

# Growth at Rural Interchanges: What, Where, Why

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Unlike in metropolitan areas, the effects of the Interstate system on economic growth in rural areas are not well understood. There, Interstates have improved accessibility of farm-to-market shipments and significantly increased job opportunities for rural residents wishing to commute to metropolitan regions. In many of these areas, congestion has been reduced and business has improved, whereas in other areas, businesses have deteriorated and economic growth has slowed or declined. Growth at interchanges typically has been limited to a narrow band along the cross streets, or no growth has occurred. The development potential of each of the 22 interchanges on Interstate 40 from Raleigh to Wilmington in North Carolina was assessed. Using a "model-by-analogy" approach, observed growth at presently developed interchanges in North Carolina is related to background data on traffic, site, and situational characteristics. These relationships were applied to the new Interstate 40 interchanges, allowing forecasts for future development pressure. Growth equations were developed using regression, with separate equations constructed for various services and establishment types. Findings indicate that each intersection within the Interstate 40 corridor will experience a different economic pressure. The greatest growth potential is at interchanges near large urban areas and at high-volume roads along the corridor, which have sewer and water service and are near a regional town. Communities and businesses in the corridor must work together to identify appropriate development patterns for each exit, make decisions about utilities provision, and take cooperative action to develop services along the corridor as a group.

Without question, the United States interstate highway system, now completed after over 40 years of construction, has significantly increased accessibility and changed the nature of the U.S. economy. Essentially, the interstate system has produced an integrated economy on the mega-geographic scale. It has tied the regions of the nation together, and has provided for unprecedented availability of consumer goods and products. Without the interstate system it would be difficult to imagine the present modern United States.

The effect of the interstate system on changing travel patterns in metropolitan areas is well documented. Virtually every large city in the country has prepared transportation plans and forecasts using elements of the interstate system as key components of their highway system. The effects of the interstate system on suburban growth and on commuter patterns in metropolitan areas is therefore well understood.

Not nearly so well understood are the effects of the interstate system on economic growth in rural areas. There, the interstate system has improved the accessibility of farm-to-

market shipments and has significantly increased job opportunities for rural residents wishing to commute to metropolitan regions. The system has also diverted traffic from other routes, bypassing communities and generating substantial changes in the local business structure. In many of these areas, congestion has been reduced and business has improved. In others, businesses have deteriorated and economic growth has slowed or declined. Typically, growth at rural interchanges has been limited to a fairly narrow band along the cross streets, often extending not more than half a mile on either side of the intersection. At many interchanges, no growth has occurred. In cases in which the interstate passed close to a small town, strip-like developments have often grown up between the community and the interstate exit.

## INTERSTATE 40 COMPLETION

After years of planning, study, and construction, the final 120-mi link of Interstate 40 connecting Wilmington, North Carolina, to Interstate 95 and Raleigh, North Carolina, is finally complete (Figure 1). Officially opened on June 27, 1990, this section of interstate links the Wilmington area, its port, and N.C. beaches to the rest of the state and nation. Along the corridor, there are reports of land speculation at interchanges, rumors of new industrial development, and a belief that the corridor will see new and rapid growth.

The N.C. Division of Community Assistance, in cooperation with the Interstate 40 Steering Committee of local governments and businesses, has initiated a study to determine the effects of Interstate 40 and to develop actions for coping with the expected effects of Interstate 40. The study has several elements, one of which is to assess development potential at each of the Interstate's 22 interchanges. The method used here, essentially "models by analogy," (i.e., observed interchange growth at other presently developed interchanges in North Carolina, is related to background data on traffic, the site, and situational characteristics). The relationships are then applied to the new Interstate 40 interchanges, and forecasts for future development pressure are made.

## LITERATURE REVIEW

From the literature, certain variables appear to be critical in determining growth along highways. Eagle and Stephanedes (1) noted that there are four ways that highways may affect

