

**Monroe Connector/Bypass  
(R-3329/R-2559)**

**Union County Growth Factors  
Technical Report**

Prepared for the North Carolina Turnpike Authority



A Division of North Carolina Department of Transportation



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November 7, 2013

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## **1.0 GROWTH TRENDS IN UNION COUNTY**

Two key questions that arose during review of the previous ICE analyses and during litigation are summarized as follows:

1. Why has Union County grown so quickly in the past even without major transportation improvements like the Monroe Connector/Bypass?
2. Why, if the socioeconomic forecasts are to be accepted, is Union County likely to continue to grow at an above average rate for the next 30 years with or without major transportation improvements like the Monroe Connector/Bypass?

Put more succinctly: “Why would Union County have such robust growth in the absence of new transportation infrastructure?” The short answer is that the factors that caused Union County to experience higher growth than any other regional county since 1990 are still in place and are likely to continue to result in higher than average growth. This section summarizes the growth trends of Union County and other regional counties and reviews some of the literature regarding why some counties grow more quickly than others do.

Analyzing regional growth dynamics requires establishing a set of counties to which one can compare growth patterns. Many definitions of the Charlotte metropolitan region exist, but the most common and applicable for an analysis of the Monroe Connector/Bypass are the following:

- The Census Bureau defines the Charlotte-Gastonia-Rock Hill, NC-SC Metropolitan Statistical Area (MSA) to include Mecklenburg, Union, Gaston, Cabarrus and Anson Counties in North Carolina and York County in South Carolina.
- The Census Bureau defines the Charlotte-Gastonia-Salisbury, NC-SC Combined Metropolitan Statistical Area (CMSA) to include all of the above counties plus Iredell, Lincoln, Rowan, Stanly and Cleveland Counties in North Carolina and Chester and Lancaster Counties in South Carolina.
- The Charlotte Regional Partnership, a regional economic development advocacy organization, defines the metropolitan area as including all of the above CMSA counties plus Catawba and Alexander Counties in North Carolina and Chesterfield County in South Carolina.
- The Charlotte DOT manages the MRM, a regional travel demand model for the metropolitan area that includes socioeconomic forecasts of population and employment at the TAZ level. The socioeconomic forecasts for the metropolitan area cover all of Mecklenburg, Union, Gaston, Cabarrus, Lincoln, Rowan and Stanly Counties plus portions of Iredell and Cleveland Counties in North Carolina and all of York County and portions of Lancaster County in South Carolina.

NCTA and its consultants determined that the CMSA was the most appropriate for comparison purposes. Table 1 summarizes the population and growth in the CMSA counties in the region from 1990 to 2010. It also shows the MRM forecast coverage for each. The MSA definition excludes counties, such as Iredell and Lincoln, each of which have captured more than three percent of regional growth in the last two decades. The CMSA definition includes a number of counties that have captured relatively small percentages of regional growth and currently have a limited relationship to the overall regional growth dynamics. Based on MPO and NC State Data Center forecasts, some of these counties are expected to see substantial increases in population in the future and therefore they will be included in the analysis. Of important note in Table 1 is the percent of CMSA population growth from 1990 to 2010. These percentages show how much of the overall growth of the region each county has captured.

**Table 1: Population and MRM Forecast Status for CMSA Counties**

County	State	MRM Forecast Coverage	Population					
			1990	2000	2010	1990 to 2010 Growth	% Growth 1990-2010	% of CMSA Population Growth 1990-2010
<i>MSA Counties</i>								
<b>Mecklenburg</b>	NC	Whole	511,433	695,454	919,628	408,195	79.5%	45.3%
<b>Union</b>	NC	Whole	84,211	123,677	201,292	117,081	139.0%	13.0%
<b>Gaston</b>	NC	Whole	174,769	190,365	206,086	31,317	17.7%	3.5%
<b>Cabarrus</b>	NC	Whole	98,935	131,063	178,011	79,076	79.9%	8.8%
<b>York</b>	SC	Whole	131,497	164,614	226,073	94,576	71.9%	10.5%
<b>Anson</b>	NC	None	23,474	25,275	26,948	3,474	12.9%	0.4%
<i>CMSA Counties</i>								
<b>Iredell</b>	NC	Partial	93,205	122,660	159,437	66,232	71.6%	7.4%
<b>Lincoln</b>	NC	Whole	50,319	63,780	78,265	27,946	55.5%	3.1%
<b>Rowan</b>	NC	Whole	110,605	130,340	138,423	27,818	25.2%	3.1%
<b>Stanly</b>	NC	Whole	51,765	58,100	60,585	8,820	17.0%	1.0%
<b>Chester</b>	SC	None	32,170	34,068	33,140	970	3.0%	0.1%
<b>Lancaster</b>	SC	Partial	54,516	61,351	76,652	22,136	40.6%	2.5%
<b>Cleveland</b>	NC	Partial	84,958	96,287	98,078	13,120	15.8%	1.5%
<b>Total</b>			<b>1,501,857</b>	<b>1,897,034</b>	<b>2,402,618</b>	<b>900,761</b>	<b>60.0%</b>	

