

*Policy Summary*

**Highways and Sprawl in North Carolina**

By

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***Abstract***

*This study carefully reviews the growth of North Carolina's 1551 Census tracts during the 1990s compared with the locations of major road improvements. Tract data on changes in population, demographics, prior density, and location are merged with detailed data on 312 major road projects completed during the 1990s, and the relationships between road investments and growth are determined for each of the 12 commuting regions. The study finds that population growth in North Carolina is complex, occurring throughout the State and throughout each region. Local growth patterns depend heavily on prior density: growth goes where there is room for it, filling in the urban tracts and lower-density edge-of-city tracts. Local zoning limits on population within tracts thus push additional growth to the region's edges. About 1/2 of the State's population growth went into tracts that had no major road improvements during the 1990s. Nearness to the Interstate system or to city centers was not a factor in most regions. Recent major road improvements, primarily urban and rural widenings, had a minor effect on growth, increasing growth by 50-550 persons per decade, per mile of investment, about 2-14 percentage points above the baseline growth. However, the relationships varied widely by region and were weak, generally explaining 10-25 percent of the variation in growth. This indicates that factors other than density or road investment (e.g., schools, taxes, sewer and water, taxes, community receptiveness) influence the location of growth significantly. The study concludes that road projects are blunt and inefficient instruments for either spurring or slowing growth, so local governments should accept responsibility for growth policies.*

***Do roads cause sprawl?***

Population growth is a major policy issue in urban America. As US cities spread out, so-called 'sprawl' fills inadequate roads and schools. But sprawl is not the only form of growth: within cities single family dwellings are being converted to multi-family dwellings and vacant lots are being developed. Density is increasing in some neighborhoods and declining in others. Growth also occurs in some rural areas.

Do roads cause sprawl? This simple question has been studied extensively yet defies an easy answer. The public often sees development follow major road investment, but just as often major road investment often follows growth. And growth goes along with many factors including a region's economic health, prior growth and available land, site suitability, zoning, sewer and water provision, other utilities, highways and roads, income, tax rates, crime, schools, housing policies, and race and other demographics. In

short, the factors affecting growth are very difficult to determine. This issue is important because road investment policy should be based on factual information concerning the causes of growth, not on opinions or anecdotes.

### ***The Study***

To clarify this complex issue the John Locke Foundation reviewed North Carolina's population growth over the past decade versus major road improvements. The study's goals are to determine where and how much population growth occurred, how growth relates to major road improvements, other factors influencing growth, and policy implications.

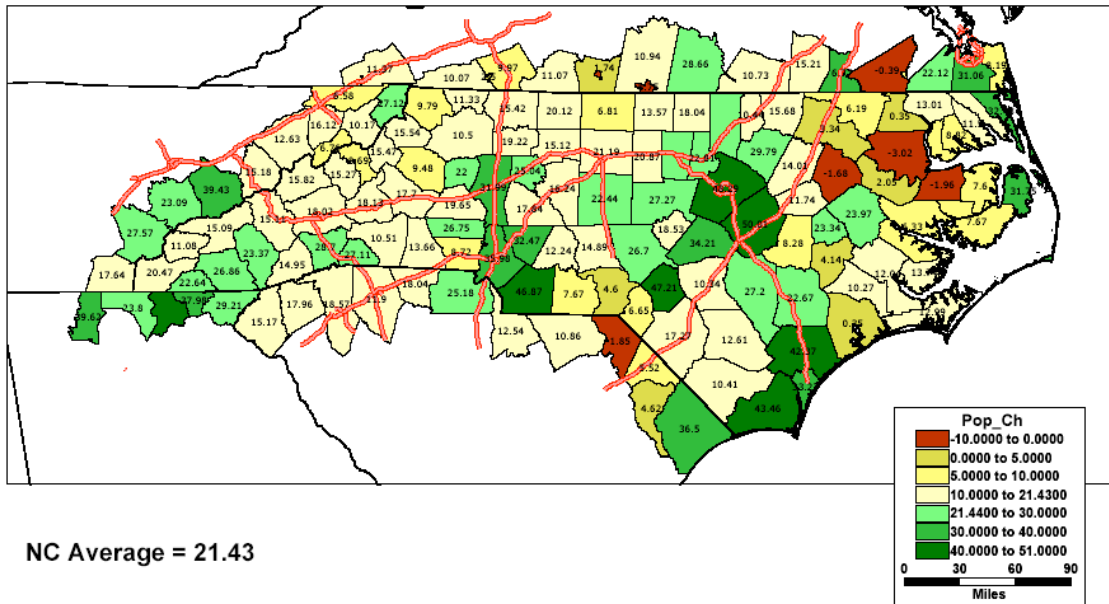
To answer these questions, the study combines detailed information on roads and growth using a computerized geographic mapping system. The study first described population growth in the State's 100 counties, 17 largest urbanized areas, and 1551 Census tracts. Counties were first grouped into 12 regions based on commuting patterns and economic inter-dependence. Next, factors that might affect growth were measured. These include prior growth and density, household income and racial data, distance to Interstates, other major roads, city centers and recreation, and other factors. Then, all major road projects completed in the 1990s were located, including new arterials, freeways, exits bridges, and major widenings of existing arterials and freeways. The review found 312 major projects throughout the State. Finally, the locations of major road improvements were related to population growth using statistical methods and computerized mapping. Conclusions and recommendations then follow.