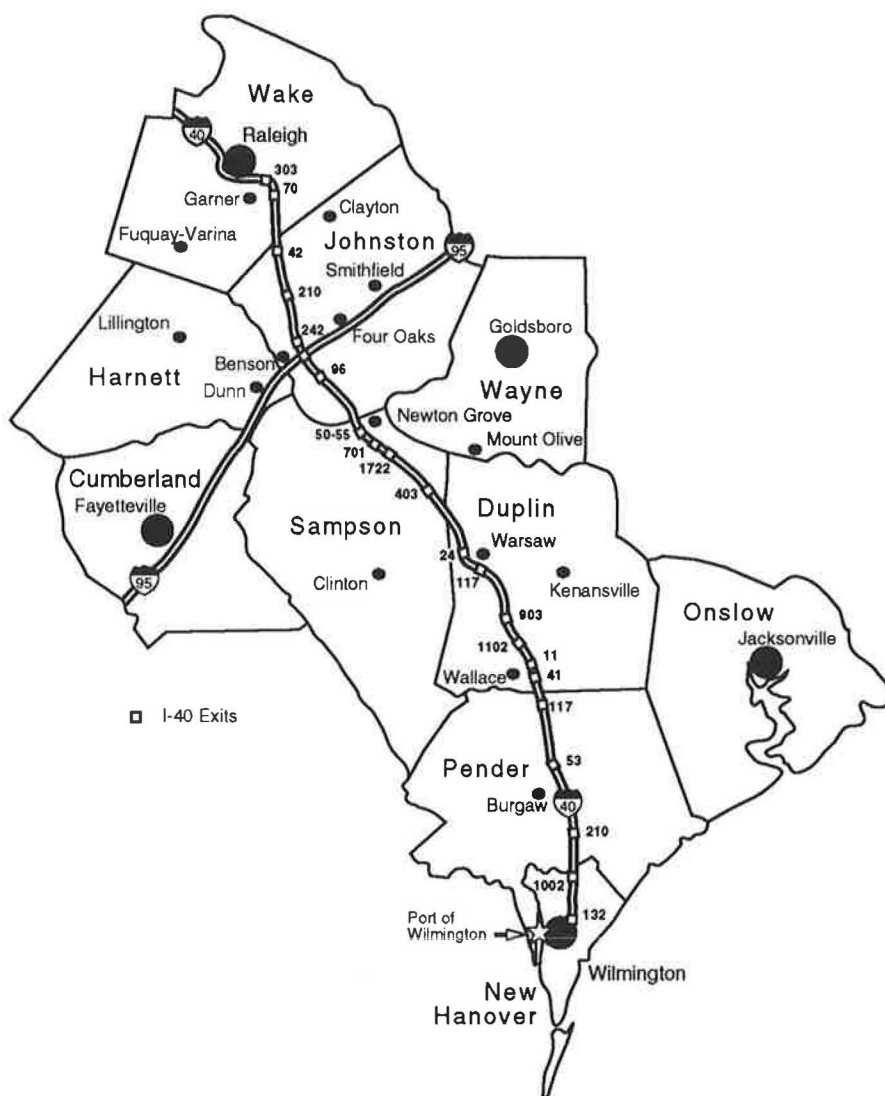


FIGURE 1 Interstate 40 corridor.

economic development, including

1. Residential location,
2. Work place location,
3. Enterprise location resulting from change in labor supply, and
4. Enterprise location resulting from decreased transportation costs.

Investigators have found that counties with interstate highways have an advantage over other counties with regard to population and employment growth, but only for counties within 25 mi of a metropolitan area. These employment effects are primarily related to industries servicing highway users (e.g., service stations, restaurants, and motels) and are not related to manufacturing or wholesale operations.

Few studies have found a strong correlation between highway and economic development. Wilson (2) maintained that, beginning in the late 1960s, efforts to link transportation investments directly to economic growth rarely have been successful. He concluded that the economic development process

is far too complex and the role of transportation is not dominant enough for causal relationships to be established. Other studies suggest that economic development would occur in relation to highway investment only if certain other criteria were met. Huddleson and Pangotra (3) stressed that net gains from highway investments will occur only if resources (human and otherwise) that were previously not utilized or underutilized are employed. A report from the University of Iowa (4) stated that results of industrial location analysis have indicated that investing in better highways will not foster economic growth if other critical factors are not present. Other authors have found that a significant relationship exists between highways and economic growth. Bohn and Patterson (5) examined population changes for all U.S. counties between 1960 and 1970 and related them to a number of variables. They found that an interstate had a substantial relationship with relative population growth. Stephanedes (6) stated that transportation investments could have an influence on the location of firms, community patterns, and how resources are developed. Later analysis by Eagle and Stephanedes (1) indicates that the correlation between highway expendi-

tures and employment is explained by two factors: (a) higher employment levels attract higher levels of highway expenditures, and (b) during the year of construction, employment levels increase.

Another body of literature deals with the locational decisions of firms. These do not generally ascribe much effect to transportation variables. Harrison and Kanter (7) concluded that labor costs and availability of appropriate physical space were most important to firms making business location decisions. In a survey of Fortune 500 firms, Schmenner (8) found the top factors to be quality of labor, climate, and proximity to markets (which could be directly related to transportation accessibility). More recently, concern for location has focused on the levels of labor skill and public education and on trainability (9).

Several studies focus directly on interchange growth. Stein (10) discovered that a large portion of development near predominantly rural interchanges consists of highway-oriented businesses such as motels, service stations, and restaurants, and that there was rapid growth in apartments, churches, schools, shopping centers, and industrial parks near predominantly suburban interchanges. Moon (11) found that four variables were important in explaining development patterns at interchanges: (a) traffic volume, (b) distance to the nearest city, (c) amount of development before interchange construction, and (d) distance to the nearest interchange. Epps and Stafford (12) found that only those interchanges previously designated as complete and unrestricted attracted any appreciable amount of economic development. Within this set, traffic volume and distance to regional centers were key variables influencing the amount of development.

The literature states that highway development will have an impact on the regions through which they run, although there is much disagreement over the type and intensity of the impact. Six variables are believed to have an impact on the amount of development at an interchange (11,12):

1. Average daily traffic (ADT) on interstate highway,
2. ADT on crossroads,
3. Location and population of communities within 10 mi of the interchanges,
4. Distances to the nearest major urban center,
5. Amount of development before the interchange construction, and
6. Distance to the next interchange.

In sum, the relationship among factors influencing growth at interchanges is complex. Generally, the amount of business activity observed at an interchange depends on traffic-related factors, particularly traffic volume and truck mix on the interstate and traffic on the cross street. Also likely to be important are locational factors, such as the distance from the interchange to major cities, the distances to the next interchange in each direction, the proximity to rest areas, and competition from other interchanges. Site factors also play a role, particularly sewer and water service, zoning, visibility, ease of access and egress, slope, and advertising. Given the constantly changing nature of such items, it is difficult to predict a growth pattern for a specific interchange in the absence of a complete picture of its site, traffic area, and locational situation.