Source: US Census 1990, 2000 and 2010, MRM Socioeconomic Forecasts

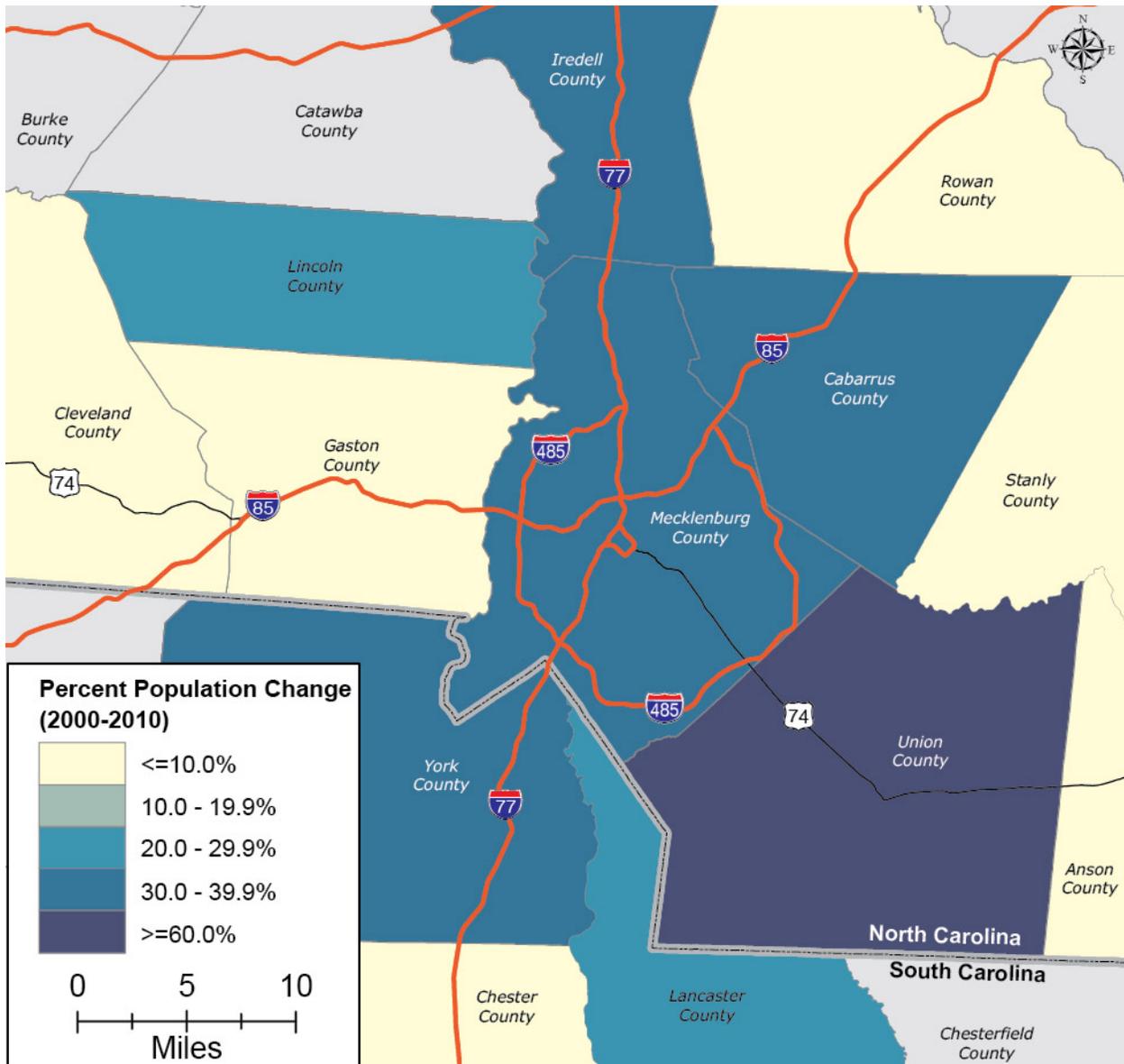
As seen in Table 1 and Figure 1, Union County has experienced the highest population growth rate in the study area since 1990. Specifically, the county witnessed a 46.9 percent population increase (39,466) from 1990 to 2000 and a 62.8 percent increase (77,615) from 2000 to 2010. Meanwhile, the CMSA experienced 26.3 percent growth and 26.7 percent growth, respectively, over the same period. In 2010, Union County accounted for 8.4 percent of the study area’s total population, up 2.8 percent since 1990. The rate of population growth in Union County has been quite high for many years. From 1990 to 2000, the average annualized growth rate was 3.9 percent. That average annualized growth rate rose significantly, to 5.7 percent from 2000 to 2005 and then fell back to 4.3 percent from 2005 to 2010. In each period, however, Union County has been the fastest growing county in the region (by percentage growth).

This high growth rate does not mean, however, that Union County has captured most of the regional growth. As Table 1 shows, Mecklenburg County has captured 45.3 percent of the regional population growth over the last 20 years. Its growth rate has been lower, however, as it was growing from a much larger population base. Union County captured the second largest share of regional population growth, with 13 percent, while York captured 10.5 percent and Cabarrus 7.4 percent. No other county captured more than 5 percent of the regional population growth over the last 20 years. Some counties, such as Lancaster County, experienced significant growth in percentage terms, but only captured small percentages of the region’s overall growth.

Historic data, therefore, suggests that Mecklenburg, Union, York, Cabarrus and Iredell Counties would capture most of the regional growth over the next 20 to 30 years. Nevertheless, dynamics that have encouraged this pattern of growth may or may not continue to exist. Therefore, understanding some of the dynamics underlying why those counties have captured a substantial share of regional growth and

whether they may continue to capture a substantial share of regional growth is critical to understanding which counties are poised to grow in the future.

**Figure 1: Population Growth in CMSA Counties, 2000 to 2010**



## 1.1 Hammer Report and Regional Forecasts

### Methods and Regional Forecast Results

Dr. Thomas Hammer completed a detailed analysis and regional forecasting process for the region in 2003 analyzing historic growth in 227 counties within 29 separate metropolitan areas and modeling those trends to identify the predictive factors that drive regional growth and the distribution of that growth

across the regional jurisdictions.<sup>1</sup> Trends are a significant driver of county-level shares of growth, but the model developed by Dr. Hammer isolates the factors that differentiate growth dynamics at the county level, which requires greater complexity than examining trends in isolation. In other words, Dr. Hammer's model attempted to isolate the factors that most strongly affected whether a county saw higher or lower growth than a trend line projection would forecast. Importantly, the Hammer Report notes the following:

*People trying to imagine . . . what the world will be like decades in the future – can easily be drawn into focusing upon what should occur rather than what is most likely to occur. Urban planners and others with a professional or personal stake in shaping the future are particularly susceptible. (The strong preference of many planners for bottom-up forecasting comes from the flattering notion that they, through the design of land use controls and mass-transit facilities, will be telling future development where to go.) Forecasts can verge into being prescriptive rather than predictive, and while prescriptive forecasts have their value, the present investigator is not in that business. So the approach described here mandates the use of allocation relationships established through formal analysis of empirical data. Statistical calibration confers advantages of realism as well as objectivity, because the interactions of urban activities over space are so complex and multifaceted that it is very hard to specify the existence, much less the magnitude, of relationships without recourse to historical evidence. (p. 4)*

Dr. Hammer's initial step was to develop a total population and employment forecast for the region overall. This step used an input-output economic model to estimate the overall employment and population based on national economic trends, local industrial sector analysis and local and national demographic trends. These regional level forecasts were driven by large-scale economic trends and demand side influences as opposed to supply side influences such as existing and future transportation infrastructure or utilities or restrictive land use policies<sup>2</sup>. It is important to stress that these projections, which developed future employment and population, did not include the Monroe Connector/Bypass. Table 2 outlines the regional forecast of population resulting from Dr. Hammer's analysis of economic and demographic trends. While the growth forecast seems very high at first glance, compared to other large growing regions in the south, the growth forecast is quite reasonable. Dr. Hammer notes:

