

# **TRIAD SE Data Forecasting: A Top-Down – Bottom-Up Approach**

**North Carolina Statewide  
Model Users' Group**

**April 26<sup>th</sup>, 2006**

**Presentation by**

**Todd Steiss  
of  
Parsons Brinckerhoff**

Top Down

County Level

County, Regional, &  
State Socioeconomic  
Forecasts

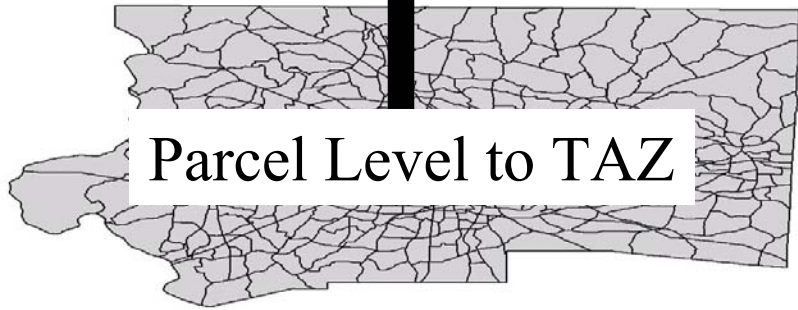
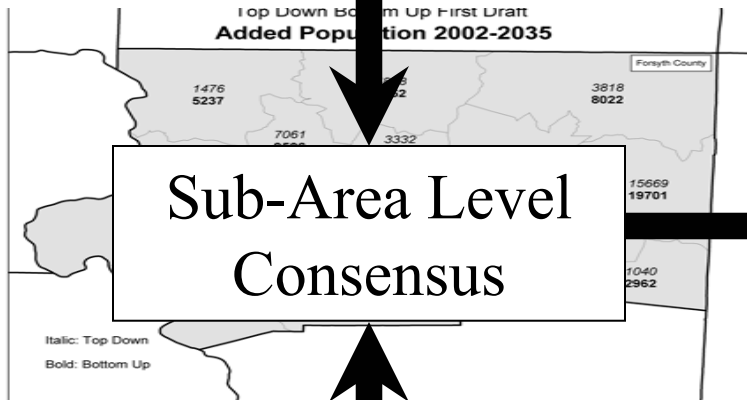
Sub-Area Level  
Consensus

TAZ Level

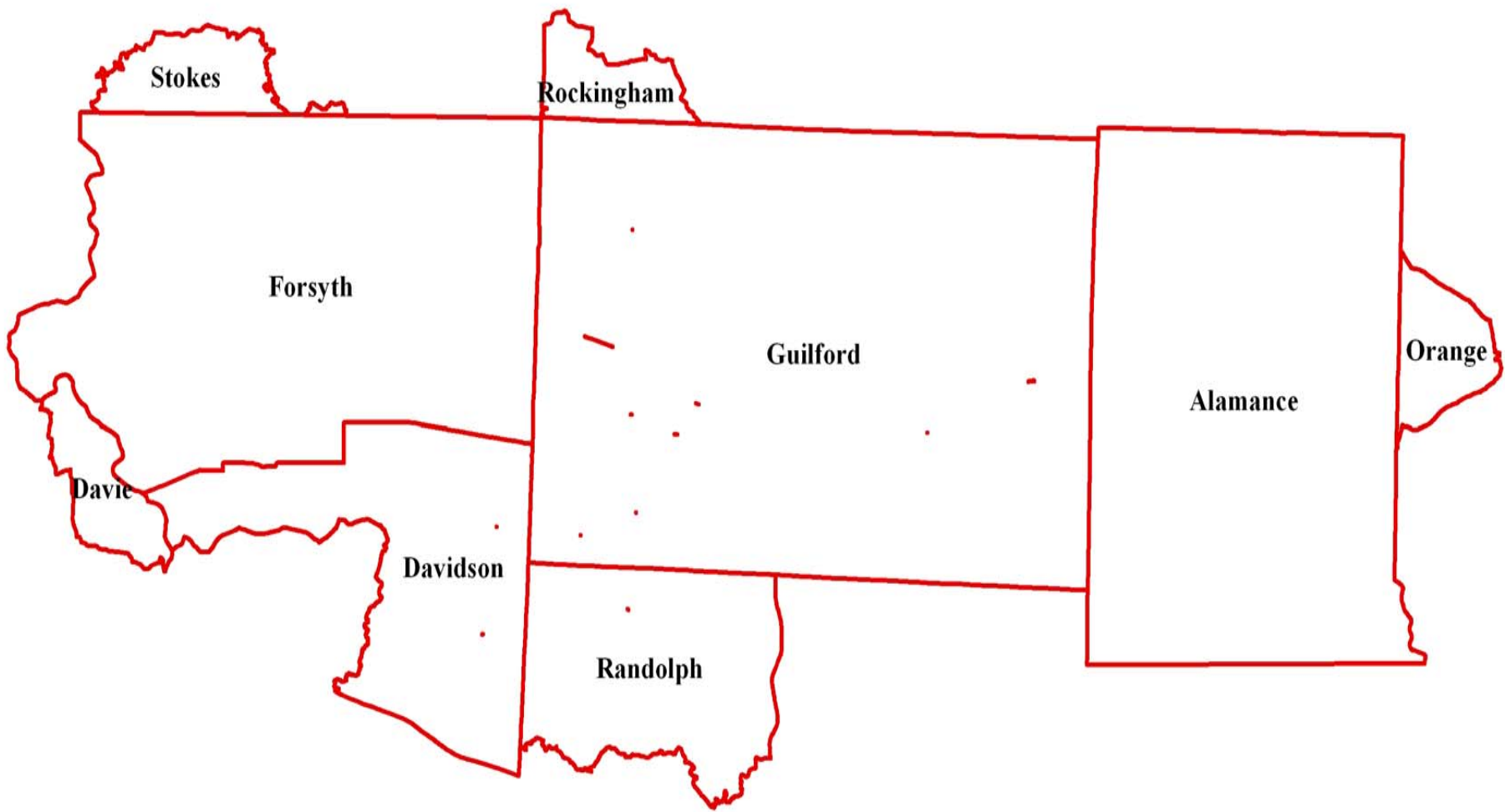
Parcel Level to TAZ

Local/Regional  
Comprehensive Plans,  
Zoning,  
Land Use, Utilities,  
Transportation Plans

Bottom Up

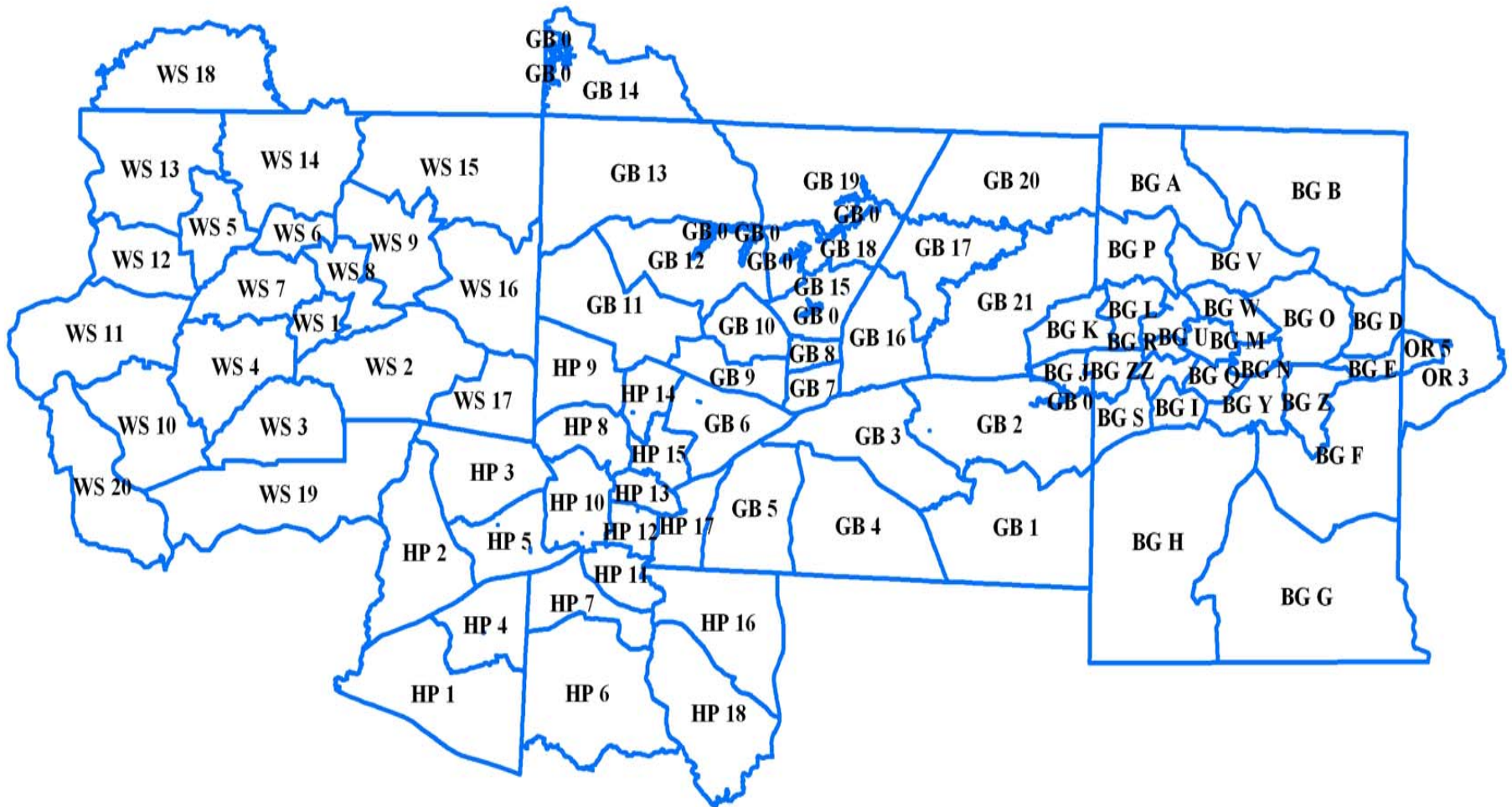


# Nine Counties in Study Area

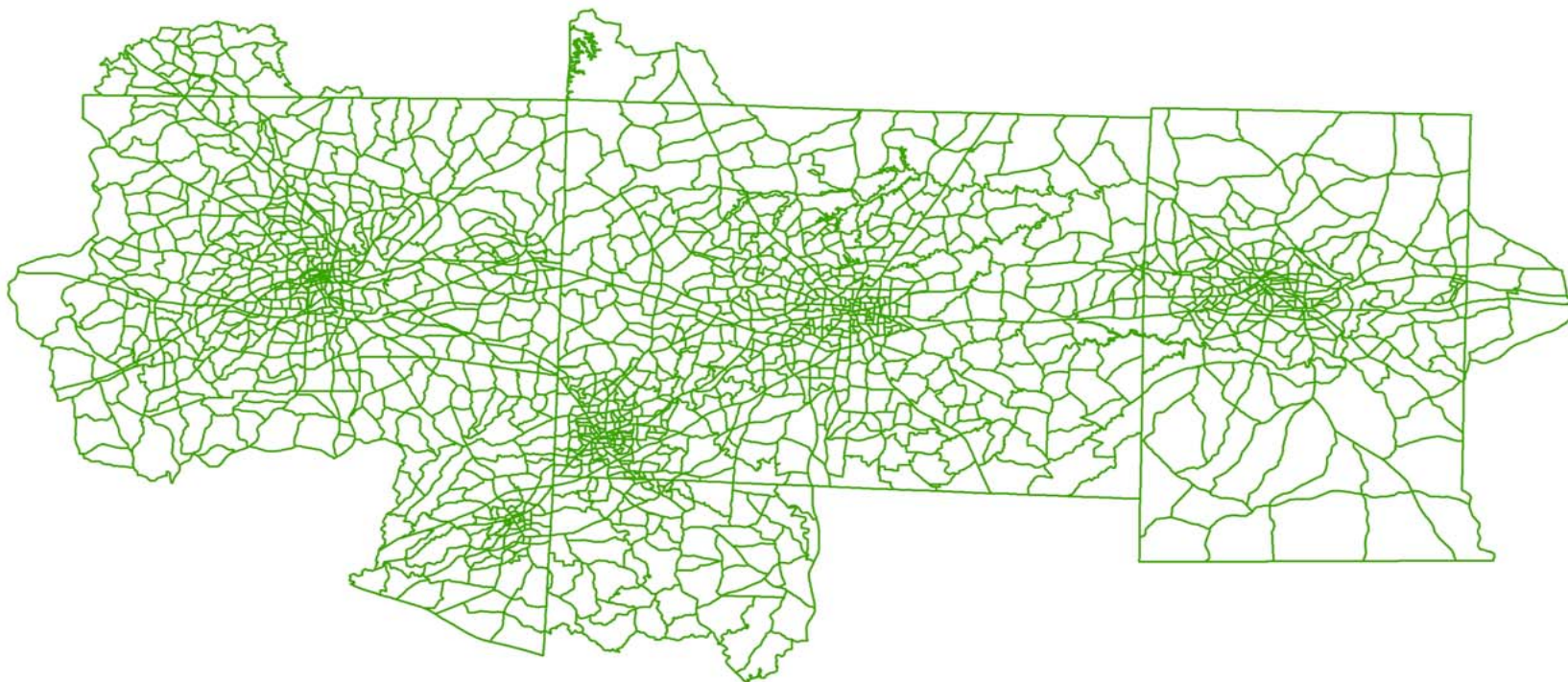


Three Full and Six Partial

# 86 Sub Areas



**1,670 TAZs**



# Top-Down Approach

# Top-Down Approach

## County Level

**Total Population**  
**2015, 2025, 2035**

**Total Employment**  
**2015, 2025, 2035**

### County Level Data Sources

- **Woods and Poole County Forecasts**
- **North Carolina State Data Center**
- **Local Land Use & Transportation Plans**
- **Previous Modeling Data**

# **Top-Down Approach**

## **General Steps**

- Obtaining Regional, County, and Local Socioeconomic Forecasts from Public and Private Sources**
- Comparing the Different SE Data Forecasts**
- Review Underlying Assumptions and Methodologies**
- Expand the Forecasts to Horizon Years (2015, 2025 & 2035)**