### ***Growth was widespread throughout the State***

The Study found that State's growth out-performed the US during the 1990s. The State's population increased 21.4 percent in 1990, versus the US growth rate of 13.2 percent. Households grew 24.4 percent versus the US's 14.7 percent; employment increased 25.8 percent compared to the US's 16.7 percent, and real per-capita income increased 17.2 percent compared to the US's 15.2 percent. Although the last two years have seen a slow-down of economic activity, North Carolina's population has continued to increase.

North Carolina's patterns of population growth are complex. Population growth during the 1990s was widespread, not just in the suburbs of large cities. Of 100 counties, 97 increased in population and 99 increased in households.

## County Population Percent Change, 1990-2000



Rapid growth occurred in suburban, recreation, retirement, mountain and coastal counties, some quite far from urban centers and Interstate highways. But growth rates varied considerably. The largest absolute growth was in urban core counties for Charlotte, Raleigh-Durham and Wilmington, while the greatest relative growth was in a combination of suburban, urban core, and rural counties. The Hispanic population has been one of the most rapidly-growing segments. In-migration is a major factor in population growth; military, education, and recreation-related migration are all underlying causes. Interstate access was only mildly correlated with county population growth during the 1990s. While some of the fastest growing counties were those with Interstates, other rapid growers had no Interstates. Similarly, some slow-growing counties had Interstates but others did not.

Employment change reflected shifts in the underlying economy toward services and away from manufacturing. Job growth was greatest in the major metropolitan and suburban counties. Individual regions varied considerably, but within regions the greatest relative job growth was generally in suburban counties. Real per-capita income growth during the 1990s was about 18 percent, with the greatest rate of growth in several small rural counties.

