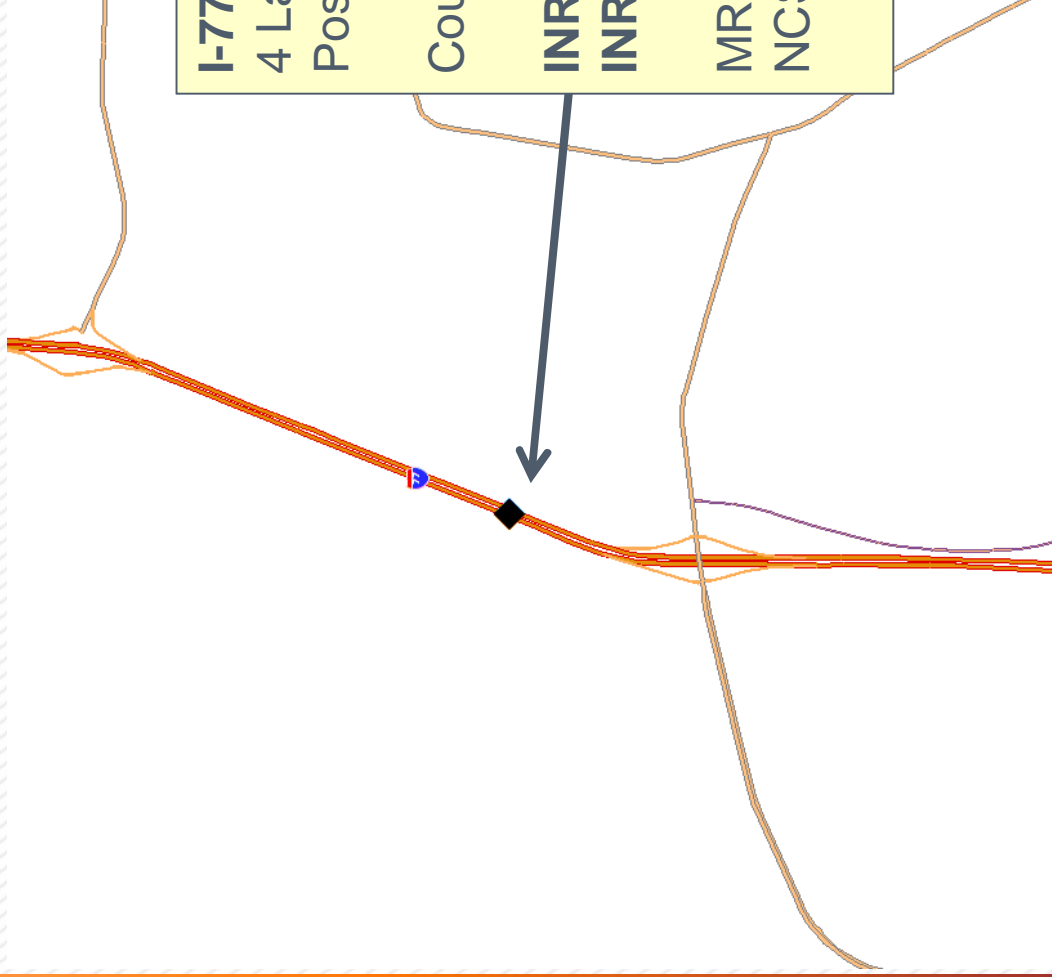
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# Count/INRIX Data Match Distribution

Functional Class	Lanes			Total
	2-3	4-5	6+	
Interstate/Freeway		13	34	47
Arterial	94	68		162
Collector/Local	44	2		46
<b>Total</b>	<b>138</b>	<b>83</b>	<b>34</b>	<b>255</b>

Functional Class	Area Type				Total
	CBD	Urban	Suburban	Rural	
Interstate/Freeway	4	8	23	12	47
Arterial	2	10	120	30	162
Collector/Local		8	34	4	46
<b>Total</b>	<b>6</b>	<b>26</b>	<b>177</b>	<b>46</b>	<b>255</b>