# **Top-Down Approach**

## **General Steps**

- **Interview Local Companies and Public Officials**
  - **Derive Insights on Spatial Patterns of Future Growth**
- **Develop Adjustment Factors**
  - **Make Forecasts Data Consistent with Triad Model V Variable Definitions**
- **Developing Market Insight Factors**
  - **Adjust Subarea-Level Growth Rates in Comparison to County-Level Growth Rates**

# Top-Down Approach

## Sub-Area Level Data Sets

**Total Population**  
2015, 2025, 2035

**Highway Retail  
Employment**  
2015, 2025, 2035

**Retail  
Employment**  
2015, 2025, 2035

**Service  
Employment**  
2015, 2025, 2035

**Industrial  
Employment**  
2015, 2025, 2035

**Office  
Employment**  
2015, 2025, 2035

# Bottom-Up Approach

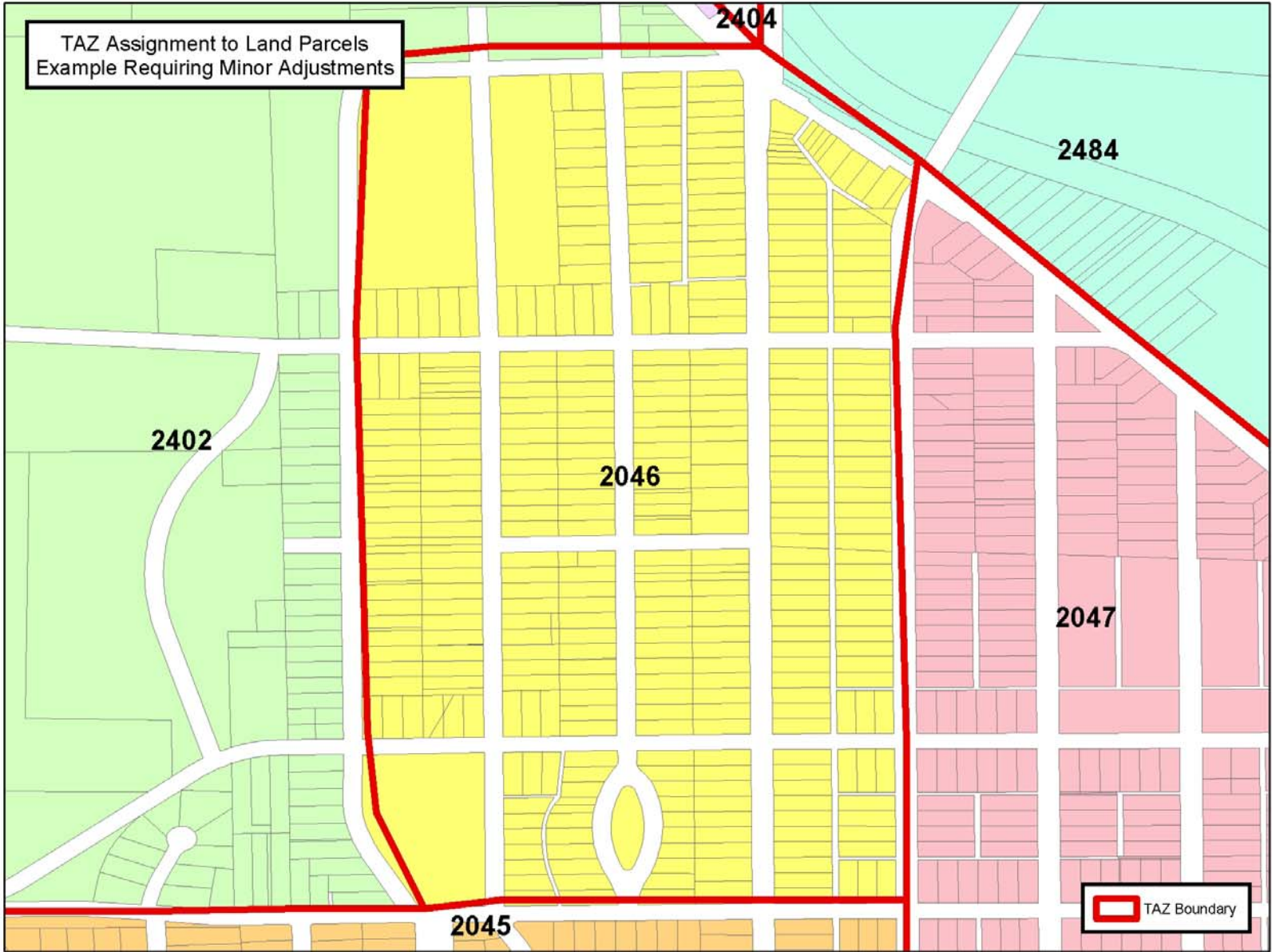
# **Bottom-Up Approach**

## **First Step**

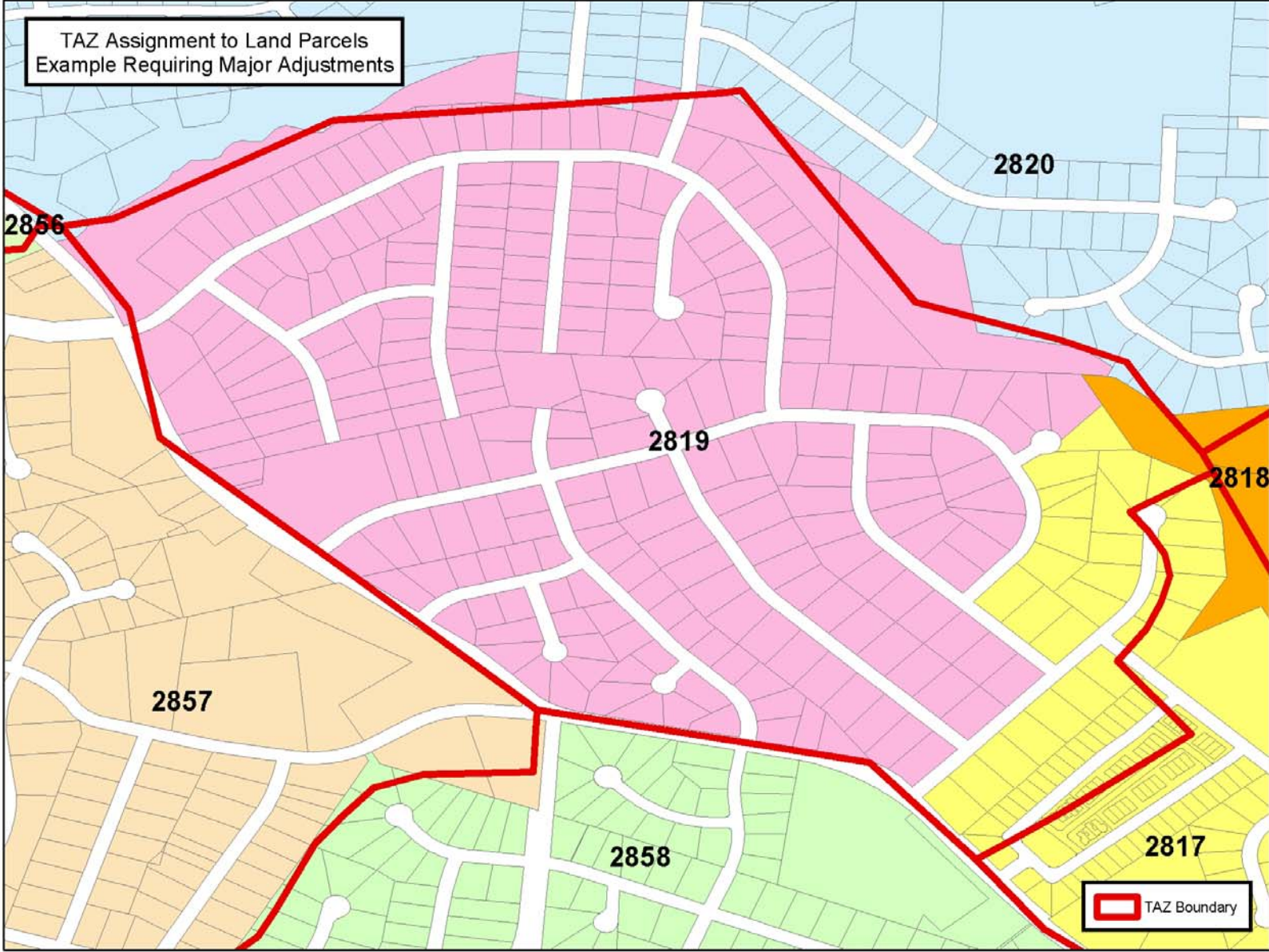
### **Assigning TAZs to Land Parcels**

- **Total Number of Parcels: Approximately 1,000,000**
- **Overlaid TAZ boundaries over land parcels using GIS**
- **Assigned TAZ numbers to parcels based on “best-fit” methodology**
- **Review all TAZs based on best-fit results**

TAZ Assignment to Land Parcels  
Example Requiring Minor Adjustments



TAZ Assignment to Land Parcels  
Example Requiring Major Adjustments



# Bottom-Up Approach

## Step Two

### Identifying Vacant and Developed Property

**Assessors Records: Several Hundred Data Fields of Information**

### Example of Variables Used

#### Property Value

Land Total Value  
Building Value  
Other Structures Value  
Total Value

#### Property Description

Land Use Code  
Units in Structure  
Zoning  
Year Built

# Identifying Vacant and Developed Property

## No Single Source to Determine Property Status

### Vacant Land

**Land Value = Total Value**  
**Land Use Code = Vacant**  
**Total Units = 0**  
**Year Built = Blank**

### Grey Area ???

**Land Value = Total Value**  
**Land Use Code = Not Vacant**  
**Total Units > 0**  
**Year Built = Blank**

### Developed Land

**Total Value > Land Value**  
**Land Use Code = Not Vacant**  
**Total Units > 0**  
**Year Built = Not Blank**



# Bottom-Up Approach

## Step Three

### Creating General Land Use Categories

#### Vacant Land

Non-Residential  
Residential  
•Single Family  
•Multi-Family

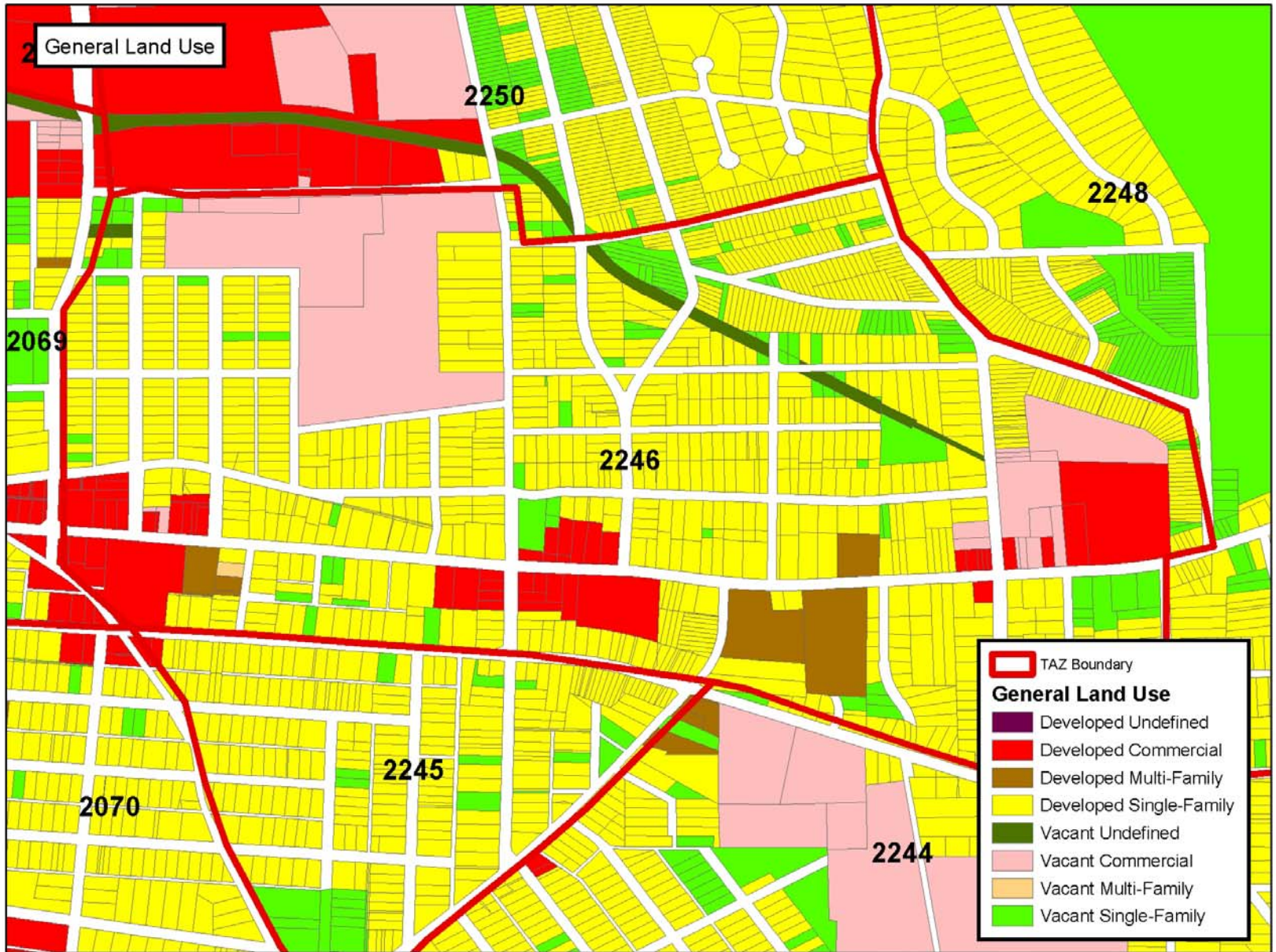
**Based on Zoning and  
Land Use Plans**