*Given the present forecast for the Charlotte region and its performance since 1990, the region's highest 30-year percent change in population will be an 83% gain for the period from 1990 to 2020. The 30-year percent changes for the region will then trend downward to 73% for the 2005-2035 interval. Thus, Charlotte will not come within thirty percentage points of the increases posted by the three monsters of the south [Dallas, Houston and Atlanta]. In fact, the Charlotte region's peak gain of 83% during 1990-2020 will only be midway between the national growth rate of 33% for that period and Atlanta's 30-year record of 134% for 1970-2000. So the future expansion of the Charlotte region will be robust but by no means unprecedented. (p 27)*

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<sup>1</sup> Hammer, Thomas, *Demographic and Economic Forecasts for the Charlotte Region*, Prepared for the Charlotte Department of Transportation, December 8, 2003.

<sup>2</sup> The Hammer Report formed part of the basis of the MPO forecasts which served as control totals for the No-Build scenario of the Quantitative ICE. The Build scenario, however, did specifically analyze how transportation improvements would change accessibility in the FLUSA and thus impact growth.

**Table 2: Forecasts of Charlotte’s Regional Population**

Year	Population	5-Year Change	Annualized Growth Rate
<b>2000</b>	1,986,903		
<b>2005</b>	2,179,103	192,200	1.86%
<b>2010</b>	2,385,288	206,185	1.82%
<b>2015</b>	2,624,430	239,142	1.93%
<b>2020</b>	2,889,969	265,539	1.95%
<b>2025</b>	3,175,350	285,381	1.90%
<b>2030</b>	3,474,012	298,662	1.81%
<b>2035</b>	3,779,397	305,385	1.70%

Source: Hammer, 2003.

Next, the overall regional forecast was apportioned among the various jurisdictions using an allocation model that distributed the forecasted regional growth to individual counties. The model used past trends and current conditions for households (by income in three groups) and earnings by industry (in 32 groups) from 227 counties across 29 metropolitan regions across the eastern United States to guide the forecasting process. The variables used to allocate growth were limited by the feasibility of collection the necessary data for large-sample model calibration.<sup>3</sup> As such, the forecast model focused mostly on demand side variables such as past economic and demographic trends, existing economic and demographic conditions, the influence of income on growth patterns and the physical proximity of places. Two major supply side factors were considered:

1. The availability of land, estimated on the basis of development magnitudes and based in part on population density (available land is defined as land physically suitable for development that is vacant or developed at very low intensity);
2. The effect that land use regulations and infrastructure policies have had on past growth would influence the model to the extent that those policies affected historic growth trends.

While physical proximity, in straight-line distance, is one factor that Dr. Hammer identified in the analysis, it was indexed by the more significant factor of available land in order to provide a predictive function for growth allocation. The other significant factor in his allocation model is household income.

Dr. Hammer’s final population estimates for each county are summarized below in Table 3. The values include a low, middle and high estimate for each jurisdiction. They do not constitute the final estimate of population for each county in the region as the forecasts were adjusted during a regional reconciliation process (See Section 4.4). The final adopted forecasts were generally within the ranges provided by Dr. Hammer.

Table 3 also shows the population totals for 2030 by county from the 2009 Forecasts. As one can see, many counties had forecasted populations near the upper limit of Hammer’s forecast. This is an expected outcome of a regional reconciliation process as CDOT, the MPOs and local partners worked together to reach an acceptable forecast of growth for the region and for each jurisdiction. Notable deviations from

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<sup>3</sup> Hammer Report, p 10

the Hammer Report forecast ranges are Gaston and Mecklenburg counties, where forecasted growth exceeded Dr. Hammer’s forecasted range. For Cabarrus, Rowan and Union, the forecasts are in the range between the Most Likely and Upper Limit forecasts from Dr. Hammer. For Lincoln, Stanly and York counties the forecasts are between the Most Likely and Lower Limit range. Other counties do not have countywide totals from the MRM model TAZ forecasts only cover portions of Iredell, Cleveland and Lancaster counties. The TAZ forecasts do not include any portion of Anson and Cherokee in North Carolina nor Chester and Union counties in South Carolina.

**Table 3: Hammer Report Population Forecast Ranges**

County	Hammer Report 2030 Population			2009 Forecasts 2030 Population
	Lower	Most-Likely	Upper Limit	
Anson County	36,967	40,847	43,175	
Cabarrus County	247,142	283,115	304,699	299,948
Cleveland County	125,373	134,563	140,077	
Gaston County	235,228	249,261	295,071	312,783
Iredell County	227,287	259,906	279,477	
Lincoln County	113,206	128,857	138,247	126,425
Mecklenburg County	1,051,400	1,157,311	1,220,858	1,271,300
Rowan County	183,747	200,639	210,774	206,060
Stanly County	80,171	87,366	91,682	81,847
Union County	268,543	312,147	338,309	337,314
Cherokee County	83,228	93,168	99,132	
Chester County	52,278	58,306	61,923	
Lancaster County	91,781	101,680	107,619	
Union County, SC	38,480	41,466	43,258	
York County	272,096	305,228	334,080	301,071