# Example Data Processing



## **I-77 North of Charlotte**

4 Lane Interstate

Posted Speed = 65

Count ID = TC5993

**INRIX TMCcode\_NB = 125-04794**

**INRIX TMCcode\_SB = 125+04795**

MRM AB/BA\_1 HR Capacity = 4400

NCSTM AB/BA 1HR Capacity = 3320

# Processing Travel Time Data

	1		2		3		4		5		6		7		8		9		10		11		12	
STATION	LONGITUDE	LATITUDE	TMC	DATE	DIR_TE	ABBA	COUNTY	NETID	DIR	F100	F200	F300	F400	F500	F6									
99	-80568214	35370001	125-08949	8/31/2010	SB	AB	Cabarrus	214852	0	31	34	26	50	107										
99	-80568214	35370001	125+08950	8/31/2010	NB	BA	Cabarrus	214852	0	62	24	22	30	25										
100	-80587110	35417337	125-09628	8/25/2010	SB	AB	Cabarrus	214781	0	34	18	23	14	24										
100	-80587110	35417337	125+09629	8/25/2010	NB	BA	Cabarrus	214781	0	20	13	12	17	35										
101	-80580697	35427178	125-11727	8/25/2010	SB	BA	Cabarrus	214803	0	34	35	26	21	29										
101	-80580697	35427178	125+11728	8/25/2010	NB	AB	Cabarrus	214803	0	28	32	17	25	41										
102	-80627964	35487276	125-11749	8/24/2010	SB	BA	Cabarrus	214257	0	19	10	7	7	15										
102	-80627964	35487276	125+11750	8/24/2010	NB	AB	Cabarrus	214257	0	23	11	12	4	11										
104	-80597682	35758090	125-12606	8/31/2010	SB	AB	Rowan	218918	0	6	3	2	2	8										
104	-80597682	35758090	125+12607	8/31/2010	NB	BA	Rowan	218918	0	5	2	4	7	9										
105	-80572435	35714898	125-09154	8/24/2010	WB	BA	Rowan	218899	0	34	15	14	30	65										
105	-80572435	35714898	125+09155	8/24/2010	EB	AB	Rowan	218899	0	31	16	19	24	35										

» Used hourly capacities from each model (C)

» Used Hourly Counts by Direction (V)