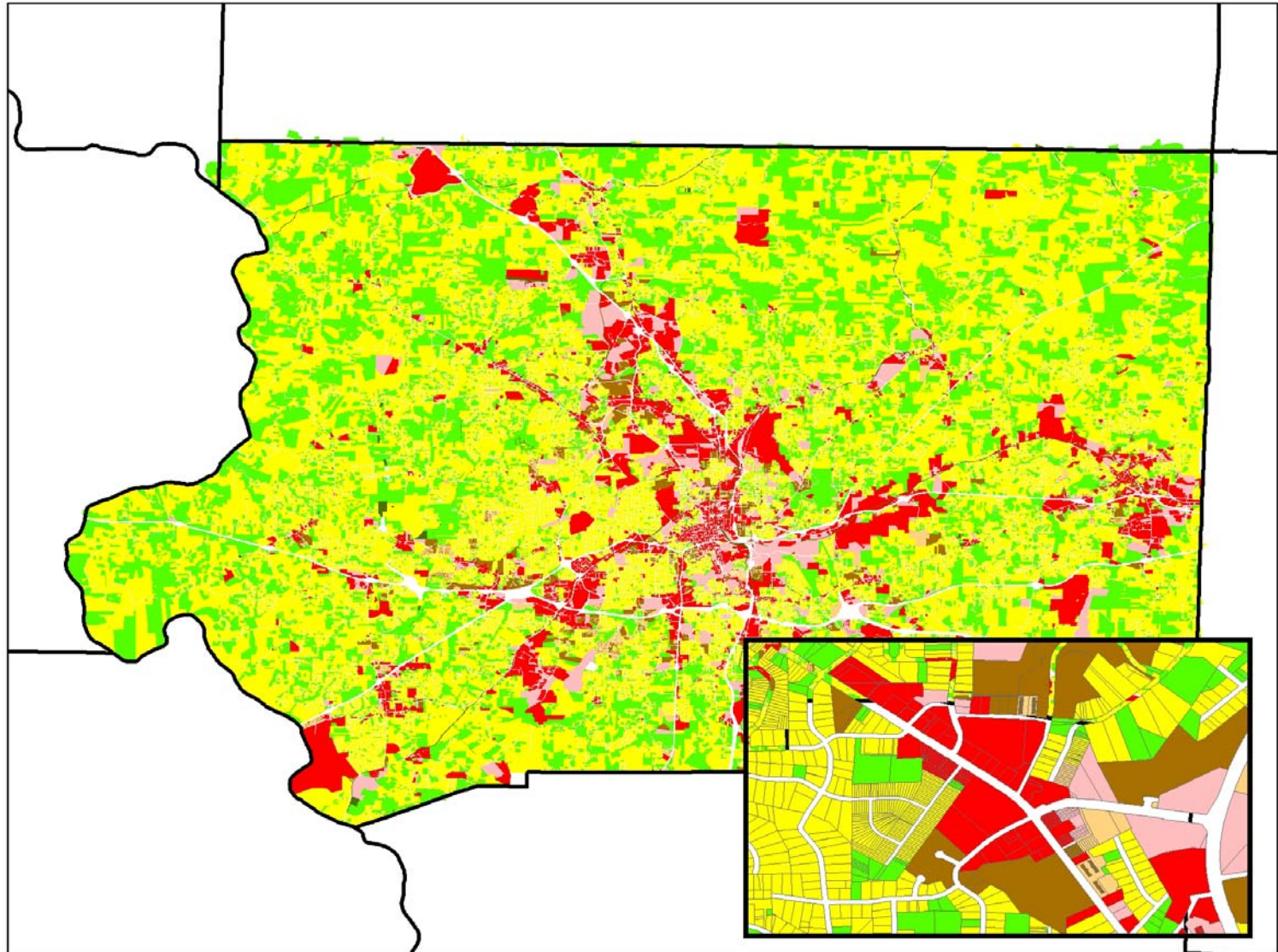
#### Developed Land

Non-Residential  
Residential  
•Single Family  
•Multi-Family

**Residential Data**  
Compare/Validate  
using Census Data

**Non-Res. Data**  
Compare/Validate  
using Info USA

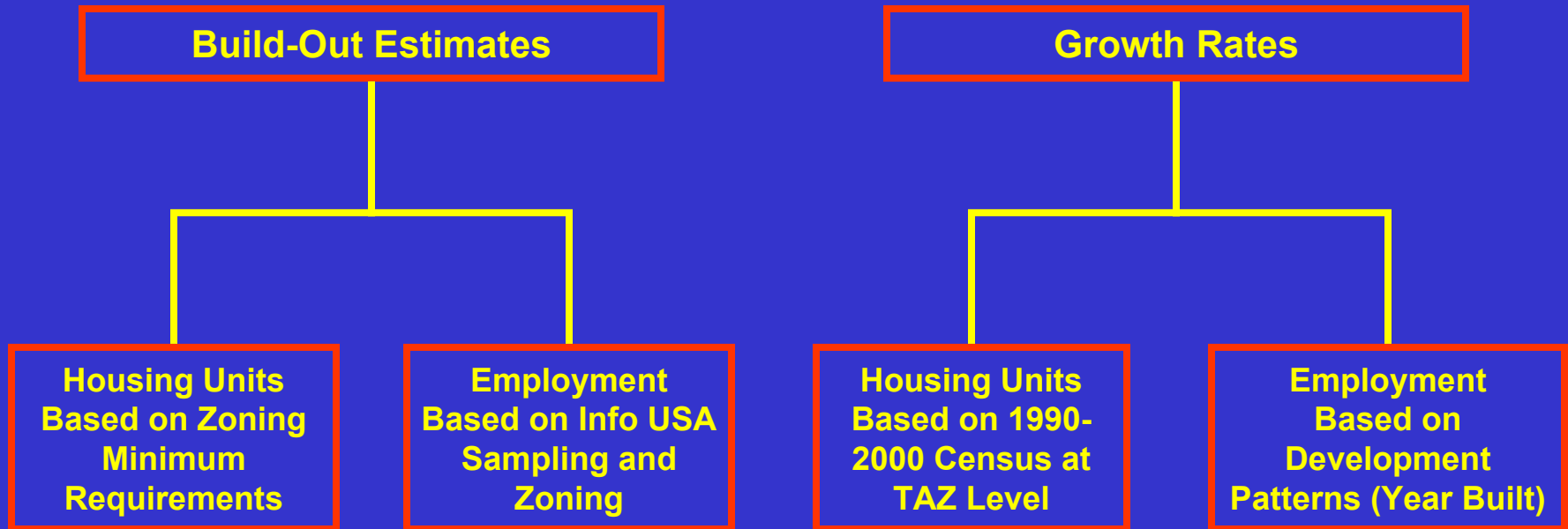




# Bottom-Up Approach

## Step Four

### Establish Build-Out and Growth Rates



# Bottom-Up Build-Out Analysis

## Housing Unit Density Look-Up Table (Example)

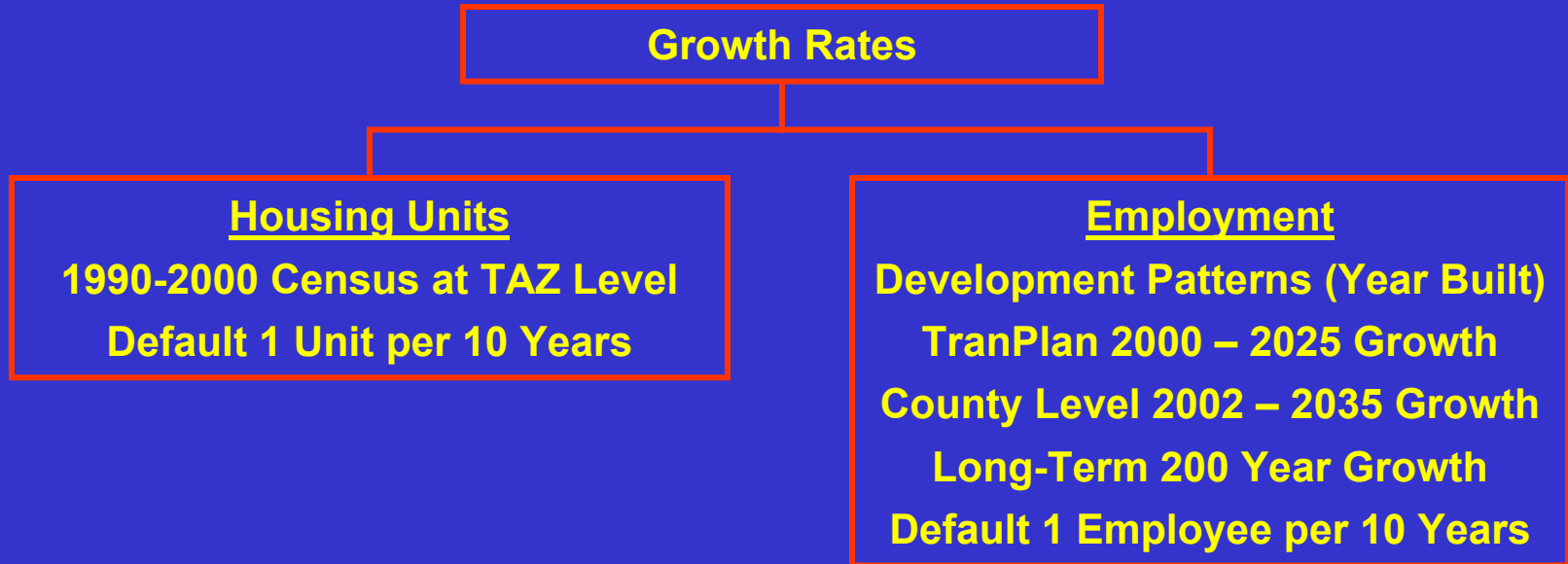
Zoning	Density	Units	Zoning	Density	Units	Zoning	Density	Units
AG	40000	SqFt/Unit	RS40	40000	SqFt/Unit	RM12-S	12	Units/Acre
AG-S	40000	SqFt/Unit	RS40-S	40000	SqFt/Unit	RM18	18	Units/Acre
MH	10000	SqFt/Unit	RS7	7000	SqFt/Unit	RM18 HO	18	Units/Acre
MH-S	10000	SqFt/Unit	RS7-S	7000	SqFt/Unit	RM18-S	18	Units/Acre
RS12	12000	SqFt/Unit	RS9	9000	SqFt/Unit	RM18-S HO	18	Units/Acre
RS12-S	12000	SqFt/Unit	RS9-S	9000	SqFt/Unit	RM5	5	Units/Acre
RS15	15000	SqFt/Unit	RSQ	3000	SqFt/Unit	RM5-S	5	Units/Acre
RS15-S	15000	SqFt/Unit	RSQ HO	3000	SqFt/Unit	RM8	8	Units/Acre
RS20	20000	SqFt/Unit	RSQ-S	3000	SqFt/Unit	RM8-S	8	Units/Acre
RS20-S	20000	SqFt/Unit	YR	130680	SqFt/Unit	RMU	20	Units/Acre
RS30	30000	SqFt/Unit	YR-S	130680	SqFt/Unit	RMU HO	20	Units/Acre
RS30-S	30000	SqFt/Unit	RM12	12	Units/Acre	RMU-S	20	Units/Acre

# Bottom-Up Build-Out Analysis

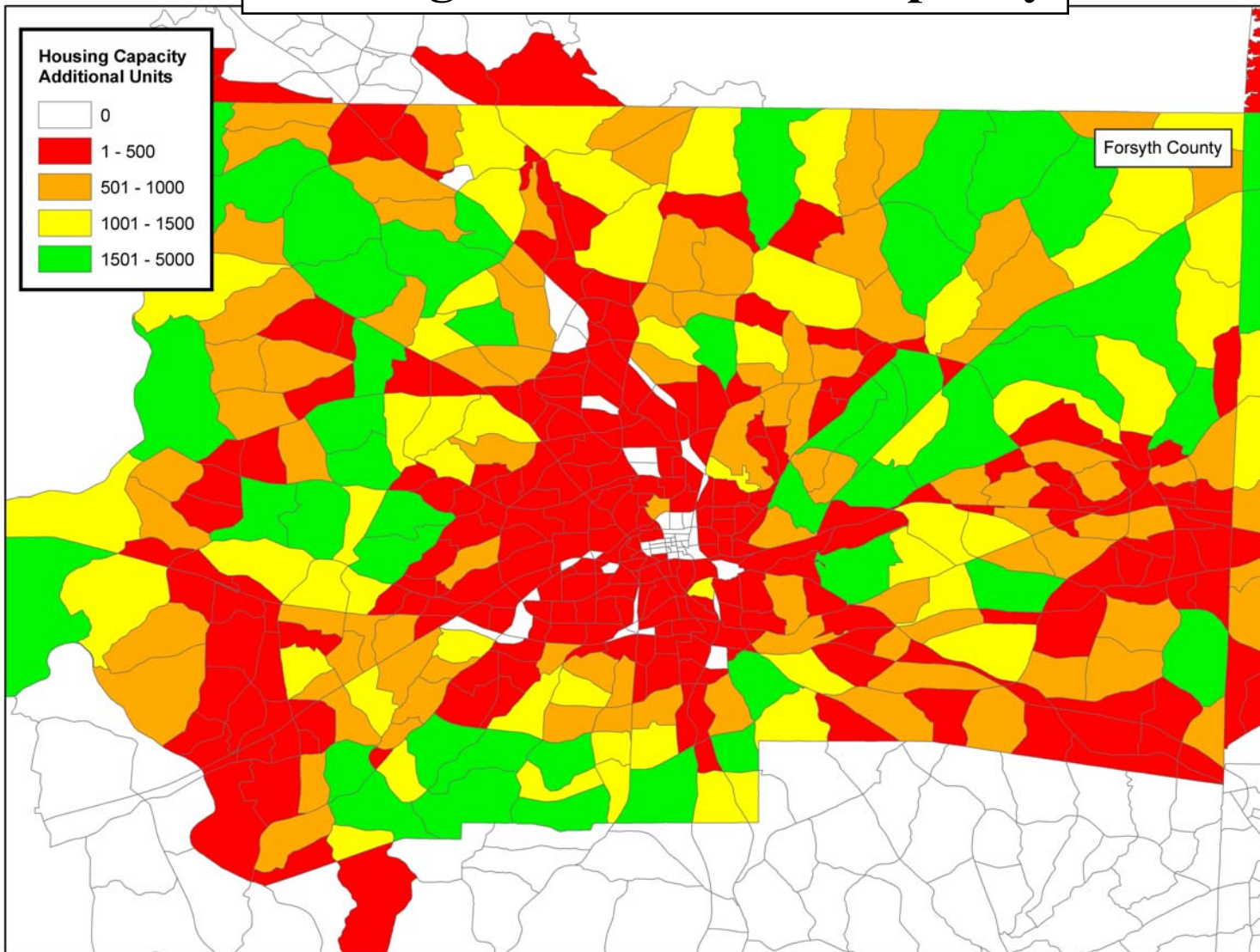
## Employment Density Look-Up Table (Example)

