Thanks For All The Hard Work, Moore County!

Darius Sturdivant

Division 8 Planning Engineer Extraordinaire

Education:
BS Civil Engineering: North Carolina Agricultural and Technical State University
MS Civil Engineering: University of Tennessee-Knoxville

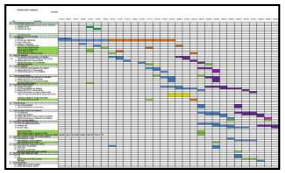
Work History:
Over 13 years with the NC Department of Transportation - Raleigh
— 2 years Traffic Engineering
— 11 years in Transportation Planning
Including 6 years as Fayetteville Area MPO Coordinator. Worked with local staff to develop a Travel Demand Model and a long range, multimodal, comprehensive transportation plan for the Fayetteville/Fort Bragg area.

Primary Job Description: To serve as a liaison between NCDOT (Raleigh) and local communities to enhance the process for developing and implementing long-range, multimodal transportation plans and initiatives.

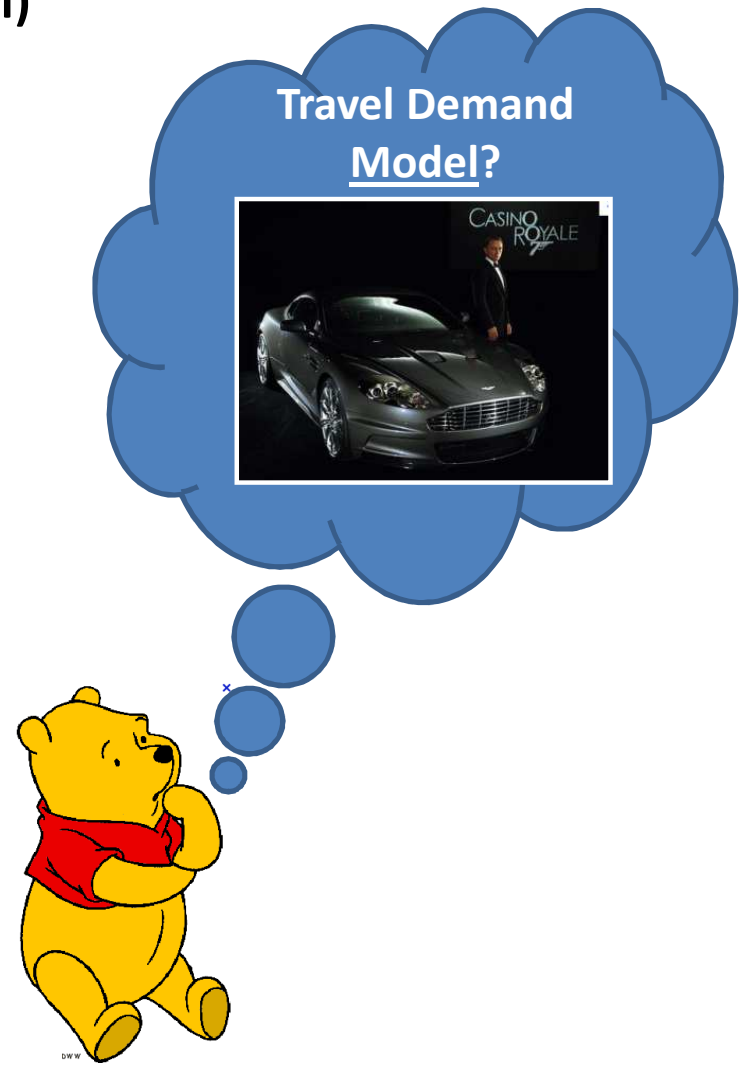
Personal connection with the area: Grandparents, great-grandparents, and prior generations of family are from northern Moore County (Robbins area).

MCTC Meeting February 2013 Agenda

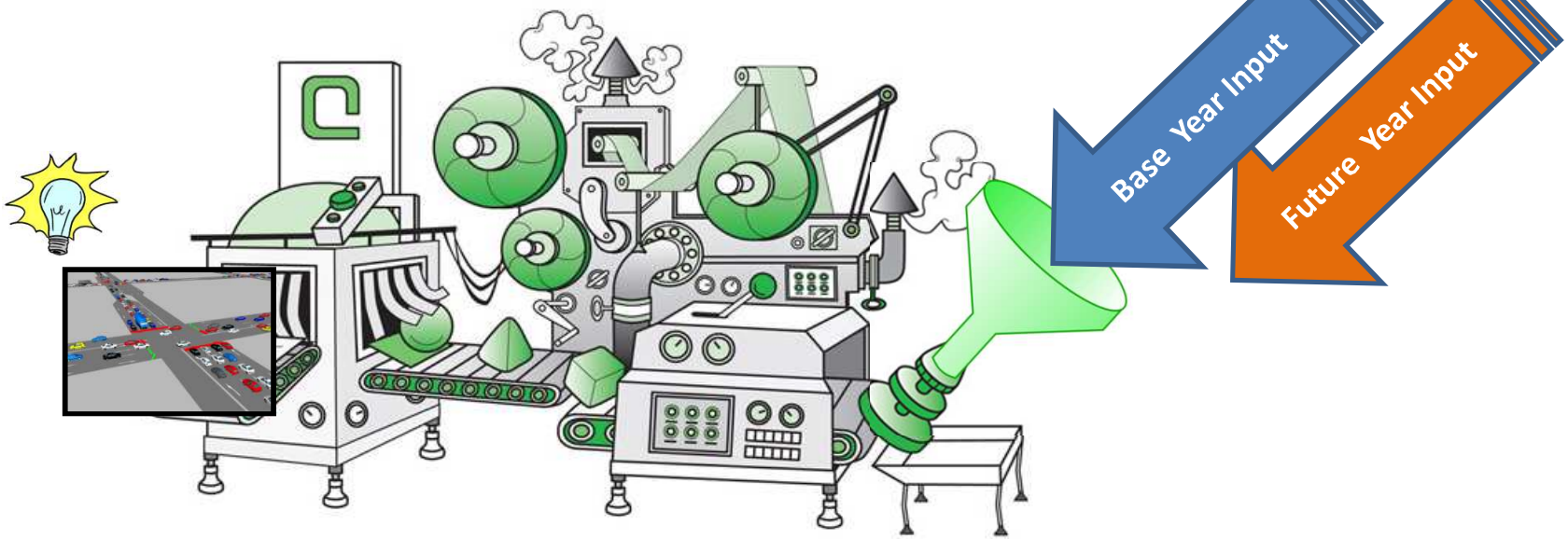
1. **Defining the Travel Demand Model (TDM)**
   - Purpose and Objectives
   - How it works
2. **How we use the model in analysis**
   - Expected Outputs
3. **Status and Projected Schedule**



4. **Work Done to Date**
   - Fun things to see
5. **Determining "Future" Inputs:**
   - Growth, Population, and Employment Data
6. **Questions**
   - Summary of Significant Events



The Model – The Big Picture



Step I Build a Replica of the Roadway System: **Mapping**

Step II Highlight the Roads You Want to Study: **NETWORK**
(Significant Roadways: # lanes, lane width, shoulder, speeds, type)

Step III Think About Boundaries: **Study Area, Municipal, Land Use**

Step IV Divide Study Area into Smaller, Manageable Sections For Study: **TAZ**s

Step V Load Model with Population, Housing, Employment Data: **Census**

Step VII Load Traffic - **Counts**

Step VIII Calibrate – **Are the outcomes consistent with known data?**

EXPECTED OUTPUT – The Big Picture CONTINUED….

First …..Run "2010 Base Year" Scenario

Base Year Input

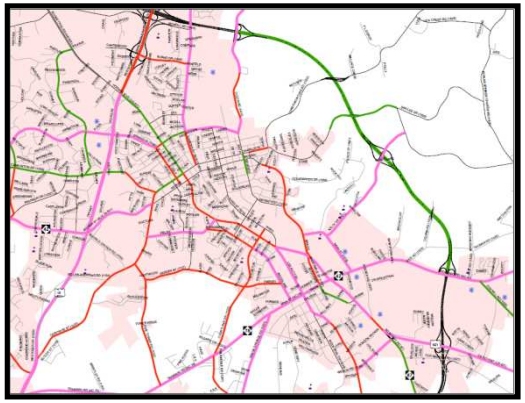
Existing Roads
Lanes,
Lane widths,
Shoulder widths,
Speeds,
Facility Type,

Capacity

Population,
Housing,
Employment

Location – Census Data

Load Current
Count Data



Model Output Highlights Deficiencies
By Degree:
Not Near Capacity,
Near Capacity, Over Capacity

**********Calibration**********

Is Result Consistent With Observed?

Approval MCTC and Local Boards

EXPECTED OUTPUT....CONTINUED

Second.....Run "2040 NO BUILD" Scenario.

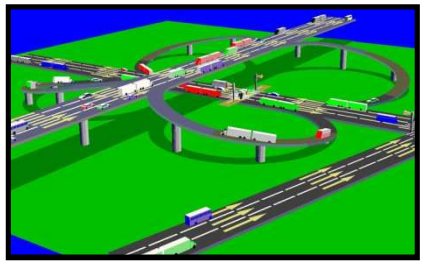
Future Year Input

Roadways added,
Lanes, Lane Width,
Shoulder Width,
Speeds, Facility Type
Developments Permitted
(or committed)

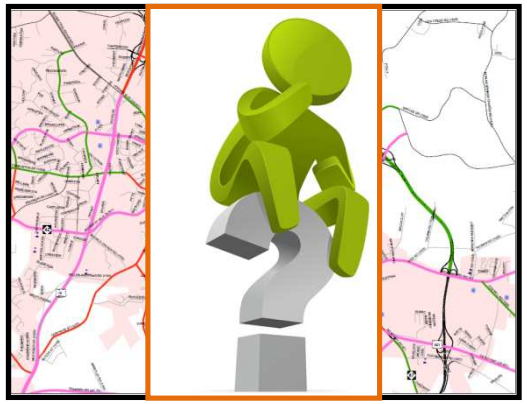
Capacity

Future Population Totals
Future Households and Where
Future Employment Data

Location = Land Use Plan



Only Improve Network
By Approved Plans Plus
Committed



How Will Future Land Use
Plans Impact Infrastructure?

The Model Can Provide Likely
Outcomes.

Test drive your land use plan.

Then, We Ask, "What Changes Do We Need to Make to Balance Local Priorities With Travel Demand Needs in the Area to *Accommodate Future Traffic*."

And Decision Makers Can Begin To Use The Model As A Tool To Plan For The Future.

Purpose of the Travel Demand Model is ….

…To Help Decision Makers See What the Future May Hold.
Is it absolute? *Nope*!
BUT IT IS A GOOD WAY TO ESTIMATE PROBABLE OUTCOMES.

Have you ever turned to one of WRAL Computer Models for storm tracking?

Travel Demand Model analysis is performed to assist decision makers in making informed transportation planning decisions.

The strength of modern travel demand forecasting is the ability to ask critical “what if” questions about proposed plans and policies.

What is a Travel Demand Model?

- It is just **ONE** of the tools used in the analysis of transportation systems . Key word being **System**.
- It can be used to help forecast travel characteristics in the future at various planning levels: local, regional, and statewide.
- It is a mathematical approach to understanding how changes in land use, population, and area employment will impact the transportation system.
- It is a way to measure the future impacts of growth and development by examining the limits of the existing infrastructure.

What a Travel Demand Model is Not….

A Traffic Impact Analysis.

Traffic Impact Analyses (TIAs):

- Also help forecast impacts of growth and development.
- Refined scale: intersection level, Level of Service, number of lanes, number of turn lanes, traffic signal phasing, cycle lengths, and signal system timing.
- Help determine pre- and post- conditions of a roadway's Level of Service in the consideration of new development.

But, TDMs and TIAs share some of the same data. TDMs can be used to develop a similar tool.

A TDM should not be considered an exact measure of future traffic volumes.

Building A Travel Demand Model

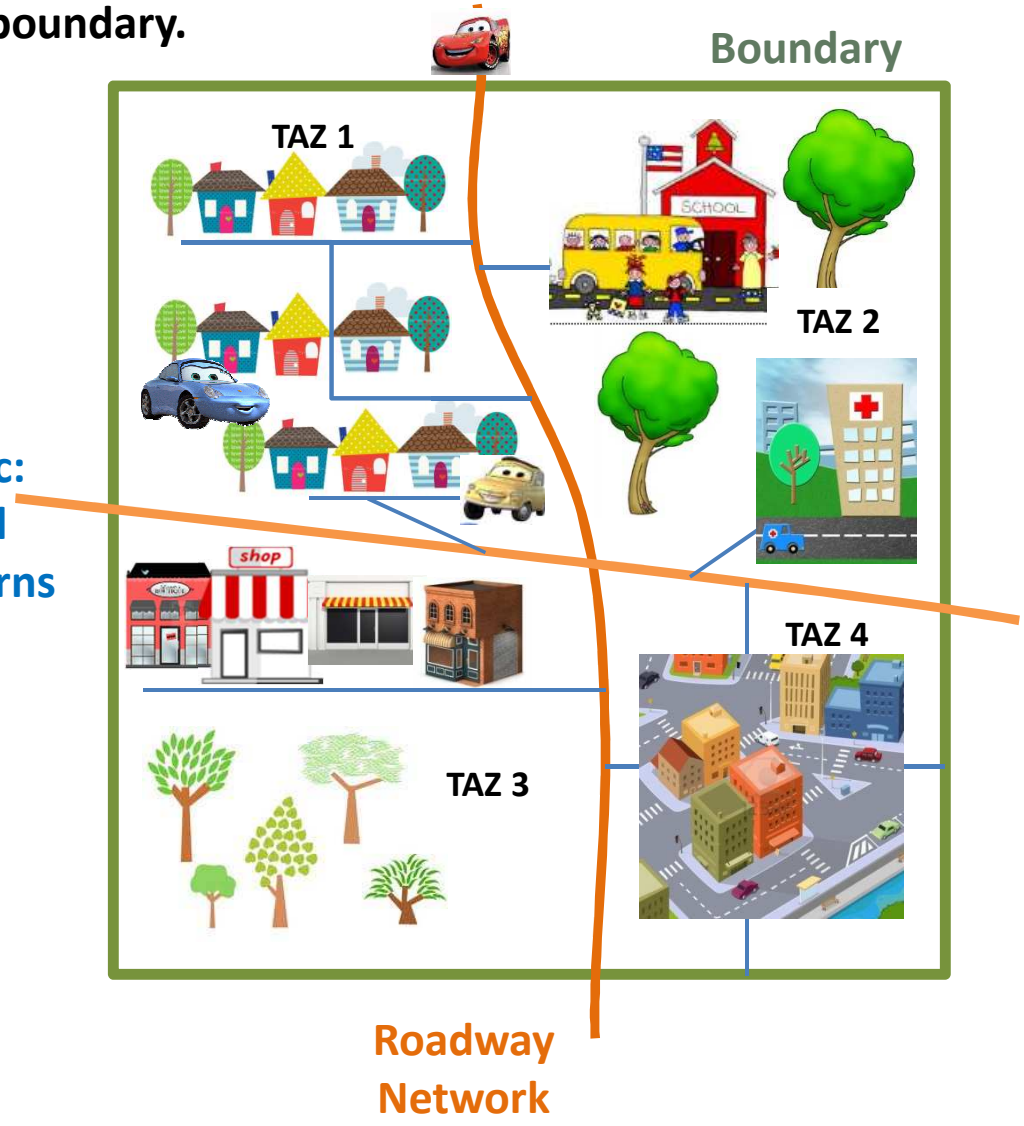
The Foundation – Network and Data

1. Define a study area using a boundary.

2. Apply the major roads within and passing through the area: all NC and US routes plus heavily or key local routes.

3. Input Census and local data about population, employment, and travel patterns.

4. Divide study area into smaller areas for closer study called <u>Traffic Analysis Zones</u> or TAZs.



How A Travel Demand Model Works

Modeling 101 – The Basics

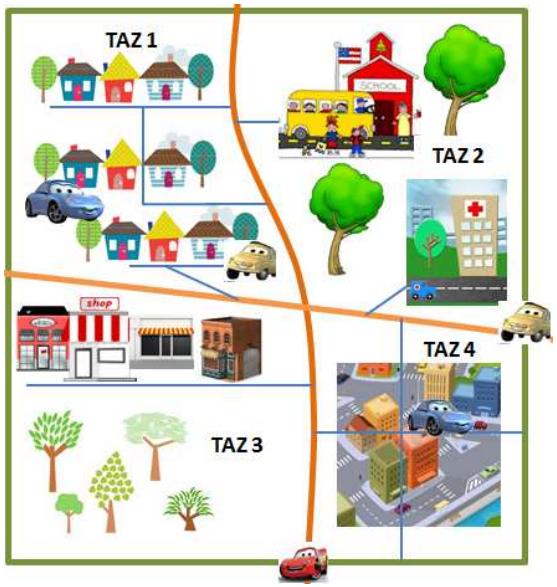
Trip Generation →	Number of trips created by a site.
Trip Distribution →	Where the trips go on the NETWORK.
Mode Choice →	Division of trips by transportation type.
Trip Assignment →	Prediction of the routes taken.

Travel Patterns and User Characteristics

How people move from place to place on the network.