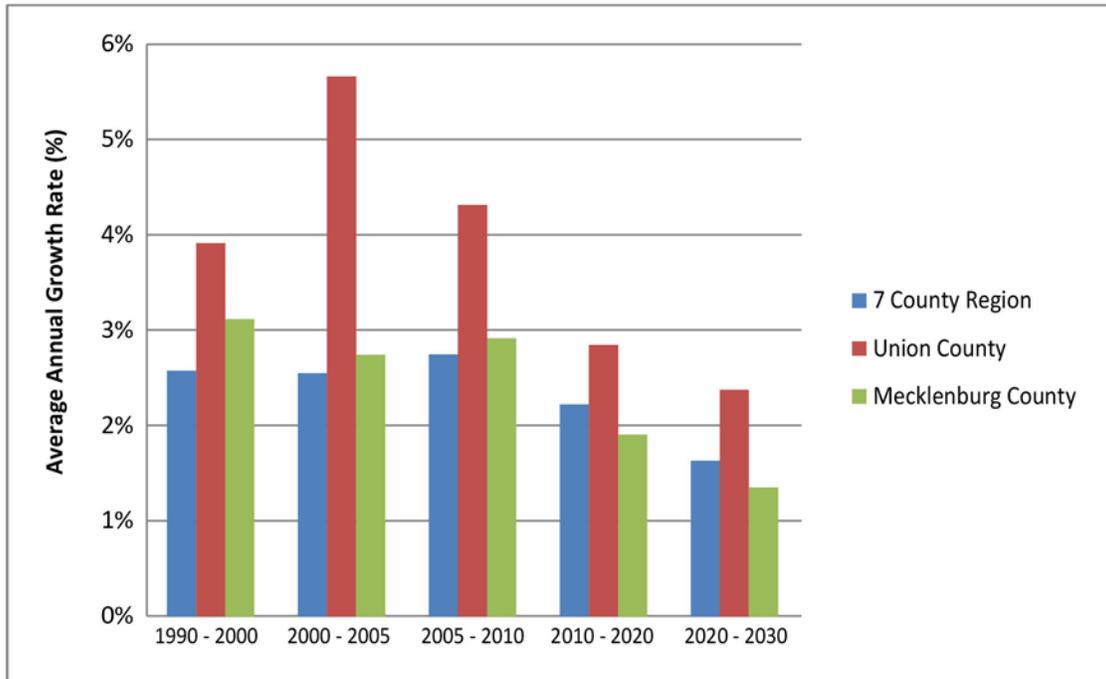
MRM TAZ Level Forecasts only cover Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan, Stanly, Union and York counties in whole. Other counties are covered in part but their totals are not shown as they are not comparable to the full county forecasts from Dr. Hammer.  
Source: Hammer, 2003; MRM Forecasts 2009

**Review of Growth Rates**

The county-level forecasts from the 2009 Forecasts place Union County’s 2030 population at 337,314. As previously noted, this county level control total forecast was developed using an economically driven modeling approach that excluded major transportation infrastructure improvements from its consideration. Growth in Union County has followed the forecasted growth rather closely. As detailed in Table 4, the population of Union County from the 2010 Census is very close to the population forecast in the 2009 Forecasts; the forecast of 2010 population was 200,450, while the 2010 Census count was 201,292. Furthermore, the growth rates projected by the MRM 2030 forecasts are modest compared to historic growth in the county. To reach the forecasted 337,317 estimate of population by 2030, growth in Union County would have to slow to an average annualized growth rate of 2.6 percent, based on the 2010

Census count. Figure 2<sup>4</sup> shows the differences in average annual growth rates across the five different periods (1990 to 2000, 2000 to 2005, 2005 to 2010, 2010 to forecasted 2020 and forecasted 2020 to forecasted 2030). The difference between 2000-2005, 2005-2010, 2010-2020 and 2020-2030 average annual growth rates reflects a typical “s-curve” of decreasing growth rates over time as a population base expands.

**Figure 2: Average Annualized Growth Rates Comparison**



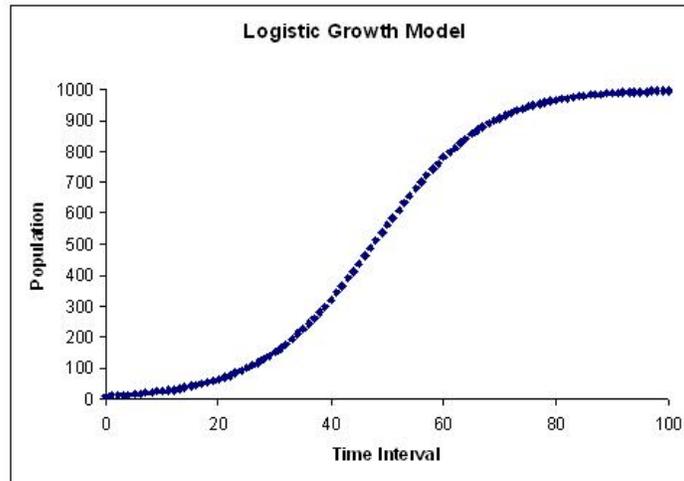
Note: The adopted MUMPO forecasts for whole counties are only available for Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan, Union and York Counties.

Sources: US Census 2000 and 2010, MUMPO 2009 Socioeconomic Forecasts

An “s-curve, or logistic model, growth pattern is a common pattern of population growth seen in fast growing regions and is also commonly seen in other population growth contexts (such as new populations in ecological models). Figure 3 shows the idealized pattern of a logistic growth model. In this example, the population begins growing at a rapid rate from time interval 0 to time interval 40. This would imply a constant or rising annual growth rate, leading to each time interval adding more persons than the previous. Eventually, annual growth rates slow (from intervals 40 to 60) to a much slower rate. Eventually, in this idealized example, growth actually stops or reaches very small annual growth rates (from intervals 80 to 100) leading to a stabilization of the population size.

<sup>4</sup> Figure 7 compares growth rates to a 7 county region as the TAZ level forecasts for whole counties are only available for Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan, Union and York Counties.

Figure 3: “S-Curve” Growth Pattern Example



### Comparison to Other Forecasts

The ICE Guidance emphasizes using adopted regional forecasts authored by MPOs where available.<sup>5</sup> However, given the questions raised about population growth in Union County, it is instructive to look at other population forecasts for the area. Forecasts from other sources show a wide range of future growth trends for Union County. Two of the most commonly cited privately developed forecasts are from Woods & Poole and Global Insights. Both firms use cohort-component projections, a demographic projection method that focuses on fertility, mortality and net migration to estimate total population by year. The Global Insight model incorporates the predictions of a regional macroeconomic model, thereby incorporating some economically driven assumptions of jobs growth into the forecasting process. The North Carolina State Data Center also generates population projections using a time series trends forecasting process. Table 4 summarizes five different forecasts of population to 2030 from four different sources:

1. MRM 2009 Forecasts (developed between 2004 and 2009)
2. Global Insights Forecasts (developed in 2009)
3. Woods & Poole Forecasts (developed in 2009)
4. NC State Data Center Forecasts (developed in 2009)
5. NC State Data Center Forecasts (developed May 2011)

As all of the forecasts operate from either demographic trend projection or economic modeling projections; they do not incorporate expectations of transportation infrastructure development except to the extent that past infrastructure development has affected past trends. One key to understanding the differences in these forecasts is to compare the actual change in each five-year increment. The demographically driven forecast approaches used by Woods & Poole and the NC State Data Center produce very similar changes in each five-year increment of their forecasts, whereas the Global Insights and MPO forecasts, which are more economically driven models, show significant differences in each five-year increment of changes.

