The Economic Impact of Interstate 73 on Virginia

Prepared for

The Harvest Foundation and

The Virginia Tobacco Indemnification and Community Revitalization Committee

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1. Executive Summary

The United States Congress designated Interstate 73/74 (I-73/74) as a corridor of national significance, connecting the Great Lakes with the Carolinas' coast. The Commonwealth Transportation Board determined that I-73 in Virginia will follow US 460 from West Virginia to Blacksburg, the Smart Road, I-81 to Roanoke, and then roughly parallel US 220 south to the Virginia-North Carolina line. The Board approved the route for the 70-mile corridor from Roanoke to the Virginia-North Carolina line. This study, produced by Chmura Economics & Analytics,[1] evaluates the economic impact of that segment, which has received the "Record of Decision" by the Federal Highway Administration.

The I-73 corridor includes six cities and counties in Virginia.

In this study, the I-73 corridor region is defined as the following cities and counties in Virginia: Roanoke City, Salem City, Roanoke County, Franklin County, Henry County, and Martinsville City.[2] In this study, economic impacts are presented for both the northern and southern corridor. The northern I-73 corridor consists of Roanoke City, Salem City, Roanoke County, and Franklin County. The southern I-73 corridor consists of Henry County and Martinsville County. For the past three decades, the six localities composing this collective region lagged the state in population and employment growth.

Economic literature indicates that highway networks are beneficial to regional economies.

Economic literature on the relationship between highway and economic development generally concludes that the following economic benefits are associated with a highway network:

1. **Travel efficiency.** The construction of a highway can reduce travel time for area businesses and residents alike. Trade, manufacturing, and construction sectors will benefit more from a new highway than other sectors such as health care and education.
2. **Attraction of service businesses.** Oftentimes, businesses such as hotels, gas stations, retail stores and restaurants cluster around interstate interchanges.
3. **Economic development benefits of firm relocations and expansions.** Several case studies have found that rural counties with an interstate highway enjoy faster population and employment growth than similar counties without an interstate highway.

In the past three decades, the economy in the I-73 corridor was below the state average in population, employment, and high-tech industry growth as well as per capita income.

The I-73 corridor region's population grew at a much slower 0.5% annual pace than the state's 1.4% in the 30 years ending with 2000. For the ten years ending in 2005, the I-73 corridor had essentially no employment growth compared to a 1.9% average annual rate in the state. The lack of employment growth in the I-73 corridor occurred

[1] Chmura Economics & Analytics, located in Richmond, Virginia, is an economic consulting firm specializing in applied economics. Since 1999, the firm's economic impact studies have centered on many different topics including highways, airports, tourism, and mixed-use developments. Further details are available at www.chmuraecon.com.

[2] The proposed I-73 will directly pass through the city of Roanoke and the counties of Roanoke, Franklin, and Henry. The I-73 corridor, defined as the region in the immediate vicinity of I-73, includes the aforementioned localities as well as the cities of Salem and Martinsville due to their close proximity to I-73.

partially because manufacturing, which has been in decline nationwide, is more concentrated in the I-73 corridor than in the state. In addition, the relatively fast-growing high-tech sector is less concentrated in the I-73 corridor region than in the state.

Per capita income in all localities of the I-73 corridor region was lower than the statewide average in 2005. Moreover, the income gap between the I-73 corridor and the state widened as I-73 corridor average income fell from 99% of the state average in 1969 to 85% by 2005.

Growth rates of the localities in the I-73 corridor region varied widely in the past three decades.

Localities in the northern part of the corridor that are close to or part of the metropolitan areas of Roanoke and Lynchburg enjoyed modest growth in population and employment while the communities in the southern part of the corridor saw a decline in both population and employment.

Traffic is expected to increase 23% from 1997 to 2020 along I-73.

The Virginia Department of Transportation (VDOT) traffic model projects an increase in traffic volume after I-73 is completed. From 1997 to 2020, total average daily traffic is expected to increase 41% on I-73 from traffic on existing roadways. The traffic volume is expected to increase an additional 6% from 2020 to 2025. The largest increase in traffic volume is projected to occur on the northern end of I-73 in the Roanoke region. The model outputs also indicate that the heavy vehicle traffic along the I-73 corridor will be between 11% and 19% of total traffic volume.

The one-time economic impact of the I-73 construction can reach $4.4 billion in the corridor region from 2012 to 2020.

From 2012 to 2020, the construction of I-73 is projected to generate $4.42 billion in economic impact in the corridor region. Of this total, $2.75 billion is direct construction spending while $1.66 billion is the ripple economic impact of the construction.[3] The construction of I-73 is forecast to directly create 3,415 new jobs per year from 2012 to 2020 and by ripple effect create an additional 1,887 jobs per year in the region. This sums to an average 5,303 jobs per year during the construction phase. Twenty-nine percent of the economic impact from the construction of I-73 is expected to occur in the southern corridor.

I-73 can provide between $141.2 and $161.0 million in annual cost savings for current businesses as a result of improved travel efficiency.

A new highway can reduce travel time for regional businesses, thus producing cost savings and improved productivity. The total cost savings for the region is estimated to reach $141.2 million in 2020 and $161.0 million in 2025, assuming the interstate is in place. The value of travel efficiency and cost savings is estimated to be 0.4% of the total corridor regional output. About 20% of the cost savings will take place in southern corridor.

[3] The direct impact is economic activity generated by a project or operation. For construction, this represents activity of the contractor. The indirect impact is the secondary economic activity that is generated by a project or operation. An example is a new office building generating demand for parking garages. The induced or household impact is economic activity that occurs when households employed by the construction firm or its suppliers spend their income in the region. The ripple effect is the sum of induced and indirect impacts.

By 2020, I-73 can support 141 service businesses and 2,455 jobs in the region with a total annual economic impact of $310 million.

In 2020, it is estimated that I-73 can support approximately 141 businesses with 44 hotels, 43 gas stations, 32 fast food restaurants, and 22 full-service restaurants. The direct output of these businesses is estimated to be $201 million in 2020 with ripple effects of $109 million. The number of business establishments in 2025 is projected to grow to 155. In terms of job creation, service businesses can support an estimated 2,455 jobs in 2020 and 2,688 jobs in 2025. The city of Roanoke is expected to land more than half of the jobs along I-73, followed by the counties of Henry, Franklin, and Roanoke.[4] In 2020, 15% of the economic impact due to service businesses is expected to take place in the southern corridor. That percentage is expected to increase to 19% by 2025 because of increases in economic activity.

The newly built I-73 can also support distribution centers, each averaging $22 million in economic impact and 277 new jobs.

The location of I-73 can attract retail distribution centers. An average distribution center employs about 200 workers and would directly generate about $14 million in economic output in 2020. Adding ripple effects, the total economic impact of a distribution center can reach $22 million in output and 277 jobs in 2020.

After I-73 is completed, it is estimated that Virginia will receive $13 to $17 million in annual tax revenue while fiscal benefits for local governments will be over $10 million per year.

After construction is complete, the state is expected to collect corporate and personal income taxes from service businesses and other businesses along I-73. Tax revenues are estimated to be $13.7 million for 2020 and $17.1 million for 2025. For local governments, I-73 is projected to contribute $10.2 million in local revenue per year, with $9.2 million in the northern corridor and $1.0 million in the southern corridor. With the increase in traffic expected by 2025, service businesses can bring $12.5 million tax revenue for local governments per year, with $10.8 million in the northern corridor and $1.6 million in the southern corridor.

Other benefits of I-73 are better market access, increased appeal for business relocations, faster population growth, increased tourism, better road safety, and improved quality of life.