From where they live….

…to where they find services.

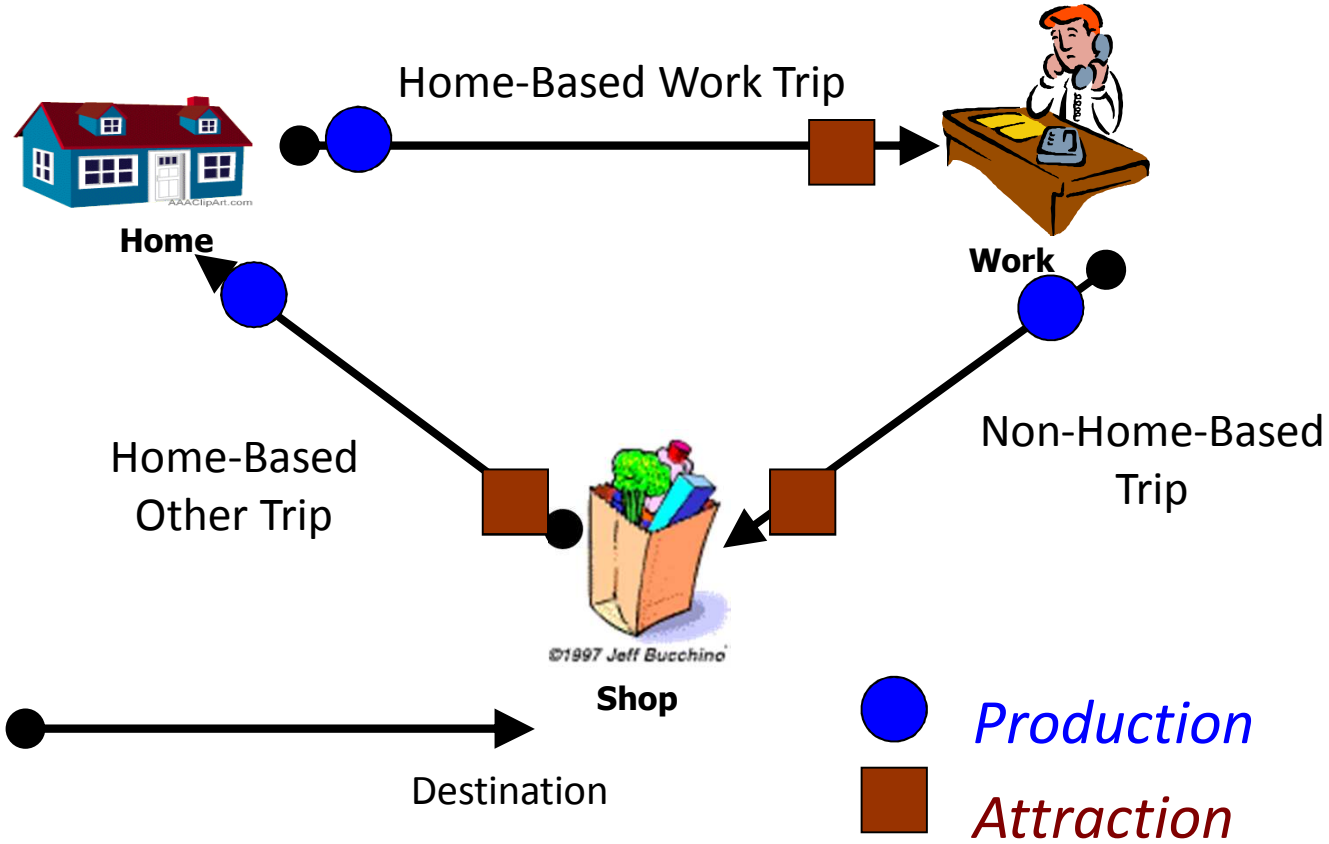


…to where they shop and play.

…to where they work.

Model Simplifies Movement of People To Specific Types of Trips…

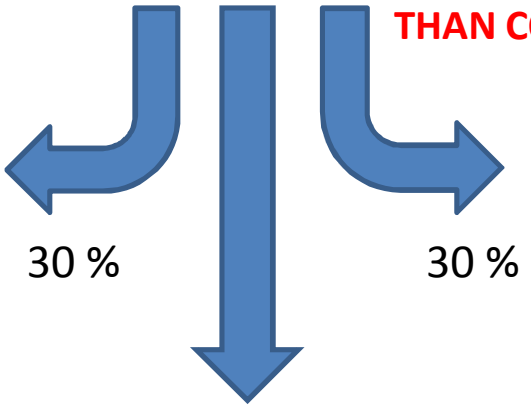
(Estimate of an Average Weekday for Most People)



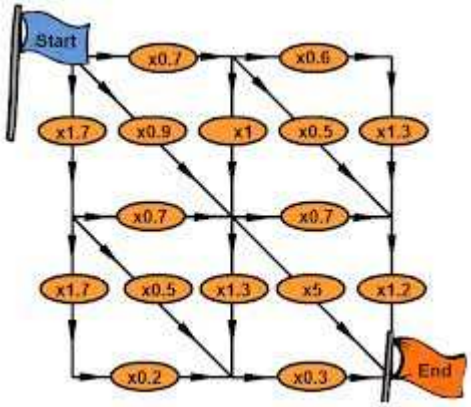
…AND PROVIDES INSIGHT TO HOW THE AREA'S TRANSPORTATION SYSTEM WILL BE AFFECTED BY EXPECTED GROWTH AND CHANGES IN EMPLOYMENT AND/OR LANDUSE.

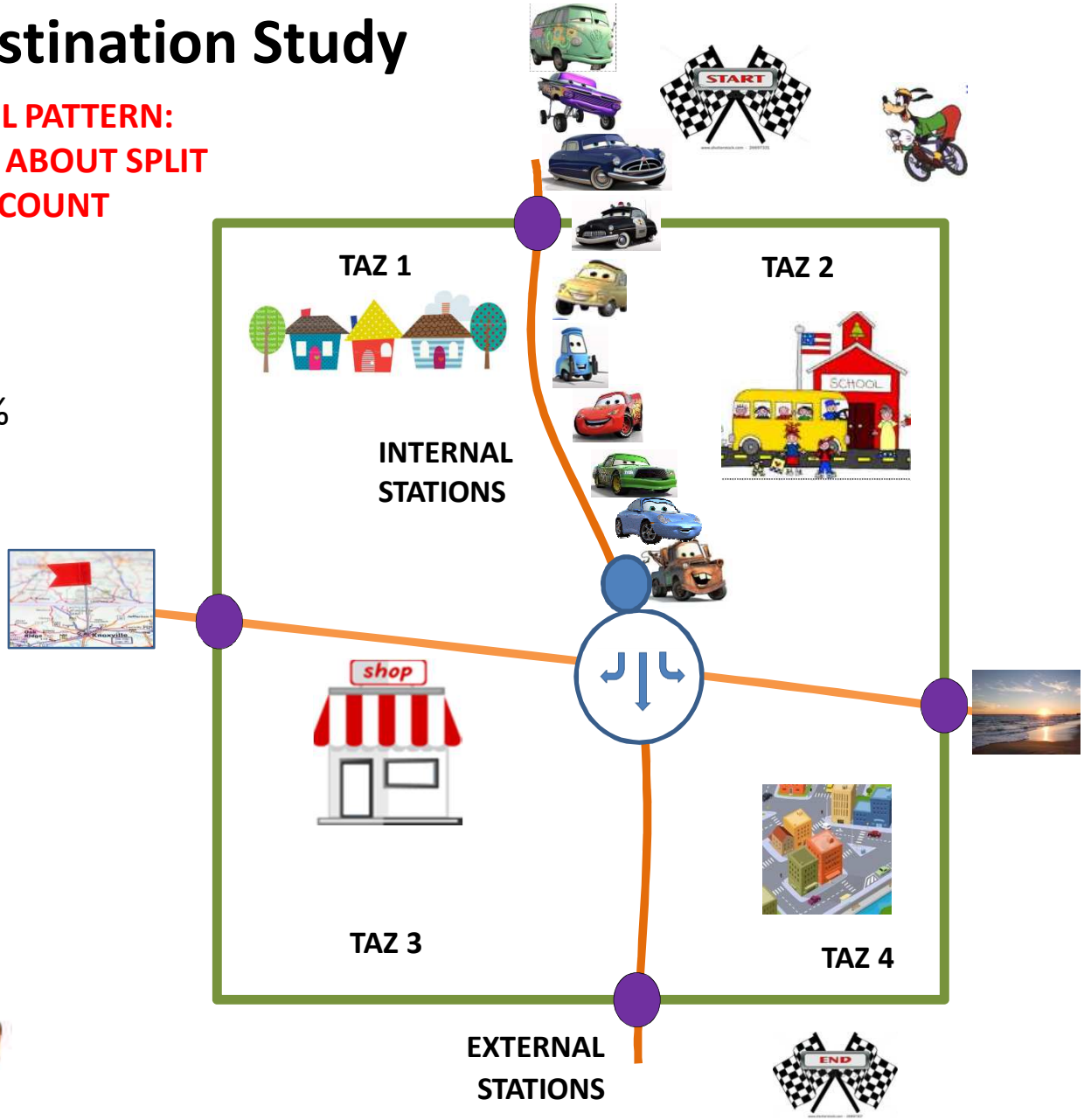
Origin and Destination Study

TRAVEL PATTERN:
MORE ABOUT SPLIT THAN COUNT



TRIP ASSIGNMENT





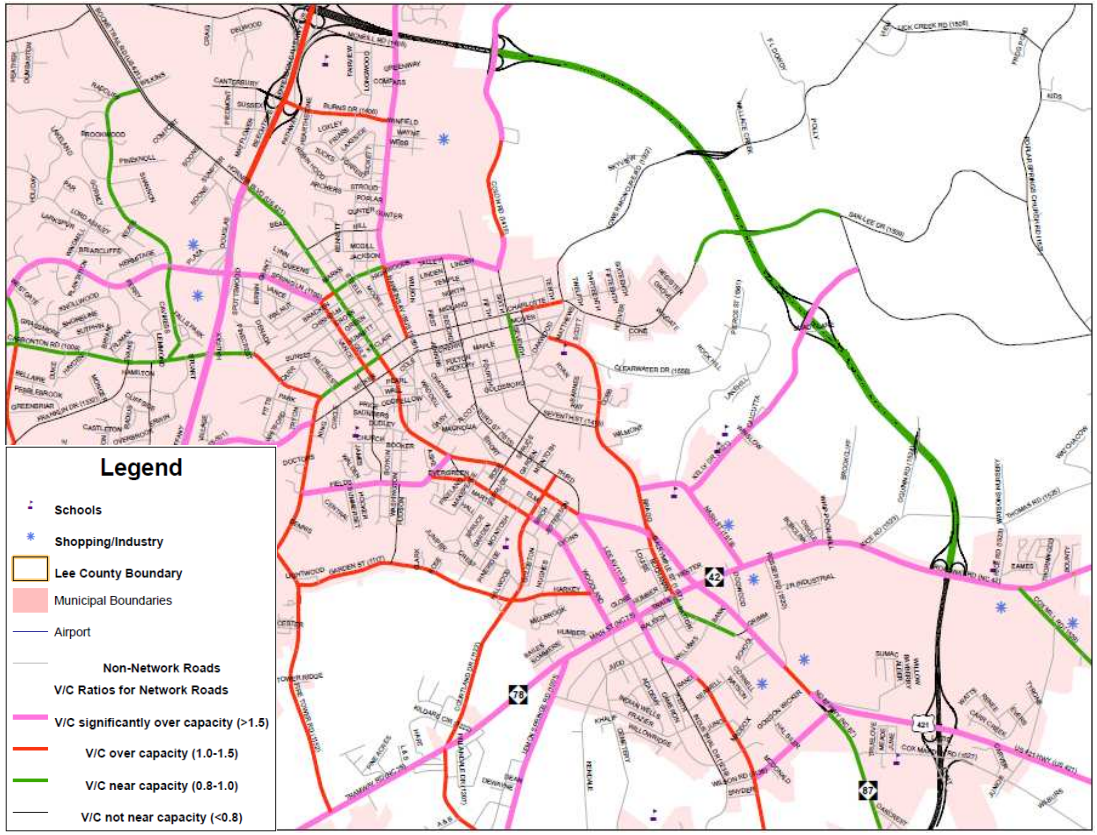
Output from the Model

BASE YEAR: 2010

- Calibrating the Model

FUTURE YEAR: 2040

- Future Capacity Deficiencies
- Scenario Testing
- Improvements to Existing
- Impacts of New Routes
- Classification of Routes
- Number of Lanes
- Air Quality
- Vehicle Miles Traveled



Example: 2035 Capacity Deficiencies Map - Lee County **(See Handout)**

http://www.ncdot.gov/doh/preconstruct/tpb/PDF/LeeCo_CapDef_2035_Aug172006_poster.pdf

Milestones Going Forward for O & D Study and Model Development

1. Data Collection is a Collaborative Process

Target : November 14th Employment Data Returned to NCDOT.

Final Municipal Submittal December 14, 2012.

Socio-economic data (population, household, employment, area data)

A. **PB** - Population and Household
B. **TARPO, Local planning staff, NCDOT** - Employment, School, Hospital, Military data
C. **MCTC, local planning staff, local county and municipal Boards** – Endorsement

FAQ's about tasks undertaken: county, municipal, RPO, and NCDOT Teaming Effort

- **INFO USA database included over 3835 employers in Moore County,**
- **Employers with over 20 employees were called. Establishments with 15-20 employees spot checked.**
- **Addresses verified and mapped.**
- **NCDOT, municipal, and county data complied and sent to PB January 8, 2013.**

Milestones Going Forward
O & D Study and Model Development

2. Origin and Destination (O&D) Study Results

Target: By the End of January

Shift due to SE submittals and holidays

A. Next MCTC Meeting –

- **Is March 13th available for MCTC?**
- **Will Need to Be a Workshop Format**
- **Recommend Extending Hours**

B. Results of O&D Study

- **PB's Development of the Moore County Model**
- **O&D Results**

—Building 2040 Moore County Workshop

Milestones Going Forward for O & D Study and Model Development

3. Base year data and results

Target: By the End of March

Shifts to the End of April

A. **MCTC meeting**

B. **PB to 2010 present base year data and results**

C. **MCTC, local planning staff, local county and municipal Boards**

4. Future year data and results

Target: By the Middle of April

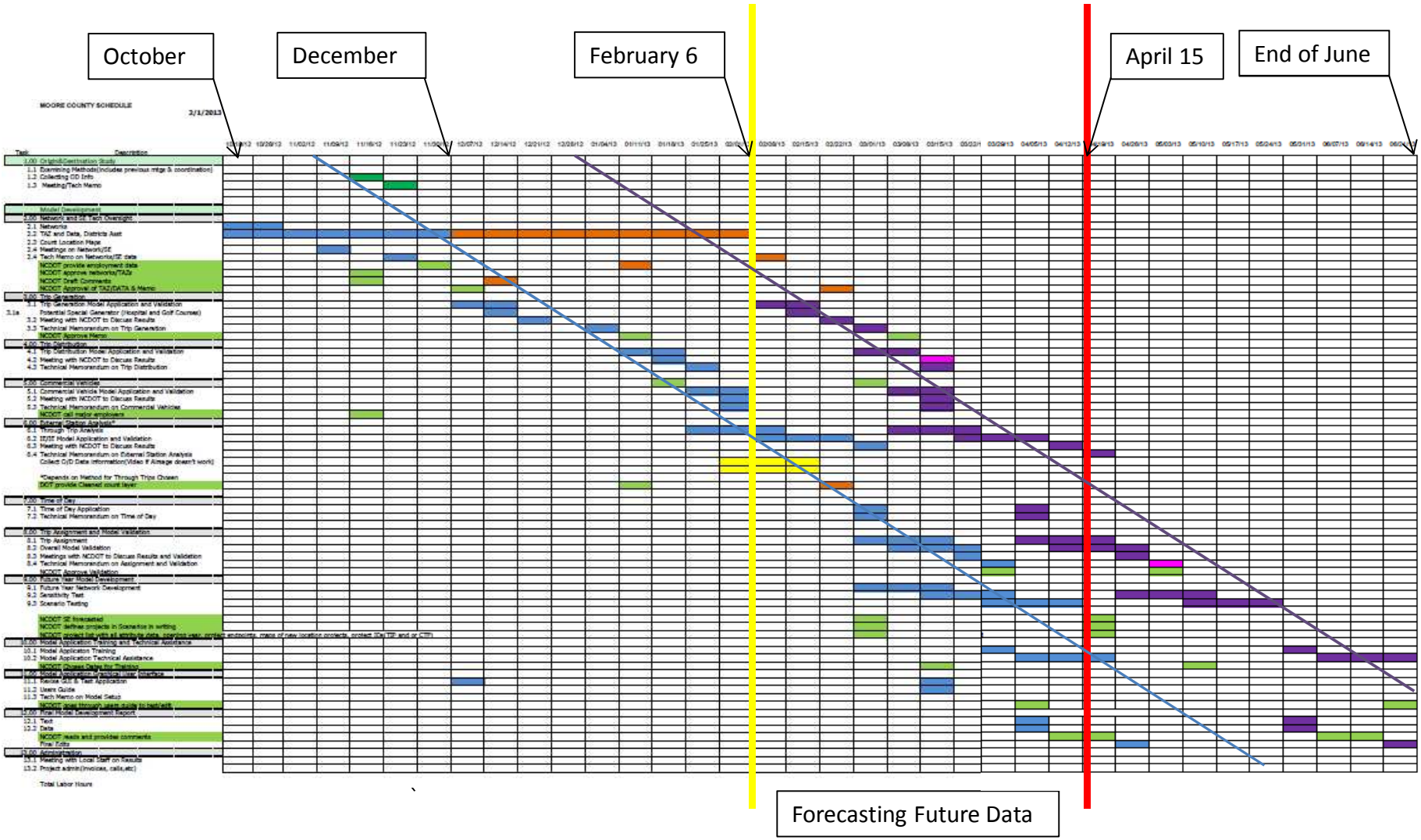
This Depends on MCTC Agreement For Future SE Data

A. **MCTC Meeting**

B. **PB to present 2040 No Build**

C. **MCTC and local planning staff to advise NCDOT on next steps**

Project Scope and Time Line – Time is of the Essence



Where We Are…..