Zoning	Density	Units	Zoning	Density	Units	Zoning	Density	Units
B2 KING	0	SqFt/Emp	H	1600	SqFt/Emp	LO HO	200	SqFt/Emp
C	2800	SqFt/Emp	HB	1600	SqFt/Emp	LO-S	1000	SqFt/Emp
C-S	300	SqFt/Emp	HB-S	2500	SqFt/Emp	MU-S	57500	SqFt/Emp
CB	100	SqFt/Emp	IP	9700	SqFt/Emp	NB	1900	SqFt/Emp
CI	900	SqFt/Emp	IP HO	2000	SqFt/Emp	NB-S	1300	SqFt/Emp
CI-S	500	SqFt/Emp	IP-S	6300	SqFt/Emp	NO	400	SqFt/Emp
CPO	1400	SqFt/Emp	LB	2800	SqFt/Emp	NO-S	1200	SqFt/Emp
GB	1100	SqFt/Emp	LB HO	800	SqFt/Emp	NSB-S	4100	SqFt/Emp
GB-S	2100	SqFt/Emp	LB-S	2700	SqFt/Emp	PB	1200	SqFt/Emp
GI	7400	SqFt/Emp	LI	3000	SqFt/Emp	PB HO	100	SqFt/Emp
GI-S	11500	SqFt/Emp	LI KING	800	SqFt/Emp	PB-S	6900	SqFt/Emp
GO	700	SqFt/Emp	LI-S	5500	SqFt/Emp	PB-S HO	200	SqFt/Emp
GO-S	1200	SqFt/Emp	LO	400	SqFt/Emp			

# Bottom-Up Growth Rate Analysis



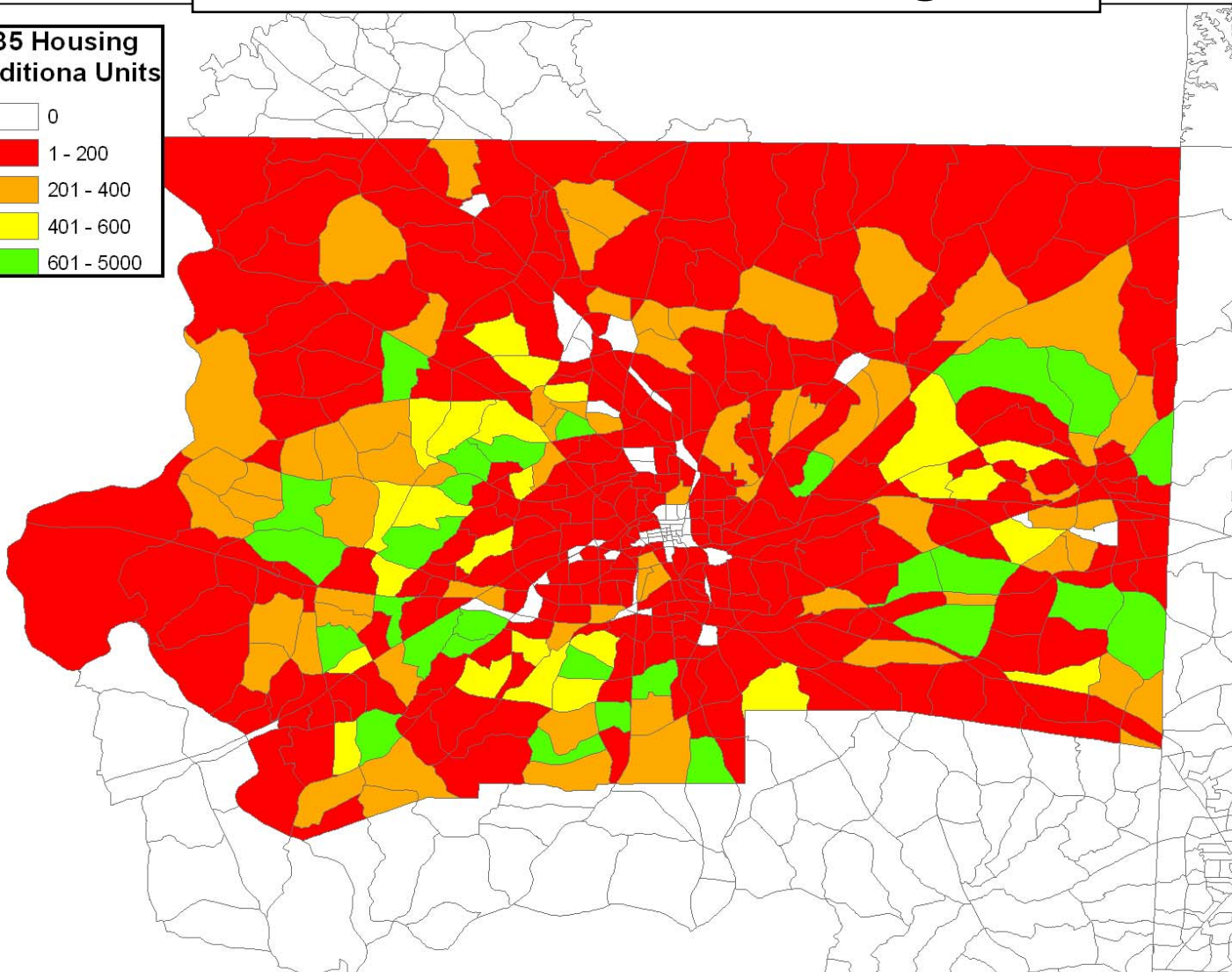
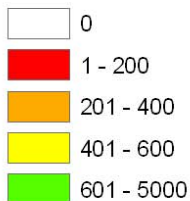
# Housing Unit Build-Out Capacity