I-73 will benefit manufacturers and agricultural businesses in the I-73 corridor by providing easy access to markets. The presence of an interstate highway can increase the appeal of the region to expanding and relocating firms, especially those in the manufacturing and transportation sectors. I-73 will also improve access to Smith Mountain Lake, a popular area for retirement and vacation homes. As a result, I-73 will have a positive effect on population and tourism growth in the region. Other benefits include fewer accidents and better safety on the roads.

There are both upside and downside risks for economic projections made in this study.

The analysis of the economic impact of I-73 attempts to project the regional economy ten to twenty years from now based on a certain set of assumptions. Some examples of these assumptions are that I-73 is a non-toll road and that there are no recessions or oil crisis during the projection period. The projection is subject to forecasting risks as actual events may change those assumptions. Unpredictable events create the potential for either larger (upside) or

[4] The cities of Martinsville and Salem are not listed here because they have no interchanges and thus would not be expected to see a direct benefit in terms of services businesses.

smaller (downside) effects than indicated here. For example, an oil crisis and rise in gas prices could reduce the traffic on the proposed I-73 and reduce the economic impact. Imposing tolls on I-73 could also reduce the use of the road and the resulting economic benefits. On the positive side, the expansion of a large manufacturing firm to the area that benefits from the new interstate would cause the projections in this report to err on the low side.

The economic impact of I-73 is summarized in Table 1.1.

Table 1.1: I-73 Economic Impact Summary

	Total Economic Impact ($MM)	Total Employment Compensation ($MM)	Total Job Creation	State Tax Revenues ($MM)	Local Tax Revenues ($MM)
Average Annual One-time Construction Impact (2012-2020)					
Northern Corridor	$346.9	$156.4	3,749	$5.7	$0.3
Southern Corridor	$143.7	$64.8	1,553	$2.4	$0.2
I-73 Corridor	**$490.6**	**$221.3**	**5,303**	**$8.1**	**$0.5**
On-going Impact (2020)-Northern Corridor					
Cost Saving (Productivity)	$111.7				
Business Services	$265.4	$89.2	2,721	$11.4	$9.2
One Distribution Center	$22.4	$12.8	277	$0.4	$0.1
Total Northern Corridor 2020	**$399.5**	**$101.9**	**2,998**	**$11.8**	**$9.2**
On-going Impact (2020)-Southern Corridor					
Cost Saving (Productivity)	$29.5				
Business Services	$44.1	$14.8	443	$1.9	$1.0
Distribution Center	$22.4	$12.8	277	$0.4	$0.0
Total Southern Corridor 2020	**$96.0**	**$27.5**	**720**	**$2.3**	**$1.0**
On-going Impact (2020)-I-73 Corridor					
Cost Saving (Productivity)	$141.2				
Business Services	$309.6	$103.9	3,164	$13.3	$10.1
One Distribution Center	$22.4	$12.8	277	$0.4	$0.1
Total I-73 Corridor 2020	**$473.1**	**$116.7**	**3,441**	**$13.7**	**$10.2**
On-going Impact (2025)-Northern Corridor					
Cost Saving (Productivity)	$129.1				
Business Services	$313.7	$105.4	2,821	$13.5	$10.8
One Distribution Center	$23.5	$13.4	277	$0.5	$0.1
Total North Corridor 2025	**$466.3**	**$118.8**	**3,098**	**$13.9**	**$10.9**
On-going Impact (2025)-Southern Corridor					
Cost Saving (Productivity)	$31.9				
Business Services	$73.2	$24.6	645	$3.2	$1.6
One Distribution Center	$23.5	$13.4	277	$0.5	$0.0
Total Southern Corridor 2025	**$128.6**	**$38.0**	**922**	**$3.6**	**$1.6**
On-going Impact (2025)					
Cost Saving (Productivity)	$161.0				
Business Services	$386.9	$129.9	3,466	$16.7	$12.4
Distribution Center	$23.5	$13.4	277	$0.5	$0.1
Total I-73 Corridor 2025	**$571.4**	**$143.3**	**3,743**	**$17.1**	**$12.5**

Figures may not sum due to rounding.
Source: Chmura Economics & Analytics

2. Introduction

In 1991, the U.S. Congress identified the need for a north-south corridor from northern Michigan to Charleston, South Carolina. This highway was designated as Interstate 73 (I-73). In Virginia, a feasibility study was initiated by the Virginia Department of Transportation (VDOT) in the mid-1990s to evaluate 13 broad corridors throughout southwest Virginia for I-73. VDOT evaluated the potential location of I-73 using the following five criteria:

1. Environmental impact
2. Economic impact
3. Traffic service
4. Capital support
5. Public support

A preliminary economic impact study was completed at the time of the location study to assist in the process of deciding the location of the road.[5]

In May 2001, the Commonwealth Transportation Board selected the I-73 corridor in Virginia. That corridor generally follows Route 460 from West Virginia to Roanoke, intersects I-81 in Roanoke, and turns south toward the North Carolina border.[6] This study only considers the economic impact of the segment from Roanoke to the Virginia-North Carolina state line. The segment from Roanoke to the Virginia-West Virginia state line is not included in this study because the intent of VDOT was to "study the remaining portion of Interstate 73 between Roanoke and the Virginia-West Virginia state line at a future date when funding becomes available."[7]

According to the Record of Decision by the Federal Highway Administration,[8] there are three major goals for the I-73 project. First, I-73 will provide safety improvements along the current US-220 corridor[9] from Roanoke to Martinsville. Currently, the area has a high percentage of truck traffic, poor sight distances, and steep grades, resulting in a large number of accidents. Second, I-73 will support economic growth, economic vitality, and maintain the existing economic competitiveness of the region. Third, it will improve operations, access, and capacity for vehicular and freight movement through the corridor as well as through the broader Michigan to South Carolina travel shed.

Though a preliminary economic impact study was conducted in the mid-1990s, it was prepared before the final I-73 corridor was chosen. The study did not include a discussion of the benefits of productivity improvement and economic development. It also did not address the fiscal benefits for state and local governments. Chmura

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[5] Source: I-73 Economic Impact Analysis, by James Gillespie of the Virginia Transportation Research Council (VTRC), January 1995. This study analyzed the economic impact of 12 route options. Its exit method estimated that route 6A (the I-73 corridor that was chosen) can directly create 2,882 jobs, similar to 2,456 jobs estimated here. Chmura estimates of ripple effects are smaller than in the VTRC study possibly due to improvement in input-output analysis methodologies since 1995.

[6] This study is based on the route listed in the Record of Decision by the Federal Highway Administration.

[7] Source: Record of Decision, Interstate 73 Location Study; Final Environmental Impact Statement, U.S. Department of Transportation, Federal Highway Administration. Retrieved on August 28, 2007 from http://www.virginiadot.org/projects/I73/I-73ROD-web.pdf.

[8] Ibid. The Record of Decision provides a final decision of the location of I-73. With it, the project can move forward to the design phase.

[9] Currently, US-220 is the major highway linking Roanoke and Martinsville. In some segments, I-73 will be built parallel to or will share the road with US-220.

Economics & Analytics (Chmura) was retained to provide a detailed economic impact analysis based on the route chosen by the Commonwealth Transportation Board. The remainder of this report is organized into seven sections. Section 3 provides a review of the economic literature on the role of highways in economic development. Section 4 is an analysis of the current economic strength of the corridor region. Section 5 summarizes the traffic analysis report provided by the Timmons Group. A detailed analysis of the economic impact of I-73 is presented in Section 6, including both the one-time construction impact and the ongoing impact due to cost savings, service businesses, and other economic benefits. Section 7 estimates the fiscal benefits for the state and local governments and Section 8 details an assessment of risk. The conclusion is in Section 9.