## METHOD

The procedure used in the analysis consists of four steps: (a) a field survey of economic activity at interchanges on North and South Carolina interstates; (b) development of equations relating interchange activity to background factors; (c) application of these equations to characteristics of the intersections on Interstate 40; and (d) forecasting future development pressure at Interstate 40 exits.

The field survey consisted of visits to 103 interchanges on six North Carolina interstates and on two South Carolina interstates, which were completed during the summer of 1990. Because the North Carolina interstate system contains over 270 interchanges, a representative sample with varying terrain, urban-rural traffic, and spacing were surveyed.

A simple field sheet was used to record information on each interchange as well as information describing the location of the interchanges on the system. The interchange survey had 36 items, including distances to towns, the nearest regional center, and rest areas and the distance to other interchanges and other interstates. Also included were traffic counts, availability of water and sewer utilities, and visibility of the interchange from the interstate. Development was categorized as residential, motel, gas station, fast food, sit-down restaurant, truck stop, office, church, bank, and mall. The data were entered into an Excel spreadsheet and uploaded to a mainframe computer data base for further analysis.

Equations for growth were developed by using stepwise regression, with separate equations constructed for residential development, gasoline stations, motels, fast-food and sit-down restaurants, and total interchange. In general, it was found that equations with three or four variables performed satisfactorily.

A careful review of the data showed that growth patterns on Interstate 95, a nearby route, are likely to be most applicable to the Interstate 40 situation. Interstate 95 is a major connector route along the eastern seaboard, connecting the northeast and southeast portions of the country. The section of Interstate 95 running through North Carolina passes through several rural counties and has been complete for nearly 20 years. On opening day 20 years ago, Interstate 95 probably looked the way Interstate 40 looks today. There was little or no development at its interchanges and both interstate and cross-street traffic volumes were only a fraction of what they are today. Twenty years ago it was hard to imagine that some of these interchanges would contain 20 or more units of development. For example, when Interstate 95 first opened, the Highway 53/210 (Fayetteville) interchange was practically empty; today there are nine hotels, two fast food restaurants, six gas stations, and four sit-down restaurants. As Figure 2 shows, development along Interstate 95 ranges from a low of two units to a high of 23 units, with the heaviest development concentrated primarily at major towns or crossroads with the heaviest volumes. Similar development potential exists at some of the Interstate 40 interchanges, provided that certain elements are present.

Growth equations along Interstate 95 were found to best reflect the Interstate 40 situation. Table 1 shows the equations selected. These equations relate development to sewer and water utilities, distance to other interstates and other interchanges, and traffic on the cross street. Generally, the equa-

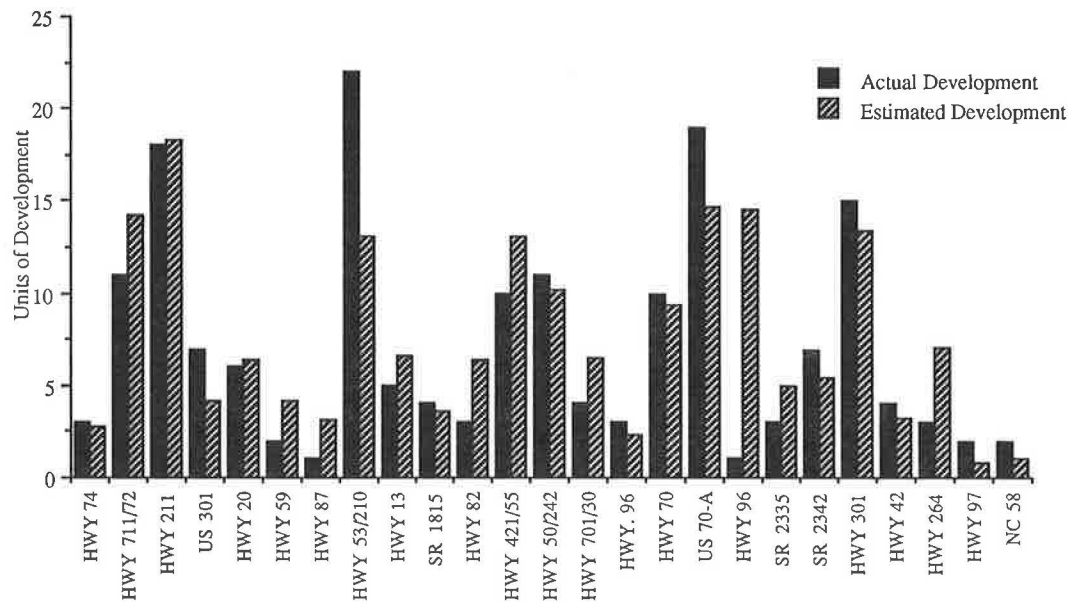


FIGURE 2 Actual versus estimated development on I-95 interchanges in North Carolina, 1990.

tions explained 60 to 70 percent of the variation in observed development. Figure 2 shows that these models generally predict quite well present development on Interstate 95. If the Interstate 40 situation can be described as similar to Interstate 95 20 years ago, then the equations would predict Interstate 40 growth development potential equally well. These equations can be interpreted best by using an example: the development pressure for motels (Table 1) at an interchange is equal to  $-.34$ , plus  $0.18$  motels for every 1,000 cars on the cross street, plus  $1.6$  motels if the exit has poor visibility, plus  $4.53$  motels if a sewage system serves the exit, minus  $.07$  motels for every mile of distance from rest areas.