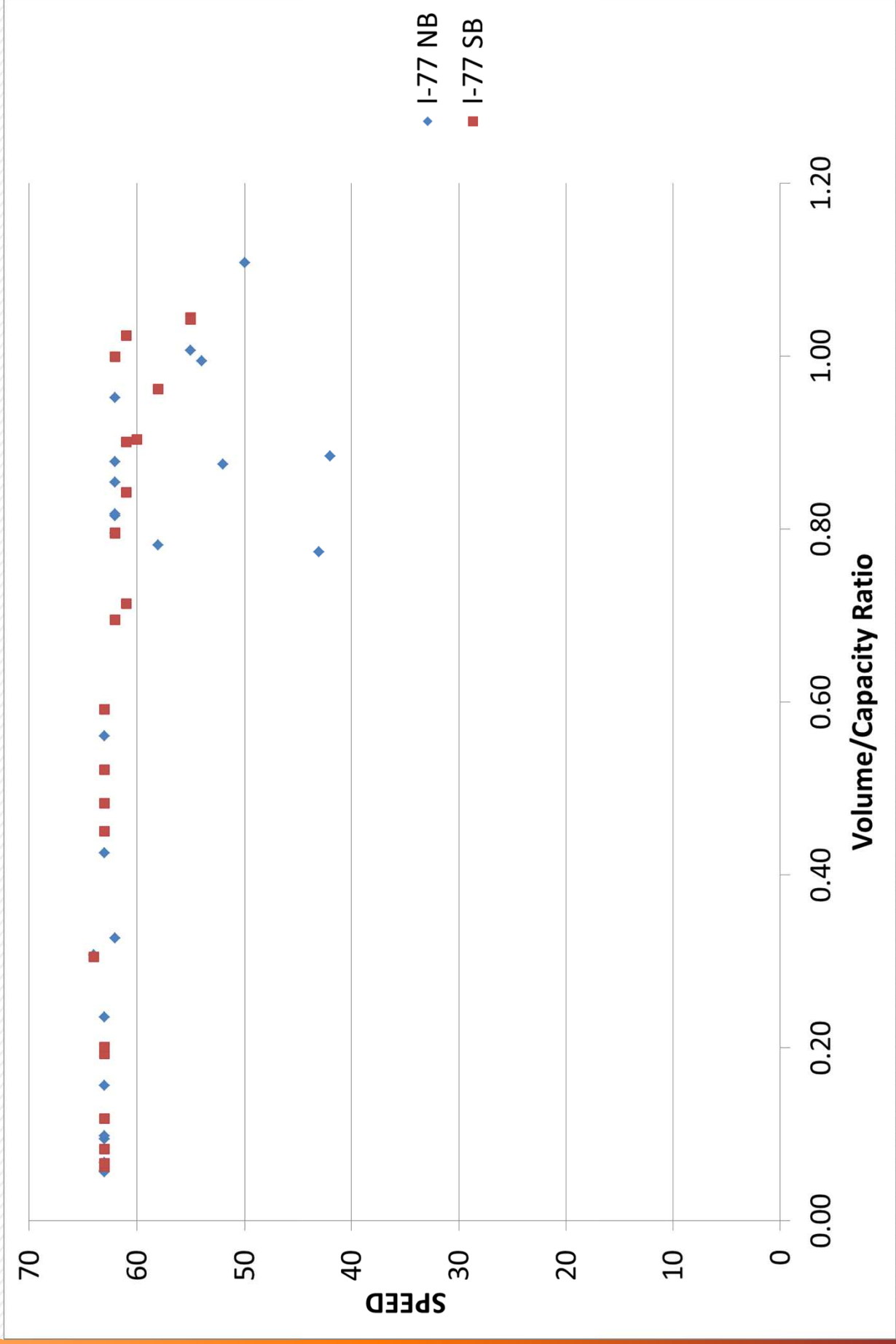
» Used INRIX Speeds, averaged to hour (S)

I-77 North of Charlotte

Travel Speed	Average Speed		Minimum Average Speed (minimum of 15 minute bins)	
	I-77 NB 125+04795	I-77 SB 125-04794		I-77 NB 125+04795
Hour				
1	64	63	63	63
2	64	63	64	63
3	64	63	63	63
4	64	64	63	63
5	64	64	63	63
6	64	64	64	64
7	63	<b>58</b>	63	<b>52</b>
8	61	<b>45</b>	61	<b>42</b>
9	63	<b>47</b>	62	<b>43</b>
10	63	<b>61</b>	63	<b>58</b>
11	63	62	63	62
12	63	63	63	62
13	63	62	63	62
14	63	62	63	62
15	63	62	63	62
16	63	62	62	62
17	61	<b>59</b>	60	<b>55</b>
18	61	<b>51</b>	60	<b>50</b>
19	63	<b>58</b>	62	<b>54</b>
20	64	63	63	63
21	64	63	64	63
22	64	62	64	62
23	64	63	64	63
24	64	63	64	63

Average speed reported in 15 minute increments – needed hourly to match count

# Speeds vs. V/C Ratio



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## Analysis completed (or under completion) using Travel Time data

1. Volume Delay Curve Review: V/C Ratio Comparison
  2. Free-Flow Speed Comparison
  3. Travel Time Index Development - Transportation Analysis Report (for City of Charlotte), which annually compiles and calculates transportation data for multi-modes – in progress
  4. Speed Profile Development for the MOVES air quality model – in progress
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## Volume Delay Curve Review