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<sup>5</sup> NCDOT & NCDENR, 2001a, p III-16

As to the actual forecast of future population in Union County, the highest forecast is from the NC Data Center in 2009, which forecasted a 2030 population of 400,683. The NC Data Center’s forecast from 2011, however, predicts a 2030 population of 271,289, the lowest of all the forecasts. The Global Insights forecast from 2009 predicts a 2030 population of 393,407, while Woods & Poole from 2009 predicts a 2030 population of 283,433. The MRM 2009 Forecasts fall generally in the middle of all these forecasts, predicting a 2030 population of 337,314 for Union County. Most interesting is how closely the MPO forecasts predicted the 2010 populations of Mecklenburg and Union Counties. In the case of Mecklenburg, the MPO forecast for 2010 population of 931,666 (Table 4) is only 1.3 percent higher than the actual 2010 Census count of 919,628 (Table 1). In the case of Union, the forecasted population in 2010 of 200,450 is only 0.4 percent lower than the actual 2010 Census count of 201,292. This compares favorably to other forecasts completed prior to 2010. The Global Insights forecasts from 2009 overestimated population in Mecklenburg and Union Counties by four percent and nine percent respectively. The Woods and Poole forecast from 2009 underestimated population for Mecklenburg and Union Counties by 0.3 percent and two percent respectively. The NC State Data Center forecasts from 2009 underestimated Mecklenburg County population by one percent and overestimated Union County population by four percent. Given that these other forecasts were all completed about one year prior to the forecast year in question (2010) whereas the MRM Socioeconomic forecasts were largely completed two years prior (and the underlying forecasting work dates back to 2004) the MRM socioeconomic forecasts for Mecklenburg and Union Counties compare favorably.

**Table 4: Comparison of Population Projections**

Global Insights (2009)									
	Mecklenburg	Change	Annualized % Change	Union	Change	Annualized % Change	Region*	Change	Annualized % Change
2005	806,834			161,765			1,314,553		
2010	956,823	149,989	3.5%	219,690	57,925	6.3%	1,570,976	256,423	3.6%
2015	1,065,308	108,485	2.2%	263,298	43,608	3.7%	1,749,656	178,680	2.2%
2020	1,171,442	106,134	1.9%	303,978	40,680	2.9%	1,920,865	171,209	1.9%
2025	1,275,768	104,326	1.7%	349,186	45,208	2.8%	2,097,412	176,547	1.8%
2030	1,382,406	106,638	1.6%	393,407	44,221	2.4%	2,280,808	183,396	1.7%
Woods & Poole (2009)									
	Mecklenburg	Change	Annualized % Change	Union	Change	Annualized % Change	Region*	Change	Annualized % Change
2005	802,400			160,876			1,307,329		
2010	916,747	114,347	2.7%	197,554	36,678	4.2%	1,497,063	189,734	2.8%
2015	1,000,055	83,308	1.8%	218,988	21,434	2.1%	1,630,535	133,472	1.7%
2020	1,084,264	84,209	1.6%	240,490	21,502	1.9%	1,765,570	135,035	1.6%
2025	1,168,900	84,636	1.5%	261,995	21,505	1.7%	1,901,371	135,801	1.5%
2030	1,253,544	84,644	1.4%	283,433	21,438	1.6%	2,037,236	135,865	1.4%

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MRM 2009 Forecasts									
	Mecklenburg	Change	Annualized % Change	Union	Change	Annualized % Change	Region*	Change	Annualized % Change
2005	837,862			168,728			1,369,445		
2010	931,666	93,804	2.15%	200,450	31,722	3.51%	1,544,779	175,334	2.44%
2015	1,025,004	93,338	1.93%	231,986	31,536	2.97%	1,719,218	174,439	2.16%
2020	1,111,254	86,250	1.63%	266,612	34,626	2.82%	1,891,996	172,778	1.93%
2025	1,196,999	85,745	1.50%	301,053	34,441	2.46%	2,063,849	171,853	1.75%
2030	1,271,300	74,301	1.21%	337,314	36,261	2.30%	2,221,345	157,496	1.48%
NC State Data Center (2009)									
	Mecklenburg	Change	Annualized % Change	Union	Change	Annualized % Change	Region*	Change	Annualized % Change
2005	796,529			159,726			1,298,879		
2010	911,252	114,723	2.7%	210,069	50,343	5.6%	1,518,920	220,041	3.2%
2015	996,414	85,162	1.8%	257,378	47,309	4.2%	1,706,871	187,951	2.4%
2020	1,081,577	85,163	1.7%	304,688	47,310	3.4%	1,894,854	187,983	2.1%
2025	1,166,740	85,163	1.5%	351,996	47,308	2.9%	2,082,842	187,988	1.9%
2030	1,253,198	86,458	1.4%	400,683	48,687	2.6%	2,274,700	191,858	1.8%
NC State Data Center (2011)									
	Mecklenburg	Change	Annualized % Change	Union	Change	Annualized % Change	Region*	Change	Annualized % Change
2005	802,998			160,260			1,305,092		
2010	923,144	120,146	2.8%	202,200	41,940	4.8%	1,510,094	205,002	3.0%
2015	1,009,658	86,514	1.8%	219,522	17,322	1.7%	1,634,793	124,699	1.6%
2020	1,095,857	86,199	1.7%	236,778	17,256	1.5%	1,758,306	123,513	1.5%
2025	1,182,056	86,199	1.5%	254,034	17,256	1.4%	1,881,818	123,512	1.4%
2030	1,268,257	86,201	1.4%	271,289	17,255	1.3%	2,005,336	123,518	1.3%

\* The Regional forecasts here are for a four county region of Cabarrus, Gaston, Mecklenburg and Union Counties. This is due to data limitations from the various sources.