## FACTORS AFFECTING DEVELOPMENT

### Motels

Locations favoring motel development are those with water and sewer systems, moderate (not high) visibility, cross-street traffic over 4,000 ADT, and proximity to intersecting interstates and rest areas. Sewer availability is the key: on average, sewer availability will generate potential for an additional 4.5 motels. Highly visible sites are more suitable for gas stations and fast-food activities. Cross-street traffic above 4,000 ADT is important, and the exit should be no more than 20 mi from the next interstate or highway's end.

Cross-street traffic seems to be more important to motel development in rural areas and less so in more developed areas. This traffic reflects the motels' need to attract other customers in addition to those that the interstate generates. Motels are also affected by the presence or absence of water and sewer systems but are not as strongly affected by visibility factors. In fact, locations somewhat removed from the interstate itself (but still near the interchange), yet not visible from the interstate, seem to be favored. This factor is probably related to noise from the interstate, or perhaps because of

opportunities for site development at locations slightly removed from the interstate. The analysis also shows that, where there is some variability, interchanges occupying relatively flat land tend to have a better chance of attracting motel facilities than those occupying steep slopes.

### Gas Stations

Gasoline station clusters are best suited to interchanges with high cross-street traffic volumes (greater than 10,000 ADT) that may require cloverleaf-type interchanges, have good water systems, and are close to both nearby towns and interstate rest areas. For a diamond-shaped intersection, a cross-street volume of at least 5,000 ADT, water service, and a location within 3 mi of town are needed for successful operation. A diamond interchange 10 mi from town on a low-volume cross-street can support at best one to two stations. Since most stations depend on local and interstate traffic for success, they must be close to nearby communities, yet easily accessible from the interstate.

### Fast-Food Restaurants

Fast-food restaurants favor sites with high cross-street traffic and water service that are close to intersecting interstates but relatively far from other exits. Essentially they thrive on both local traffic and interstate traffic, particularly at exits isolated from other exits. Sites with water service and traffic above 7,000 ADT and that are more than 10 mi from other exits can support two to three restaurants.

### Sit-Down Restaurants

The analysis found that sit-down restaurants favor high local-traffic sites close to intersecting interstates. No strong rela-

TABLE 1 Equations of Development Along I-95 in North Carolina

Development Measure	Type of Development				
	Motels	Stations	Gas Rest.	Fast Food Rest.	Sit-down Residential
Intercept	-0.34	6.76	-0.34	.64	1.07
Traffic: mainline traffic (000) cross-street traffic (000)	+0.18	+0.097	+0.15	+0.23	-0.021
Visibility: visible partially visible not visible	+1.60				
Terrain: flat hilly steep					
Utilities: water system sewer system	+4.53	+1.42	+1.054		
Intersection type: diamond cloverleaf		-3.50			
Locational: distance to town distance to reg. center distance to next interchange		-0.175	+0.114		
distance to rest area	-0.07	-0.069			
distance to intersecting interstate	-0.046		-0.018	-0.024	
R-Square	.65	.67	.67	.58	.39
n	24	24	24	23	24

tionships with other variables were noted. Sites with high volume on cross streets (>10,000 ADT) and within 5 mi of another interstate or the highway's end can support one to two such services.

### Single-Family Residential Developments

The least satisfactory of the equations tested were those for residential development. From the analysis, it appears that residential development is not a particularly viable activity at interchanges. Generally, development that does occur tends to be clustered. A negative relationship was found between residential development and traffic on both the interstate and the cross street. Residential development was found to be particularly negatively related to cross-street traffic: cross streets with heavy volumes (>20,000 vehicles per day) were found to have only half the residential development of low-volume cross streets. Most low-volume interchanges can be expected to have some residential development, particularly if they are close to town. Also, contrary to development patterns elsewhere, residential development near interchanges is not strongly associated with other suburban developments, such as malls and hotels. Residential development is more likely in the 1 to 2 mi band beyond the immediate exit.

Notably absent from these relationships are distance to regional centers and interstate traffic volume. The presence of gas stations and fast-food restaurants was found not to be

seriously affected by interstate traffic counts. This finding reflects the fact that, along most stretches of the interstate system, there is generally enough traffic to support these facilities. Without exhibiting any variability from one place to another this is not going to be a factor in siting gas stations and fast-food restaurants. Cross-street traffic, on the other hand, is fairly important in those places in which development activity is lacking (i.e., rural areas) and, as with interstate traffic counts, not very important in more urbanized areas in which development is more dense. Other factors that are important, especially for the fast-food restaurants, are the presence of water and sewer systems and, for both gas stations and fast-food restaurants, a degree of interchange visibility from the interstate. Finally, interchanges not requiring extensive grading tend to have more gas stations and fast-food development than those requiring extensive grading.