### ***Urbanized areas are spreading out and traffic is increasing***

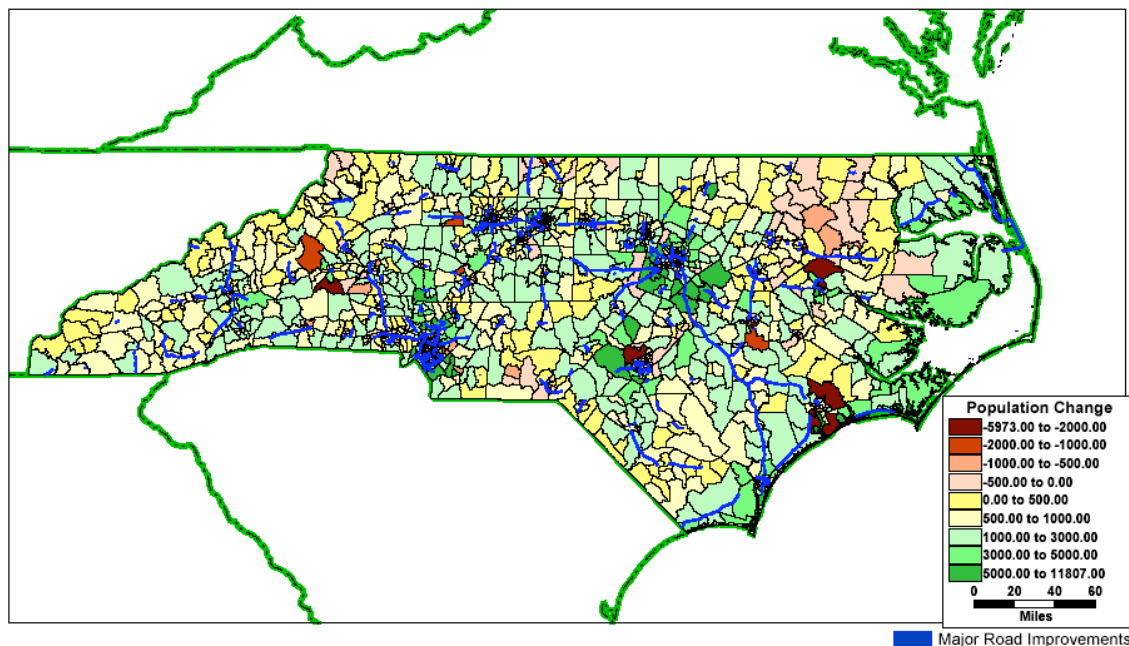
North Carolina's urbanized areas continued to spread out and increase in population during the 1990's. Growth has been most rapid in western and smaller regions, slowest in the largest and eastern regions. Overall average densities are declining, but the smaller cities are increasing in density while the larger ones are declining.

Urban travel has been increasing about as fast as the urban population, about 50 percent in 10 years. However, rural travel has been increasing almost 10 times faster than rural population (30 percent in 10 years) because of tourist, inter-county and inter-state travel. Within urbanized areas freeway travel is increasing as a share of total travel, about 126 percent in 11 years. However expanded freeway capacity has resulted in only 28 percent growth in average freeway traffic per lane. Most of the state's urbanized areas have less freeway traffic per lane than the national averages, and freeway traffic congestion is lower in smaller regions than larger regions.

***Growth is also occurring throughout each region***

Population growth is occurring in tracts throughout the State. The average change in tract population during the 1990s was 972 persons per decade, about 21 percent.

Population Change and Major Road Projects, 1990-2000



However, the average growth varied from 495 in the Greenville-Rocky Mount region to 1512 in the Triangle (Raleigh-Durham) region. Only a few tracts lost population. With just one exception (northeast coastal plain) these tracts were scattered throughout the state. Tract densities are generally rising throughout the State. Growth was greatest in tracts with mid-range densities, from about 133-433 in density, but less in low-density rural or in high-density urban tracts. These are generally suburban tracts near the edges of urban regions.

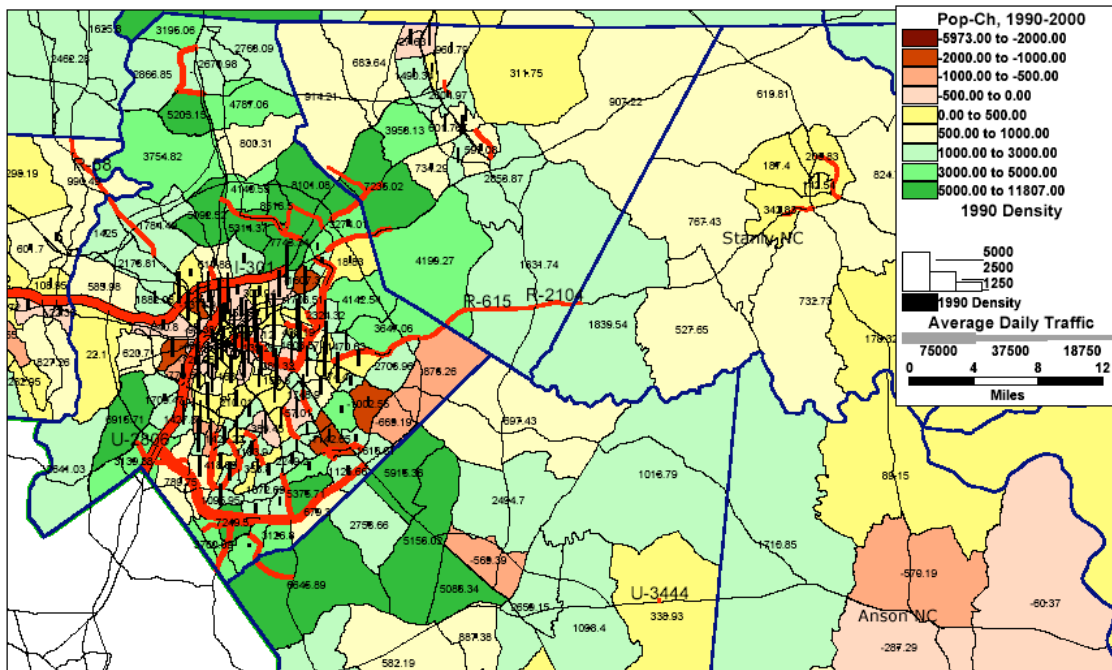
***In urban areas, prior density determines tract growth rates***