- Goal was to plot observed volume/capacity ratios to see how model speed curve profiles compare to observed speed behavior
  - Data sources:
    - Volumes – Traffic Count Data, hourly by direction
    - Capacities – Metrolina Model, NC Statewide Model
    - Speeds – INRIX Speed Data, averaged to hour (to match counts)
  - Prepared series of plots matching volume delay curves by facility types
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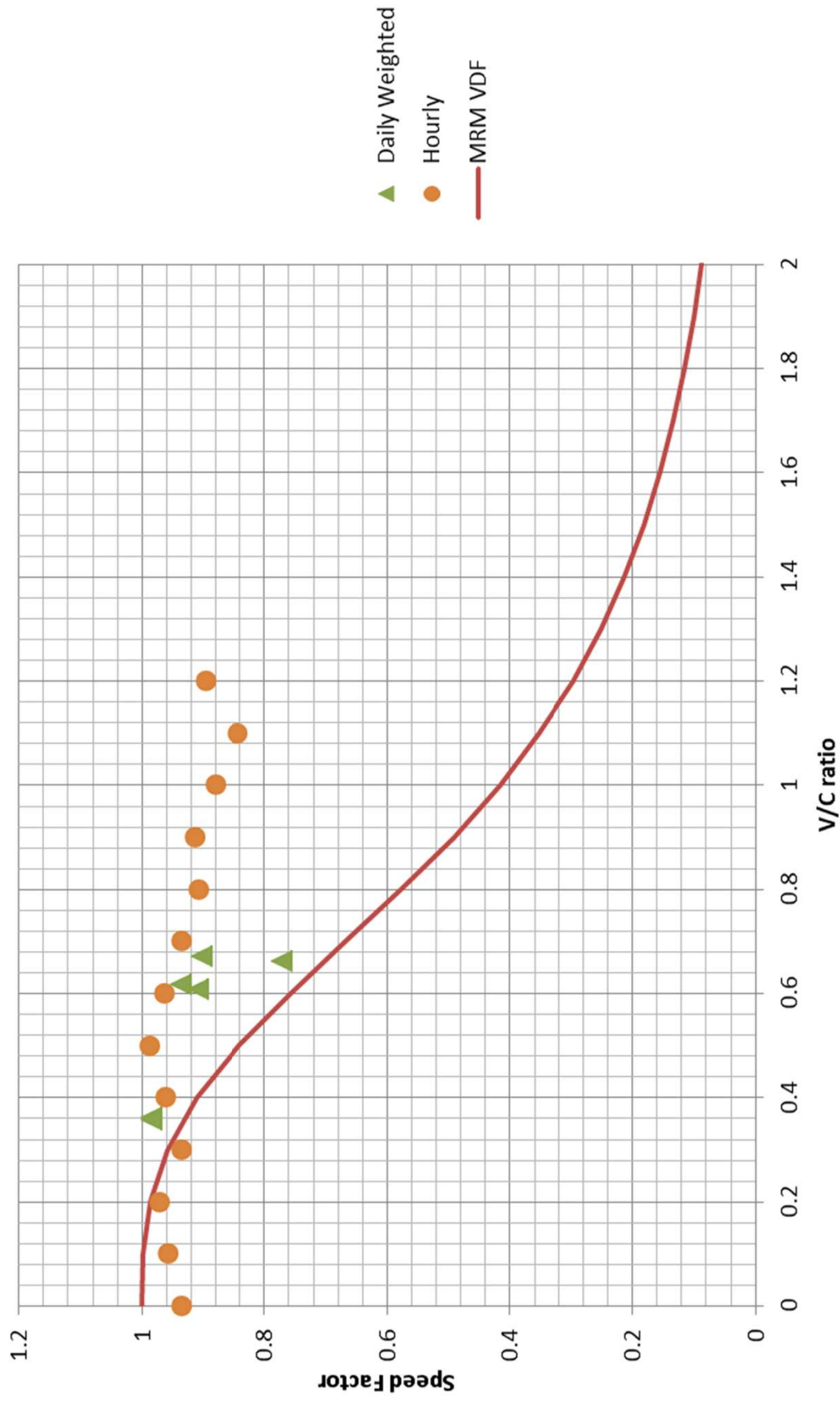
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## Volume Delay Curve Review