PARSONS BRINCKERHOFF

MODEL UPDATE

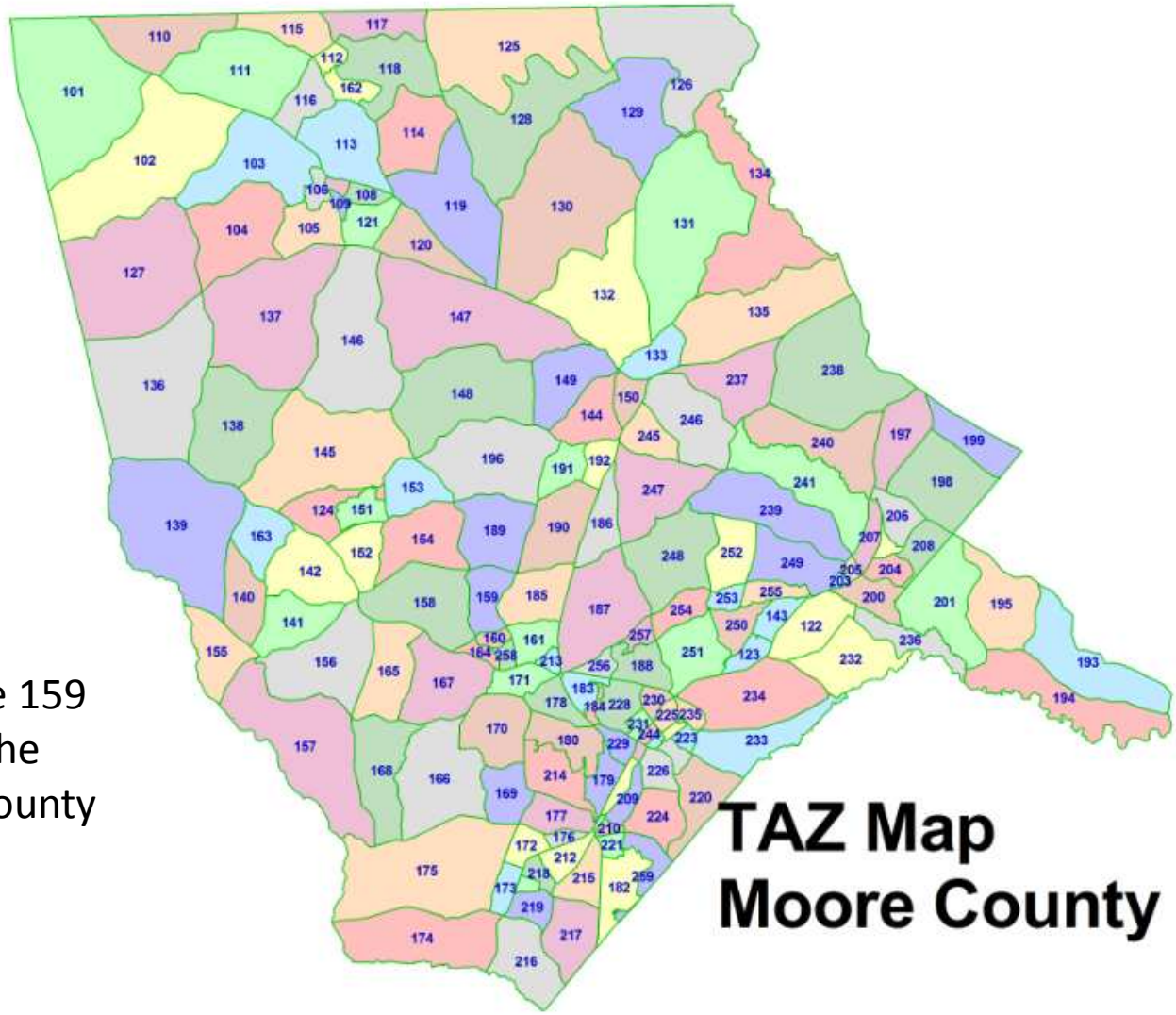
1. **Working with PB on O & D Study Methodology.**
   - Optimal survey methods given construction concerns
   - Cell phone technology much higher rate of capture - AirSage
   - Need to validate rate of success against existing, calibrated model.
   - Adjustment period encountered for transition existing algorithms applications in rural areas. **External to External Stations ONLY**

   Test Data was processed over the weekend 2/2-3/2013. Outputs will enter validation process this week by both PB and AirSage.

2. **Model development**
   - Waiting for Airsage/PB to provide validation for External Station Links
   - Network cleaned,
   - Existing Population, Housing and Employment Loaded
   - Working on Distribution which includes O & D Study Information (March 13th).

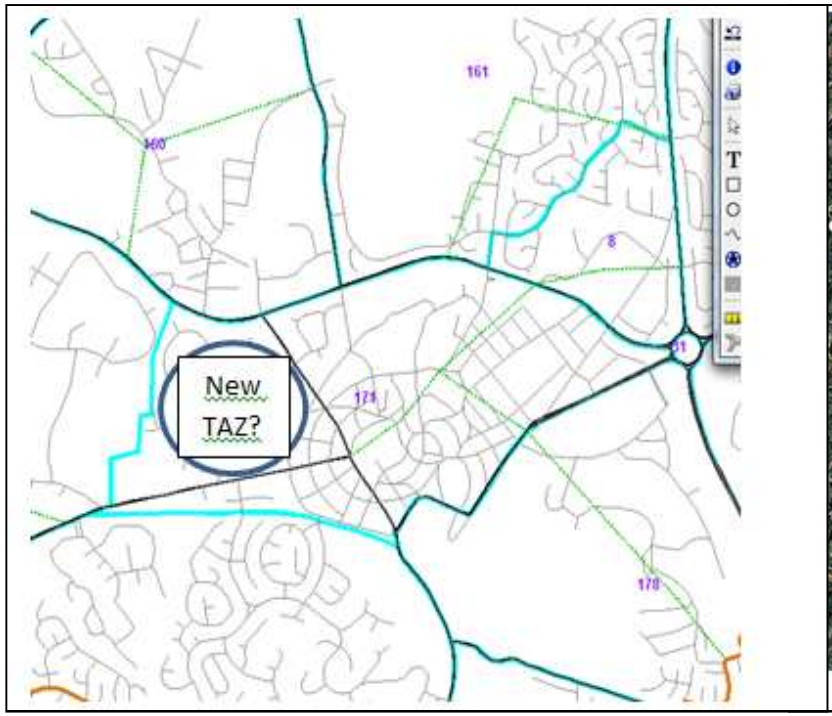
Work Accomplished…..

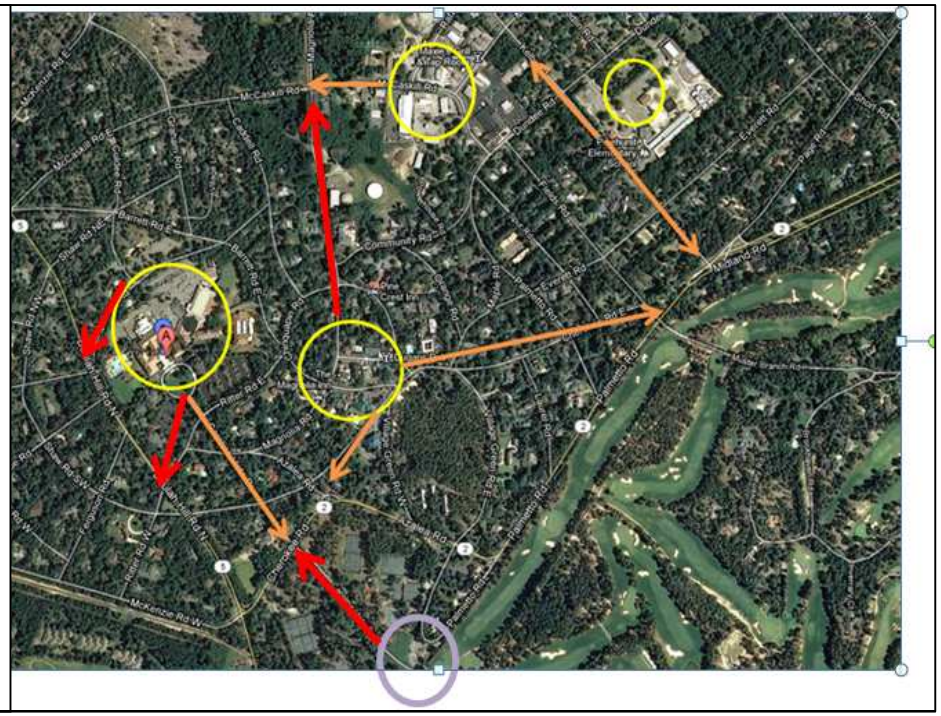
1. Traffic Analysis Zones Finalized



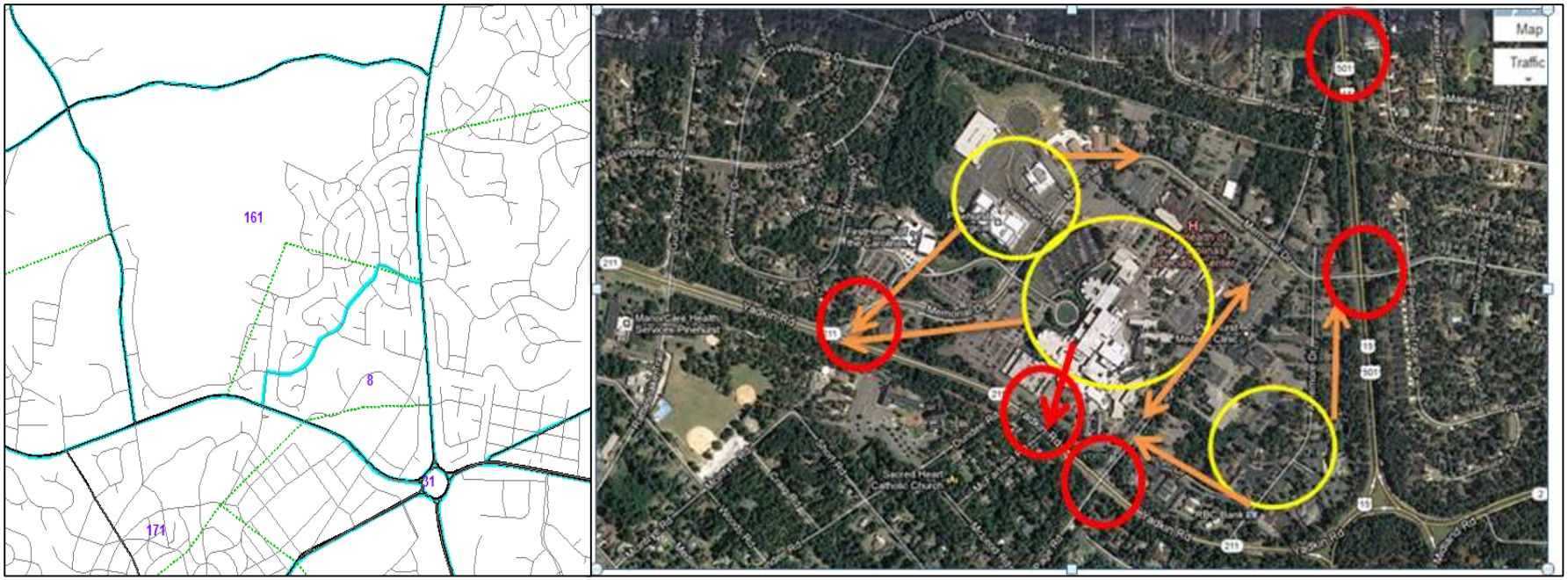
There are 159 TAZ's in the Moore County Model.

What Was Involved
In Providing Review and Comments to Consultant?