All of the models of population growth developed for the 12 regions of the State were relatively weak in strength. The best of these models explained about 45 percent of the variation in tract growth, and most of the models explained just 10-25 percent of the

variation in tract growth. This key finding means that numerous local factors primarily determine tract growth within urban areas.

The key factor determining tract growth is prior density: **as tracts fill up toward their practical maximum density, their growth slows down.** Growth slows by 300-800 persons per decade for each 1000-person increase in prior density, depending on region. This occurs because parcels become harder to assemble, prices rise, remaining lots are less desirable, some residential lots get converted to non-residential use, and family size declines as neighborhoods mature. Although ‘in-fill’ development can continue to add population in fully developed tracts, this process is slower than development in more open tracts.

Figure IV.6  
**Charlotte Commuting Region (East)**  
**Population Change, Prior Density and Major Road Projects, 1990-2000**



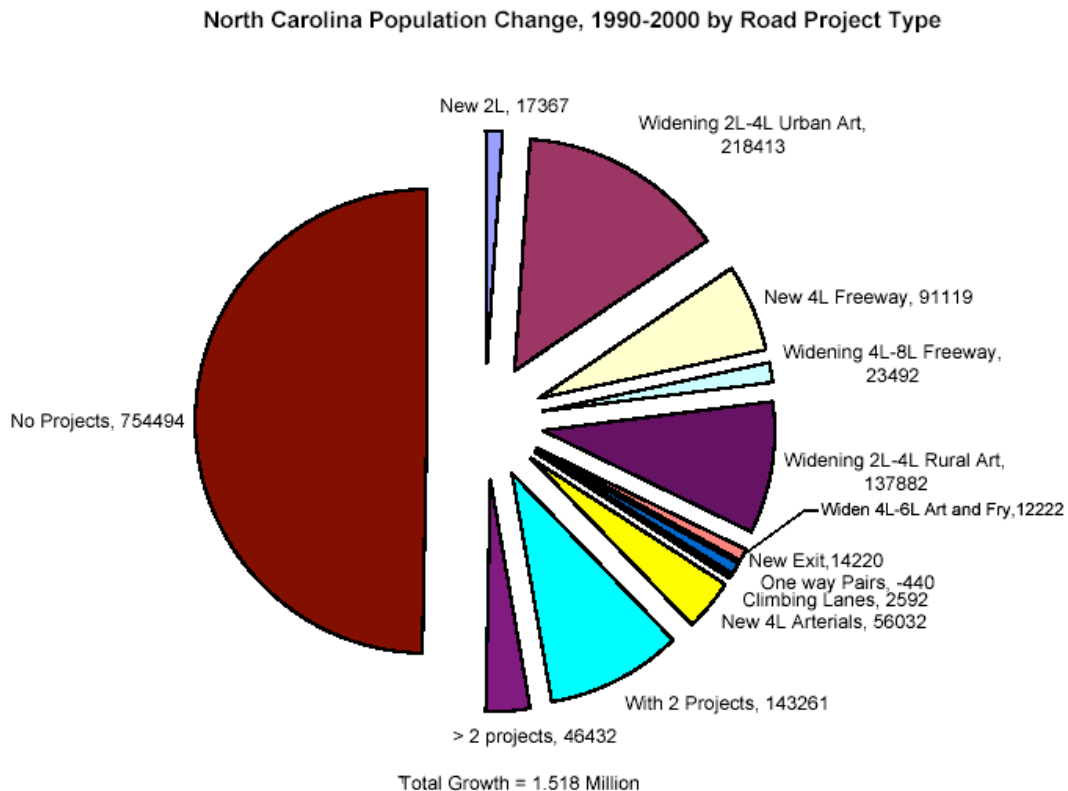
The maximum density of the inner rings of most regions was found to be about 1700-2700 persons per square mile; however, within each region a few generally smaller tracts had considerably higher densities. These maximums reflect lot sizes and home sizes prevalent between 1900 and 1945, when most of these inner rings were developed. However, the lot and home sizes of rings farther out are invariably lower, reflecting different styles in recent decades. Thus, maximum densities are limited to the land use patterns in place when each tract was initially developed.