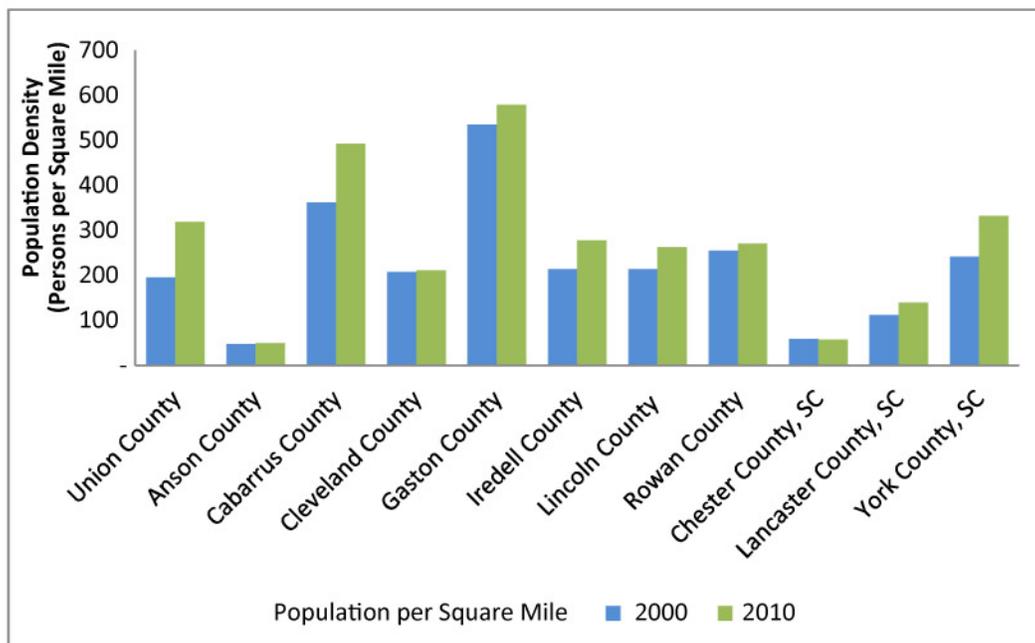
## 1.2 Growth Factor: Land Availability

The Hammer Report indicates that land availability is the major factor driving higher than trend line growth. The data used to capture land availability in his analysis was population and employment density. Therefore, a comparison of population density provides a rough estimate of the land availability in each jurisdiction as those counties with higher population densities would naturally have lower land availability due simply to the fact that more land was already developed.

In 2000, Union County had a population density of 196.0 persons per square mile, ranking it tenth out of 13 counties in the CMSA. In 2010, Union County’s population density was 319 persons per square mile,

fifth highest of the 13 counties and only four percent lower than the fourth highest county, York (see Figure 4). For comparison, the most densely populated county in the region, Mecklenburg County, had population densities of 1,327.6 and 1,755.6 per square mile in 2000 and 2010 respectively. The vast difference in population densities between Mecklenburg County and its surrounding counties indicates that there is substantial land available for development in the less developed surrounding counties. Furthermore, the lower population density of Union County relative to Cabarrus and Gaston Counties indicates more land is likely available in Union County versus those two counties. Based on Dr. Hammer’s criteria, one would expect growth to be higher in Union County than in Cabarrus or Gaston over the next 20 years. Figure 4 compares the population density for the 12 suburban counties in the CMSA. Mecklenburg is excluded from this figure to make comparison between the suburban counties clearer.

**Figure 4: Population Density in the CMSA 2000 and 2010 (Excluding Mecklenburg County)**

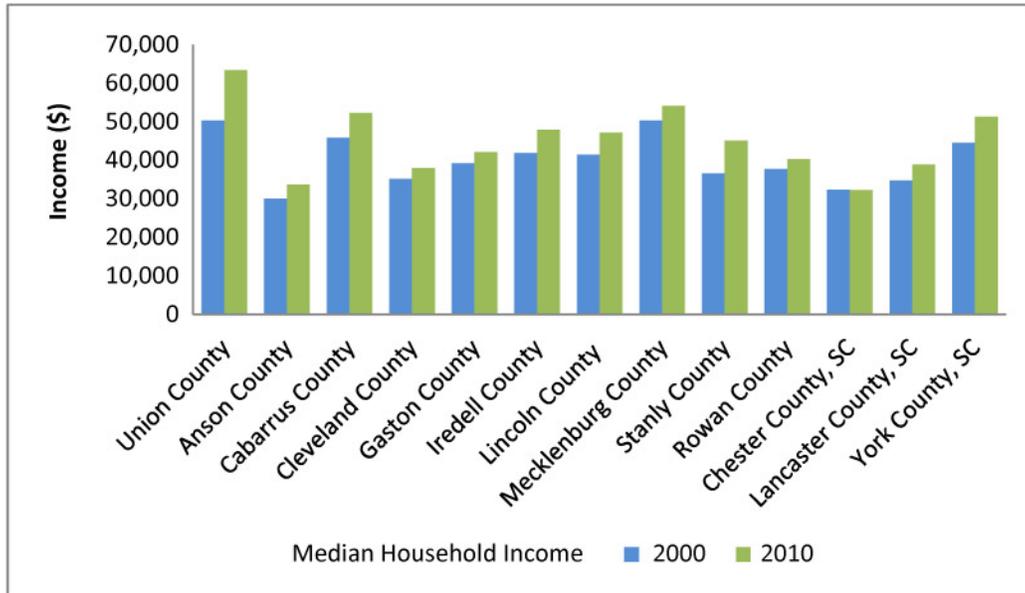


Note: Mecklenburg County Densities: 1,327.6 (2000) and 1,755.6 (2010) per square mile.  
 Source: US Census 2000 and 2010

### 1.3 Growth Factor: Income

According to the empirical study by Dr. Hammer, income differences also play a key role in attracting growth to certain counties. In particular, areas with higher median household income typically see higher than trend line growth. Union County currently has the highest median household income in the region (Figure 5). In 2000, the county’s median household income (\$50,354) was comparable to that of Mecklenburg County (\$50,311). Based on 2010 Census Data, however, Union County has seen a 25.9 percent increase in median household income, while Mecklenburg County has seen a much more modest (7.5 percent) increase. Again, based on Dr. Hammer’s criteria, one would expect Union County to grow faster than trend line growth would suggest.

**Figure 5: Median Household Income in the CMSA 2000 and 2010**



Source: American Community Survey 2008-2010, 3-Year Estimates, Table S2503 (Financial Characteristics)

#### 1.4 Growth Factor: Housing Affordability

Other factors that often drive growth are housing affordability, school quality and commuting times. Dr. Hammer’s report did not address these factors in his analysis, but they are commonly cited reasons for household location decisions from surveys by the National Association of Realtors<sup>6</sup>. According to the American Community Survey, Union County has the highest median housing costs (\$1,146 per month). Furthermore, as shown in Table 5, it also has the highest median home values in the CMSA. When assessing the relative ratios of housing costs to income in each county, however, Union County is actually more affordable than Mecklenburg County and is on target with the regional median. For example, a median household in Union County spends 21.7 percent of its income on housing costs. Meanwhile, a median household in Mecklenburg County spends 23.8 percent of its income on housing costs. Union County, however, becomes substantially less affordable when one substitutes the county’s median household income with the *region’s* median household income. When doing so, Union County’s housing stock remains the least affordable in the region, typically requiring 28.7 percent of household income.