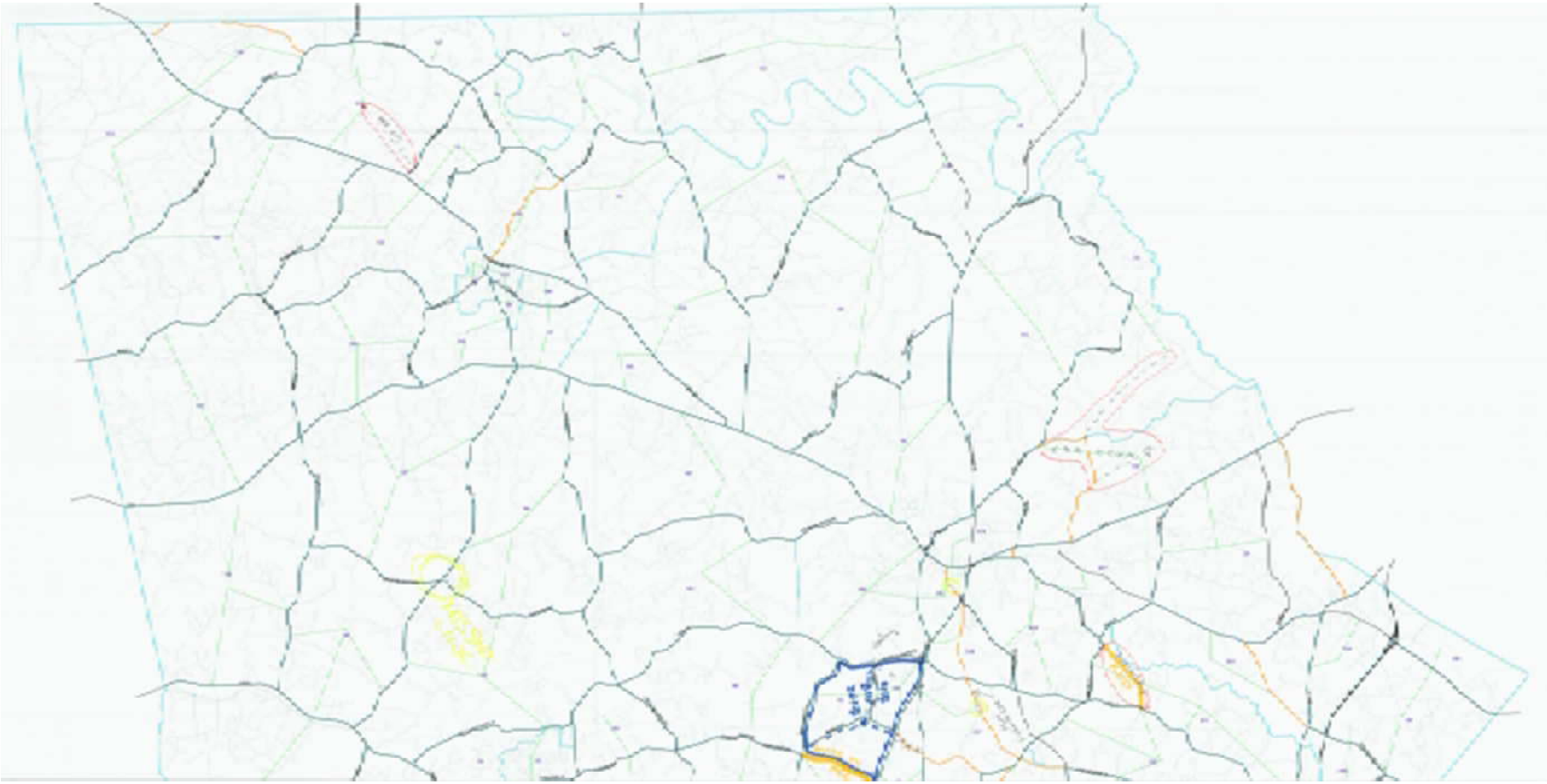




Review of Consultant's TAZs – Collaborative Process
RPO, County input, and NCDOT



Comments on Northern Moore County TAZs

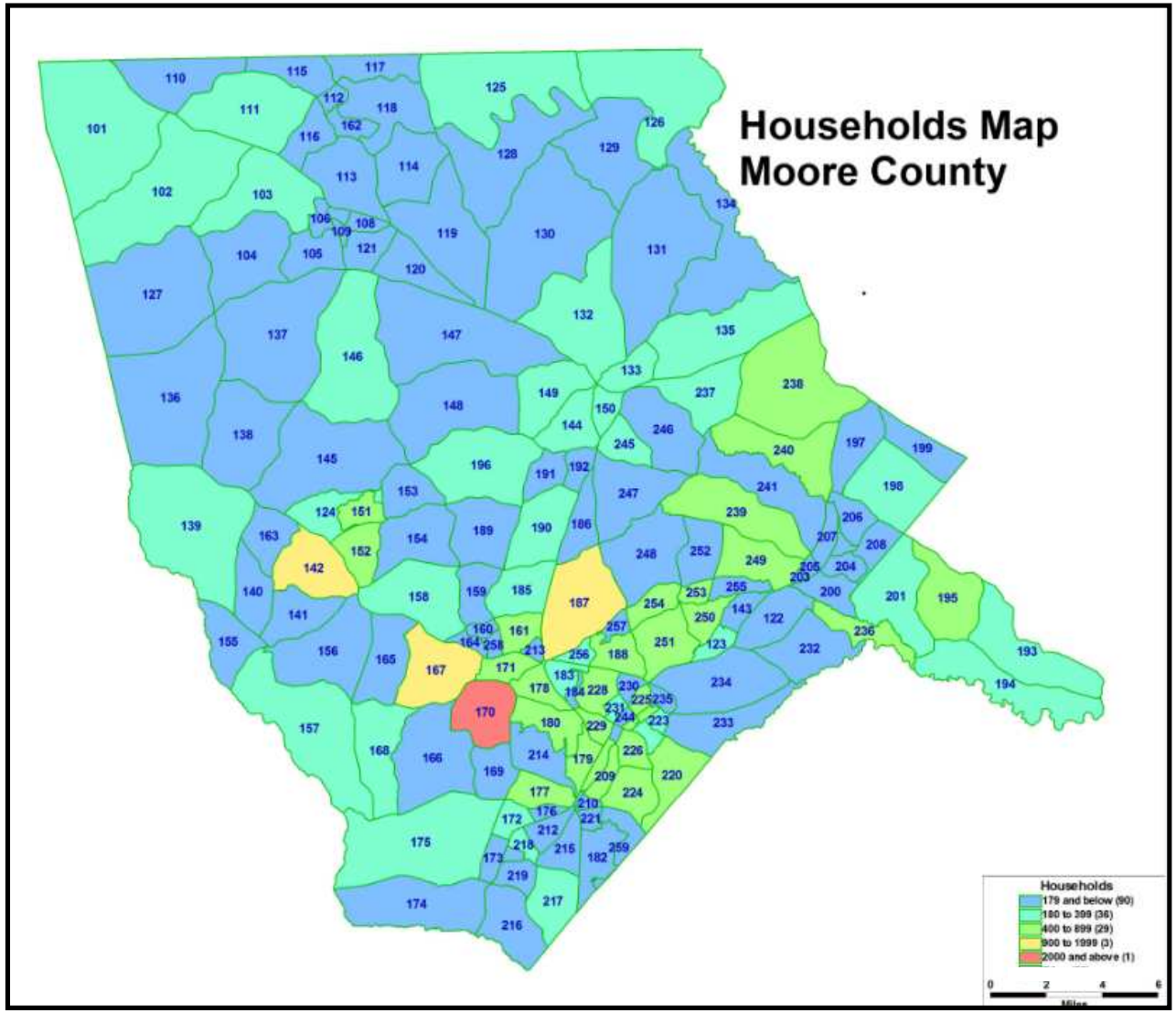


Comments on Southern Moore County TAZs

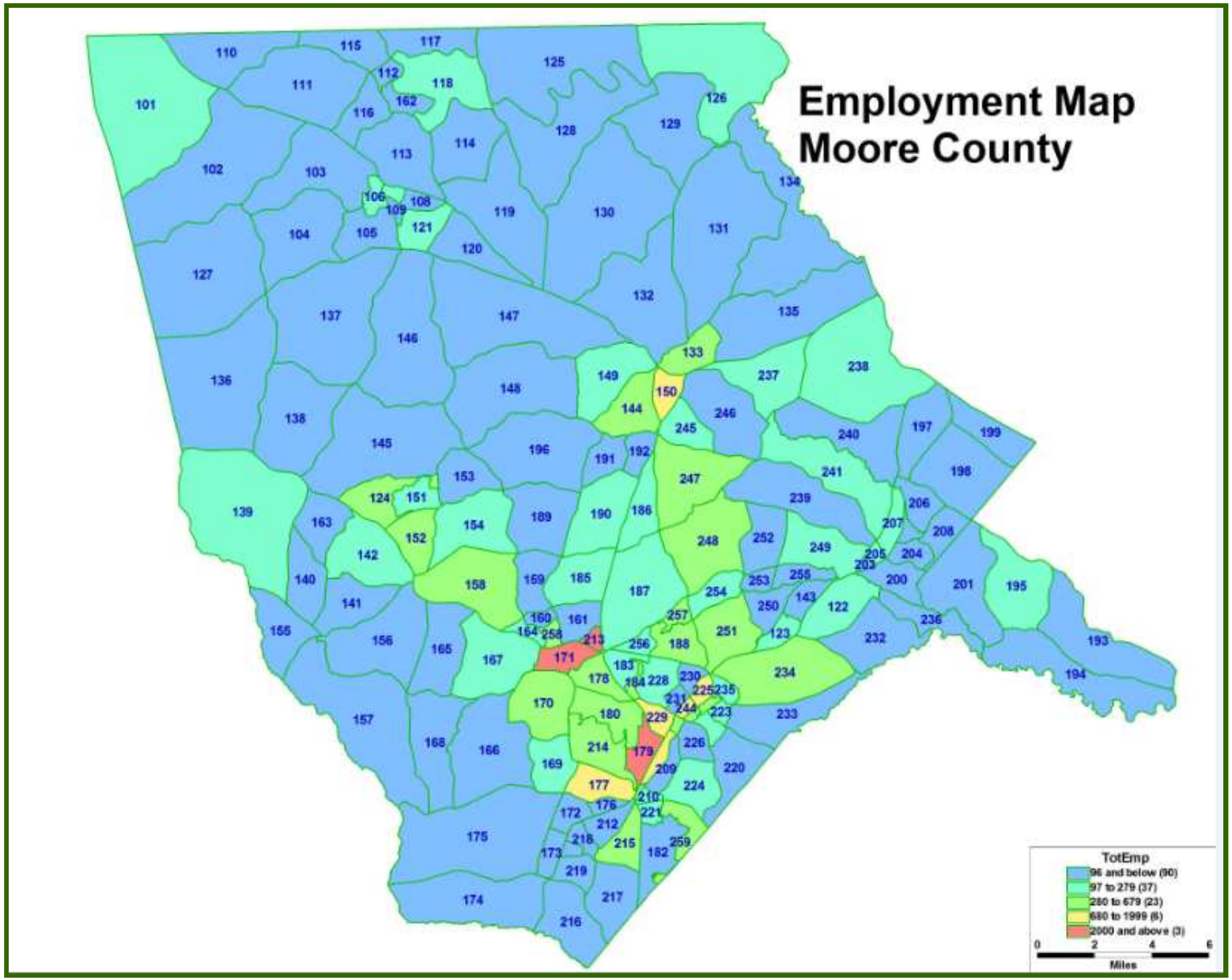
Additional Comments TAZs

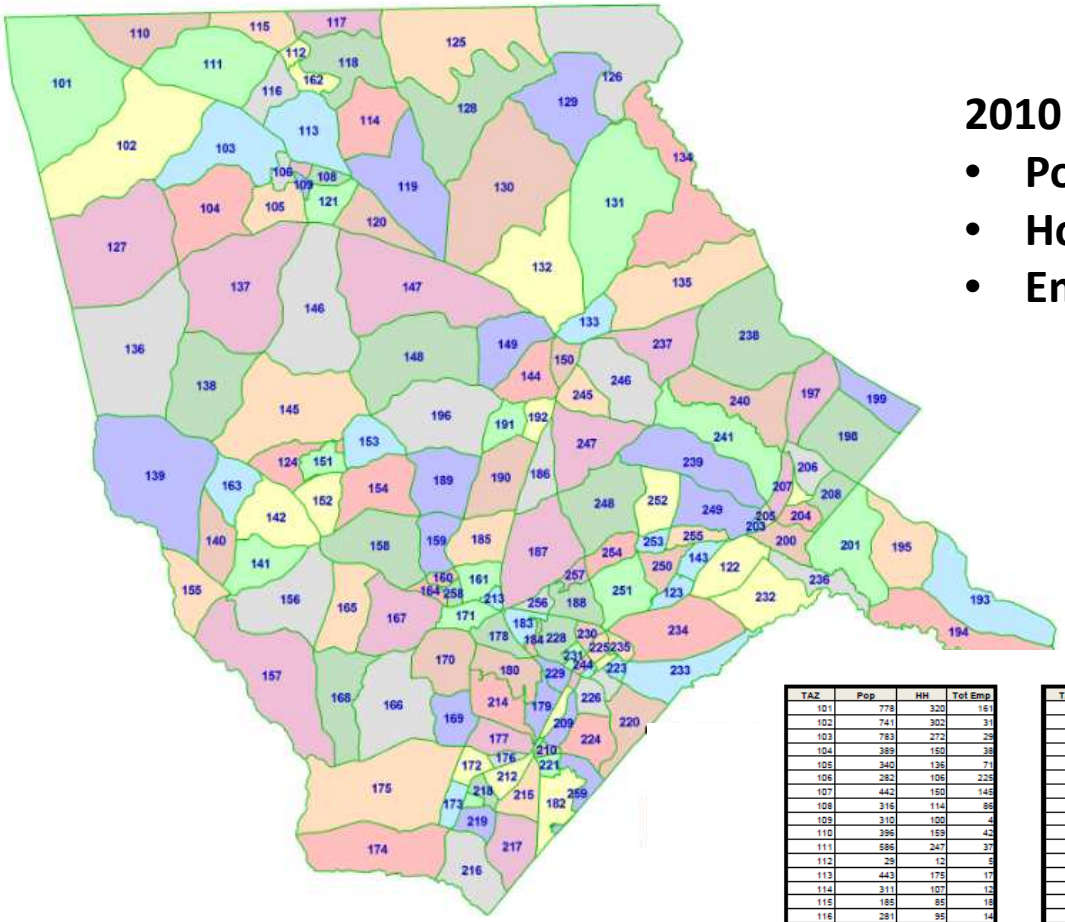
Work Accomplished…..continued

2. 2010 Census Data – Population, # of Households, Employment Data cleaned, compiled, mapped, and loaded into the model.



Work Accomplished…..continued





2010 Base Year Census Data

- **Population**
- **Households**
- **Employment**

Moore County Travel Demand Model

County Traffic Analysis Zones

Moore County
SE Data by TAZ

TAZ	Pop	HH	Tot Emp
101	778	320	161
102	741	302	31
103	783	272	29
104	389	150	38
105	340	136	71
106	282	106	225
107	442	150	145
108	316	114	86
109	310	100	4
110	396	159	42
111	586	247	37
112	29	12	5
113	443	175	17
114	311	107	12
115	185	85	18
116	281	95	14
117	164	71	12
118	222	98	241
119	301	116	1
120	285	112	11
121	327	119	99
122	392	146	119
123	428	198	211
124	631	259	459
125	547	228	19
126	738	323	135
127	445	172	15
128	437	165	19
129	85	40	0
130	234	94	5
131	196	77	7
132	620	248	42
133	436	208	415
134	304	130	11
135	805	310	46
136	324	138	21
137	404	159	34
138	393	140	38
139	428	182	200
140	150	56	4
141	199	78	46
142	2132	905	200
143	291	112	9

TAZ	Pop	HH	Tot Emp
144	509	252	433
145	458	172	32
146	620	225	36
147	347	139	22
148	150	63	6
149	455	188	170
150	619	219	1058
151	1498	617	192
152	913	423	377
153	54	24	0
154	245	104	117
155	107	39	3
156	267	98	18
157	827	375	76
158	602	238	314
159	301	118	62
160	308	133	18
161	1832	750	27
162	45	19	0
163	211	68	7
164	115	59	158
165	71	27	10
166	412	166	11
167	1927	900	213
168	445	200	20
169	466	177	205
170	4542	2090	424
171	1332	601	2497
172	949	344	21
173	221	93	70
174	17	8	0
175	436	186	14
176	102	48	58
177	1297	548	686
178	823	489	455
179	1437	599	3213
180	1649	781	562
181	134	60	41
182	167	66	12
183	698	306	139
184	49	26	507
185	577	219	113
186	264	102	214

TAZ	Pop	HH	Tot Emp
187	2939	1349	213
188	1142	577	377
189	295	114	25
190	503	200	111
191	143	61	10
192	206	74	3
193	609	225	15
194	1029	384	7
195	1271	560	157
196	448	199	41
197	375	156	86
198	552	190	45
199	127	44	3
200	225	87	29
201	476	187	86
202	4	2	0
203	99	31	92
204	108	47	6
205	161	66	100
206	47	21	7
207	106	49	157
208	113	44	3
209	997	483	28
210	423	171	205
211	38	16	331
212	159	59	82
213	431	168	2923
214	273	119	423
215	197	74	362
216	371	156	38
217	665	245	5
218	526	202	51
219	167	68	68
220	1380	527	65
221	440	169	171
222	1310	690	773
223	487	291	221
224	1162	444	120
225	1076	565	1030
226	1052	462	45
227	170	111	284
228	1303	650	223
229	1248	580	1202

TAZ	Pop	HH	Tot Emp
230	344	145	47
231	803	306	89
232	328	134	15
233	360	164	4
234	245	124	613
235	440	169	97
236	1310	690	1
237	487	291	251
238	1162	444	150
239	1076	565	83
240	1052	462	28
241	170	111	182
242	1303	650	310
243	1248	580	348
244	344	145	858
245	803	306	115
246	328	134	83
247	360	164	323
248	245	124	294
249	1162	444	101
250	1076	565	13
251	1052	462	374
252	170	111	11
253	1303	650	0
254	1248	580	130
255	344	145	0
256	803	306	99
257	328	134	383
258	360	164	403
259	245	124	338

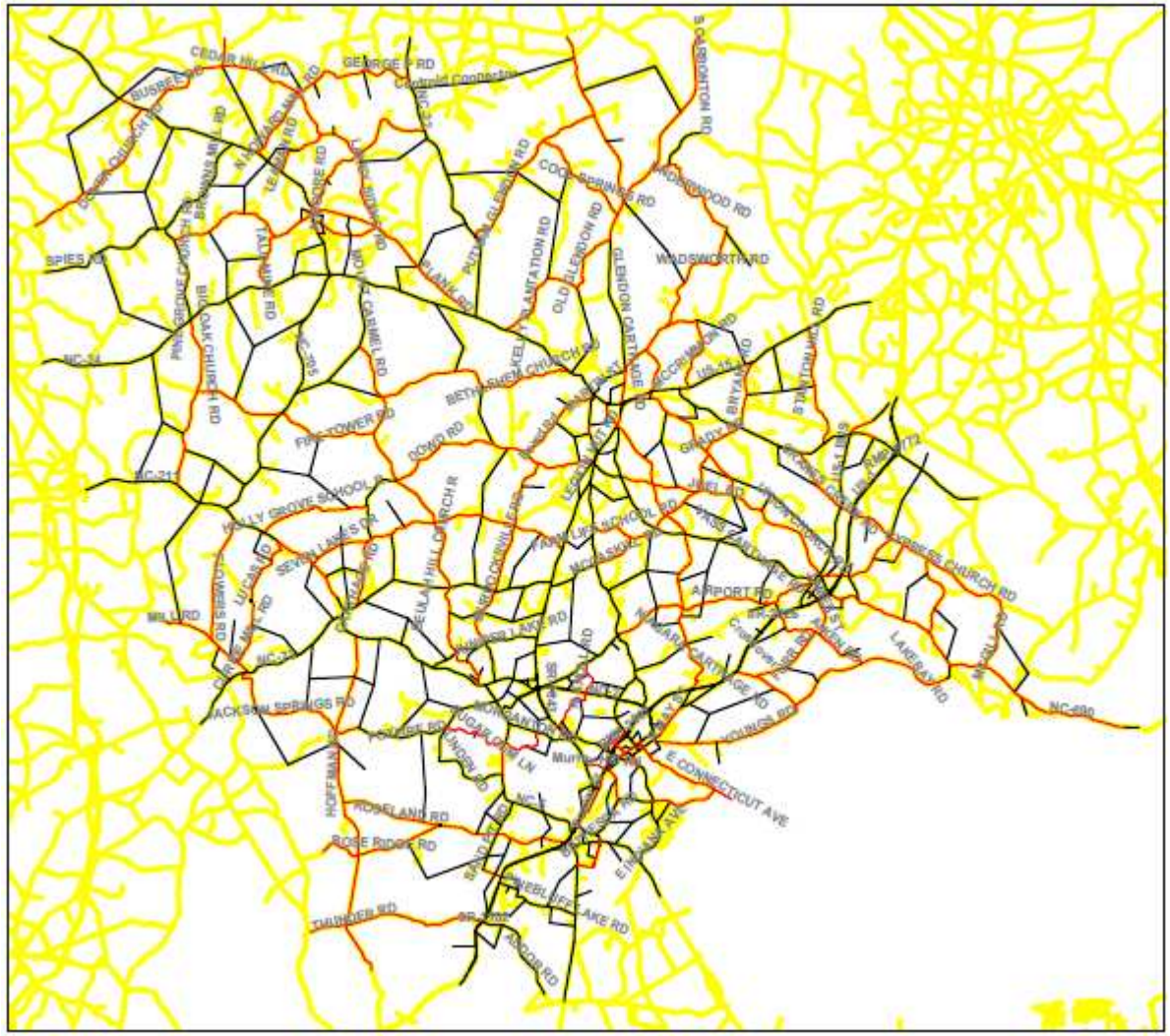
Work Ahead…..