As growth slows in near-full tracts, additional growth must necessarily go to tracts that have available space. Thus, an inevitable result of population growth in regions with limited space in urban tracts is growth in nearby suburban and rural tracts. Since growth can only go “up” or “out”, **regions cannot grow without spreading out if density is capped in most tracts.**

In two regions (Charlotte and Greenville-Rocky Mount), prior per-capita income was found to influence growth: higher income tracts grew more rapidly. But in most regions tract demographics were not significant in determining growth rates and were certainly not as important as prior density. Distance to the city center is a factor influencing growth in several urban regions. Growth slows by about 25-45 persons per decade for each mile out from the city center. Distance to Interstates is important in influencing growth in 3 regions (Triad, Asheville, Hickory-Morganton). In those regions, growth slows by 28-50 persons per decade for each mile distant from the Interstate system. Distance to key recreational features (the Blue Ridge Parkway and the coast) influences growth in regions with those features. Growth slows with increasing distance from the Blue Ridge Parkway or coast. However, the effect is minor and varies widely, the largest being the coastal effect in the Jacksonville region.

***Road improvements have generally minor effects on growth rates***

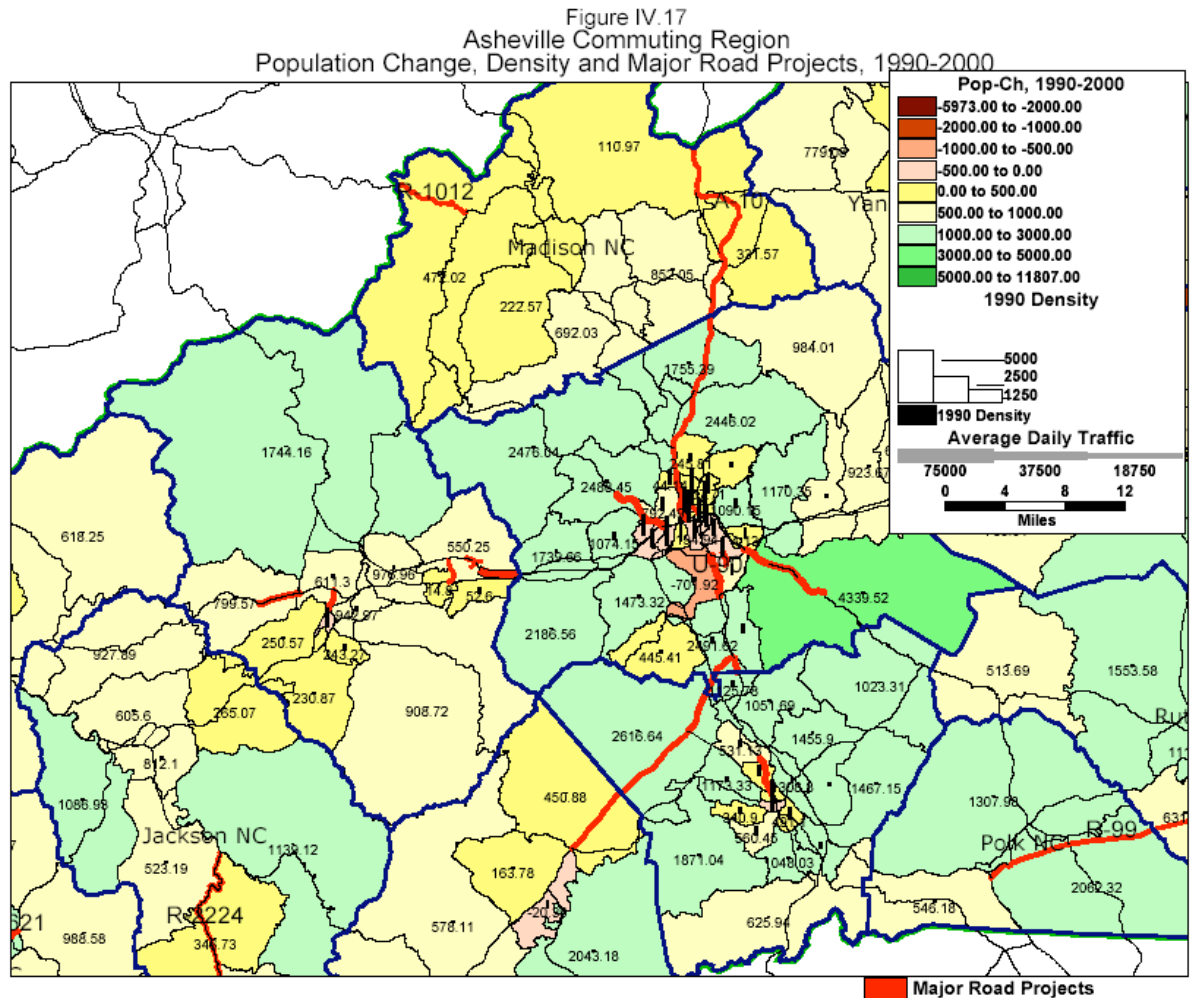
Major road improvements were found to have only a minor impact on growth rates. In urban areas, major road project locations were only weakly correlated with recent growth. During the 1990’s, about 61 percent of the State’s tracts received no major road improvement, and **about 20% of the population growth in North Carolina occurred in tracts with no major road improvement.**