In contradiction to previous findings of other researchers, there are no strong relationships between shopping development and distance either to the nearest small town or to the nearest regional center. Again, traffic along the interstates has become sufficient in and of itself to make such businesses viable enterprises, even in the absence of large or small population clusters nearby. The only circumstance in which these distance variables seem to be important is, again, in more rural areas, where distance to a small town has some minor impact. These results appear to contradict some of the findings of earlier studies [e.g., Epps and Stafford (12)]. But these earlier studies were based on data collected early in the life

**TABLE 2** Correlations Among Interchange Measure of Development: I-95 in North Carolina

	Motels	Gas Stations	Truck Stops	Fast Food Rest.	Sit Down Rest.	Malls	Churches	Banks
Motels	-	-	-	-	-	-	-	-
Gas Stations	.67	-	-	-	-	-	-	-
Truck Stops	-.03	-.01	-	-	-	-	-	-
Fast Food Rest.	.60	.53	.09	-	-	-	-	-
Sit Down Rest.	.86	.58	.07	.71	-	-	-	-
Malls	.46	.61	-.17	.56	.64	-	-	-
Churches	.14	.06	.45	.02	.04	-.20	-	-
Banks	.01	.24	.45	.28	.04	-.03	.30	-
Residential	-.34	-.15	.07	-.32	-.62	-.41	.08	.08

n = 25

of the Interstate system, when main-line traffic levels were generally lower and the system was incomplete. Development on Interstate 95 through North Carolina and beyond is now more extensive and traffic levels are higher, making other factors more critical. These findings mean that most counties along Interstate 40 need not wait for rising interstate traffic to "float the boat" of interchange development: if the services are otherwise justifiable, development can be planned now.

There also was considerable correlation between various development types at North Carolina interchanges (Table 2), indicating a symbiotic effect between various kinds of activities at any major interchanges. Motels, gas stations, and fast-food and sit-down restaurants tend to develop together, with sit-down restaurants more closely aligned with malls. All are strongly negatively associated with residential development. Truck stops are generally not correlated with either of these groups, but there is some correlation with certain businesses (banks and churches).

### STAGES IN INTERCHANGE DEVELOPMENT

The typical sequence of development at an interchange would seem to be as shown in Table 3. Initially, a rural interstate passes through generally undeveloped lands, some of which may be in agriculture or other light use (Stage 0). There may be a strip residential development along the cross street, particularly if (as is often the case) it is close to a small community. If traffic is low (less than 2,000 ADT), more residential development may occur (Stage 1).

Depending on circumstances, the interchange may then evolve in several ways. A prerequisite for nonresidential economic growth is cross-street traffic volume: traffic levels greater than about 4,000 ADT are needed to support even minimal development (Stage 2). If the interchange has 4,000 ADT on the cross street, is a diamond design, has moderate or good visibility, and is within 10 mi of a small town and an interstate rest area, it will likely be able to support one gas station and one small motel (Stage 2A). The addition of water service

will increase gasoline service development to two to three stations. This pattern could be described as "light tourist" because it serves family travel needs.

More extensive economic growth creating a small island of development (Stage 2B) can also develop from light tourist services. This pattern, termed "economically competitive" often occurs when cross-street traffic is greater than 8,000 ADT, both water and sewer service is available, the nearby town is within 3 mi of the site, and the exit is at least 5 mi from nearby exits and has good visibility. In these circumstances, typical development would include two to four gas stations, one to two fast-food restaurants, and two or more motels. This development can challenge businesses in or closer to the small community, creating some tension.

For interchanges closer than 2 mi to the community and on heavy-volume streets (>12,000 ADT), "economic integration" (Stage 2C) can occur, which eventually consolidates the activities of the interchange with those of the community. Development strips are most likely to evolve along such connecting streets, particularly if they are widened to four or more lanes. In these circumstances, typical development would include four or more gas stations, three or more fast-food and motels, and two or more sit-down restaurants. Residential development would generally be pushed out by rising prices and traffic. In extreme cases, malls and other businesses can join this development.

A "heavy tourist-oriented" focus can evolve if circumstances are special: the intersection must be close to intersecting interstates or beltways with cloverleaf intersections, have both water and sewer service, be within 2 to 3 mi of a town, and have moderate visibility. In these circumstances, there is potential for six or more motels, three or more sit-down restaurants, three or more fast-food restaurants, and three or more gas stations (Stage 3A), depending on traffic volume.

Truck stops, a special activity, generally require sites at least 3 mi from a town, at least 20 mi from intersecting interstates, lower cross-street traffic volume (<6,000), and good visibility. Usually one to three stops can be supported in a