1. Roadway Characteristics
   - Speed Limits
   - Number of Lanes
   - Lane Width
   - Shoulder width
   - Facility Type

2. Red Represents Data
   2B Checked

These are the factors that impact capacity

NCDOT - IN PROGRESS



Done

Study Area

Network

TAZs

Done

2010 Base Year Census Data

- Population
- Households
- Employment

In Progress

Roadway Characteristics

Guess What's Next…

Forecasting SE Data Through Study Year 2040

Next, We Have To Repeat the Process for 2040
That's where the MCTC Comes in…Now It is Your Turn!

Disclaimer:

The Following Steps Show What We Have to Accomplish Together As a Team
It May Seem Like a Pretty Steep Mountain to Climb…
Don't Worry, I HAVE A PLAN! There's an NCDOT procedure for that…..
And You have the best teammates in the state of North Carolina!

Ok, Here's the "To Do" List …….

Step 1. Population – Control Totals

How much will you grow and where?

- Population – Totals by TAZ
- Households – Types and #'s by TAZ

— 1 Person HH
— 2 Person HH
— 3 Person HH
— 4 Person HH
— 5+ Person HH

This can be made easier by maintaining the same breakdown by percentage that exists in Base Year, but this too can be adjusted as the MCTC.

Next on the List is to Repeat the process for 2040 That's where the MCTC Comes in…Now It is Your Turn!

Step 2. Employment – Control Totals

How many jobs by 2040 will Moore County create? What type? And where?

Employment – Totals by TAZ

- Employment – Types
  - Retail
  - High Retail (high turn over labor)
  - Industry
  - Service
  - Special Generators (Hospitals, Resorts)

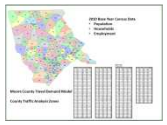
This part may take a little Exercise! Workshop, That Is… March 13th – Round 1

Plan A – NCDOT Standard Methodology

<u>Let's Go Back to The Point Where It Looked Simple</u>

And let's think about this diagram as Moore County

If we already know the current SE data in each TAZ.

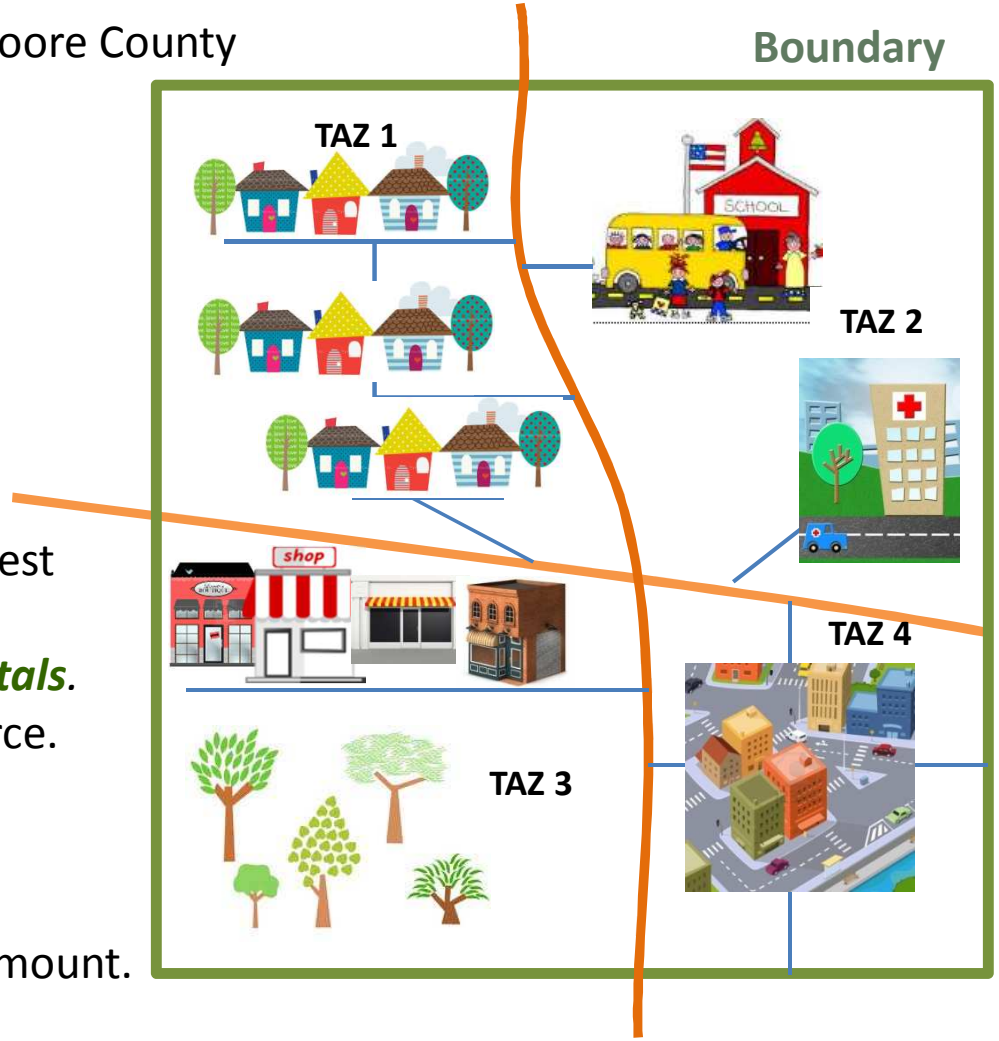


Then the only thing we really have to decide is how much each category grows in each TAZ.

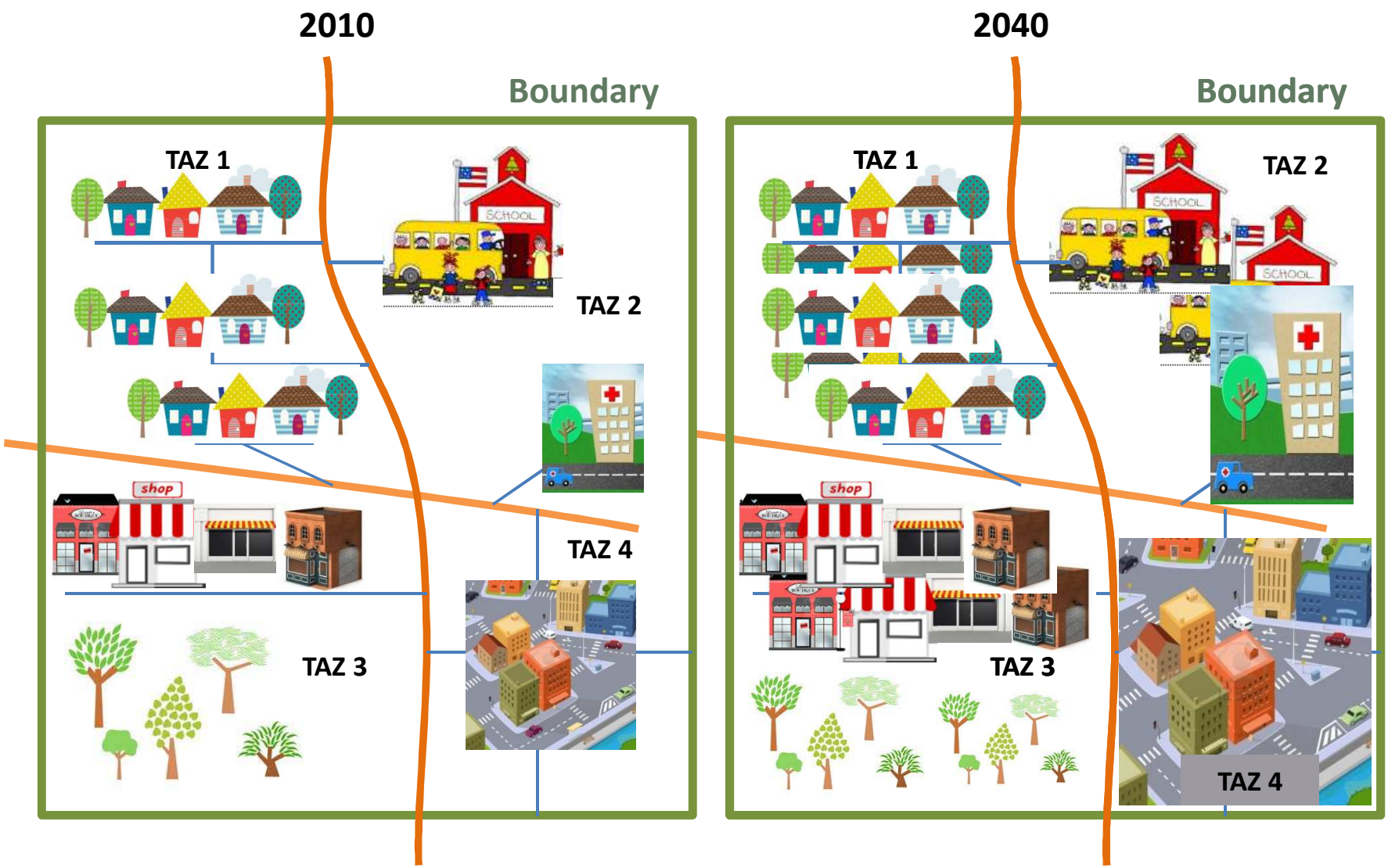
Let's start with Population…it's the easiest of the two.
We do need some decide on control totals.
Census projections are a good first source.

Start with percent growth in each area:

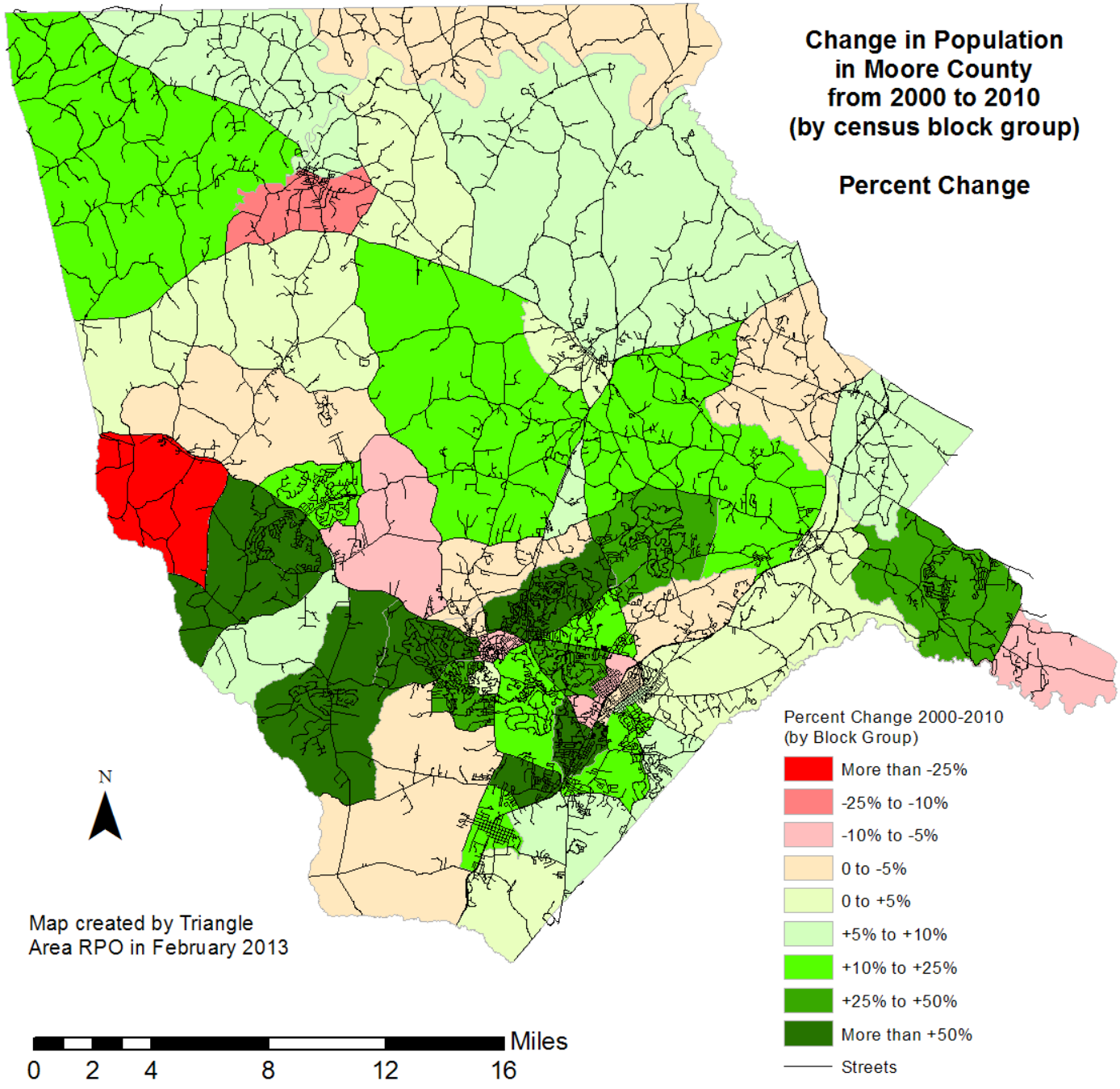
- Some TAZ's may lose population.
- Some TAZ's may only grow a small amount.
- Others TAZ's may BOOM!
- Distribute control totals by percent growth in each area.



The Plan – NCDOT Standard



Let's look at Moore County From 2000 to 2010 – Take it Away Matt!