Urban arterial widening is correlated with tract growth in 4 regions (Charlotte, Triad, Asheville, Eastern NC). **Growth increases by 106-525 persons/decade, per mile of urban arterial widening.** The effect is greatest in the Charlotte region and smallest in the Asheville region. The greatest effect is about 1500 daily trips, is about the same as a

single small McDonald's restaurant. Within regions, this effect is largest in suburban tracts at the edges of regions which have some development space available and nascent congestion, and smallest in in-city tracts that are mostly developed. In urban areas transportation departments typically add capacity to deal with existing congestion, so it is more likely that the urban growth preceded the need for the widening than vice-versa.

Rural arterial widening is correlated with additional growth in 6 regions. **Tract growth is increased by 50-550 persons per decade, per mile of rural arterial widening.** The effect is greatest in the Asheville area and lowest in Eastern NC. Within regions the largest effects occur at the rural-suburban interface, the smallest in rural areas distant from urban regions. Since most rural road widening is not done for congestion relief but for access, it is more likely that the widening of rural arterials caused the growth than vice versa.



**The relative effect of urban and rural arterial widening, new arterials or new freeways is about a 2-14 percentage point increase in the decade growth rate, per mile of improvement.** The effect is modest compared to the background growth rate, which was typically about 20-30 percent per decade.

Other types of road projects generally had little or no impact on growth in most regions. But in a few other cases, other road projects are correlated with growth. In Charlotte, new 4-lane arterials are correlated with an increase of about 456 persons per decade, per mile of improvement. In the Triad region, a new freeway exit was correlated with about 4845 persons per decade, per mile of improvement. This was the largest effect observed in the