TABLE 3 Stages in Interchange Development

Stages	Requirements
0. Minimal development <ul style="list-style-type: none"> <li>• forest</li> <li>• agriculture</li> <li>• agric.-residential</li> </ul>	Initial setting; no requirements
1. Residential <ul style="list-style-type: none"> <li>• Single family homes</li> <li>• medium sized lots</li> </ul>	<ul style="list-style-type: none"> <li>• traffic &lt;2000 ADT</li> <li>• not close to town</li> <li>• rural setting</li> </ul>
2.A. Light tourist services <ul style="list-style-type: none"> <li>• 1+ gas station</li> <li>• 1 small motel</li> </ul>	<ul style="list-style-type: none"> <li>• traffic &gt;4000</li> <li>• water service</li> <li>• moderate visibility</li> <li>• within 10 mi. of town and rest area</li> <li>• diamond design</li> </ul>
2.B. Economically Competitive <ul style="list-style-type: none"> <li>• 2-4 gas stations</li> <li>• 1-2 fast-food rest.</li> <li>• 2+ motels</li> </ul>	<ul style="list-style-type: none"> <li>• traffic &gt;8000</li> <li>• water and sewer</li> <li>• town &lt;3 mi.</li> <li>• more than 5 mi. from next exits</li> </ul>
2.C. Economic Integration <ul style="list-style-type: none"> <li>• 4+ gas stations</li> <li>• 3+ fast-food rest.</li> <li>• 3+ motels</li> <li>• 2+ sit-down rest.</li> <li>• no residential</li> <li>• other business/malls</li> </ul>	<ul style="list-style-type: none"> <li>• traffic &gt;12000</li> <li>• water and sewer</li> <li>• town &lt;2 mi. away</li> </ul>
3.A. Heavy Tourist <ul style="list-style-type: none"> <li>• 6+ motels</li> <li>• 3+ sit-down rest.</li> <li>• 3+ fast-food rest.</li> <li>• 3+ gas</li> </ul>	<ul style="list-style-type: none"> <li>• water and sewer</li> <li>• 2-3 mi. from intersecting interstate</li> <li>• moderate visibility</li> </ul>
3.B. Truck Stop <ul style="list-style-type: none"> <li>• 3+ gas stations/truck stops</li> <li>• 1-2 fast-food rest.</li> <li>• no malls</li> <li>• 1-2 motels</li> </ul>	<ul style="list-style-type: none"> <li>• 3-5 mi. from town</li> <li>• 20+ mi. from intersecting interstate</li> <li>• water service</li> <li>• 1-2 per int. segment (100 mi.)</li> <li>• traffic &lt;6000</li> <li>• visibility good</li> </ul>

100-mi stretch of interstate. At such sites, one typically finds three or more gas stations and truck stops, one to two fast-food sites, no malls, and one to two smaller motels.

## POLICY ANALYSIS

The findings from the previous section were used to estimate interchange development pressure along Interstate 40, concentrating on the section between Wilmington and Raleigh (Figure 1). Some of these interchanges have been opened a number of years, and others have just recently opened (in 1990). A baseline estimate of 20-year development pressure was prepared assuming existing site and physical and utility conditions and 1989 traffic. In addition, the effect of selected policies, particularly those relating to sewer and water service and future traffic is shown. Table 4 summarizes the findings by site; Figures 3 through 5 show the data graphically.

Estimates of development pressure should be viewed cautiously: development pressure is not a prediction of what will happen, but instead a relative prioritizing of the possible development on each interchange because of its circumstances. Local governments often have the power to change, control, or accelerate actual development through a variety of policies. This analysis is intended to show which interchanges are likely

to come under pressure for future development so that governments will have information for planning.

The analysis shows that the intersections on Interstate 40 between Raleigh and Wilmington each have different development pressures. Some have potential for significant development because of their unique present locations, possibilities for sewer and water, and cross-street traffic, whereas others appear to have less development potential.

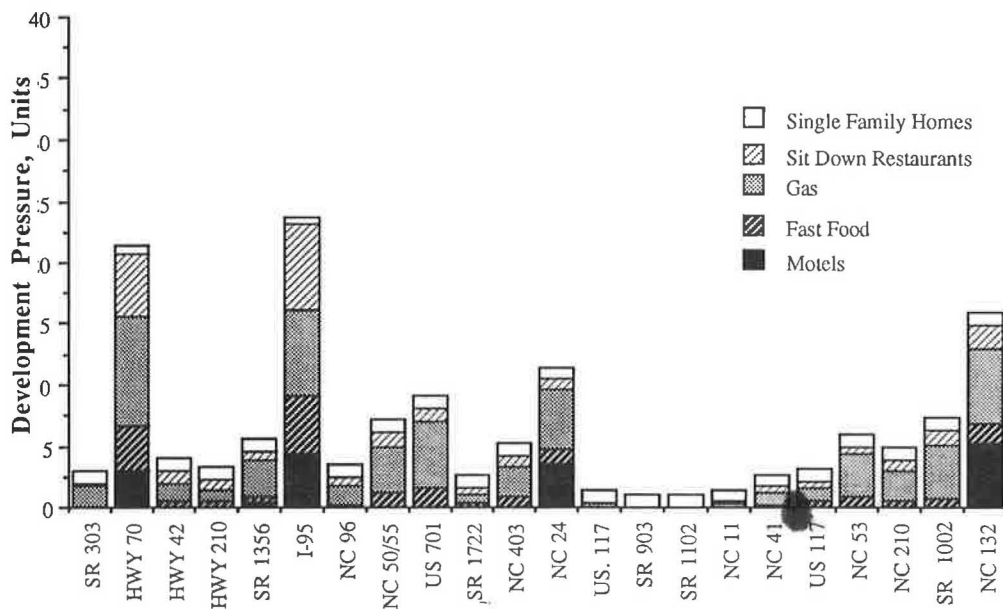
In the upper end of the corridor, just south of Raleigh, there are two exits, the first of which (SR-303) has moderate to low development potential. Residential development is more likely because of the close proximity to Raleigh. The second (U.S. 70) interchange has high development potential, with 30 or more units of development potential by the year 2008, if the sewer is extended to the entire intersection (currently water and sewer service some of the interchange). This interchange is especially well-suited for gas stations, fast food, and mall and motel development. U.S. 70 has high traffic volume, which is projected to increase substantially over the next 20 years. An economically integrated development form is likely.