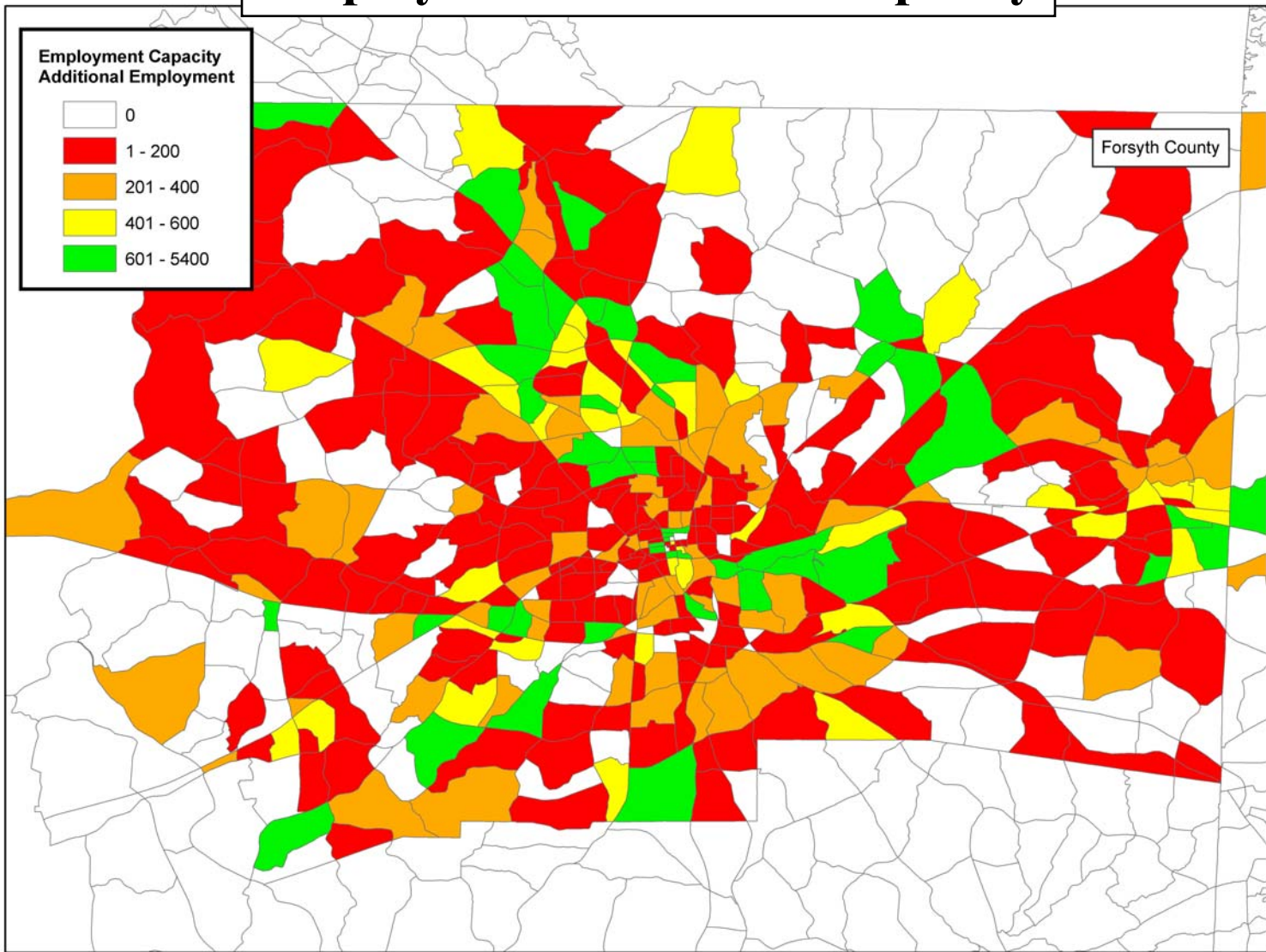


# 2002-2035 Additional Housing Units

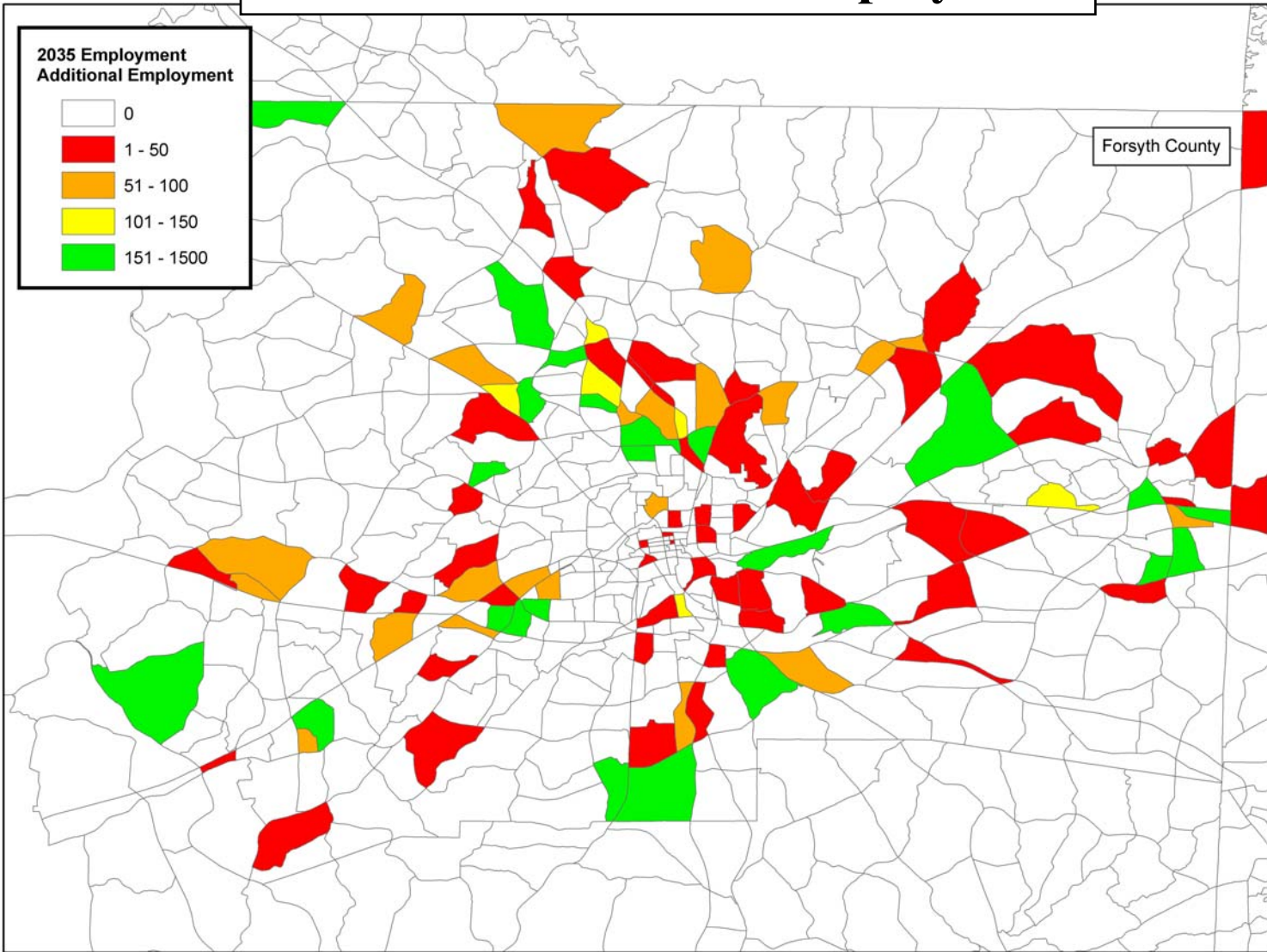
## 2035 Housing Additiona Units



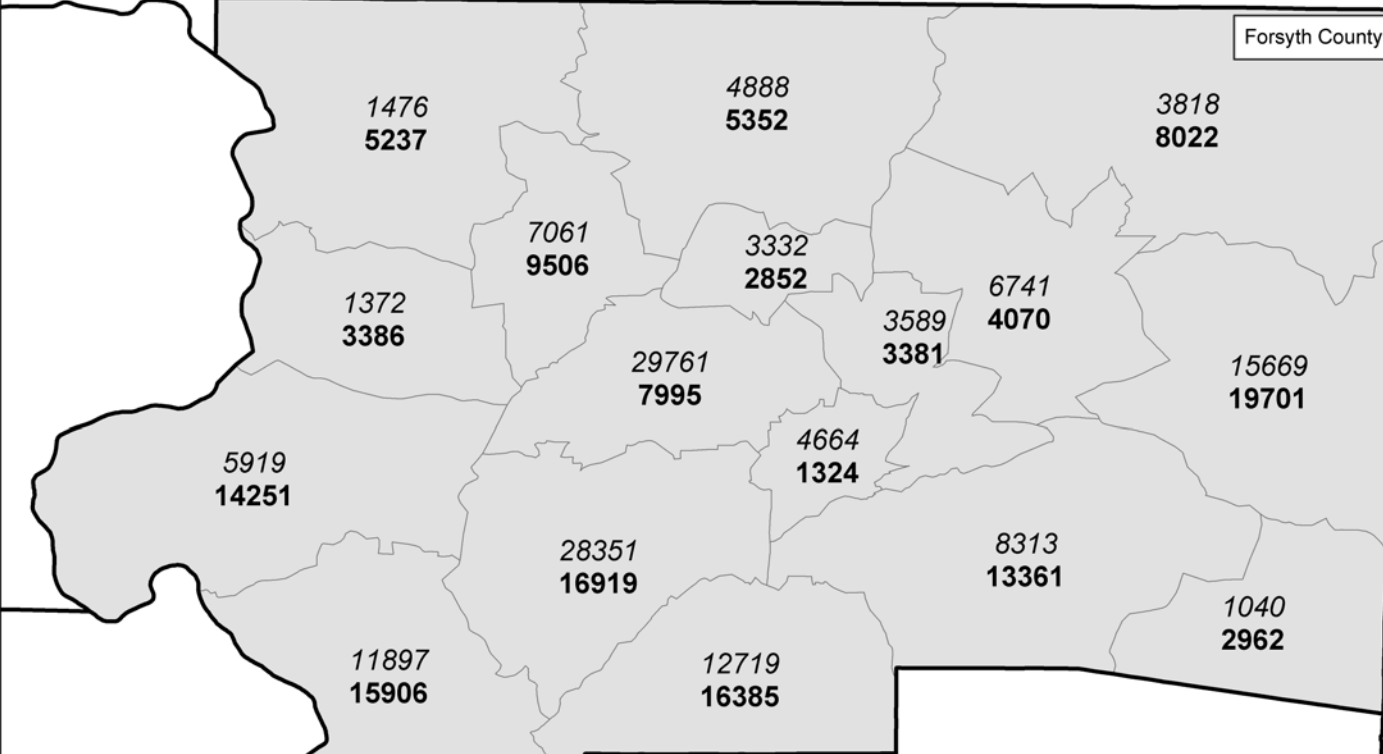
# Employment Build-Out Capacity



# 2002-2035 Additional Employment

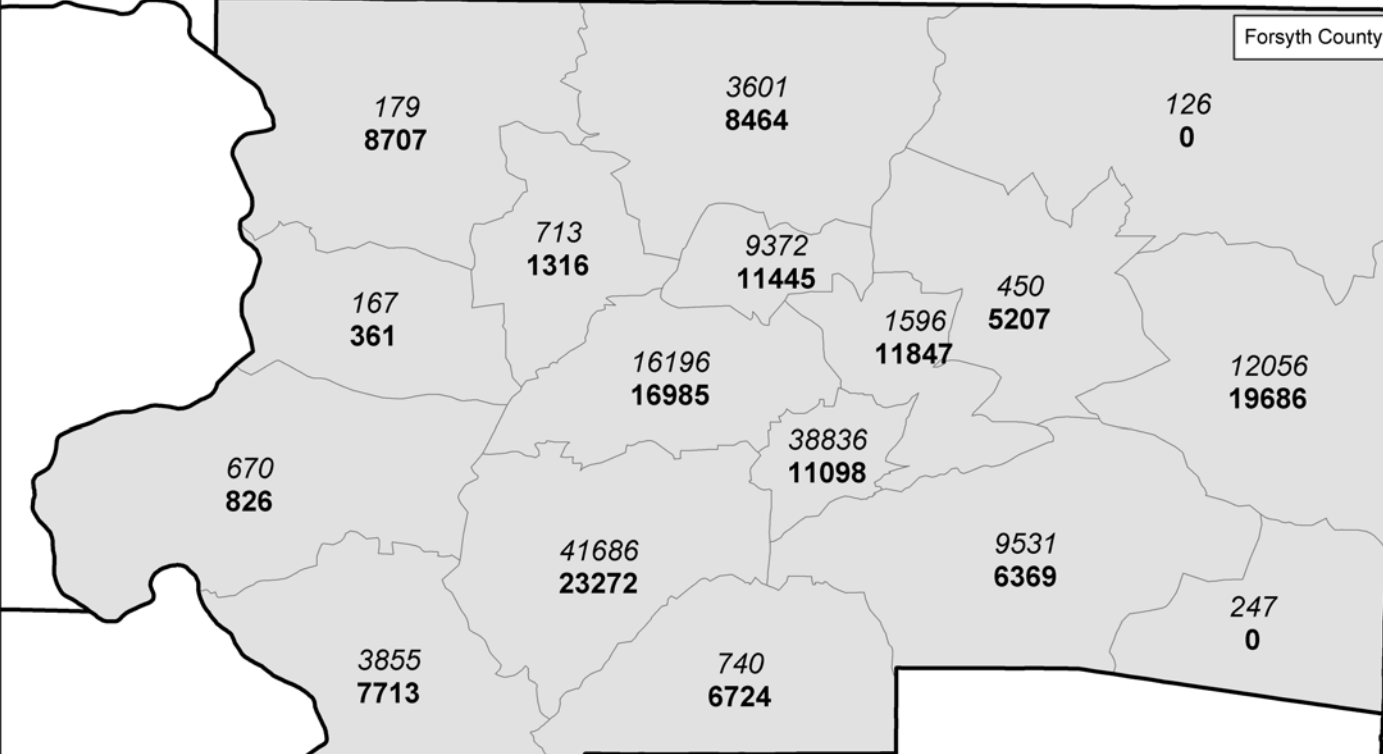


# Top Down Bottom Up First Draft Added Population 2002-2035



*Italic: Top Down*  
**Bold: Bottom Up**

# Top Down Bottom Up First Draft Added Employment 2002-2035



Italic: Top Down  
 Bold: Bottom Up

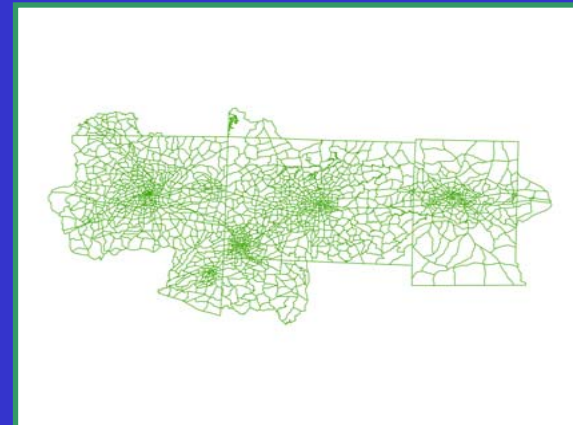
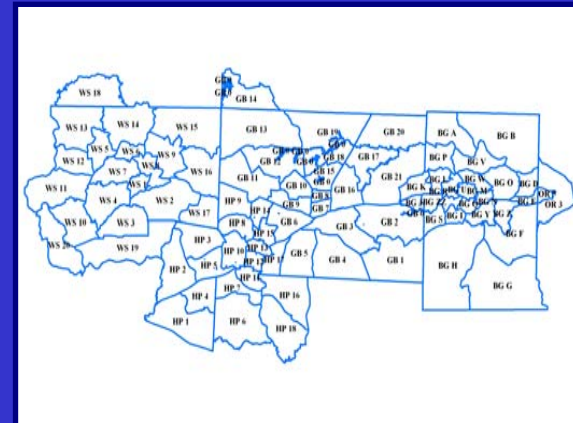
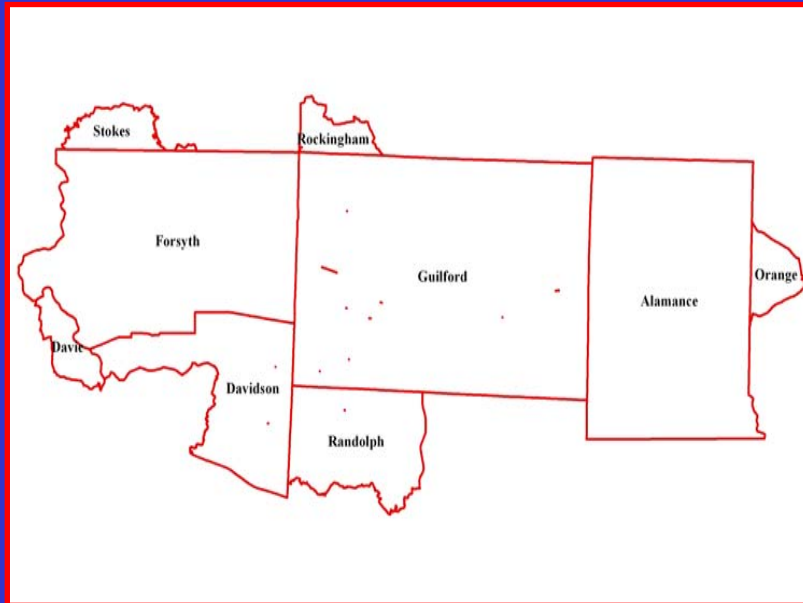
Forsyth County

# Forecast Spreadsheet

# Spreadsheet Data Levels

## Sub Area Level

## County Level



## TAZ Level

# County Control Totals

**Total Population**  
2002, 2015, 2025, 2035

**Households**  
2002, 2015, 2025, 2035

**Total Employment**  
2002, 2015, 2025, 2035

**Household Autos**  
2002, 2015, 2025, 2035

**Primary Students**  
2002, 2015, 2025, 2035



# Sub Area Control Totals

**Total Population**  
2002, 2015, 2025, 2035

**Group Quarters Pop**  
2002, 2015, 2025, 2035

**Highway Retail  
Employment**  
2002, 2015, 2025, 2035

**Industrial  
Employment**  
2002, 2015, 2025, 2035

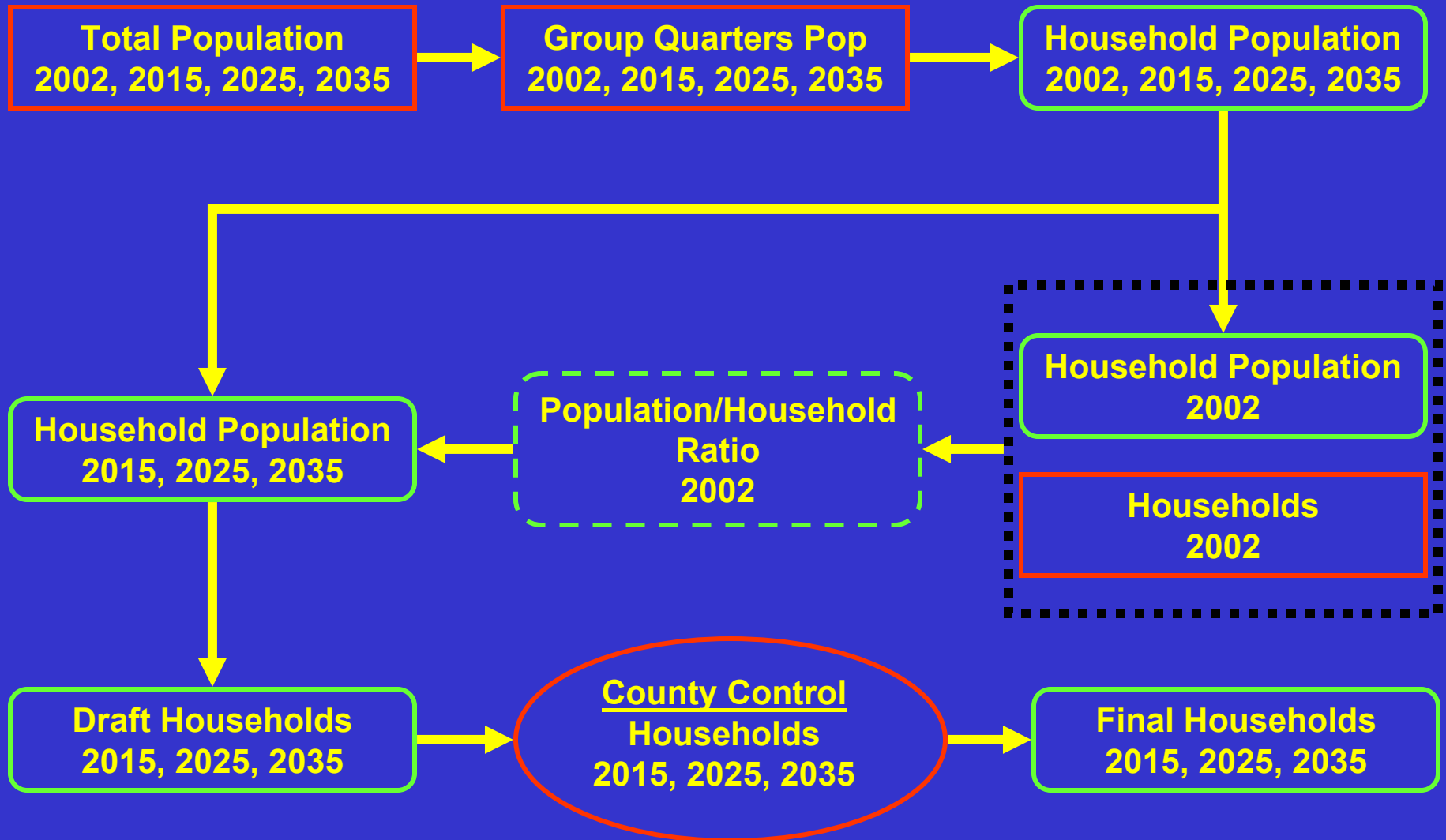
**Retail  
Employment**  
2002, 2015, 2025, 2035