- Cautions on this analysis:
    - Can't observe volume/capacity > 1 in reality
    - Smaller bin sizes would have been more ideal (15-minute increments)
    - Was only prepared to review existing curves, not develop new ones
    - Didn't capture any of the "worst" congestion/bottlenecks locations
    - Should have screened out low volume samples
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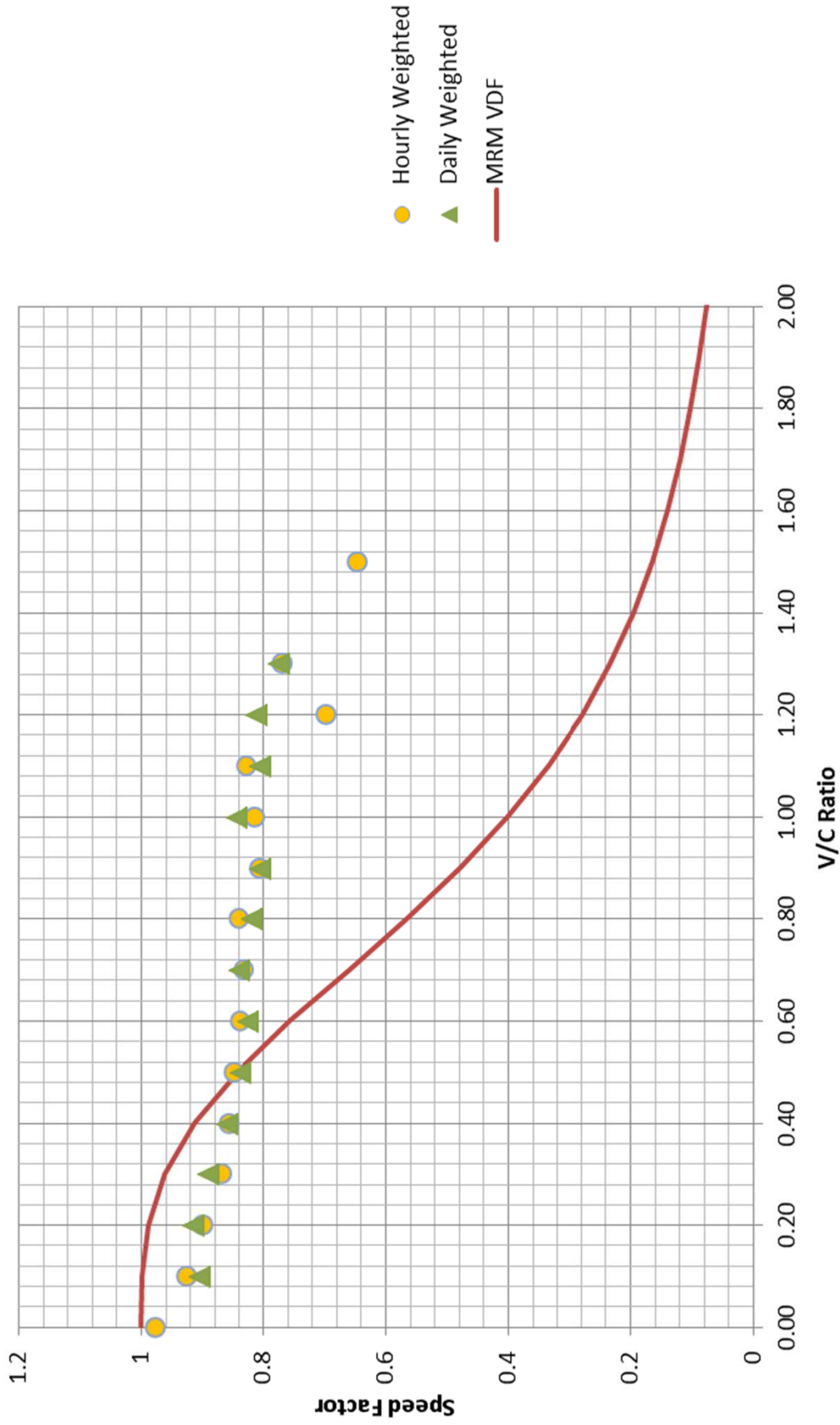
# Volume Delay Curve Review