<sup>6</sup> National Association of Realtors, “Profile of Home Buyers and Sellers,” 2011

**Table 5: Selected Housing Characteristics for the CMSA**

	Union County	Anson County	Cabarrus County	Cleveland County	Gaston County	Iredell County	Lincoln County	Mecklenburg County	Stanly County	Rowan County	Chester County, SC	Lancaster County, SC	York County, SC
<b>% Owner-occupied</b>	83.3	65.3	74.1	66.2	68.1	74.1	74.9	61.9	69.7	69.7	76.4	73.1	72.1
<b>% Renter-occupied</b>	16.7	34.7	25.9	33.8	31.9	25.9	25.1	38.1	30.3	30.3	23.6	26.9	27.9
<b>Median Home Value (\$1,000)</b>	203.2	81.7	172.2	104.8	124.5	168.2	156.7	190.9	124.0	128.7	85.8	129.4	164.7
<b>% Single Family Detached Housing</b>	84.9	68.2	76.6	67.5	75.0	73.0	67.9	60.3	74.9	67.5	68.5	75.0	68.1
<b>Median Number of Rooms per Unit</b>	6.4	5.3	5.7	5.3	5.3	5.7	5.6	5.6	5.5	5.4	5.5	5.6	5.7
<b>Percentage of Units by Number of Bedrooms</b>													
<b>No bedroom</b>	0.7	0.5	0.8	0.8	1.3	0.6	0.6	1.2	0.9	1.5	0.1	1.2	0.7
<b>1 bedroom</b>	2.6	5.0	4.5	4.8	5.7	3.7	2.5	10.9	5.2	3.8	4.5	3.0	5.7
<b>2 bedrooms</b>	14.4	30.4	24.4	31.8	30.9	24.4	27.5	25.1	27.5	31.7	32.6	27.5	24.5
<b>3 bedrooms</b>	49.7	52.3	47.1	52.4	47.3	50.3	53.0	39.1	54.4	48.1	48.1	52.9	48.6
<b>4 bedrooms</b>	22.6	10.5	17.7	8.7	12.3	16.6	12.9	19.1	9.5	11.9	11.2	12.7	16.1
<b>5 or more bedrooms</b>	10.0	1.4	5.5	1.5	2.5	4.3	3.5	4.5	2.7	3.0	3.5	2.7	4.3

Source: American Community Survey 2008-2010, 3-Year Estimates, Table DP04 (Selected Housing Characteristics)

The fact that Union County has higher than average housing costs is not necessarily a deterrent to growth. The higher cost for housing in Union County is also reflective of the larger size of housing units in the County. As shown in Table 5, Union County has the highest percentage of owner occupied housing, the highest percentage of single family detached housing and the highest median number of rooms per unit (a full 12 percent higher than the next highest county). Furthermore, nearly one-third of housing units in Union County have four or more bedrooms, much higher than typical for the CMSA. All of these housing characteristics suggest that the higher housing costs reflect the fact that housing in Union County is larger, newer and likely built to serve the higher income households moving to the county. Overall, then, the housing stock itself would be a positive indicator of future growth.

### 1.5 Growth Factor: School Quality

The quality of a school district is also an important factor driving household location decisions. Jack Dougherty<sup>7</sup> succinctly describes how public school quality helps to drive suburban growth:

*“[S]hopping for schools” clearly became an important family strategy for upward mobility, as higher-salary positions increasingly depended on educational credentials, which in turn relied on the status of one’s public school system. During the course of the twentieth century, suburban families became more conscious of this equation: buying a home in the “right” neighborhood in*

<sup>7</sup> Dougherty, Jack. “Shopping for Schools: How Public Education and Private Housing Shaped Suburban Connecticut.” *Journal of Urban History* 28, no. 2 (March 2012): 205-224.

*order to send their children to a “good” public school, would increase their odds of being accepted to a “top-ranked” college, and help them to land the “perfect” job.*

Other researchers have shown the strong correlation between school district quality and the value of housing, which shows the high demand for housing in good school districts. Theodore Crone notes, “home buyers seem to evaluate the quality of public education at the district level.”<sup>8</sup> Finally, other researchers have noted that “[i]n towns where it is easy to build more housing, better quality schools do not lead to higher property values. Instead, they lead to more real estate development.”<sup>9</sup>

Since most school districts in North Carolina and South Carolina conform to county boundaries, households, therefore, are likely to consider location decisions by county when “shopping for schools.” Comparisons with York County schools are slightly more complicated as York County is divided into four separate school districts. Two major sources of data provide insight into the perceptions of quality of schools in the area, average SAT scores and the percentage of students graduating in four years. These factors are summarized in Table 6 and Table 7, respectively. SAT comparisons among the 16 school districts show that Union County has the second highest average SAT composite score and is the highest among the districts that cover whole counties. Similarly, Union County had the second highest rate of students taking the SATs, but first among districts that cover whole counties. Four-year graduation rates show the same dynamics, with Union County second overall and first among countywide school districts. These measures indicate that the Union County School District would be a highly desirable school district in which to locate for households concerned with public school quality. Therefore, demand for housing in Union County will be higher, particularly among families with school age children or families that anticipate having children in the near future.

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<sup>8</sup> Crone, Theodore M. “Capitalization of the Quality of Local Public Schools: What Do Home Buyers Value?” Working Paper No. 06-15, Federal Reserve Bank of Philadelphia. August 2006.

<sup>9</sup> Sinai, Todd. “Feedback between Real Estate and Urban Economics.” *Journal of Regional Science*, 50: 423-448. February 2010.