3. Literature Review

Over the years, there have been a significant number of studies investigating the roles of a highway system in economic development. These studies have covered a wide range of geographical areas and have utilized a variety of economic analysis tools. In terms of geographical region, some studies have a broad scope, such as the entire national interstate highway system, while others have been as specific as a single road or interchange. In terms of methodology, previous studies have generally used either econometric regression for national studies or a case study approach for regional studies. The economic impact literature generally supports the conclusion that "the development of the interstate highway system has had a significant positive effect on the nation's economic performance since 1956" (NCHRP, 2006).[10]

Due to the sheer size of the literature, it is not possible to include all studies in this review. Moreover, Chmura prepared a comprehensive literature review entitled "Highway Investment and Economic Development: I-73 and the Roanoke Valley" in 2000.[11] For that reason, the following literature review summarizes the results of key studies included in the review completed by Chmura in 2000 and emphasizes studies published after 2000. Representative studies are categorized into the following four sections: 3.1 Aggregate National Studies; 3.2 Regional Studies; 3.3 Studies Discussing Social Benefits; and 3.4 Previous Economic Impact Studies on I-73.

3.1. Aggregate National Studies

National studies usually analyze the interstate highway system as a whole. They normally use econometric methods to quantify the effect of highway investment on business cost, output, and productivity.

The best known and most cited example of an aggregate national study was conducted by Nadiri and Mamuneas (1996)[12] who found that interstate highway investments lowered production costs and distribution costs in virtually every industry sector. In terms of economic impact, U.S. industries have realized production and distribution cost savings averaging 24 cents annually for each dollar invested in the non-local road system.

The study also concluded that interstate highway investments have made significant contributions to U.S. productivity growth, which refers to the average output for unit input factors. During the 1950s, highway network investments contributed to 31% of U.S. productivity growth. The contribution of the highway network to productivity growth was 25% in the 1960s but then fell to 7% in the 1980s. The relatively smaller effect from 1950 to 1990 reflects the diminishing marginal product of highway investment. In other words, as the interstate highway system was built up to its capacity, its incremental effect diminished.

Nadiri and Mamuneas also found that the benefit of highways varies by industry. Not surprisingly, industries that rely on transportation generally reap the most benefits. Wilbur Smith Associates (2006) listed the following vehicle-

[10] Source: The Economic Impact of the Interstate High System, Technical Memorandum Task 2, National Cooperative Highway Research Program (NCHRP), Project 20-24 (52), FY 2006. Retrieved June 27, 2007 from http://www.interstate50th.org/index.shtml.
[11] See http://www.chmuraecon.com/services.aspx?c=study.
[12] Source: Contribution of Highway Capital to Output and Productivity Growth.

intensive industries that experience the most productivity gains from interstates: trade; finance, insurance, and real estate; construction; and transportation equipment manufacturing.[13]

A study by Rephann and Isserman (1994) investigated the economic effects of new highways on nonmetropolitan cities, the urban fringe, and more spatially isolated rural areas and counties adjacent to the highway-located counties during both construction and post-construction periods. The authors used a quasi-experimental matching method where counties with new highways were matched with counties without new highways based on certain similarities to discern the economic impact in terms of income growth by industry. Results of the study showed that during the highway construction period, the income growth was positive and statistically significant for the construction industry and for total earnings in the region.

In the post-construction period, Rephann and Isserman found that the effect on counties with cities of more than 25,000 people was positive. The study also concluded that urban spillover counties—counties near or containing large cities—exhibited positive total income growth along with significant and positive population growth. The initial effects centered on population growth, after which manufacturing, transportation, and public utilities showed positive and statistically significant effects. The counties without a city or not near a metropolitan area displayed a small effect on total income or earnings. The counties adjacent to the interstate counties experienced job losses as a result of businesses relocating from those counties to the counties with the interstate.

Chandra and Thompson (2000)[14] examined the economic effects, as measured by wage growth, of new highway construction on rural areas. Their study, which included all rural counties in the nation, showed that the wages of industries with more regionally traded goods (retail sales, government, and farming) improved in the direct counties but declined in the adjacent counties. A spatial competition model was constructed to show that direct counties draw economic activity away from the adjacent counties. This study also showed that the wages of industries with more nationally traded goods (manufacturing) increased in both direct counties and adjacent counties.

3.2. Regional Studies

Regional studies usually focus on a particular segment of highway and its economic impact on a region. Instead of taking an econometric approach, these studies commonly use a case study approach to estimate the impact of a highway. They often focus on indicators such as job creation, firm relocation, and tourism.

Regional studies generally fall into two categories. The first is the analysis of economic impact after the completion of a highway. These studies are based on actual data collected through surveys or interviews. Some compare economic indicators before and after the highway construction. Other studies choose a similar region without highway construction as a control and analyze the difference between the regions. The second type of analysis utilizes forecasting. With this form of research, simulation models are used to estimate the potential impact of a highway based on assumptions and projections. The economic impact of I-73 provided in this report relies on forecasting.

[13] Source: Delta Development Highway System Plan, prepared by Wilbur Smith Associates for the Delta Regional Authority.
[14] Chandra, Amitabh and Eric Thompson, 2000, "Does Public Infrastructure affect Economic Activity? "Evidence from the Rural Interstate Highway System." *Regional Science and Urban Economics,* 30: 457-490.

3.2.1. Evaluating Post-construction Impact

A report by Jack Faucett and Associates and the Economic Development Research Group[15] studied a number of new highway corridors after completion and found that an interstate highway alone does not guarantee economic development success, but that it needs to be combined with other infrastructure and incentive policies to be most effective. This research correlated county-level data on population, employment, income, etc., with the periods before, during, and after the completion of an interstate highway. In some counties, changes implied that the influence of the interstate is positive from an economic development standpoint. Manufacturing employment increased 30% in Wisconsin's I-43 corridor. Laurens County corridor in Georgia (I-16) experienced a 40% increase in population and a 100% increase in employment between 1969 and 2002. This area in Georgia developed into a major logistic and warehousing center. However, the study also found areas where construction of interstate highways did not result in more jobs or residents.

One particularly applicable case study by Faucett and Associates[16] is that of I-81 in Virginia. Not only is I-81 in close proximity to the proposed I-73, but the regions surrounding I-81 are similar to those in the I-73 corridor. Consequently, the changes in the I-81 corridor in Virginia may provide valuable information in projecting the employment and demographic trends for the I-73 corridor. Faucett and Associates found that the population and employment growth of the I-81 corridor in Virginia, though lagging behind the state average, outperformed the nonmetropolitan counties and cities of Virginia. From 1971 to 2002, average employment growth of Virginia's I-81 corridor averaged 2.0% per year compared with 1.3% for all nonmetropolitan Virginia areas. As a result of I-81, distribution centers have become an increasingly important industry for localities along the I-81 corridor. In fact, as a result of economic and population growth in the corridor, three new metropolitan statistical areas (MSAs) were designated in the region since 2000—Blacksburg, Harrisonburg, and Winchester.

An economic impact study of I-86 in western New York utilized a similar approach to Faucett and Associates and found that employment growth of the I-86 corridor performed better than the comparison regions, especially in the manufacturing sector.[17] Four years after the completion of the highway, researchers surveyed communities along I-86 in terms of their population, business establishments, and property values. They also chose a similar community in up-state New York without an interstate as a comparison region. The study found that property values in communities along the highway increased by 7.6% in the two years immediately after I-86 completion.[18] This study concluded that the highway also spurred new manufacturing plants and warehouse distribution centers in the region.

3.2.2. Simulating Potential Impact

In cases where actual post-construction data were not available, researchers utilized simulation models such as REMI and IMPLAN to estimate the economic impacts of a highway. In these studies, rather than collecting before and after data, the job creation and economic outputs are calculated using an economic simulation model.

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[15] Source: Economic Effects of Selected Rural Interstate at the County Level, 2005, by Jack Faucett Associates and the Economic Development Research Group.