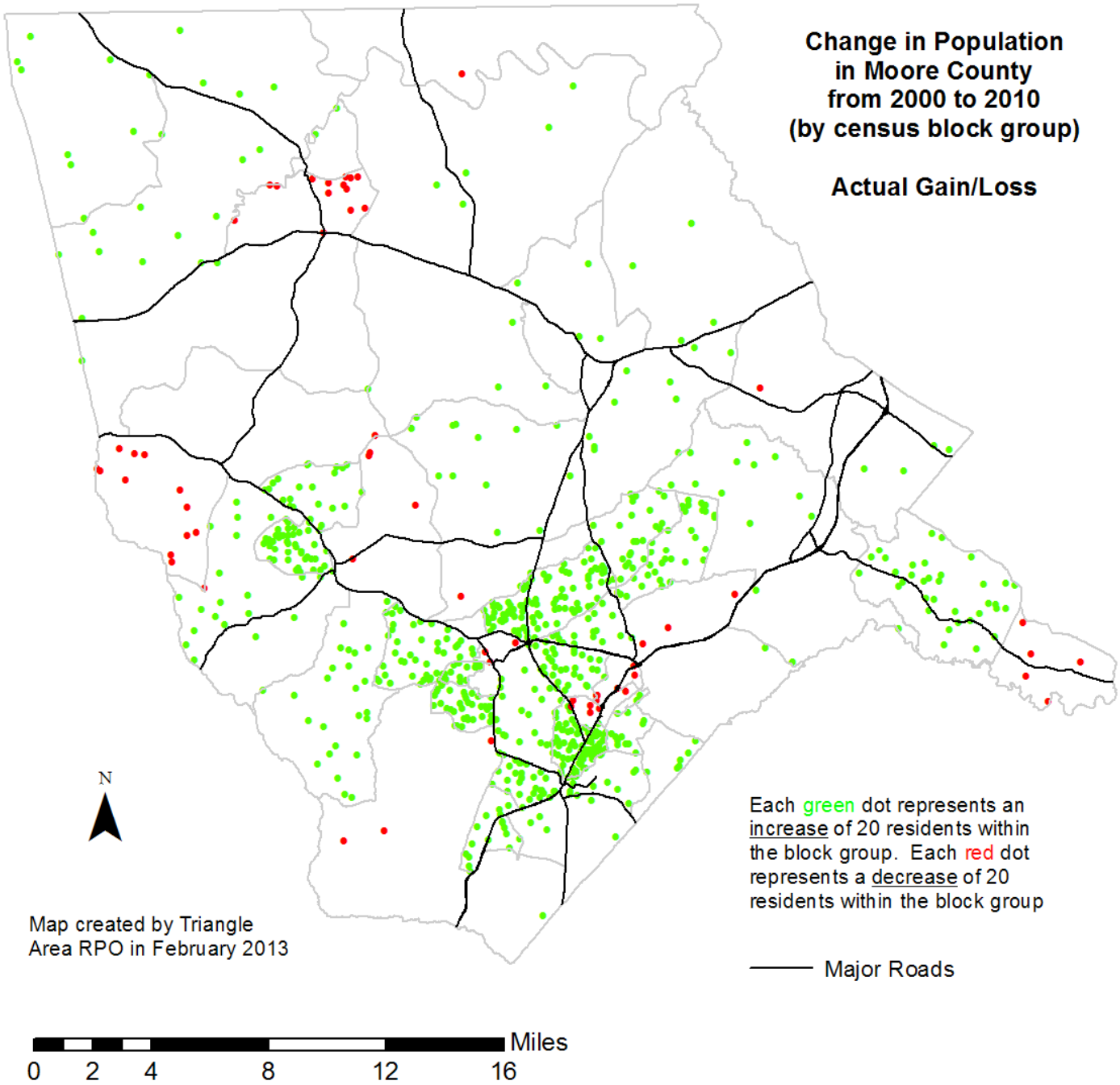


2000 Population of Moore County: 74,771

2010 Population of Moore County: 88,247

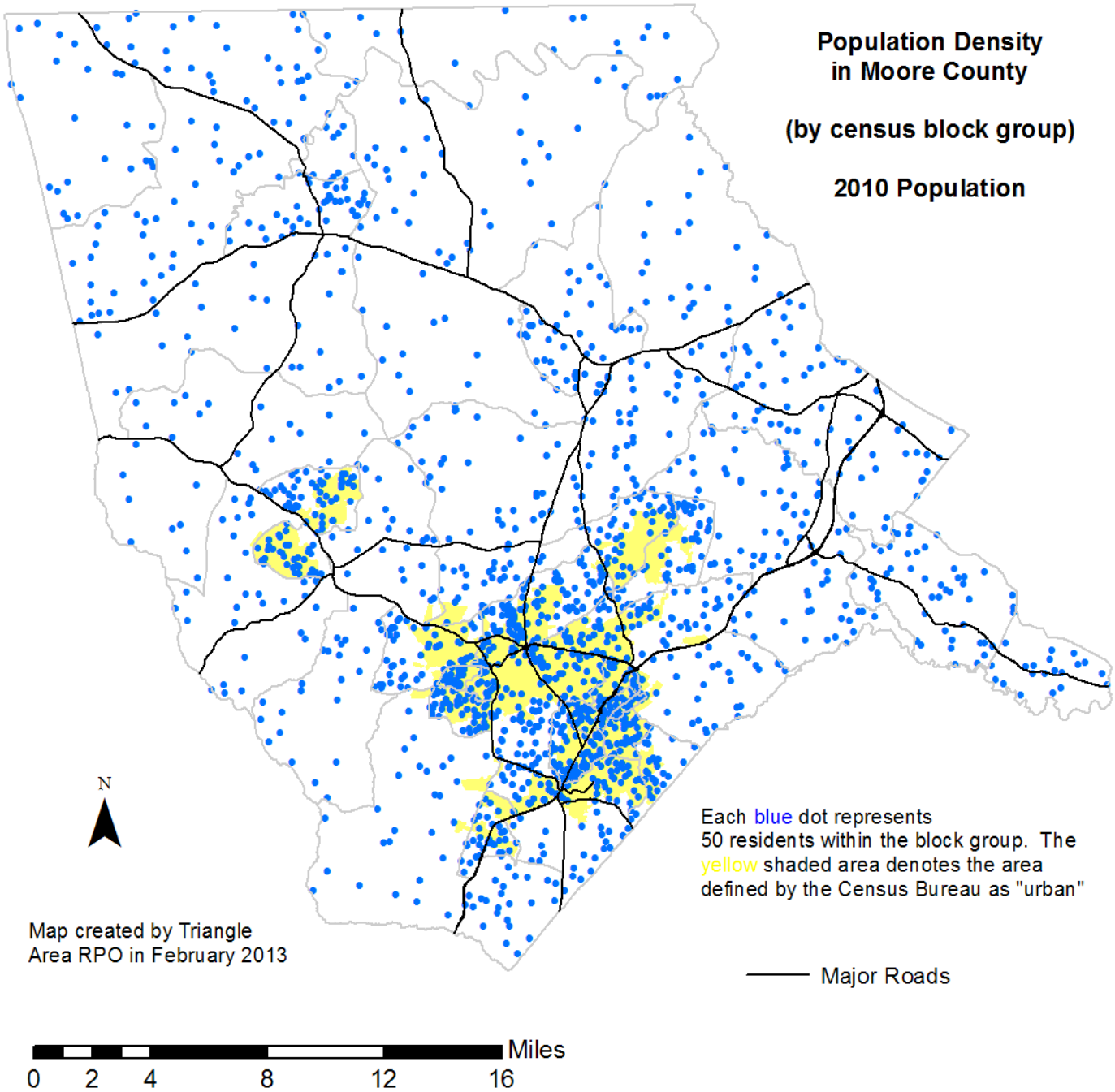
18% growth countywide

Highest growth occurred in southern part of county – some areas of county lost population



Overall, Moore County added 13,476 new residents between 2000 and 2010.

Most of the growth occurred in the Pinehurst/S.P./ Aberdeen area, plus surrounding towns, and in Seven Lakes and Woodlake.



Today, Moore County's population is concentrated in the southern half of the county, roughly from Seven Lakes and Whispering Pines southward to Pinebluff.

This roughly corresponds with the areas the Census Bureau defines as "urban" (yellow on map).

The Plan – NCDOT Standard Methodology…continued

TRYING TO KEEP EMPLOYMENT FORECAST AS SIMPLE AS POSSIBLE

Need a Place to start….
Know it is an iterative process…
Adjustments Welcome and Encouraged…

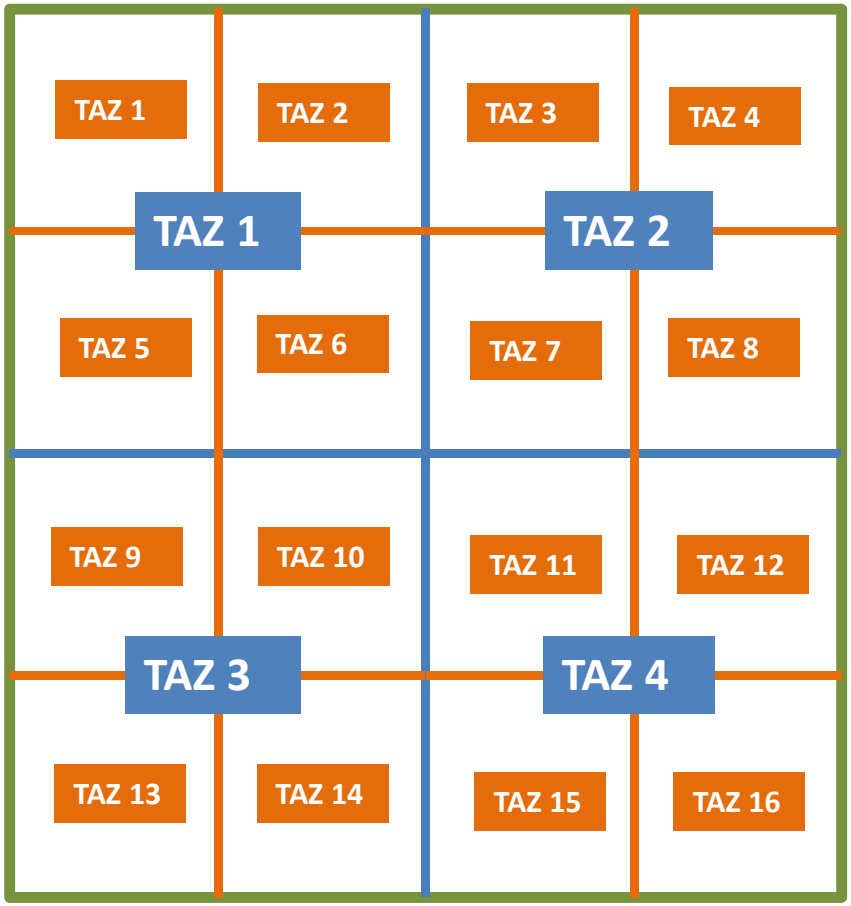
The Statewide Model

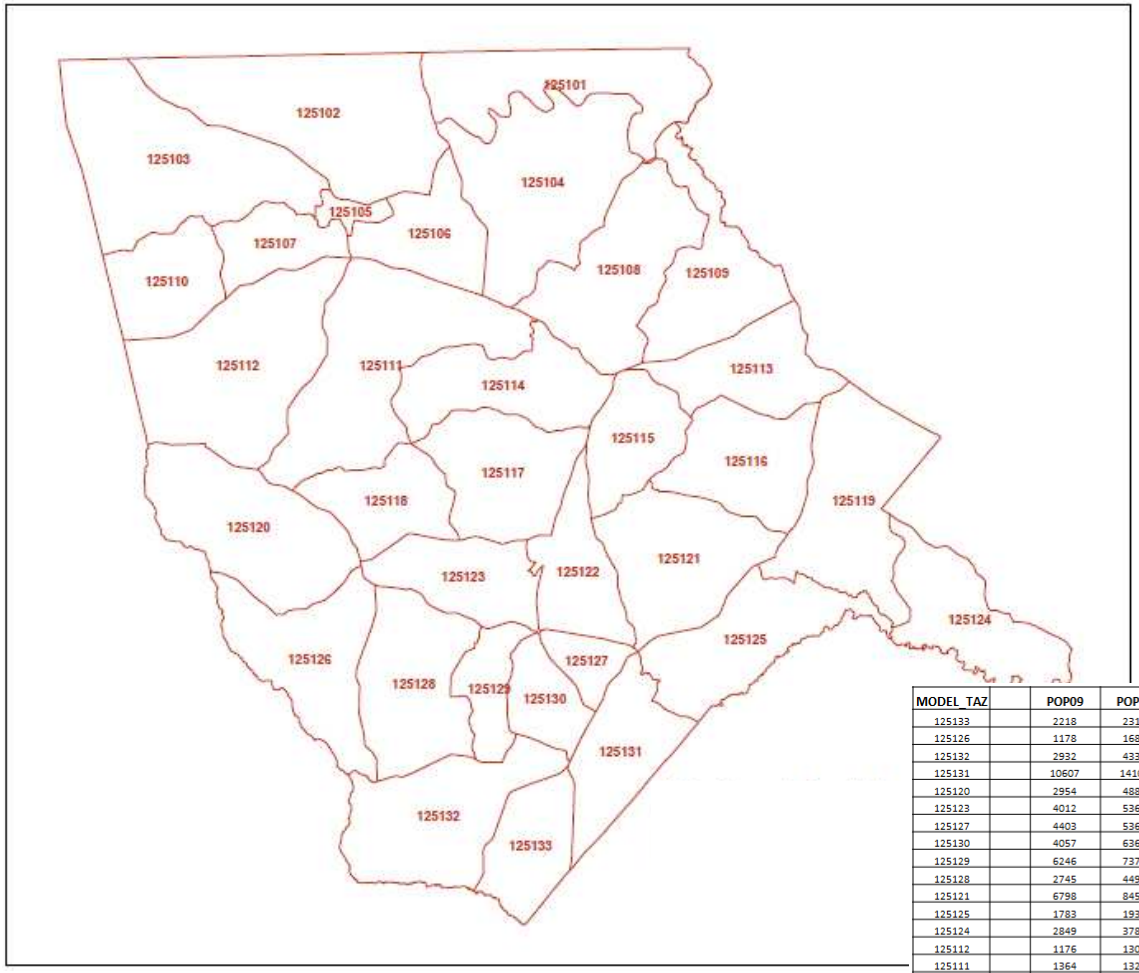
- Developed for NCDOT's Over Arching State Transportation Plan.
- Has a TAZs Specific to Moore County
- Has fewer and larger TAZs than the county model.
- Has TAZs with 2020 SE Data
- Has TAZs with 2040 SE Data

Add Moore County TDM TAZ's

- Divide forecasted Statewide SE Data By our Moore County TAZ Boundaries

Moore County





Building the Basis
For Future Analysis….

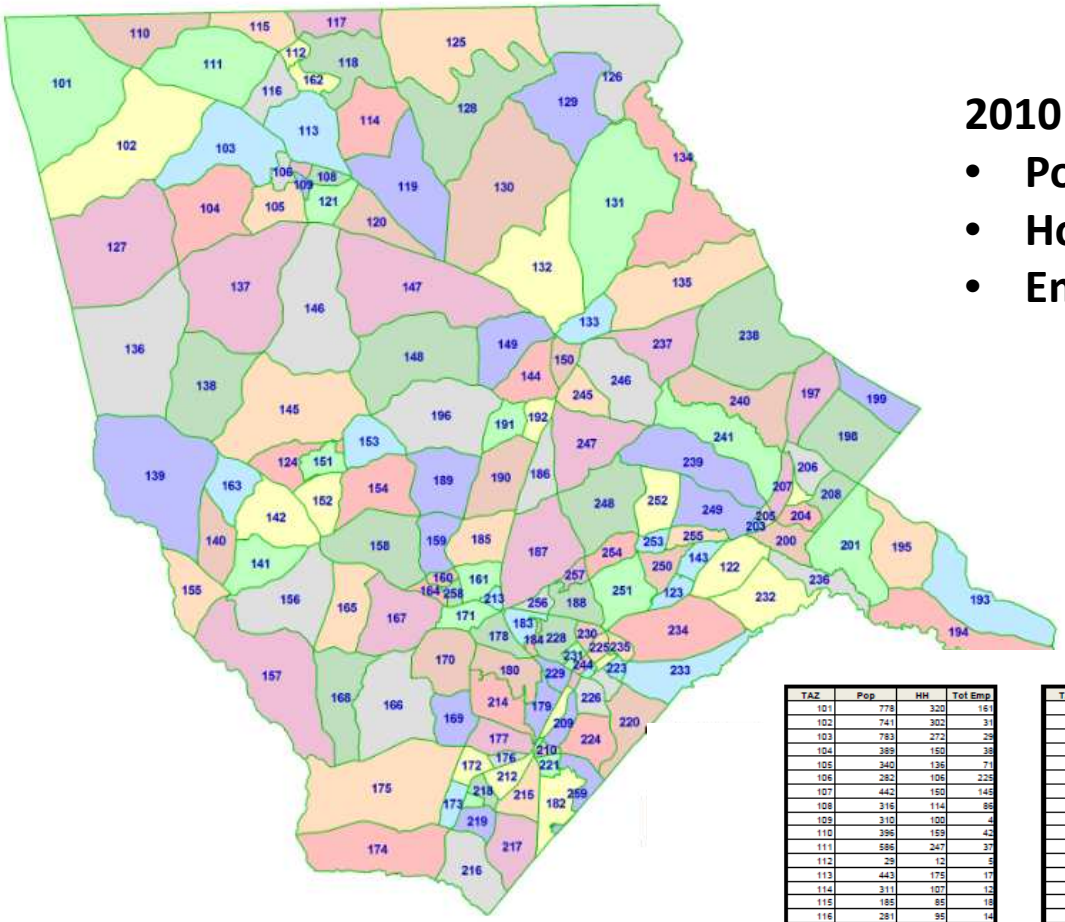
A Place to Start

2020 2040 Base Year Census Data

- **Population**
- **Households**
- **Employment**

MODEL_TAZ		POP09	POP20	POP40		HH09	HH20	HH40		TOTEMP09	TOTEMP20	TOTEMP40
125133		2218	2310	2645		860	925	1022		593	712	1050
125126		1178	1685	2587		502	742	1099		94	113	167
125132		2932	4334	6783		1191	1810	2733		526	631	930
125131		10607	14109	20478		4883	6751	9536		7272	8721	12867
125120		2954	4882	8189		1201	2063	3348		508	610	899
125123		4012	5363	7794		1624	2243	3166		4611	5530	8159
125127		4403	5369	7283		1983	2501	3274		2414	2895	4271
125130		4057	6360	10292		1914	3143	4974		6745	8089	11934
125129		6246	7372	9564		2835	3437	4335		4644	5569	8217
125128		2745	4494	7477		1243	2094	3361		467	560	826
125121		6798	8459	11553		2852	3663	4871		3174	3807	5616
125125		1783	1933	2305		774	863	995		631	757	1117
125124		2849	3781	5479		1145	1564	2189		229	274	405
125112		1176	1303	1603		467	534	633		133	159	235
125111		1364	1322	1370		512	512	512		153	184	271
125118		3296	3941	5221		1408	1732	2213		2105	2524	3724
125117		1572	1932	2629		638	808	1060		229	275	405
125115		1443	1652	2091		557	658	809		568	681	1005
125122		5056	7444	11630		2368	3589	5410		1513	1815	2678
125116		2089	2549	3452		780	982	1283		291	349	514
125119		2401	2478	2764		929	985	1069		762	914	1348
125110		438	501	633		170	199	243		24	28	42
125107		738	727	779		287	293	304		87	105	154
125106		912	887	920		348	347	347		107	129	190
125104		751	830	1016		297	338	399		38	46	67
125108		1216	1411	1822		513	616	769		278	334	492
125113		1785	1856	2126		699	752	831		451	541	798
125102		2628	2697	3017		1054	1113	1203		829	994	1467
125101		674	714	839		278	306	347		45	53	79
125109		1104	1283	1667		435	524	656		70	83	123
125103		2267	2687	3526		881	1072	1358		304	365	538
125105		1393	1341	1387		488	482	482		556	666	983
125114		1818	2323	3248		745	1007	1397		2653	3182	4694
Totals		**86,903**	**110,329**	**154,168**		**36,861**	**48,648**	**66,228**		**43,104**	**51,693**	**76,266**