## Interstate/Freeway Facilities



# Volume Delay Curve Review

## Major Arterials



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## Free Flow Speed Comparison

- The goal of this analysis was to review existing Metrolina free-flow speed factors by facility type and area type
  - Also potential source of factoring posted speeds to free-flow for NC Statewide Model
  - Issues encountered:
    - Maximum Reference Speed of 65 MPH
    - INRIX Data is more reliable with more samples –free-flow speeds usually occur when the least number of samples occur
  - Selected 85% percentile highest reported 15 minute speed increment as free-flow speed (96 time slots per day, chose the 14<sup>th</sup> highest)
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# Free Flow Speed Comparison – Metrolina Region INRIX Data

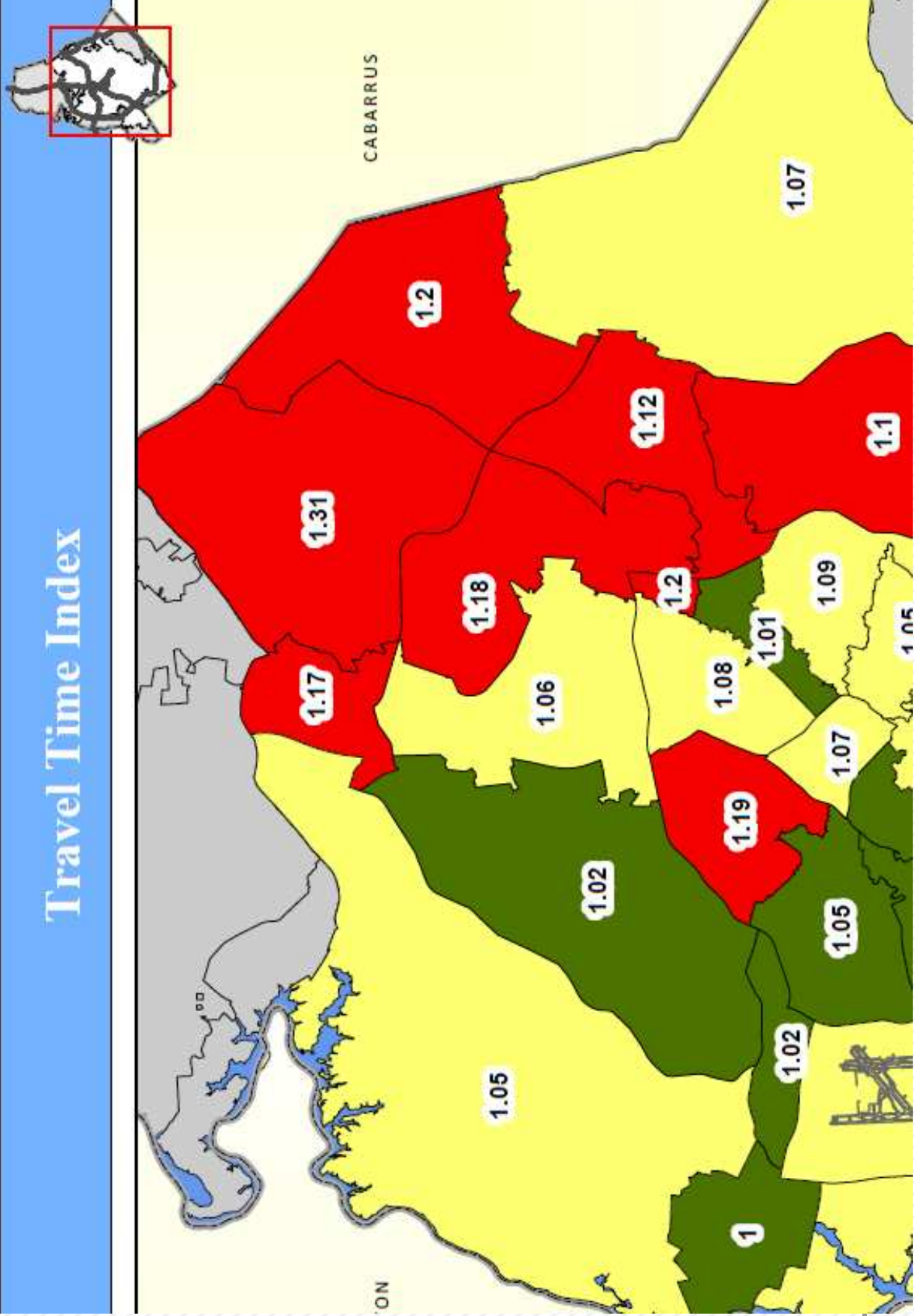
## FREE FLOW SPEED

Facility Type	Area Type		
	Urban	Suburban	Rural
Freeway	1.03	1.01	1
Arterial (Undivided)	0.95	1.03	1.04
Arterial (Divided)	0.89	1	1.1
Collector	0.88	1.02	1.05

## AVERAGE DAILY SPEED (Weighted by Hourly Count)

Facility Type	Area Type		
	Urban	Suburban	Rural
Freeway	0.96	0.95	0.99
Arterial (Undivided)	0.76	0.87	0.94
Arterial (Divided)	0.71	0.87	1.06
Collector	0.72	0.88	0.93

# Travel Time Index Development



# MOVES Speed Profile Development

Speed Bin Distributions by County, Functional Class, Area Type, etc.

	HOUR													
Count of AverageSpeed	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Row Labels	1	2	3	4	5	6	7	8	9	10	11	12	13	14
25002	2	2	2	2	2	2	2	2	2	2	2	2	2	2
60 to 65	2	2	2	2	2	2	2	2	2	2	2	2	2	2
25003	66	60	57	65	81	98	100	100	100	102	102	102	102	100
0 to 10	1	1												
10 to 20	5	4	3	3	4	4	1	3	3	3	3	3	3	3
20 to 30	4	2	2	4	3	4	4	5	5	2	3	4	4	3