[16] Source: Economic Effects of Selected Rural Interstate at the County Level, 2005, by Jack Faucett Associates and Economic Development Research Group. This study was prepared for Federal Highway Administration, U.S. Department of Transportation.

[17] Source: Preliminary Economic Impact of the Southern Tier Expressway: Western Portion, prepared by Southern Tier West Regional Planning and Development Board, Economic Development Research Group, and Cambridge Systematics, Inc.

[18] The longer-term impacts of I-86 on property value were not available.

The economic impact analysis of the Maine East-West Highway utilized simulation methodology. This study, which was conducted during the planning phase of the project, estimated the direct economic impacts in several categories. The direct impacts in transportation costs, industry productivity, and tourism impacts (including purchase of service businesses) were estimated. The Maine study also analyzed the impact on business attraction, relocation, and retention through a case study of two similar highway investments in other parts of New England, I-89 and I-91. The researchers found that counties served by I-89 and I-91 experienced faster job growth than counties without interstate connections.

Other studies suggest that for firm location, though highway connectivity is important, its value has diminished over time. Firms also consider other factors such as proximity to markets, available workforce, and local tax incentives in relocation and expansion decisions (Wilbur Smith Associate, 2006).[19]

Using a REMI model, Wilbur Smith Associates (1998) researched the economic impact of the Appalachian Development Highway System (ADHS) for the Appalachian Regional Commission. They selected 12 highway segments in the Appalachian region. In addition to the one-time construction impact, their study estimates the following three direct ongoing impacts of the highways:

1. Lower transportation costs and improved productivity
2. Service businesses impact which includes gas stations, hotels/motels, restaurants, gift shops, and other businesses that are typically located near highways
3. Tourism impact from the highways bringing in more visitors to the region

The three direct impacts were input into the REMI model to estimate the overall economic impact. The researchers found that from 1965 to 1995, 16,000 jobs were created that would not have existed without the ADHS; the ADHS increased gross regional product by $1 billion in 1995; and the ADHS highway system created travel efficiencies valued at $4.89 billion from 1965 through 1995.

3.3. Studies Discussing Social Benefits

In addition to job creation and increased income, there are other benefits of interstate highways. Thompson and Chandra (1998) characterized these benefits as fewer accidents, time savings, and lower vehicle operation costs.[20]

Interstate highways are usually safer than other highways for a number of reasons. They are typically wider, have more lanes, are straighter than other principal arterial highways, and have controlled access through on-ramps. In fact, there are 0.8 fatalities for each 100 million miles driven on interstate highways compared to 1.8 fatalities per 100 million miles driven on other principal arterial highways. The statistics for injuries are similar—there is an average of 45.8 injuries for every 100 million miles on interstate highways compared to 169.4 on other principal arterial highways.

Due to higher speed limits and controlled access, driving on interstate highways saves time for drivers. Thompson and Chandra estimate that a vehicle saves 10.1 seconds per mile in driving time by traveling on an interstate

[19] Source: Delta Development Highway System Plan. Prepared by Wilbur Smith Associates for Delta Regional Authority.
[20] Source: Economic Impact of Interstate Highways in Kentucky, by Eric Thompson and Amitabh Chandra. 1998 Kentucky Annual Economic Report.

highway rather than on another principal arterial highway. Vehicle operating costs on an interstate highway is marginally lower than other principal highways.

3.4. Previous Economic Impact Study of I-73

During the location study phase of I-73, James Gillespie of the Virginia Transportation Research Council completed an economic impact analysis of I-73. The main purpose of the Gillespie study was to rank order 12 different route options in terms of economic impact. The two methods used in this study were an "exit" method and a "dollar" method. The "exit" method uses a narrow interpretation of the economic impact of highways because it only estimates the economic impact of service businesses.[21] Based on the Hartgen et al. (1992) paper on the relationship between rural interchanges and service businesses, Gillespie estimated that the proposed I-73 (alternative 6 in their study) could support 61 gas stations, 60 new restaurants, and 52 new hotels, with a total job creation of 4,830.[22] The "exit" method did not capture other economic benefits of an interstate highway such as cost savings for existing businesses.

The "dollar" method evaluated the impact of I-73 on the overall regional economy based on aggregate studies reviewed in section 3.1 of this report. The method assumes that for every 1% increase in highway stock in the region, regional economic activity increases by a certain percentage. However, Gillespie did not provide a justification on the magnitude of this percentage. In the most optimistic scenario, Gillespie estimated that I-73 (alternative 6) will create 3,186 jobs. Though this method captured the potential effect of the highway on the overall economy, the drawback of the Gillespie study is that it did not try to reconcile the seemingly different results of the "exit" and "dollar" methods. Readers were left wondering about the size of the economic impact of I-73.

The Economic Development Research Group conducted a separate study on the potential economic impact of I-73 on the city of Roanoke. The report studied the impact of I-73 on retail, office, and tourism industries. It concluded that I-73 (with a central alignment through the city of Roanoke) could generate 5,670 jobs for the city of Roanoke. However, many of those jobs would be the result of business relocations between Roanoke and the surrounding areas. This study did not attempt to evaluate the economic impact on the entire I-73 corridor region.

[21] In this study, service businesses refer to those around interstate interchanges that serve motorists. Typical service businesses are gas stations, restaurants, and hotels.

[22] This number may not be directly comparable with that found in the Chmura study as the route and interchanges may have changed since the 1995 study.

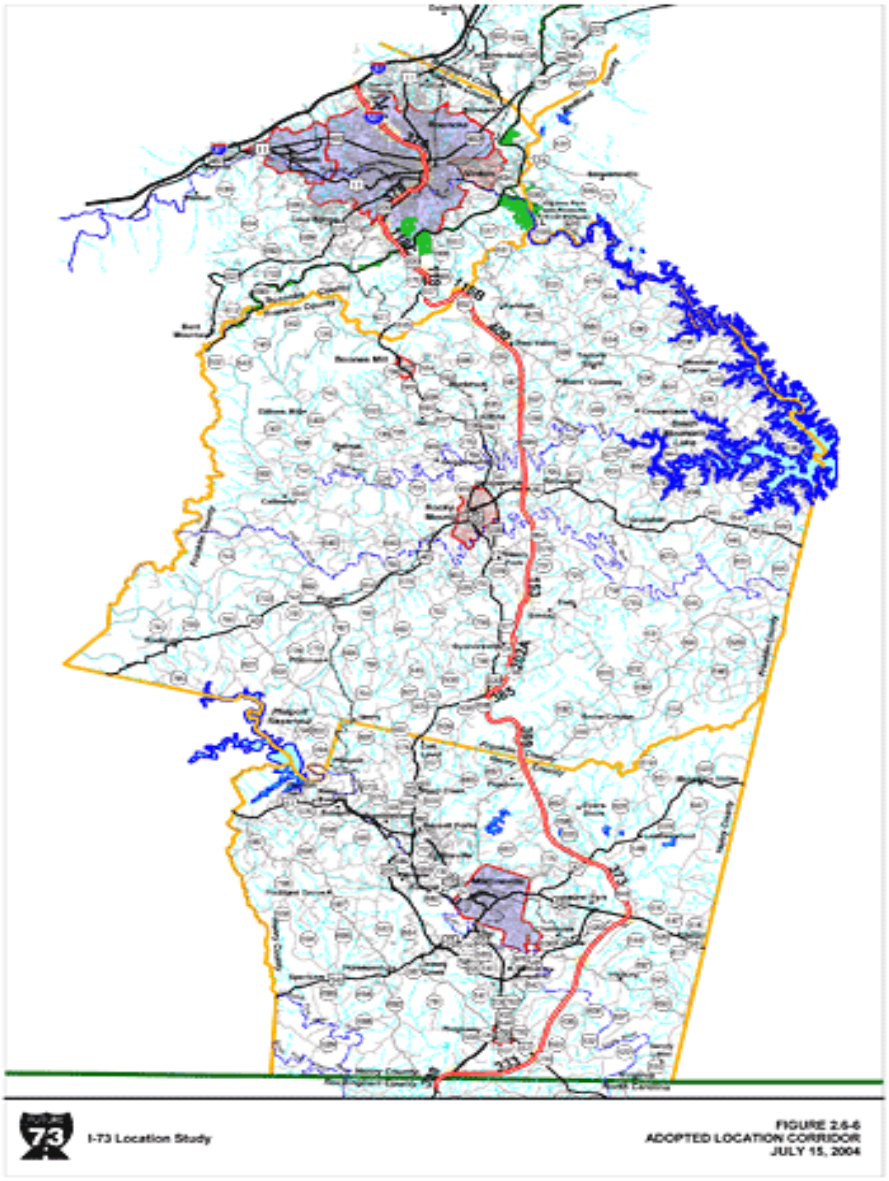
4. Location and Economic Overview of the I-73 Corridor Region