Further south, interchanges at N.C. 42 and N.C. 210 have already begun to experience some growth: currently there are two gas stations with other sites in development. The site pressure was estimated at about four units, under present

**TABLE 4 Twenty-Year Development Potential and Character of I-40 Interchanges**

Interchange	Without sewer/water		With sewer/water	
	1989 Traffic	2008 Traffic	1989 Traffic	2008 Traffic
Gamer SR 303	3.1 LT	3.3 LT	7.0 CE	7.6 CE
Garner NC 70*	21.3 CE	28.3 EI	25.8 CE	32.8 EI
Clayton NC 42	4.0 LT	6.0 LT	10.4 CE	13.7 EI
Smithfield NC 210	3.3 RES	3.6 LT	9.4 CE	9.8 CE
Benson SR 1356	S/W Available		12.6 CE	12.9 CE
Benson I-95	23.7 HT	34.6 HT	30.1 HT	41.6 HT
Benson NC 96	3.5 RES	3.8 RES	9.9 LT	10.3 LT
Newton Grove NC 50-55*	7.1 CE	8.1 CE	10.3 EI	11.7 EI
Newton Grove US 701*	9.1 CE	10.0 CE	12.1 CE	13.3 CE
Newton Grove SR 1722	2.6 RES	2.7 RES	7.2 LT	7.3 LT
Faison NC 403	5.2 LT or T	5.9 LT or T	10.6 CE	11.5 CE
Warsaw NC 24	S/W Available		11.5 CE	12.8 EI
Warsaw NC 117	1.4 RES	2.0 RES or T	3.7 RES or T	4.4 RES or T
Magnolia NC 903	1.1 RES	1.1 RES	2.5 LT	2.6 LT
Rose Hill SR 1102	1.1 RES	1.1 RES	3.1 LT	3.2 LT
Tin City NC 11	1.5 RES	1.7 RES	3.5 LT	3.8 LT
Wallace NC 41	2.7 LT	3.4 LT	5.6 CE	6.6 CE
Willard US 117	3.1 RES	3.7 LT	6.5 CE	7.3 CE
Burgaw NC 53	6.1 LT	6.5 LT	10.4 CE	11.2 CE
Rocky Pt. NC 210	5.0 LT	5.5 LT	10.6 CE	11.4 CE
Castle Hayne NC 132	7.3 LT	8.0 CE	14.0 EI	14.9 EI
	S/W Available		16.0 HT	17.7 HT

\* - water only available  
 RES - Residential  
 LT - Light Tourist  
 HT - Heavy Tourist  
 CE - Competitive Economy  
 EI - Economic Integration  
 T - Truck-stop Focus



**FIGURE 3 Twenty-year development pressure at I-40 exits, 1989 traffic levels.**



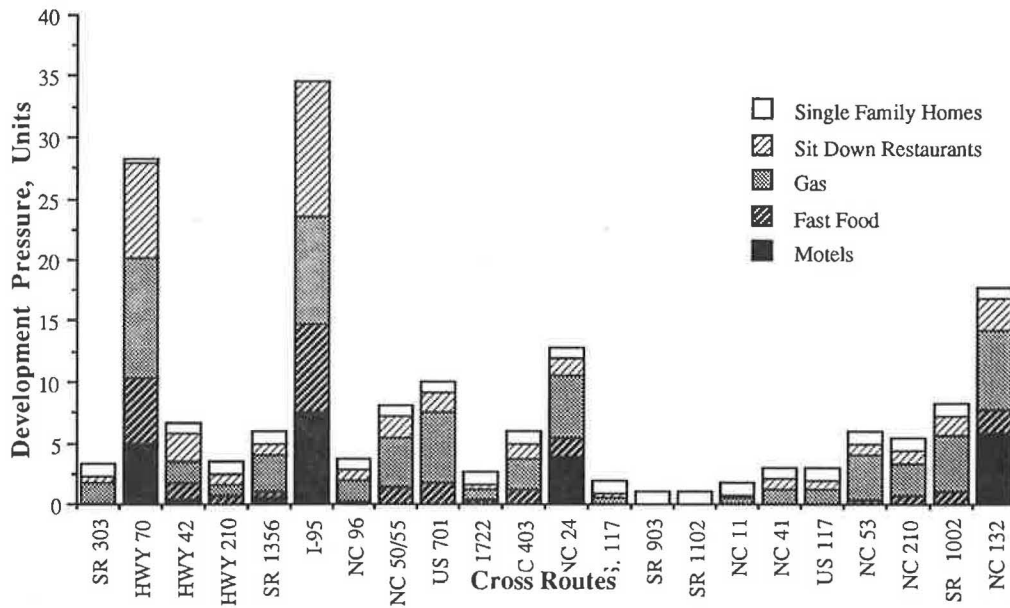


FIGURE 4 Twenty-year development pressure at I-40 exits, 2008 traffic levels.