**Service  
Employment**  
2002, 2015, 2025, 2035

**Office  
Employment**  
2002, 2015, 2025, 2035

**School  
Employment**  
2002, 2015, 2025, 2035

# Household/Population Sub Area Control Totals And Calculations



# Employment Sub Area Control Totals And Calculations

**Highway Retail Employment**  
2002, 2015, 2025, 2035

**Service Employment**  
2002, 2015, 2025, 2035

**Industrial Employment**  
2002, 2015, 2025, 2035

**Office Employment**  
2002, 2015, 2025, 2035

**Retail Employment**  
2002, 2015, 2025, 2035

**School Employment**  
2002, 2015, 2025, 2035

**Total Employment**  
2002, 2015, 2025, 2035

# TAZ Base Year Data

2000

Total Population  
Group Quarters Population  
Households  
Occupied Housing Units  
Vacant Housing Units

2002

Total Population  
Group Quarters Population  
Households

2002

Highway Retail Emp  
Industrial Emp  
Retail Emp  
Service Emp  
Office Emp  
School Emp  
*Primary School Emp*  
*University Emp*

2002

Primary Stu  
Full-Time University Stu  
Part-Time University Stu  
Total University Stu  
Total Full-Time Stu  
Total Part-Tome Stu

# TAZ Input Variables

## Housing Growth Variables

1990 Census Housing Units  
2000 Census Housing Units

## Housing Unit Build-Out

Vacant Land Additional Units <sup>1</sup>  
Developed Land Additional Units <sup>1</sup>  
Total Additional Units <sup>1</sup>  
*Override Unit Adjustment*

## Growth Rate Adjustment Factors

Growth Area <sup>1</sup>  
Activity Center <sup>1</sup>  
Highway <sup>1</sup>  
Transit <sup>1</sup>  
Utilities <sup>1</sup>  
*Override Rate Adjustment*

## Employment Growth Variables

2000 TranPlan Employment  
2025 TranPlan Employment  
1990 Year Built Employment <sup>1</sup>  
2002 Year Built Employment <sup>1</sup>

## Employment Build-Out

Total Additional Employment <sup>1</sup>  
*Override Employment Adjustment*

## Household Autos <sup>2</sup>

2000 Autos per Household  
2000 Household Autos

## School Enrollment <sup>3</sup>

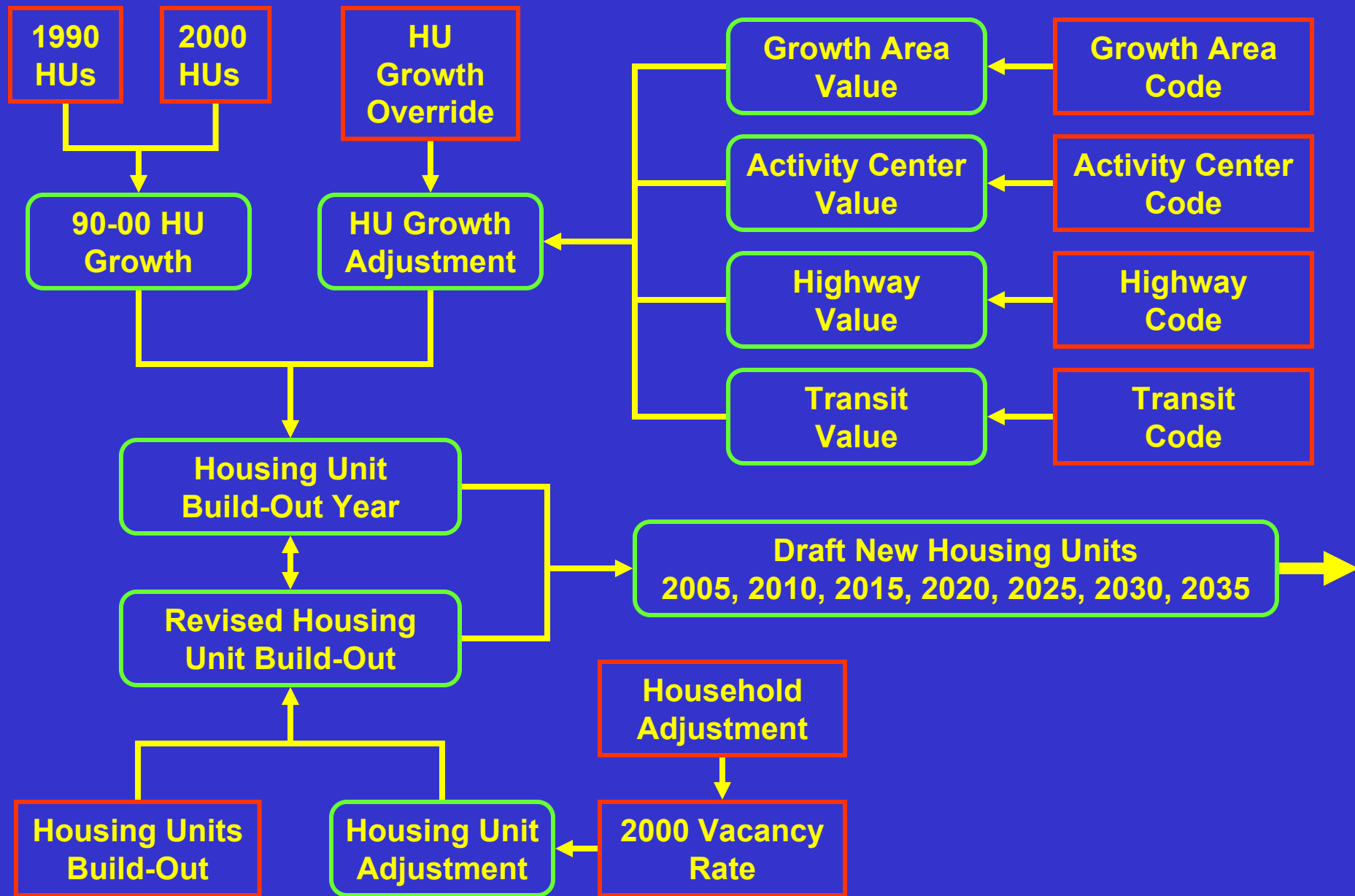
School Phasing: 2015, 2025, 2035  
School Size: Small, Medium, Large

<sup>1</sup> From Bottom-Up Analysis

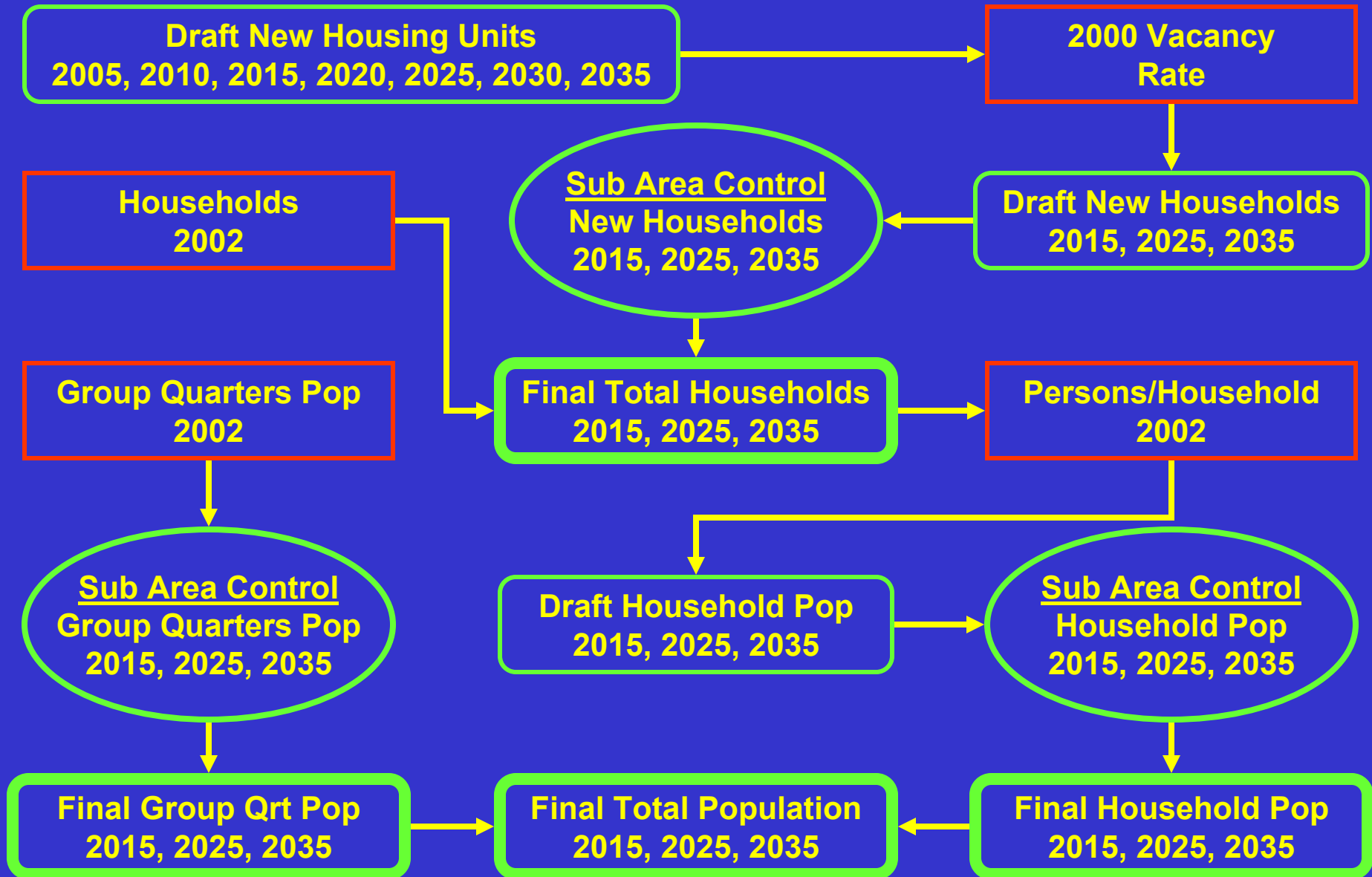
<sup>2</sup> From Auto Availability Analysis