30 to 40	10	7	7	11	17	24	29	27	26	30	28	26	25	25
40 to 45	15	13	6	5	6	13	21	18	18	19	21	24	25	21
45 to 50	14	14	17	18	23	25	24	23	24	27	26	23	23	27
50 to 55	12	19	13	17	16	22	16	19	20	18	17	19	18	16
55 to 60	5	9	9	7	12	6	5	5	4	3	4	3	4	5
25004	28	28	28	28	28	28	28	28	28	28	28	28	28	28
30 to 40														
40 to 45														
45 to 50								2						
50 to 55								2						
55 to 60	1						1	2	2					1



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## Issues and Limitations with Travel Time Data

1. Length of segments in speed database can impact segment speed – intersection delay is spread over segment length
  2. Data not “lane specific”, cannot evaluate lane specific questions and may have difficulty capturing lane specific problems (weaving, ramp queues)
  3. May need to factor count data with seasonal adjustments to match INRIX average data or use date-specific INRIX data that matches count timestamp
  4. Recommend 15-minute count data to compare with INRIX data
  5. Remove samples with low volume counts from analysis – low confidence
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## Upcoming and Future Efforts

1. Statewide Project Prioritization – Travel Time Savings Estimation (NCDOT Strategic Planning Office)
  2. Corridor Study Simulation Results Validation (CDOT)
  3. Congestion Management Process – Look at travel time indexes for various time periods (peak hour, peak period) and durations of congestion (CDOT)
  4. Capacity Factors – Use with count data to estimate capacity factors
  5. Peak Spreading – Analyze speed data to improve time-of-day modeling
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# Contact Information

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