**Table V.1: Summary of Incremental Impacts of Major Road Improvements**

Commuting Region	Type of Road Improvement	Growth Effect, 10-yr Tract Pop Change, per mile of Improvement	'Baseline' Growth Rate, 1990-2000	Growth Rate with Improvement	Difference in Percentage Points
Statewide	1-mile of Rural Arterial Widening	123	20.4	22.5	2.1
Charlotte	1-mile of Urban Arterial Widening	525	38.1	50.9	12.8
	1-mile of New Arterial	456	38.1	49.2	10.9
Triangle	1-mile of New Freeway	354	31.7	40.1	8.4
	1-mile of Freeway: Widen to 8 Lanes	-1130	31.7	4.6	-28.1
Triad	1-mile of Urban Arterial Widening	237	16.7	22.6	5.9
	New Exit – 1 mi. work	4846	16.7	136.3	119.6
Asheville	1-mile of Urban Arterial Widening	107	21.9	24.6	2.7
	1-mile of Rural Arterial Widening	552	21.9	35.8	13.9
	1-mile of New Freeway	86	21.9	24.1	2.2
Wilmington	- (no road effects)	-	38.8	38.8	(no effects)
Fayetteville	1-mile of Rural Arterial Widening	207	12.5	16.1	3.6
Jacksonville	1-mile of Rural Arterial Widening	193	22.5	26.5	4.0
Hickory-Morganton	- (no road effects)	-	17.0	17.0	(no effects)
Greenville-Rocky Mt	- (no road effects)	-	11.0	11.0	(no effects)
Boone-Spruce Pine	1-mile of Rural Arterial Widening	123	12.5	15.8	3.3
Eastern NC	1-mile of Urban Arterial Widening	144	35.8	40.0	3.2
	1-mile of Rural Arterial Widening	51	35.8	37.3	1.5
Western NC	1-mile of Rural Arterial Widening	78	16.6	18.7	2.1

entire analysis. And in the Triangle region, widening freeways to 8 lanes was correlated with a slow-down of growth by 1100 persons per decade, per mile of widening. No other factors related to major roads (their cost, impact on traffic, or timing) were found to influence growth.

***Road improvements are an inefficient means of affecting growth***

The key finding of this analysis is that **the determinants of tract growth are largely local in character**. This means that local governments hoping to direct or limit growth should generally look within, not to Raleigh or Washington, for the key actions needed.



**A tract's prior growth is critical in determining its future growth. Near urban regions, growth goes primarily to tracts that have room for it.** High-density tracts that were full at the beginning of the 1990s grew little during the 1990s, and tracts that had lower mid-range density in 1990 generally experienced more rapid growth during the 1990s. In rural areas, prior density has less impact in slowing growth.

**Major road improvements generally have only a minor effect on growth.** For most of the cities and most of the improvements reviewed, the correlation between growth and major road improvements was quite weak. Since many factors influence tract growth, it would be a rare tract for which development was critically dependent on major road improvements.

**In several regions (Charlotte, Triad, Asheville, Eastern NC) urban road widenings were found to modestly increase tract growth, and in 6 regions rural widening were found to modestly increase tract growth. The impact of a mile of road widening is about 2-14 percentage points added to decade baseline growth, at maximum about the same as a single small McDonald's restaurant.** So, even a very large road improvement would have much less effect on traffic generation ('induced traffic') than a modest commercial strip with just 5-6 restaurants or stores. The 'induced traffic' effect of the widening itself is small relative to the carrying capacity of the expansion.

Therefore, **transportation investments appear to be generally blunt and inefficient means of spurring development or of preventing it.** Even a major road investment is likely to have only modest effect on the growth of a tract compared to zoning limits or exemptions. And the lack of a major transportation project is not likely to prevent development of otherwise viable tracts. In urban areas, road investments should be made primarily to save travel time, operating costs and accidents; and in rural areas, to improve transportation access and community mobility, rather than to spur growth. Elected and/or appointed officials should approach with caution proposed changes in infrastructure funding policy that offer hope of either slowing or stopping sprawl or growth or spurring development.

In conclusion, this study of the linkage between growth and road improvements in North Carolina finds only a minor correlation between road investments and growth. Major road improvements can have a modest effect on the magnitude of growth and its specific location, but they are not in and of themselves, are neither sufficient nor necessary for growth. Most growth will occur in the absence of road improvements, going to locations in urban areas where space is available.

#### ***About the Author***

David T. Hartgen is Professor of Transportation Studies at the University of North Carolina at Charlotte, where he initiated the Center for Transportation Studies and now teaches and conducts research on a wide range of studies. He is US Editor of the international journal *Transportation* and is an Adjunct Scholar at the John Locke Foundation. He is a graduate of Duke University and is a registered Professional Engineer.