Statewide Transportation Model
by
STM Traffic Analysis Zones



2010 Base Year Census Data

- **Population**
- **Households**
- **Employment**

Moore County Travel Demand Model

County Traffic Analysis Zones

Moore County
SE Data by TAZ

TAZ	Pop	HH	Tot Emp
101	778	320	161
102	741	302	31
103	783	272	29
104	389	150	38
105	340	136	71
106	282	106	225
107	442	150	145
108	316	114	86
109	310	100	4
110	396	159	42
111	586	247	37
112	29	12	5
113	443	175	17
114	311	107	12
115	185	85	18
116	281	95	14
117	164	71	12
118	222	98	241
119	301	116	1
120	285	112	11
121	327	119	99
122	392	146	119
123	428	198	211
124	631	259	459
125	547	228	19
126	738	323	135
127	445	172	15
128	437	165	19
129	85	40	0
130	234	94	5
131	196	77	7
132	620	248	42
133	436	208	415
134	304	130	11
135	805	310	46
136	324	138	21
137	404	159	34
138	393	140	38
139	428	182	200
140	150	56	4
141	199	78	46
142	2132	905	200
143	291	112	9

TAZ	Pop	HH	Tot Emp
144	509	252	433
145	458	172	32
146	620	225	36
147	347	139	22
148	150	63	6
149	455	188	170
150	619	219	1058
151	1498	617	192
152	913	423	377
153	54	24	0
154	245	104	117
155	107	39	3
156	267	98	18
157	827	375	76
158	602	238	314
159	301	118	62
160	308	133	18
161	1832	750	27
162	45	19	0
163	211	68	7
164	115	59	158
165	71	27	10
166	412	166	11
167	1927	900	213
168	445	200	20
169	466	177	205
170	4542	2090	424
171	1332	601	2497
172	949	344	21
173	221	93	70
174	17	8	0
175	436	186	14
176	102	48	58
177	1297	548	686
178	823	489	455
179	1437	599	3213
180	1649	781	562
181	134	60	41
182	167	66	12
183	698	306	139
184	49	26	507
185	577	219	113
186	264	102	214

TAZ	Pop	HH	Tot Emp
187	2939	1349	213
188	1142	577	377
189	295	114	25
190	503	200	111
191	143	61	10
192	206	74	3
193	609	225	15
194	1029	384	7
195	1271	560	157
196	448	199	41
197	375	156	86
198	552	190	45
199	127	44	3
200	225	87	29
201	476	187	86
202	4	2	0
203	99	31	92
204	108	47	6
205	161	66	100
206	47	21	7
207	106	49	157
208	113	44	3
209	997	483	28
210	423	171	205
211	38	16	331
212	159	59	82
213	431	168	2923
214	273	119	423
215	197	74	362
216	371	156	38
217	665	245	5
218	526	202	51
219	167	68	68
220	1380	527	65
221	440	169	171
222	1310	690	773
223	487	291	221
224	1162	444	120
225	1076	565	1030
226	1052	462	45
227	170	111	284
228	1303	650	223
229	1248	580	1202

TAZ	Pop	HH	Tot Emp
230	344	145	47
231	803	306	89
232	328	134	15
233	360	164	4
234	245	124	613
235	440	169	97
236	1310	690	1
237	487	291	251
238	1162	444	150
239	1076	565	83
240	1052	462	28
241	170	111	182
242	1303	650	310
243	1248	580	348
244	344	145	858
245	803	306	115
246	328	134	83
247	360	164	323
248	245	124	294
249	1162	444	101
250	1076	565	13
251	1052	462	374
252	170	111	11
253	1303	650	0
254	1248	580	130
255	344	145	0
256	803	306	99
257	328	134	383
258	360	164	403
259	245	124	338

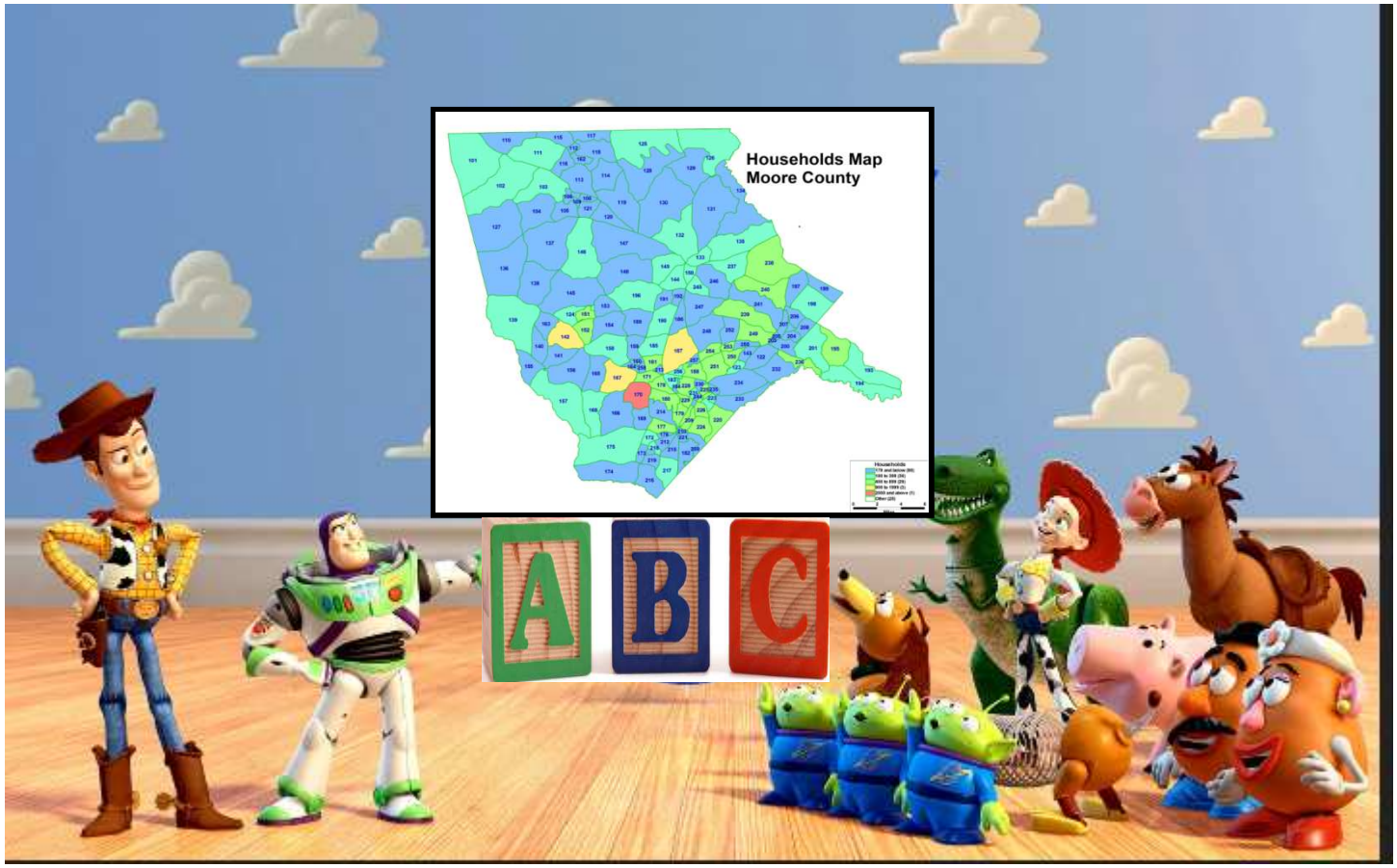
Plan B

Can Be Used With (As an Enhancement) or Instead of "The Plan"

- Important to have Consistency Between Land Use and Transportation

- Moore County Land Use Committee
  - Process of Updating the County Land Use Plan through **2030**.
  - County Planning Department has provided a report on Forecasted Growth based on Census and area growth trends to the Committee.
  - At the same meeting, *with the intent of seeking MCTC approval and recommendation*, the Land Use Committee was asked to consider sharing their results for forecasted growth with the MCTC for use in the Model. *Final decision will be made at February meeting.*
  - NCDOT recommends using the Land Use Committee's forecasted data. This will provide consistency between plans and help decision makers see how the plan will likely impact the roadway infrastructure.
  - ***If** provided and **if** MCTC agrees this is preferable*, NCDOT will run a 2030 and a 2040 Future Year No Build Scenario to allow everyone to compare compatible results.
  - If the steering committees have not reached an agreement on the county's forecasted data, HAVE NO FEAR….NCDOT IS HERE!
  - And we have finally reached Standard Ground. We are in the midst of Engineering Procedures! And can handle that March 13th. Rhett Fussell will be here to lead the exercise!

Discussions, Questions and, Hopefully, Some Answers….



AirSage – What we do

AirSage aggregates and analyzes wireless network data to determine the location and movement of cell phones, while maintaining strict user privacy.

- AirSage analyzes signaling data that is continuously generated during normal operation of the wireless network – ***covering mobile devices*** connected to that network.
- AirSage is ***the only company with access to this unique data***, via contracts with major wireless carrier partners.
- The AirSage system ***operates transparently to mobile users*** and the wireless network. There is no user opt-in or handset software (embedded or otherwise) required.
- With current partners , Sprint and Verizon, the AirSage platform supports real-time, network-wide coverage of ***over 125 million mobile devices***.
- These 125 million "mobile sensors" generate about ***12 billion location events per day***.
- The AirSage system ***fully protects user privacy***. AirSage does not have access to subscriber-identifying information, and AirSage data products cannot be used to locate or "track" individual subscribers.

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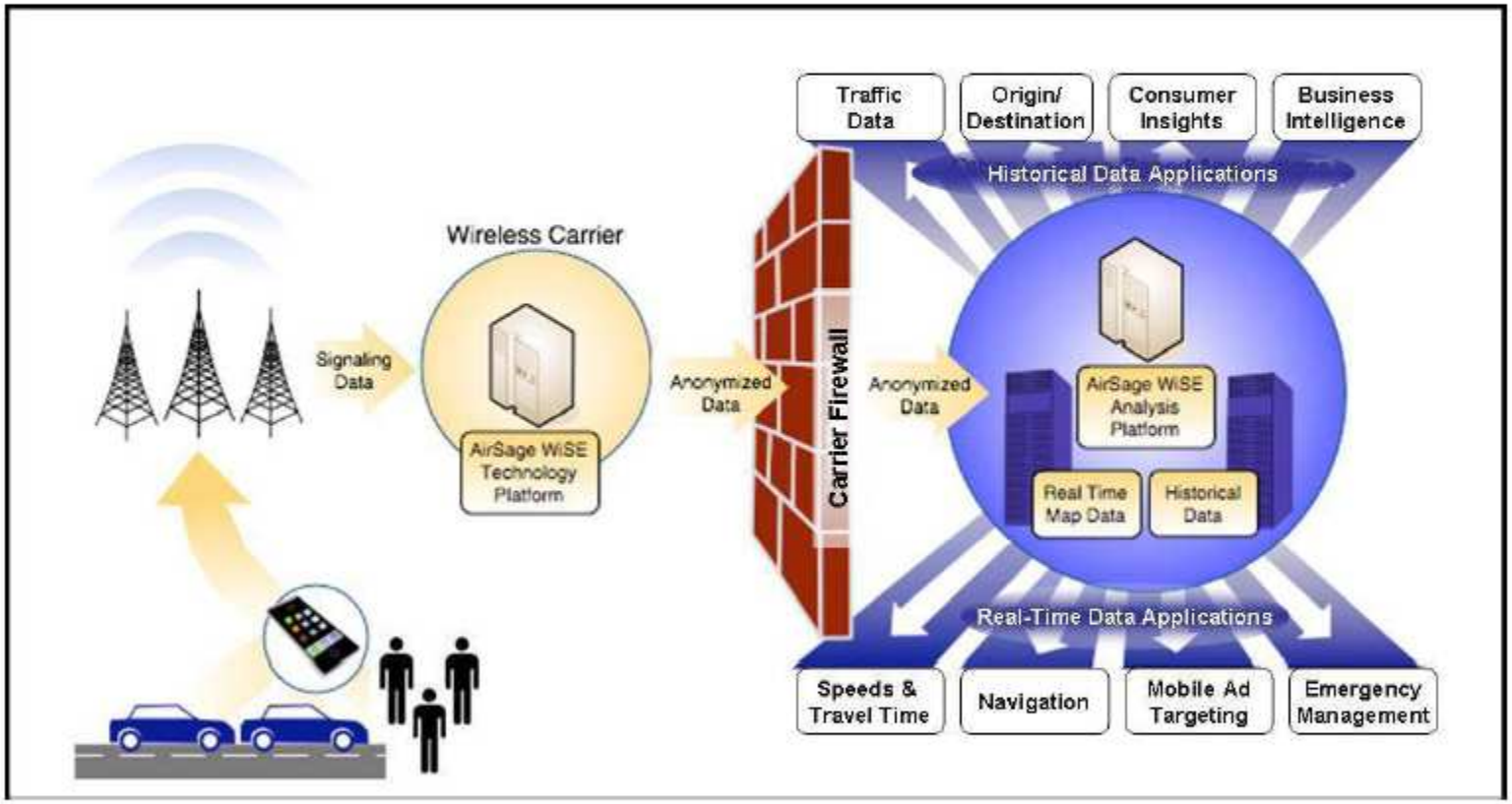
AirSage Information Flow



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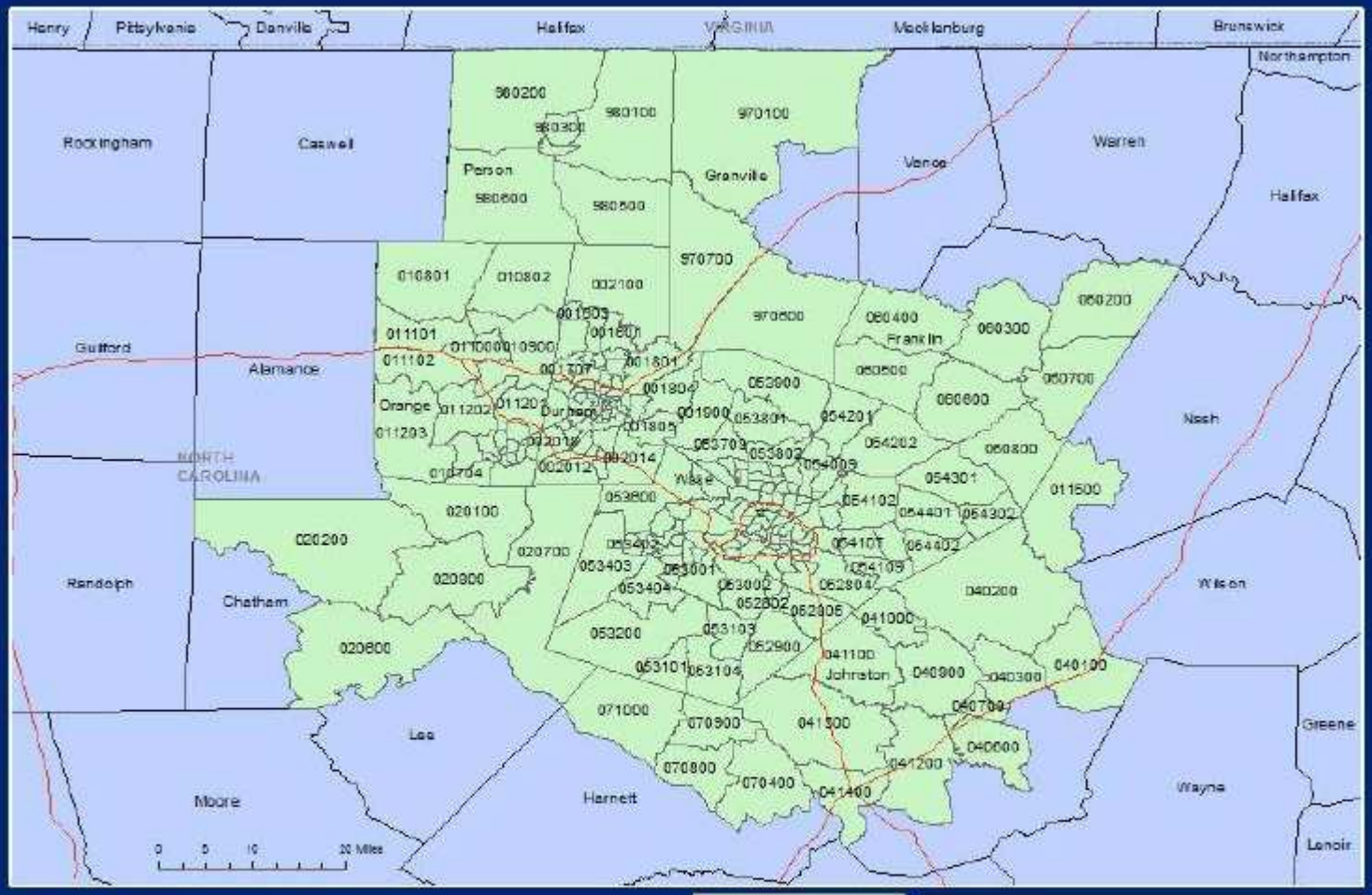
Capital Area Metropolitan Planning Area By Census Tract

The Difference Between Planning



Raleigh Study Area

A map of the Raleigh study area at the census tract level.