<sup>3</sup> From School Enrollment Analysis

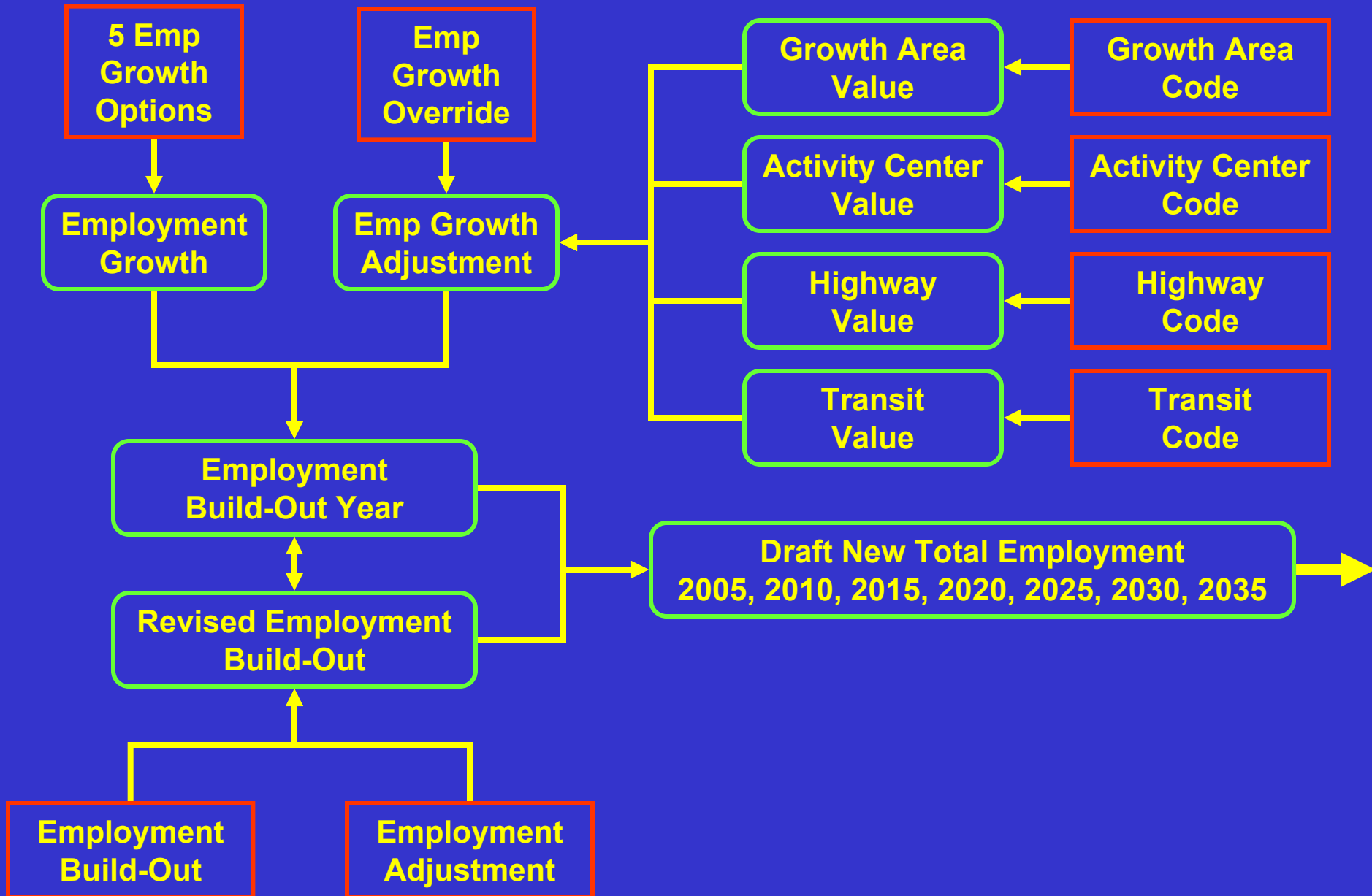
# Draft TAZ Level Housing Units



# Final TAZ Level Households and Population



# Draft TAZ Level Total Employment



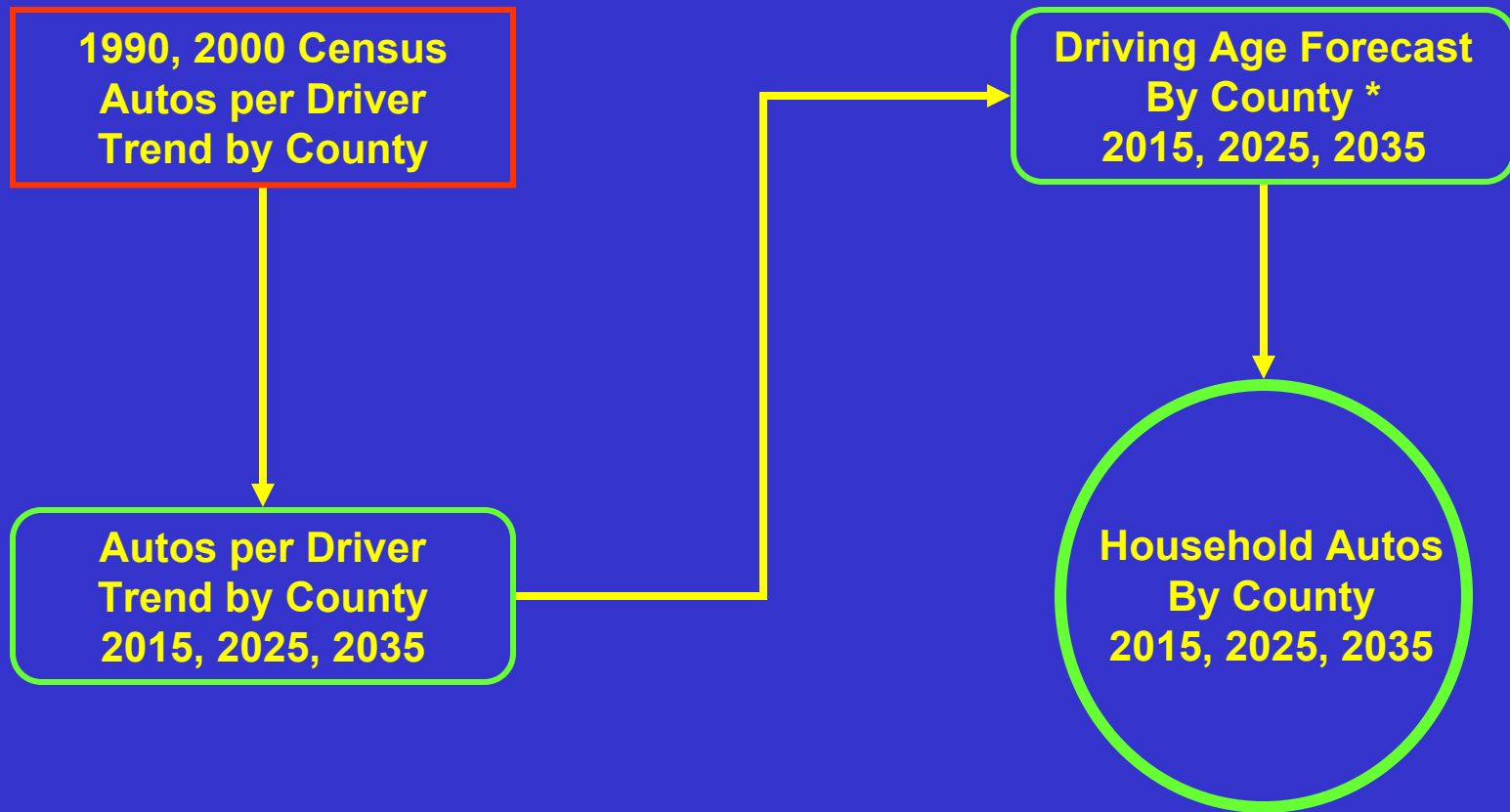


# Final TAZ Level Employment



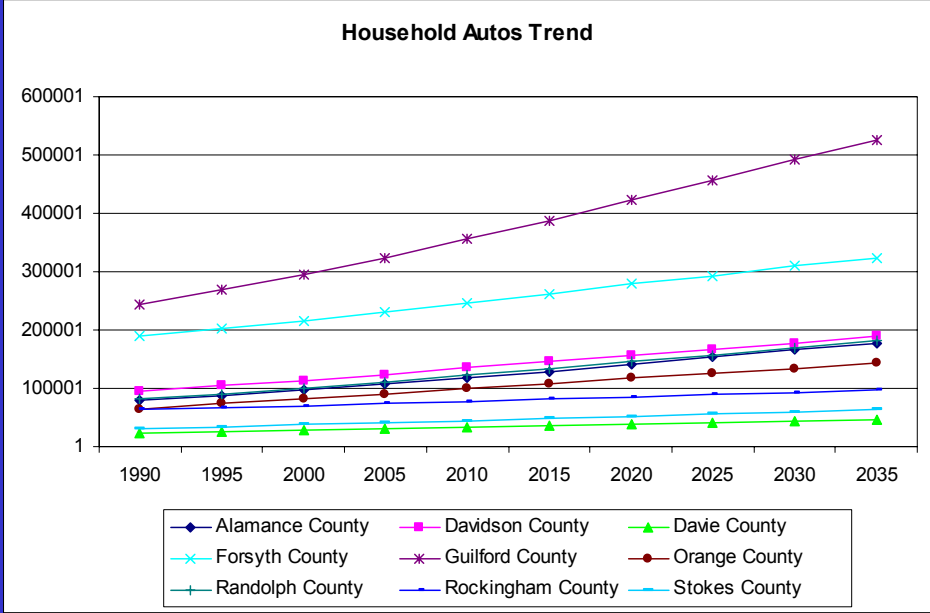
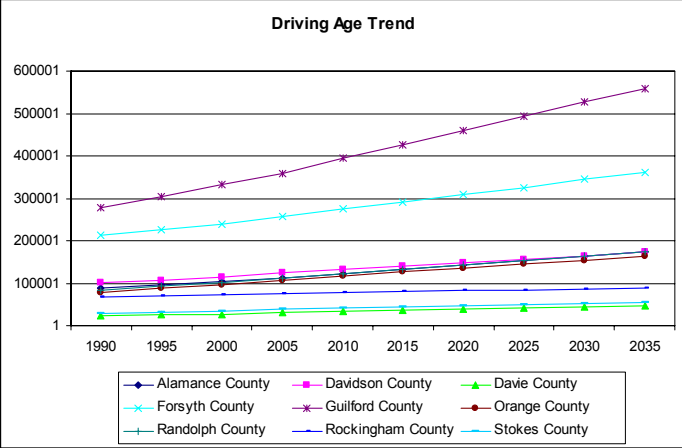
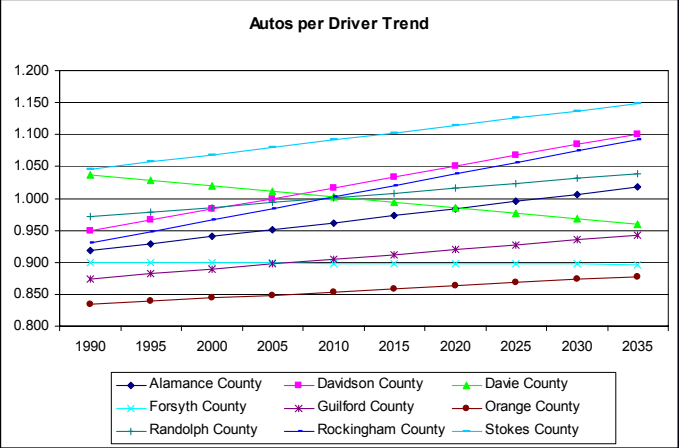
# **Analysis External To Spreadsheet**

# Household Autos Analysis

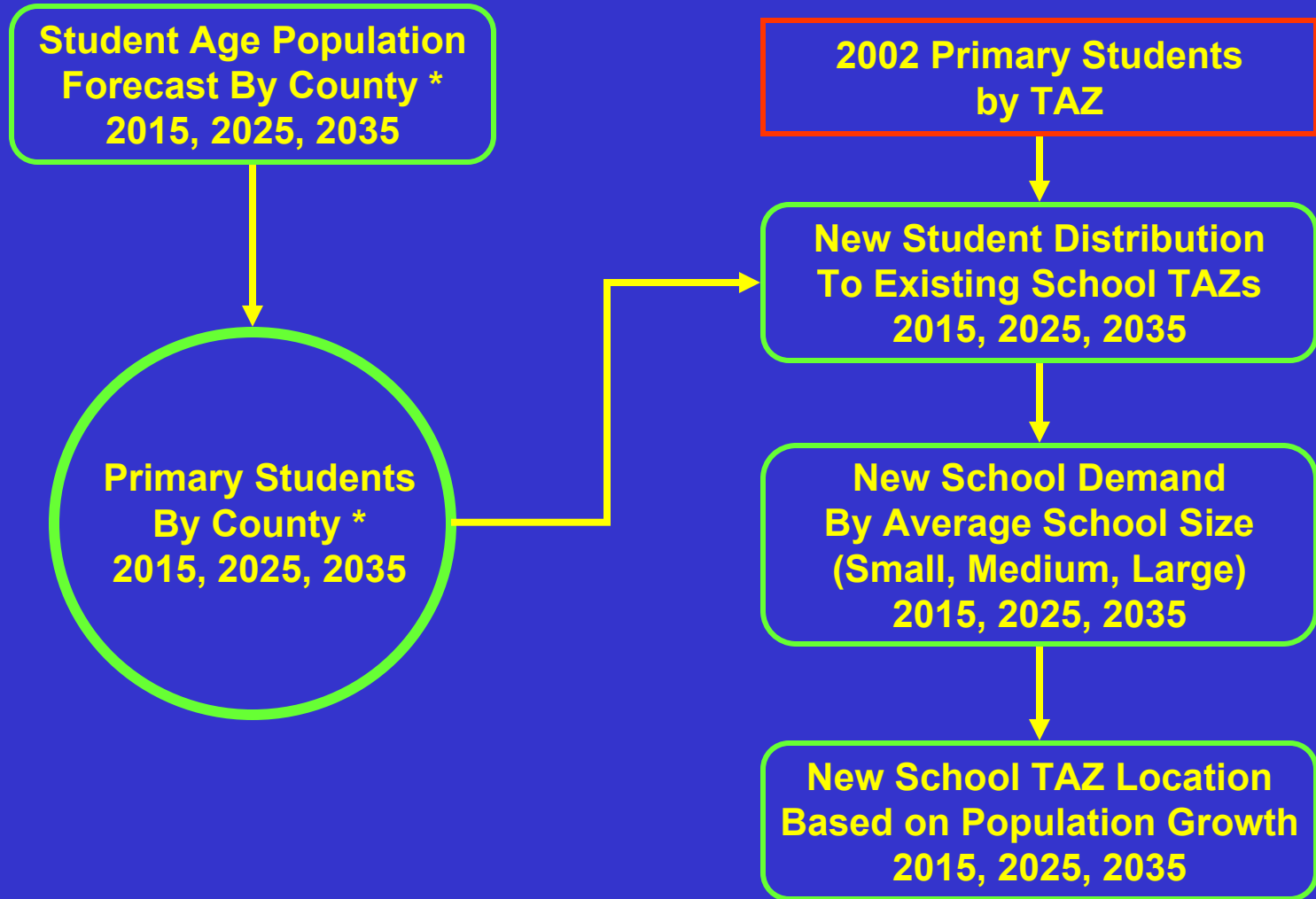


\* From State Data Center. 2035 Interpolated. Adjusted to county control totals.

# Autos per Household Analysis



# Primary Student Analysis



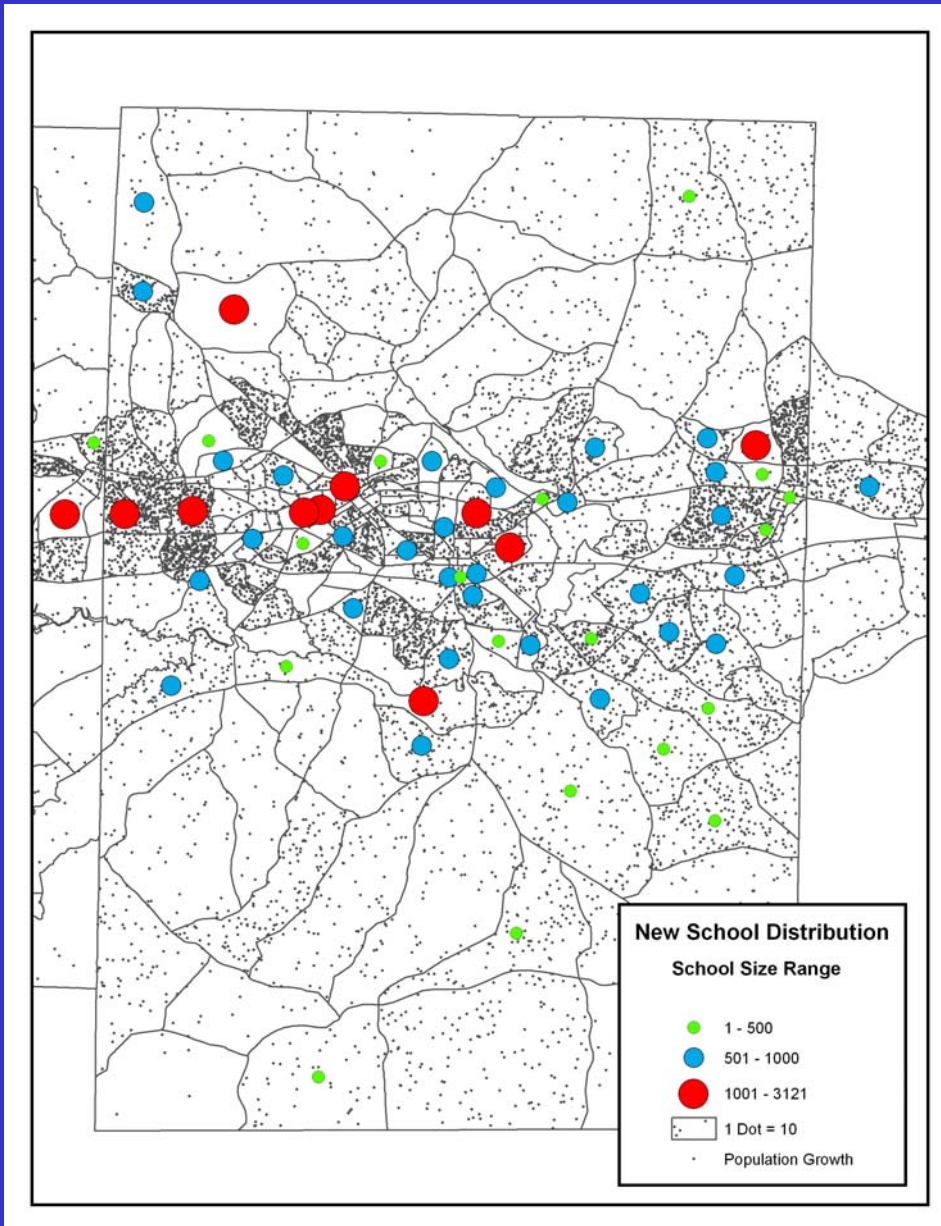
\* From State Data Center. 2035 Interpolated. Adjusted to county control totals.