**Table 6: Average SAT Scores for Major School Districts in the CMSA**

School System	# Tested	% Tested	Math (M) Score	Critical Reading (CR) Score	Writing (W) Score	M+CR	M+CR+W
Anson County Schools	159	53.7	436	427	407	863	1270
Cabarrus County Schools	1169	65.3	522	497	483	1019	1502
Cleveland County Schools	589	58.6	500	470	451	970	1421
Gaston County Schools	1136	58.3	495	480	455	975	1430
Iredell-Statesville Schools	847	60.4	524	502	480	1026	1506
Lincoln County Schools	449	58.7	513	478	456	991	1447
Charlotte-Mecklenburg Schools	5240	68.5	507	495	480	1002	1482
Rowan-Salisbury Schools	676	51.9	495	474	453	969	1422
Stanly County Schools	339	57	495	465	442	960	1402
Union County Public Schools	1635	68.7	524	503	491	1027	1518
Chester, SC	93	27	491	451	453	942	1395
Lancaster, SC	399	54	454	440	423	894	1317
York 1	137	42	478	457	432	935	1367
York 2 - Clover	243	59	493	486	460	979	1439
York 3 - Rock Hill	645	54	482	470	455	952	1407
York 4 - Fort Mill	477	72	535	529	505	1064	1569

Sources: North Carolina State Board of Education, Accountability Services, Division SAT Report 2011; South Carolina Department of Education, Public School District Distribution Mean SAT Scores for 2011

**Table 7: Four-Year Graduation Rate for Major School Districts in the CMSA**

School System	Graduation Rate (%)
Anson County Schools	75.9
Cabarrus County Schools	84.1
Cleveland County Schools	73.2
Gaston County Schools	75.4
Iredell-Statesville Schools	85.1
Lincoln County Schools	81.6
Charlotte-Mecklenburg Schools	73.5
Rowan-Salisbury Schools	76.9
Stanly County Schools	77.9
Union County Public Schools	89.1
Chester, SC	73.1
Lancaster, SC	73.7
York 1	78.3
York 2 - Clover	77.3
York 3 - Rock Hill	73.5
York 4 - Fort Mill	91.2

Sources: North Carolina State Board of Education, Accountability Services Division, 4-Year Cohort Graduation Rates; South Carolina Department of Education, Annual School District Report Cards

## 1.6 Growth Factor: Commute Time

As the realtor survey shows, access to jobs is an important factor to household location decisions. The Census Bureau tracks travel time to work and comparisons among counties in the region are revealing. Table 8 summarized commute times for regional counties between 2000 and 2010. In 2010, the average commuting time for Union County residents (27.8 minutes) is about eleven percent higher than the regional (MSA) average of 25.1 minutes. Relative to other jurisdictions, Union County had the highest commute times in the region in 2000 and is a close third to Chester and Lancaster Counties in 2010. Compared to 2000, commute times for Union County residents and across the region are down slightly, except for Chester and Lancaster Counties in South Carolina. The raw decline in commute times is not as instructive as the relative differences compared to regional averages. The raw differences may be misleading due to changes in survey methods the Census has instituted from 2000 to 2010, specifically, the Census changed its methods in gathering data on this question. In Census 2000, questions regarding commute lengths and modes were included on the “long form”, which 1 in 6 household received. For the 2010 Census, no “long form” was used and instead the American Community Survey has replaced it. The American Community Survey reaches fewer households but surveys annually. Since the survey methodology is different, direct comparisons are less revealing.

In 2000, Union County commute times were on average 29 minutes, just more than eleven percent higher than the regional average. Thus, over the last ten years, Union County has grown faster than any other county despite having some of the longest commute times in the region. Furthermore, average commute times for Union County residents have not risen dramatically, either in raw averages or in comparison to regional averages, during the past decade despite the significant growth in population within the county and region.

While it may seem counter-intuitive that households would choose to live where commute times are longer, research suggests, that within a reasonable range of commute time, households will choose locations based more on other preferences, such as school quality, neighborhood quality, affordability or other factors. In their summary of research on the impacts of transportation on land use, the National Research Council<sup>10</sup> noted the following:

*Research on commuting patterns within the current distribution pattern of jobs and residences in the Los Angeles metropolitan area, however, indicates that commuting trips are two-thirds greater than would be required if workers were located in neighborhoods that minimized their commutes (Small and Song 1992). This indicates that a key assumption of location theory does not hold in practice. The excess commuting that occurs may be explained by preferences for neighborhoods with low crime rates or amenities such as schools; the difficulty of minimizing commutes for both workers in dual worker households; and other influences, such as racial discrimination (Giuliano and Small 1993; Mills 1994).*

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<sup>10</sup> National Research Council. *Expanding Metropolitan Highways: Implications for Air Quality and Energy Use -- Special Report 245*. Washington, DC: The National Academies Press, 1995, p. 189.

**Table 8: Average Commute Times for the Eight-County Region**

County	2010		2000	
	Mean Travel Time to Work	Difference from Regional Average	Mean Travel Time to Work	Difference from Regional Average
Anson County	-	-	27.5	
Cabarrus County	26.0	3.6%	27.0	3.4%
Cleveland County	-	-	23.5	-
Gaston County	25.0	-0.4%	24.6	-5.7%
Iredell County	24.2	-3.6%	24.5	-6.1%
Lincoln County	-	-	27.1	3.8%
Mecklenburg County	24.7	-1.6%	26.0	-0.4%
Rowan County	23.2	-7.6%	23.3	-10.7%
Stanly County	-	-	25.3	
Union County	27.8	10.8%	29.0	11.1%
Chester County	28.1	11.9%	27.8	6.5%
Lancaster County	27.9	11.1%	27.0	3.4%
York County	24.0	-4.4%	27.2	4.2%
Charlotte MSA	25.1		26.1	

Notes: 2010 Travel Time data not available for Anson, Cleveland and Lincoln Counties.

Sources: 2000 Census Summary File 3, American Community Survey 2008-2010 3-Year Estimates Table S0802

### 1.7 Growth Factors Conclusions

The data presented here demonstrate a number of key points underpinning the No-Build Alternative forecast used in the Monroe Connector/Bypass ICE analysis. The forecasting process identifies the key factors that drive the distribution of growth within an economic region, and income and land availability are primary. A review of updated data from the 2010 census reveal that the MRM 2009 Forecasts are very close, despite the economic slow-down that occurred in the second half of the 2000-2010 decade, and they are the most accurate among available data sources. The 2010 Census data also show that Union County has a clear advantage among counties in the region in attracting growth on the basis of income, land availability, and several other factors that drive household location decisions. These insights provide a strong basis for the assumption in the ICE analysis that the MRM forecasts are reasonable for a No-Build Alternative. For the past decade, Union County has exhibited strong growth, and the factors driving those trends are poised to continue attracting growth to Union County regardless of whether the Monroe Connector/Bypass is constructed.

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