4.1. Location of I-73

In May 2001, the Commonwealth Transportation Board selected a route alternative for I-73 (see map below). Starting at the northern end of the corridor, the approved location for I-73 begins at the existing interchange of I-81 and I-581 and continues along I-581 through Roanoke City to the Elm Avenue interchange, then follows Route 220 through Roanoke and into southern Roanoke County before turning southeast following Route 687 into Franklin County.

In Franklin County, the I-73 corridor travels south, staying west of Route 116 and passing to the southwest of Red Valley. Near Red Valley, the corridor travels almost due south, crossing the Blackwater River and crossing Route 40 in the vicinity of Hodgesville. It continues south, crosses the Pigg River, and runs east of Henry Fork. Continuing to the south, it travels west of Sontag and east of Sydnorsville. The corridor then continues to the southwest towards Route 605. I-73 turns southeast near Route 605 and enters Henry County to the east of Oak Level.

Continuing southeast through northern Henry County, I-73 passes to the east of Figsboro, crosses Route 57, and turns to the southwest as it crosses US 58 well east of Laurel Park. Continuing on a southwesterly course east of Martinsville, the corridor traverses east of Carlisle and the community of Ridgeway. After crossing Route 87, I-73 bears due west to existing U.S. Route 220 before turning south to the Virginia-North Carolina state line.



There are currently 21 interchanges planned for the I-73 corridor. The locations of the interchanges have not yet been decided. Those decisions will be made during the final engineering phase, which will include public hearings. For the purpose of this report, the 21 interchanges provided by VDOT are analyzed. Seven are located in Roanoke City, three in Roanoke County, five in Franklin County, and six in Henry County. Interchanges in the city of Roanoke are close to each other to handle a high volume of traffic. Interchanges in Franklin and Henry Counties provide access to communities such as Boones Mill, Rocky Mount, and Martinsville. Interchanges are also planned where I-73 crosses major roadways such as U.S. 58 and VA 40.

Table 4.1: I-73 Corridor Proposed Interchange Location		
1	I-581 at Route 101 (Hershberger Rd.)	Roanoke City
2	I-581 at Valley View Rd.	Roanoke City
3	I-581 at U.S. Route 460 (Orange Ave.)	Roanoke City
4	I-581 at Williamson Rd.	Roanoke City
5	I-581 at Elm Ave.	Roanoke City
6	U.S. Route 220 at Franklin Rd.	Roanoke City
7	U.S. Route 220 at Wonju St.	Roanoke City
8	U.S. Route 220 at Route 419	Roanoke County
9	U.S Route 220 at Route 679 (Buck Mountain Rd.)	Roanoke County
10	U.S. 220 near Route 668 (Yellow Mountain Rd.)	Roanoke County
11	Route 657 at Red Valley	Franklin County
12	Route 697 southwest of Burnt Chimney	Franklin County
13	Route 40 at Hodgesville	Franklin County
14	Route 619 northwest of Sontag	Franklin County
15	U.S. Route 220/Route 618	Franklin County
16	Route 890/108 north of Figsboro	Henry County
17	Route 57 southwest of Dyers Store Rd.	Henry County
18	U.S. Route 58 east of the Route 648/Route 620 intersection	Henry County
19	Route 650 near Tanyard Creek Crossing	Henry County
20	Route 87 north of the Route 750 intersection	Henry County
21	U.S. Route 220 south of intersection with Route 689	Henry County

Source: I-71 Final Environmental Impact Statement. Volume 1. Chapter 2: Alternative (2.6), and Chmura

4.2. Economic Background of Communities in the I-73 Corridor

I-73 will directly pass through Roanoke City, Roanoke County, Franklin County and Henry County. Two independent cities, Salem and Martinsville, do not have I-73 passing through, but are in close enough proximity to I-73 that they will also be directly impacted. As a result, these cities are also included in the I-73 corridor region.

The localities in the I-73 corridor grew at different rates over the past three decades. Communities in the northern part, including Franklin County, Roanoke County, Salem City, and Roanoke City, enjoyed healthy growth in terms of population and employment. The localities in the southern part of the corridor, such as Henry County and the city of Martinsville, saw a decline in both population and employment. Changes in population, employment, income, and industry mix are examined in more detail below.

4.2.1. Population

The I-73 corridor's population grew at a much slower pace than the state in the 30 years ending in 2000, and the gap widened between 1980 and 1990. Strong population growth in Franklin County, which advanced at a faster pace than the state in two of the last three decades, offset some of the decline in other I-73 corridor localities (Table 4.2). Roanoke County experienced the most consistent average annual growth (0.8%) in all three decades.

Table 4.2: Average Annual Population Growth Rate			
Locality	1970-1980	1980-1990	1990-2000
Virginia	**1.4%**	**1.5%**	**1.4%**
I-73 Corridor	**1.0%**	**0.1%**	**0.4%**
Henry County	1.3%	-0.1%	0.2%
Martinsville City	-0.8%	-1.2%	-0.5%
Franklin County	2.9%	1.0%	1.8%
Roanoke County	0.8%	0.8%	0.8%
Salem City	0.9%	-0.1%	0.4%
Roanoke City	0.8%	-0.4%	-0.2%
Source: U.S. Census Bureau			

In the ten-year period from 1990 to 2000, the cities of Roanoke and Martinsville lost population (Table 4.3), while Franklin County added the most people. The city of Martinsville lost population in each of the last three decades for a total loss of more than 4,000 people, while the population for the city of Roanoke declined by more than 5,000 people over the 20 years ending in 2000.

Table 4.3: Population Estimates					
Locality	1970	1980	1990	2000	Average Annual Growth Rate
Virginia	**4,648,494**	**5,346,818**	**6,187,358**	**7,078,515**	**1.4%**
I-73 Corridor	**278,848**	**308,666**	**312,138**	**326,068**	**0.5%**
Henry Co.	50,901	57,654	56,942	57,930	0.4%
Martinsville City	19,653	18,149	16,162	15,416	-0.8%
Franklin Co.	26,858	35,740	39,549	47,286	1.9%
Roanoke Co.	67,339	72,945	79,332	85,778	0.8%
Salem City	21,982	23,958	23,756	24,747	0.4%
Roanoke City	92,115	100,220	96,397	94,911	0.1%
Source: U.S. Census Bureau					

4.2.2. Employment

Employment growth in the I-73 corridor was considerably slower than in the state. Over the last 36 years, employment in the I-73 corridor increased 49% (+71,465 jobs) while employment in the state grew 220% (Table 4.4). From 1995 to 2005, the I-73 corridor added a mere 485 jobs with Henry County/Martinsville City[23] shedding more than 9,000 jobs and Roanoke City losing more than 4,000 jobs. Roanoke County/Salem City added the most jobs of all localities in the I-73 corridor (+9,541 jobs) during this ten-year period, followed by Franklin County (+4,717). The job loss in Roanoke City seemed to be compensated by gains in counties surrounding the city (Roanoke County and Franklin County), which reflects inter-regional migration of jobs. The job loss in Henry/Martinsville was not offset by a resulting increase in nearby localities.