Legend
- Capital Cities
- Interstate Highways
- State Boundaries
- Raleigh Census Tracts
- Counties

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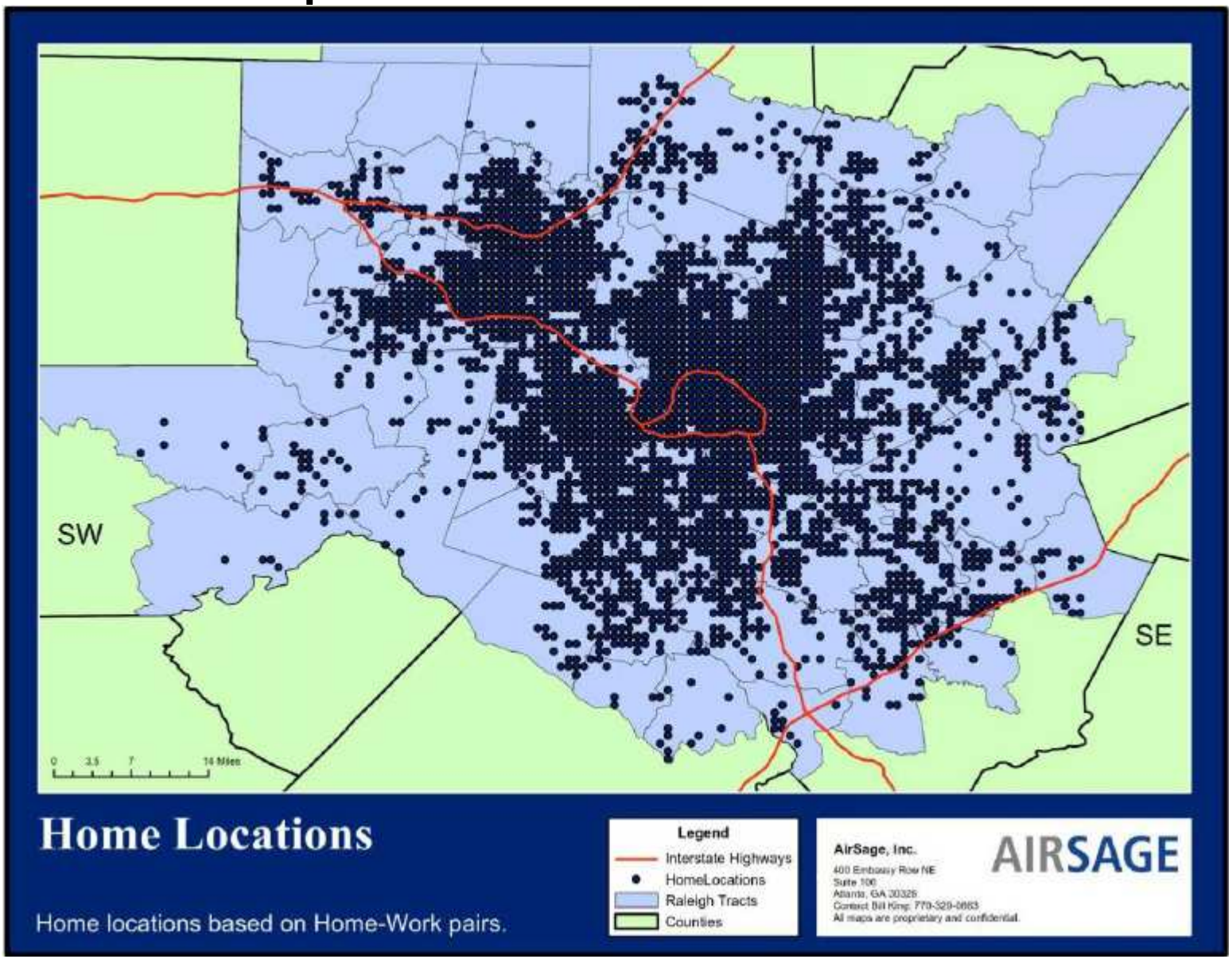
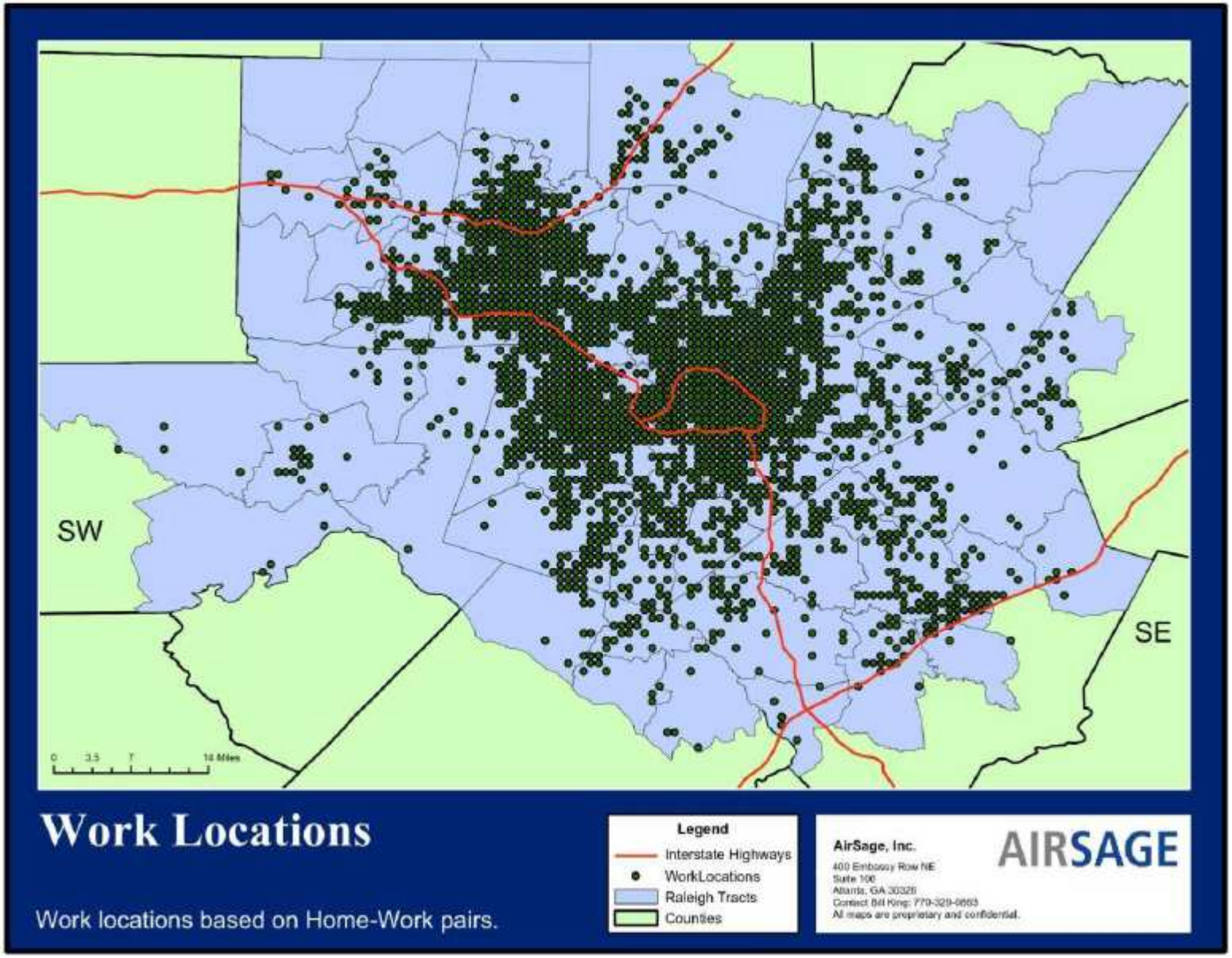
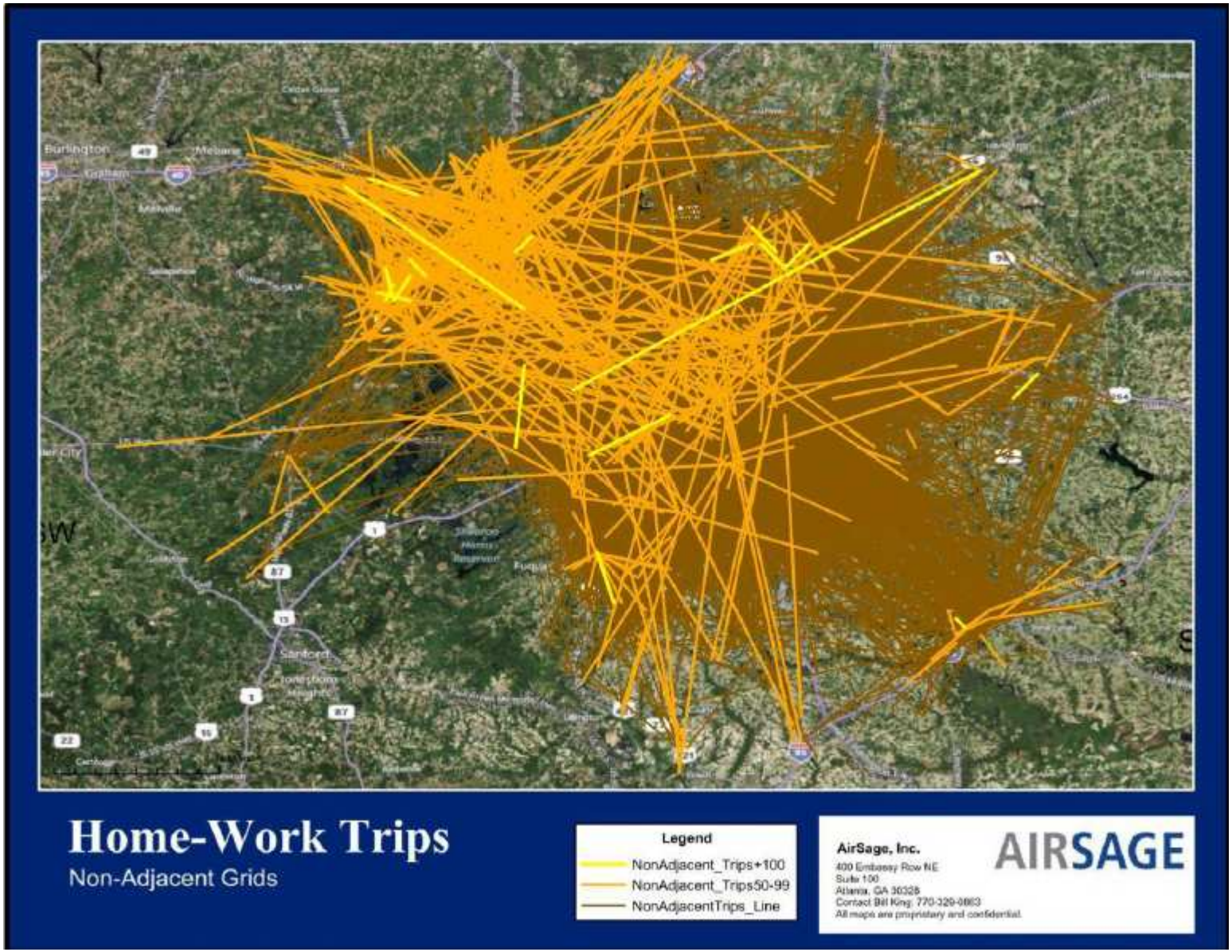
Snap Shot of Data Points at 12:01 AM

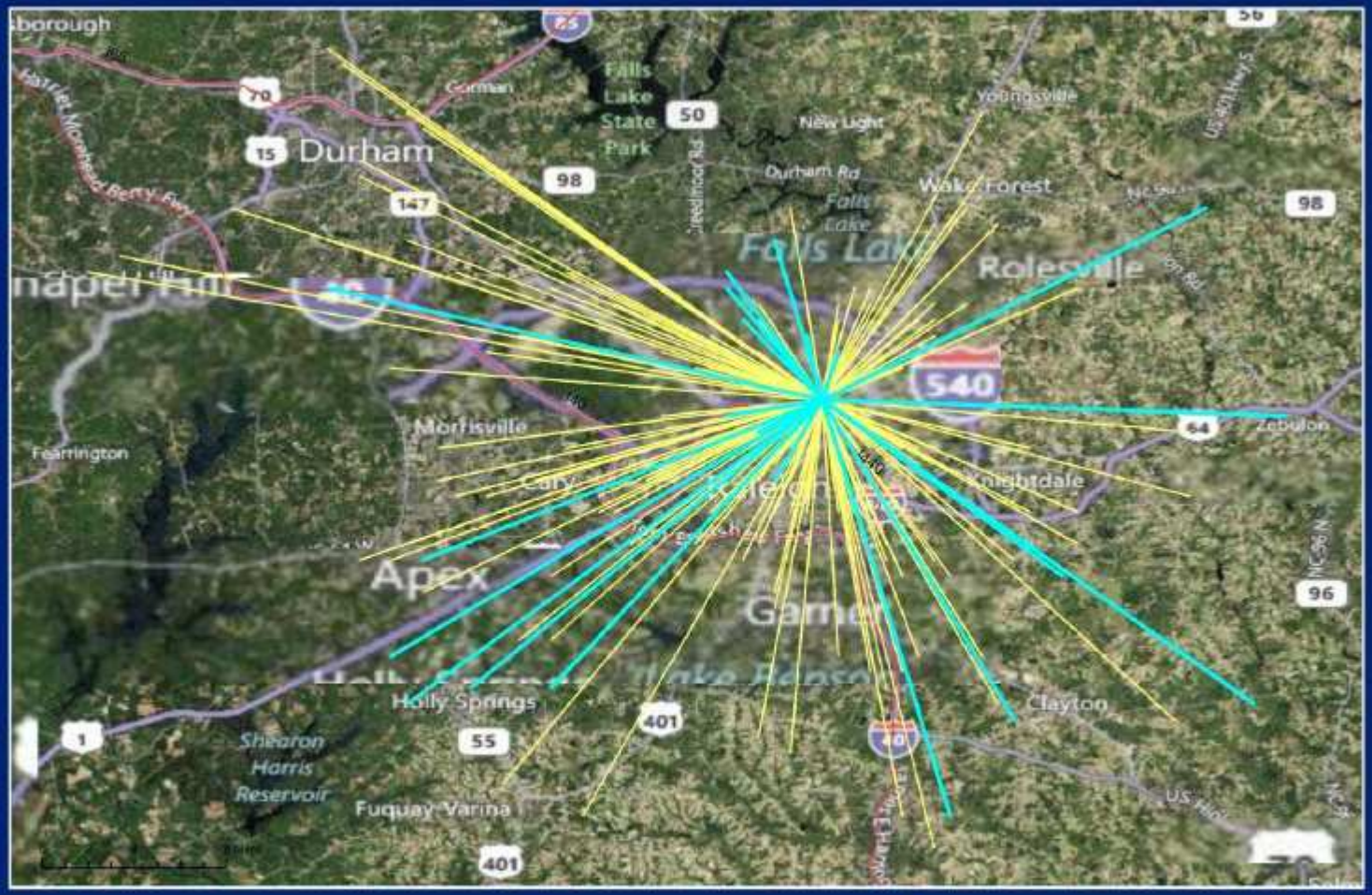


Snap Shot of Data Points Mid-Work Day



Resulting Vectors





Raleigh Home-Work Pairs

Home-Work pairs from Wal-Mart Shopping Center area to its non-adjacent trip pairs. Highlighted lines are 30+ trips during study period.

Legend

- Commercial_Area_Trips
- Interstate Highways
- Raleigh Tracts
- State Boundaries

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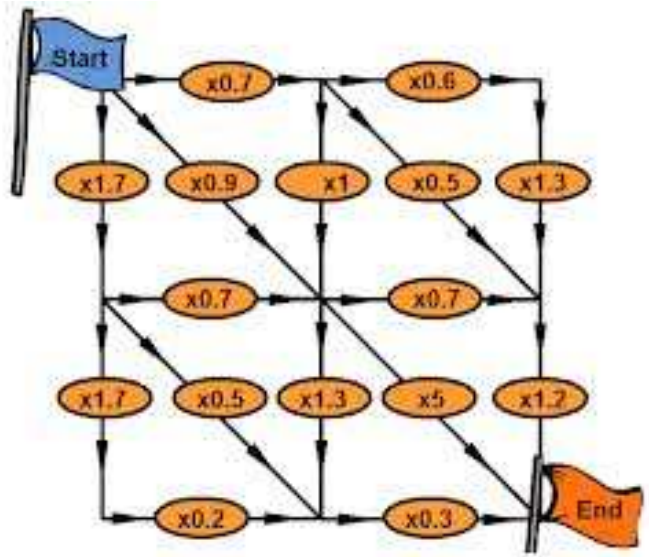

Vectors to Routes

The model “thinks” about things in terms of equations.

Using relationship between Distance, Speed, and Time, the model associates choices in route with a cost value of the drivers time. Path becomes an algorithm of probabilities generated, and eliminated, seeking the least cost scenario.

The model will choose to send a driver an alternative route if the normal route reaches capacity and congestion occurs.