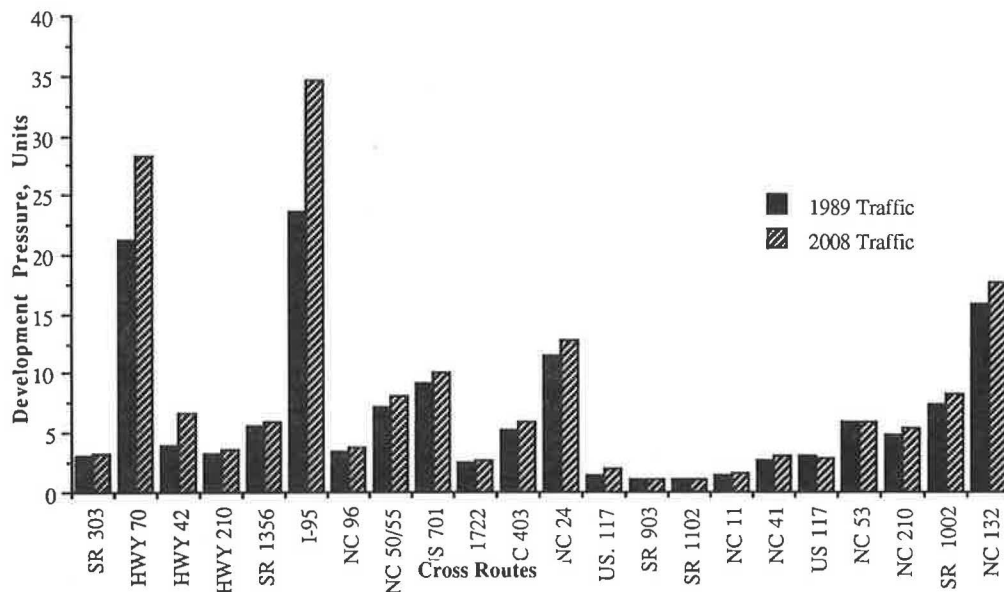


FIGURE 5 Twenty-year development pressure at I-40 exits, 1989 versus 2008 traffic.

circumstances. If sewer and water service is provided, there is a good possibility that the interchanges will experience additional growth.

There are three Interstate 40 interchanges in the Benson area (SR-1356, Interstate 95, and N.C. 96). Interstate 95 carries a large volume of traffic, but, as with most cloverleaf interstate-to-interstate intersections, it does not allow for direct development; the interchanges nearby could receive development instead (see Table 3, Stage 3A). State Road 1356 is also suited to serve traffic coming from Interstate 95, since sewer and water are extended to this location. An estimate of development pressure at the Interstate 95/In-

terstate 40 location, about 23 units, will show up as increased development pressure at the Interstate 95 Benson exit. The exit at N.C. 96 appears to have only light development pressure.

Toward the corridor center, the Newton Grove area is served by three exits: N.C. 50/55, U.S. 701, and SR-1722. The N.C. 50-55 and U.S. 701/13 exits appear to have some development potential. North Carolina 50-55 has water but not sewer; thus a major element for development is already in place. It is estimated that the interchange could be developed into a stand-alone economically competitive site, with perhaps eight or more units of development. At the U.S. 701 exit, similar

development potential exists. At SR-1722, south of Newton Grove, development potential is light.

The N.C. 24 interchange has considerable development pressure. Water and sewer main lines are in place. The interchange could be developed into a medium tourist site, with the potential to expand to an economically competitive node for the communities. This intersection's rest area enhances its development potential, although visibility may be a problem. Some signing might be required.

There is moderate economic development pressure at N.C. 53 and N.C. 210, with the edge going to N.C. 53. Either the Burgaw or the Rocky Point exit probably could be developed into a competitive economic node if sewer and water were provided. Development may not be cost-effective for the Rocky Point site. If sewer and water cannot be provided, then development would probably remain limited to light tourist service.

North of Wilmington, the exit for Castle Hayne (SR-1002) appears to have quite high development pressure. According to the analysis, SR-1002, which has no sewer or water, has high potential for gas station development. North Carolina 132, the formal end of Interstate 40, has higher development potential; it is heavily residential in character now. Both interchanges benefit from their close proximity to Wilmington.

This analysis concludes with a number of general points. First, the importance of providing sewer and water services in both controlling and encouraging development at intersections should be noted. Without sewer and water, the development pressure on most interstate intersections is limited; conversely, with sewer and water services provided, development pressure will be considerable. Provision of sewer and water can generally double the development pressure for most interchanges. Local governments need to understand this linkage and use it in conjunction with other planning tools to encourage the kind of development they seek.

Second, although traffic growth will improve the competitiveness of some intersections, traffic increases alone are not likely to significantly increase development pressure. It was found that development pressure depends more upon site characteristics and the locational positioning of the intersection with respect to its community and the corridor, than it does on traffic.

Most exits in the corridor will not be able to support unlimited economic growth. Since the total economic potential growth for the corridor is limited, communities must work together to plan comprehensively for reasonable expectations at specific interchanges as well as a solid development pattern for the entire corridor.

In summary, it was found that each of the corridor's interchanges will experience a different economic pressure, which can be used effectively by local communities and the corridor as a whole. The communities and businesses in the corridor need to work together to identify appropriate development patterns for each exit, make decisions with respect to the provision of utilities, and take cooperative actions to develop the services along the corridor as a group. Such a cooperative process can lead to an environment that is both economically active and aesthetically pleasing and that provides appropriate services at appropriate points.

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