[23] These localities are combined by the Bureau of Economic Analysis.

Table 4.4: Total Employment (Full Time and Part Time)					
Locality	1969	1975	1985	1995	2005
Virginia	**2,147,852**	**2,425,437**	**3,198,218**	**3,931,060**	**4,728,967**
I-73 Corridor	**145,855**	**161,371**	**192,950**	**216,835**	**217,320**
Henry Co. & Martinsville City	39,306	39,418	47,385	45,964	36,795
Franklin County	9,913	11,383	13,869	16,277	20,994
Roanoke County & Salem City	33,702	40,239	51,256	67,588	77,129
Roanoke City	62,934	70,331	80,440	87,006	82,402
Source: Bureau of Economic Analysis					

The average annual pace of job growth in the I-73 corridor was considerably slower than the state's pace over the last 36 years. In each of the last three decades (Table 4.5), the average annual growth rate in the I-73 corridor was outpaced in the state by 0.9 percentage points or more. For the ten years ending in 2005, the I-73 corridor showed essentially no growth while the state grew at a 1.9% average annual rate. Over the 36 years ending in 2005, Roanoke County/Salem City displayed the most robust growth while the Henry County/Martinsville City locality grew at the slowest pace.

Table 4.5: Average Annual Growth Rate in Total Employment				
Locality	1969-1975	1975-1985	1985-1995	1995-2005
Virginia	**2.0%**	**2.8%**	**2.1%**	**1.9%**
I-73 Corridor	**1.7%**	**1.8%**	**1.2%**	**0.0%**
Henry Co. & Martinsville City	0.0%	1.9%	-0.3%	-2.2%
Franklin County	2.3%	2.0%	1.6%	2.6%
Roanoke County & Salem City	3.0%	2.4%	2.8%	1.3%
Roanoke City	1.9%	1.4%	0.8%	-0.5%
Source: Bureau of Economic Analysis				

4.2.3. Income

Per capita income in all localities of the I-73 corridor was lower than the statewide average in 2005. Moreover, for the I-73 corridor as a whole, the income gap with the state widened in recent years (Table 4.6). While the average income of residents living in the I-73 corridor was 99% of the state average in 1969, it fell to 85% of the state average by 2005. Roanoke County/Salem City showed a per capita level of income most similar to the state while Henry County/Martinsville City had the lowest per capita level of income of the localities.

Table 4.6: Per Capita Income (2005 dollars)					
Locality	1969	1975	1985	1995	2005
Virginia	**$18,918**	**$21,625**	**$27,885**	**$30,826**	**$37,503**
I-73 Corridor	**$18,654**	**$19,923**	**$25,081**	**$27,332**	**$31,750**
Henry Co. & Martinsville City	$17,167	$17,004	$22,565	$23,622	$25,312
Franklin County	$14,537	$15,284	$20,634	$23,259	$27,584
Roanoke County & Salem City	$19,408	$20,428	$28,412	$33,709	$35,140
Roanoke City	$19,828	$22,021	$25,209	$25,099	$32,512
Source: Bureau of Economic Analysis and Bureau of Labor Statistics					

The average annual growth rate in per capita income was consistently lower in the I-73 corridor when compared with the state. Franklin County and Roanoke County/Salem City displayed the highest growth rate among I-73 communities, with each experiencing an average annual growth rate better than the state in two of the last three decades (Table 4.7). The Henry County/Martinsville City locality displayed consistently slower growth in per capita income with an exception of 2.9% growth from 1975 through 1985.

Table 4.7: Annual Average Growth Rate in Per Capita Income (2005 dollars)				
Locality	1969-1975	1975-1985	1985-1995	1995-2005
Virginia	**2.3%**	**2.6%**	**1.0%**	**2.0%**
I-73 Corridor	**1.1%**	**2.3%**	**0.9%**	**1.5%**
Henry Co. & Martinsville City	-0.2%	2.9%	0.5%	0.7%
Franklin County	0.8%	3.0%	1.2%	1.7%
Roanoke County & Salem City	0.9%	3.4%	1.7%	0.4%
Roanoke City	1.8%	1.4%	0.0%	2.6%
Source: Bureau of Economic Analysis and Bureau of Labor Statistics				

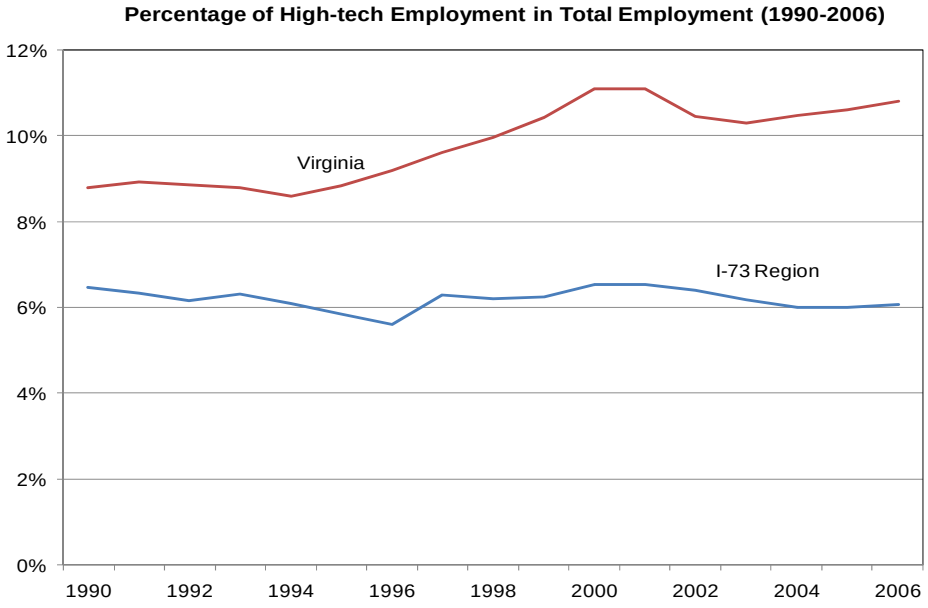
4.2.4. Industry Mix

While the manufacturing industry was responsible for the largest number of employees in the I-73 corridor for a majority of the 31 years ending in 2000, the services industry recently became the largest industry with respect to payrolls (Table 4.8). In 2000, the services industry was responsible for 35,697 jobs while manufacturing accounted for 30,822 jobs. From 1969 through 2000, the manufacturing industry shed over 5,000 jobs, the largest drop of any industry in the I-73 corridor. Trade (wholesale and retail) showed impressive growth, more than doubling in the number of jobs in both the I-73 corridor and the state over the last 31 years.