# Primary Student Analysis

## New Student Distribution (Example)

School Size	2002 School Count	2002 Student Distribution	2002 School Density	2015 School Distribution	2015 New School Estimate	2025 School Distribution	2025 New School Estimate	2035 School Distribution	2035 New School Estimate
0 – 500	11	3356	305	845	3	1411	5	2271	7
500 – 1000	17	10783	634	2710	4	4538	7	7294	12
1000+	6	8400	1400	2111	2	3535	3	5682	4
	34	22539	2339	5666	9	9484	15	15247	23

# Primary Student Analysis



# Lessons Learned

- **Know the Definitions Being Used in Employment**

- The NC ESC reports INSURED employment: Does not include agricultural workers, the military, proprietors, household, and miscellaneous employment.
- BEA data (and W&P) includes employment not reported by BLS.



# Lessons Learned

- **Use Census Geography to Define TAZs**

- Makes Comparison of Block Level Census Data Possible
- Makes it Easier to Relate Block Group Level Census Data to TAZs (Example: Household Income, Autos Available)
- TAZs Can be Used as Geography for the Census Transportation Planning Package (lots of census data at the TAZ level including commuter flows)

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**April 26<sup>th</sup>, 2006**

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Parsons Brinckerhoff**

# **Base Year Data Review**

## **Main Concerns**

- **Vacant Units Included in Household Count**
- **Group Quarters Population Omitted**
- **Data Entry Errors/Other Flags**
- **Assignment of Census Blocks to TAZs**

## Vacant Units Included in Household Count

TAZ	2000 Housing Units	2000 Households	2000 Vacant Units	2002 Households	2000 - 2002 Household Change	2000 - 2002 Population Change
444	1306	1230	76	1306	76	0
479	771	695	76	771	76	1
420	949	885	64	949	64	0
741	746	682	64	746	64	0
107	400	341	59	400	59	0
508	309	253	56	309	56	0
482	863	815	48	863	48	2
439	270	228	42	270	42	1
466	154	116	38	154	38	2
12	412	377	35	412	35	0
459	780	749	31	780	31	2
72	468	438	30	468	30	-2
11	218	190	28	218	28	0

## Group Quarters Population Omitted

County	TAZ	2002 Household Population	2002 Group Quarters Population	2002 Households	2002 Persons/ Household	2000 Census Group Quarters Population	Adjusted 2002 Persons/ Household
Forsyth	2418	3072	0	130	23.6	2809	2.0
Forsyth	2062	1301	0	91	14.3	1138	1.8
Forsyth	2011	861	0	16	53.8	842	1.2
Forsyth	2080	541	0	85	6.4	404	1.6
Forsyth	2066	642	0	109	5.9	356	2.6
Forsyth	2414	421	0	75	5.6	244	2.4
Forsyth	2028	219	0	1	219.0	219	0.0
Forsyth	2041	243	0	15	16.2	210	2.2
Forsyth	2464	574	0	197	2.9	188	2.0
Forsyth	2043	190	0	3	63.3	179	3.7
Forsyth	2424	716	0	240	3.0	175	2.3
Forsyth	2468	1362	0	564	2.4	164	2.1
Forsyth	2454	609	0	189	3.2	157	2.4

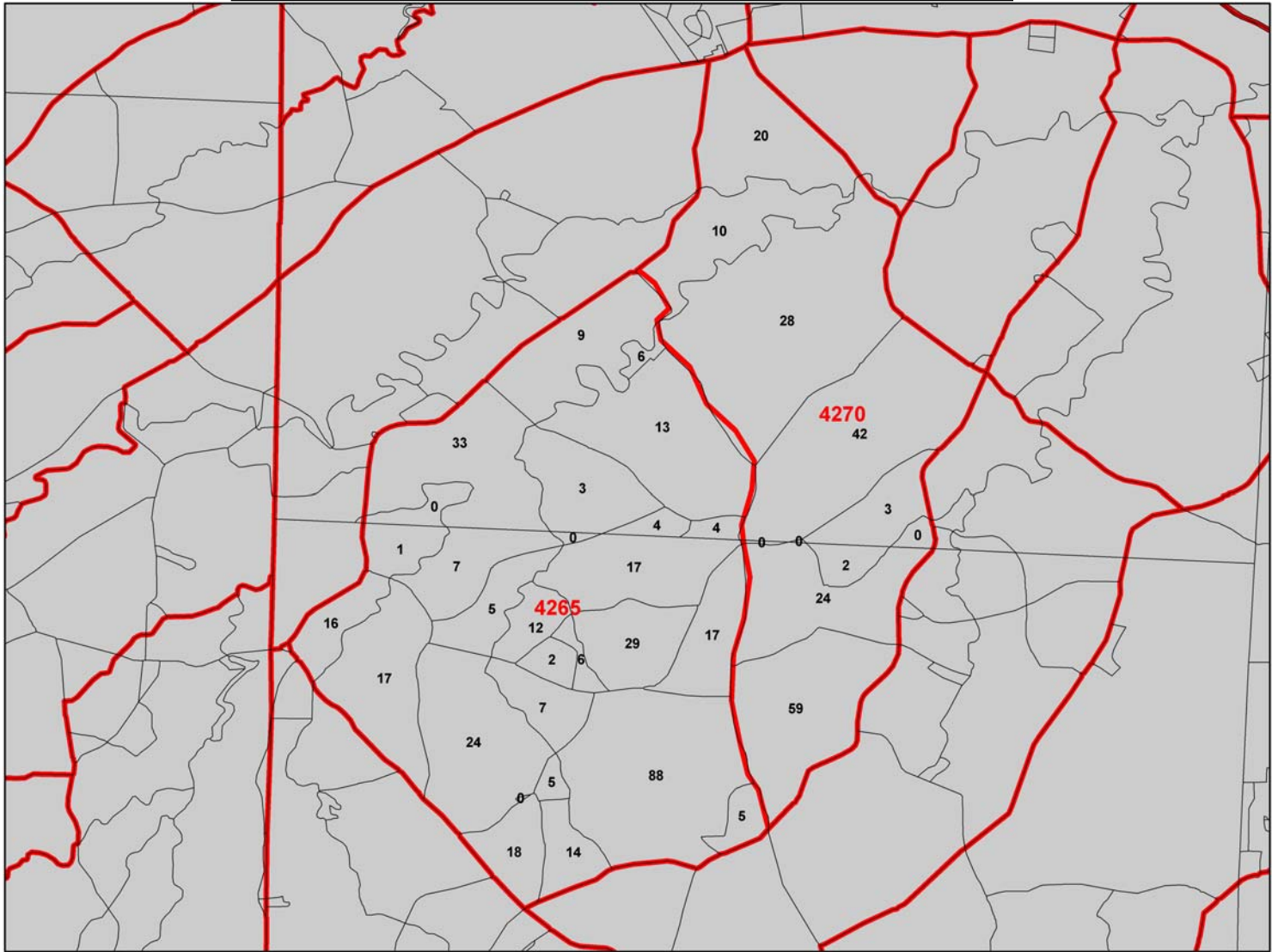
## Data Entry Errors/Other Flags

County	TAZ	2000 HH Pop	2000 HH	2000 Pers/HH	2002 HH Pop	2002 HH	2002 Pers/HH	00 - 02 Pop Change	00 - 02 HH Change	New Housing Pers/HH
Forsyth	2412	799	258	3.1	199	258	0.8	-600	0	NA
Alamance	4065	126	57	2.2	139	59	2.4	13	2	6.5
Alamance	4176	437	211	2.1	495	219	2.3	58	8	7.3
Randolph	3286	404	149	2.7	520	181	2.9	116	32	3.6
Alamance	4238	643	434	1.5	669	270	2.5	26	-164	-0.2
Alamance	4268	428	434	1.0	445	181	2.5	17	-253	-0.1
Alamance	4237	643	434	1.5	669	270	2.5	26	-164	-0.2

## Assignment of Census Blocks to TAZs

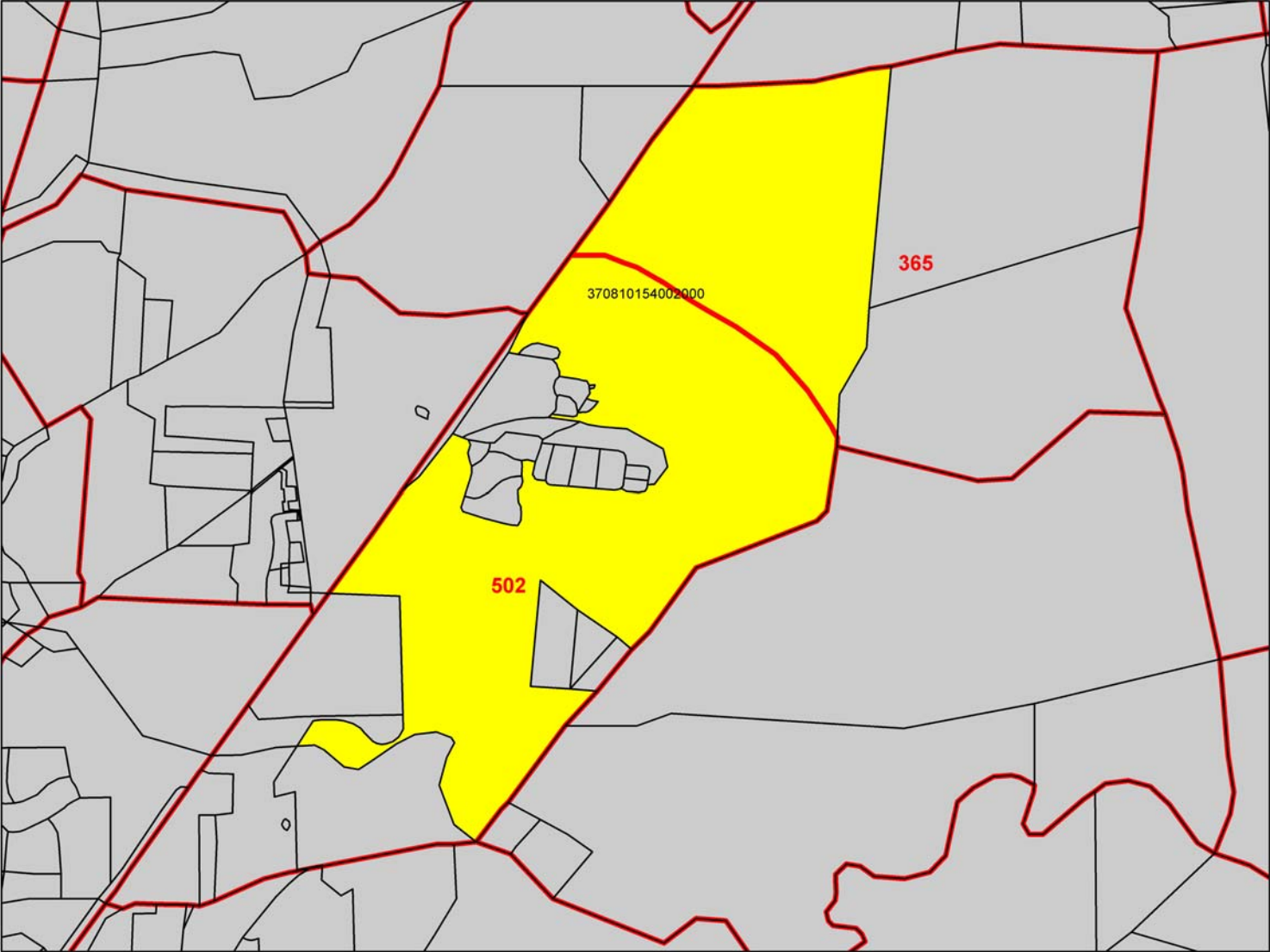
County	TAZ	2000 Model Housing Units	2000 Census Housing Units	Census - Model Difference
Alamance	4235	408	487	79
Alamance	4261	308	229	-79
Alamance	4236	373	399	26
Alamance	4262	219	193	-26
Alamance	4265	330	362	32
Alamance	4270	220	188	-32

# Assignment of Census Blocks to TAZs





# Assignment of Census Blocks to TAZs



# Review Final Forecasts

# Population Adjustments By County

County	2002 Population			2035 Population		
	July	October	Difference	July	October	Difference
Alamance	135,755	135,755	0	223,752	223,749	-3
Davidson	70,581	70,581	0	116,959	119,554	2,595
Davie	8,526	8,526	0	15,479	15,479	0
Forsyth	315,970	315,970	0	503,041	503,063	22
Guilford	432,595	432,567	-28	676,476	674,508	-1,968
Orange	5,664	5,664	0	11,319	11,319	0
Randolph	37,429	37,429	0	64,824	64,191	-633
Rockingham	4,843	4,843	0	9,359	9,358	-1
Stokes	14,056	14,056	0	23,397	23,400	3

<b>Total</b>	<b>1,025,419</b>	<b>1,025,391</b>	<b>-28</b>	<b>1,644,606</b>	<b>1,644,621</b>	<b>15</b>
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# Employment Adjustments By County

County	2002 Employment			2035 Employment		
	July	October	Difference	July	October	Difference
Alamance	60,260	59,722	-538	104,159	103,235	-924
Davidson	21,996	22,308	312	35,403	36,230	827
Davie	996	1,205	209	4,965	3,028	-1,937
Forsyth	180,848	181,032	184	312,523	312,853	330
Guilford	268,960	264,841	-4,119	472,969	474,581	1,612
Orange	1,595	1,595	0	4,224	4,232	8
Randolph	10,676	10,766	90	17,731	18,082	351
Rockingham	653	653	0	4,531	4,562	31
Stokes	3,476	3,742	266	6,476	6,741	265

<b>Total</b>	<b>549,460</b>	<b>545,864</b>	<b>-3,596</b>	<b>962,981</b>	<b>963,544</b>	<b>563</b>
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