Table 4.8: Industry Mix Changes as a Percentage of Total Employment								
	Agriculture & Mining	Construction	Manufacturing	TWU*	Trade	FIRE**	Services	Government
I-73 Region								
1969	NA	6.0%	31.6%	7.3%	18.7%	5.8%	17.9%	10.7%
1972	NA	6.1%	31.3%	7.2%	18.7%	6.3%	18.2%	10.7%
1982	NA	4.7%	27.5%	5.3%	21.1%	5.9%	21.3%	11.1%
1992	NA	5.4%	22.6%	5.5%	23.1%	7.5%	24.6%	10.6%
2000	NA	6.2%	17.3%	5.4%	23.1%	8.0%	28.4%	10.7%
Virginia								
1969	1.3%	5.7%	18.3%	5.0%	17.0%	5.8%	17.3%	29.6%
1972	1.3%	6.2%	17.9%	5.0%	17.8%	6.6%	18.3%	27.0%
1982	1.6%	5.1%	14.8%	4.8%	19.1%	7.3%	22.5%	24.9%
1992	1.3%	5.7%	11.6%	4.5%	20.1%	6.7%	27.9%	22.2%
2000	1.4%	6.4%	9.2%	4.9%	20.0%	7.2%	32.3%	18.6%

*Transportation, Warehousing, and Utilities
**Finance, Insurance, and Real Estate
Source: Bureau of Economic Analysis

Growth of the high-tech industry in the region lagged behind the state and the region did not capitalize on the high-tech boom in the late 1990s. The percentage of high-tech employment in the I-73 corridor fluctuated around 6% during the past 16 years. For the same period, the percentage of high-tech employment in Virginia increased from 9% to 11%.[24]



[24] There is no standard or widely accepted definition of high-tech industries. The definition used here is the same one used by Chmura's *Virginia Economic Trends*.

In terms of the growth performance of industries, the services industry displayed the most impressive consistent growth for the I-73 corridor region from 1969-2000 with average annual growth rates ranging from 2.6% to 5.1% (Table 4.9). However, the pace of growth in services for the I-73 corridor was slower than in the state. From 1982-2000, finance, insurance, and real estate (FIRE); transportation, warehousing, and utilities (TWU); and construction all grew at impressive paces. Agriculture and mining as well as manufacturing contracted from 1982-2000. In the state, agriculture and mining experienced positive growth for the same period while manufacturing declined over the eight years ending in 2000.

Table 4.9: Average Annual Employment Growth Rate in Industries

	Agriculture & Mining	Construction	Manufacturing	TWU*	Trade	FIRE**	Services
I-73 Corridor							
1969-1972	0.1%	-0.4%	1.0%	4.4%	1.4%	5.7%	2.6%
1972-1982	5.2%	-0.9%	0.2%	-2.0%	2.3%	-4.6%	5.1%
1982-1992	-3.5%	3.3%	-0.3%	6.3%	3.7%	15.0%	3.8%
1992-2000	-5.0%	2.6%	-2.2%	3.8%	1.9%	2.9%	4.2%
Virginia							
1969-1972	2.2%	4.4%	1.0%	2.2%	3.5%	6.7%	3.7%
1972-1982	4.4%	0.4%	0.5%	2.0%	3.2%	3.4%	4.5%
1982-1992	1.0%	4.0%	0.3%	2.1%	3.3%	2.0%	5.0%
1992-2000	3.0%	3.8%	-0.6%	3.4%	2.3%	3.2%	4.2%

*Transportation, Warehousing, and Utilities
**Finance, Insurance, and Real Estate
Source: Bureau of Economic Analysis

The relatively slower growth in the I-73 corridor compared with the state is also apparent in the change in the number of business establishments (Table 4.10). For the ten years ending in 2006, the number of business establishments in the I-73 corridor increased 5.3% while the number of establishments jumped 18.1% in the state. With the exception of manufacturing, the state experienced better growth than the I-73 corridor in the number of business establishments. FIRE experienced the fastest percentage growth in business establishments in the I-73 corridor (+25.1%), but still fell short of the state's growth (+31.4%). The trade industry experienced the greatest decline in establishments (-6.6%), but also fell in the state (-2.4%).

Table 4.10: Change in Number of Business Establishments by Industry 1996-2006

Locality	Total	Agr. & Mining	TWU*	Mfg.	Const.	Trade	FIRE**	Services
Virginia	**18.1%**	**-7.4%**	**18.8%**	**-6.5%**	**28.6%**	**-2.4%**	**31.4%**	**28.0%**
I-73 Corridor	**5.3%**	**16.7%**	**14.7%**	**-4.4%**	**9.4%**	**-6.6%**	**25.1%**	**12.1%**
Henry County	2.3%	-26.7%	51.2%	3.7%	-2.2%	-8.5%	48.9%	6.2%
Martinsville City	-9.8%	0.0%	-17.6%	-3.7%	-22.9%	-22.5%	-1.2%	-1.8%
Franklin County	33.8%	56.0%	8.3%	-6.5%	50.2%	20.4%	93.9%	41.4%
Roanoke County	28.7%	33.3%	25.0%	13.3%	17.2%	19.7%	82.7%	36.4%
Roanoke City	-9.5%	-60.0%	-9.2%	-16.9%	-11.0%	-18.3%	-5.9%	-1.1%
Salem City	4.7%	0.0%	88.2%	-5.9%	-2.9%	-12.1%	25.0%	15.2%

*Transportation, Warehousing, and Utilities
**Finance, Insurance, and Real Estate
Source: Virginia Employment Commission

In summary, growth in the I-73 corridor lagged behind other parts of the state during the past few decades in terms of population, employment, income, and number of firms. The industry structure of the region is skewed toward the manufacturing and trade sectors. The economies of the localities on the northern end of I-73 (Franklin and Roanoke Counties) grew at a faster pace than communities on the southern end (Henry County and Martinsville City). The cities of Roanoke and Salem fell in between in economic performance—while they were losing population and jobs to the 'suburban' counties of Roanoke and Franklin; they still outperformed their neighbors in the southern end of the I-73 corridor.

5. Traffic Impact

Generally speaking, the sources of regional economic impact attributable to a new highway can be grouped into the following three categories:

1. Temporary construction impact
2. Increased economic efficiency
3. Strategic development or business attraction effects[25]

Both the increased economic efficiency and business attraction will be affected by projected traffic volume on I-73 and the surrounding roads. Consequently, the first step in analyzing the economic impact of I-73 is to estimate the traffic pattern and volume on the new road. Chmura retained the Timmons Group to provide a traffic projection. This section summarizes their findings.[26]

Table 5.1 shows the actual 1997 daily traffic volumes as well as the projected average daily traffic for 2020 and 2025 under 'no-build' and 'build' scenarios.[27] The forecasts were calculated utilizing a travel demand model designed specifically for I-73 by VDOT. The traffic model projected an increase in traffic volume after I-73 is completed. From 1997 to 2020, under the no-build scenario, total average traffic on existing corridor roadways is expected to increase 16%. The traffic volume on I-73 is expected to be larger, 41% more than 1997 volume. The traffic volume is expected to increase by an additional 6% from 2020 to 2025. The largest increase in traffic volume is projected to occur on the northern end of I-73 in the Roanoke region. The model outputs also indicate that the heavy vehicle traffic along the I-73 corridor will vary between 11% and 19% of total traffic volume. In the highly urbanized northern section, the percentage of heavy vehicle traffic is projected to be lower than in the southern section.

[25] The same framework was used in Delta Highway System study.
[26] See Appendix 3 for the complete Timmons report which is based on VDOT reports.
[27] The Year 2020 and 2025 were chosen by VDOT in its travel demand simulation. Neither Chmura nor Timmons ran a separate travel demand model for this study.

Table 5.1: I-73 Corridor Average Daily Traffic Volumes					
		2020 Projection		2025 Projection	
Route and Location	1997 (Actual)	No-build Scenario	I-73 Selected Route	No-build Scenario	I-73 Selected Route
I-581 – South of I-81	76,000	84,500	99,800	86,500	107,800
I-581 – North of U.S. Route 460	75,100	91,300	106,600	95,300	115,100
I-581 – Route 460 to U.S. Route 11	89,300	108,700	126,900	113,400	137,100
I-581 – Route 11 to U.S. Route 24	76,200	92,700	108,200	96,700	116,900
U.S. Route 220 – Route 24 to Wonju St.	58,300	68,200	98,700	70,600	106,600
U.S. Route 220 – Wonju St. to Route 419	48,600	54,500	69,300	55,900	74,800
Route 419 to U.S. Route 220 Connector	32,300	36,100	51,800	37,000	53,100
U.S. Route 220 Connector to Route 122	27,100	27,200	36,500	27,200	37,700
Route 122 to Route 40	27,100	27,200	32,600	27,200	33,800
Route 40 to U.S. Route 220 Connector	17,500	18,100	32,400	18,200	33,800
U.S. Route 220 Connector to South of Franklin County Line	19,600	19,800	23,500	19,800	23,500
South of Franklin County to Route 57	21,400	21,700	23,500	21,800	23,500
Route 57 to U.S. Route 58	20,400	20,700	20,400	20,800	20,400
South of U.S. Route 58 to Route 650	12,900	20,100	16,800	22,000	16,800
Route 650 to Route 87	12,900	18,600	16,800	20,100	16,800
South of Route 87 to N. Carolina state line	11,400	17,500	16,800	19,200	16,800
Total	626,100	726,900	880,600	751,700	934,500

Source: Virginia Department of Transportation, "I-73 Final Environmental Impact Statement" Chapters 3.1 and 4.1

A traffic origin and destination analysis was conducted for two major cities in the I-73 corridor, Roanoke and Martinsville. For northbound traffic leaving the Martinsville area, 60% is from areas south of the Virginia-North Carolina border and 54% is bound for out-of-state destinations. For southbound traffic leaving the Roanoke area, about 40% is from out-of-area traffic from I-81 or I-73. Forty percent of all southbound traffic leaving Roanoke is destined for areas beyond the Virginia-North Carolina state line.

The Final Environmental Impact Statement by VDOT indicates that the I-73 corridor as a whole showed a positive net present value (NPV) and a benefit cost ratio greater than 1.0. This implies that the I-73 corridor is an economically viable investment. However, the benefit in this calculation only includes travel efficiency and cost savings, it does not include the economic impacts of I-73 construction or the attraction of new businesses—these impacts are analyzed in Section 6.

6. Economic Impact in the Region

This study uses the methodology employed in several studies that were reviewed in Section 3.2. Since I-73 has not been built, a before/after analysis is not feasible. As a result, prior studies were used to create assumptions regarding service business jobs and other economic development jobs that may result from I-73. Generally speaking, the sources of regional economic impacts attributable to a new highway can be grouped into the following three categories:

1. Temporary construction impact
2. Increased economic efficiency
3. Strategic development or business-attraction effects[28]

Estimates from the three categories above are input into an IMPLAN model[29] to measure the multiplier impacts of I-73 on regional industries.

6.1. One-time Impact of Construction

The construction of I-73 will create jobs in construction and related industries such as design and site development during the construction phase of the highway. In turn, the construction companies will boost their purchasing from suppliers. As a result, the I-73 construction will bring more sales to local suppliers; and some suppliers will see enough sales to add employees.[30] In addition, area restaurants and shops will benefit as the construction workers spend their income at local establishments.[31] The economic impact of construction is temporary, however, lasting only during the construction phase.

The construction of I-73 in Virginia is assumed to begin in 2012 with completion in 2020. The total cost is assumed to be $3.992 billion in 2017 dollars, as stated by the U.S. Department of Transportation.[32] Costs include pre-construction design and engineering work, purchasing rights-of-way, and the construction of the road. Different types of spending will impact industries in the region with varying magnitudes. For example, the money spent on rights-of-way represents a transfer or property which will not generate additional economic impact on the I-73 corridor region. Among estimated costs to construct I-73, the major expenditure categories include preliminary engineering (13% of the total cost), rights-of-way (11% of total cost), major structure (29% of total cost), and sub-base and base (35% of the total cost).[33] The cost estimates are displayed in Table 6.1 below.

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[28] The same framework was used in the Delta Highway System study.

[29] IMPLAN is an economic impact assessment modeling system. It allows the user to build economic models to estimate the impacts of economic changes in states, counties, or communities. It was created in the 1970s by the Forestry Service and is widely used by economists to estimate the impact of specific events on the overall economy. It is one of the two most commonly used models to estimate the economic impact of an event. The other often-used model is REMI.

[30] This is referred to as the indirect impact.

[31] This is referred to as the induced impact. The sum of the indirect and induced impact is referred to as the ripple impact.

[32] Source: Record of Decision, Interstate 73 Location Study; Final Environmental Impact Statement, U.S. Department of Transportation, Federal Highway Administration. Retrieved on August 28, 2007 from: http://www.virginiadot.org/projects/I73/I-73ROD-web.pdf.

[33] Spending on major structure in highway engineering includes construction of bridges and ramps. Sub-base is a layer of aggregate below the base layer. The materials for sub-base are crushed stones, crushed slag, or concrete. Base is a layer between the road surface layer and the sub-base layer.

Table 6.1: Construction Cost Estimate (2017 Dollars, $Million)		
	Cost Estimate	Cost Distribution
Preliminary Engineering	$510	13%
Rights of Way	$443	11%
Major Structure	$1,143	29%
Drainage & Grading	$335	8%
Sub-base & Base	$1,411	35%
Surface	$149	4%
Total	**$3,992**	**100%**
Sources: FHA Record of Decision, Timmons Group		

In conducting the economic impact analysis, Chmura assumes the total cost estimate is distributed evenly from 2012 to 2020. Though the $3.992 billion cost estimate is based on 2017 dollars, the economic impact presented here is calculated at the dollar value of the year when it is spent. For example, the total economic impact of $445 million in 2012 in Table 6.2 is in 2012 dollars, rather than the 2017 dollars cited in the FHA Record of Decision.[34]

Table 6.2: Economic Impact of I-73 Construction on the I-73 Corridor				
		Direct	Ripple	Total
2012	Spending ($MM)	$286	$173	$459
	Employment Compensation ($MM)	$129	$78	$207
	Employment	3,415	1,887	5,303
2013	Spending ($MM)	$291	$176	$467
	Employment Compensation ($MM)	$131	$79	$211
	Employment	3,415	1,887	5,303
2014	Spending ($MM)	$296	$179	$475
	Employment Compensation ($MM)	$133	$81	$214
	Employment	3,415	1,887	5,303
2015	Spending ($MM)	$301	$182	$482
	Employment Compensation ($MM)	$136	$82	$218
	Employment	3,415	1,887	5,303
2016	Spending ($MM)	$306	$185	$491
	Employment Compensation ($MM)	$138	$83	$221
	Employment	3,415	1,887	5,303
2017	Spending ($MM)	$311	$188	$498
	Employment Compensation ($MM)	$140	$85	$225
	Employment	3,415	1,887	5,303
2018	Spending ($MM)	$315	$191	$506
	Employment Compensation ($MM)	$142	$86	$228

[34] This treatment is easier for readers to understand the economic impact. It also simplifies estimating tax receipts for a particular year. Chmura uses a price deflator estimated by the IMPLAN model. For example, IMPLAN shows that the construction price deflator is 1 for 2004, 1.137 for 2012, and 1.229 for 2017. As a result, $1 in construction spending in 2017 dollars will be $0.925 in 2012 dollars. (1.137/1.229).

Table 6.2: Economic Impact of I-73 Construction on the I-73 Corridor				
	Employment	3,415	1,887	5,303
2019	Spending ($MM)	$321	$194	$515
	Employment Compensation ($MM)	$145	$87	$232
	Employment	3,415	1,887	5,303
2020	Spending ($MM)	$326	$197	$523
	Employment Compensation ($MM)	$147	$89	$236
	Employment	3,415	1,887	5,303
9-Year Total	Spending ($MM)	$2,752	$1,663	$4,415
	Employment Compensation ($MM)	$1,241	$750	$1,991
	Employment	30,739	16,984	47,724
Note: Figures may not sum due to rounding.				
Source: IMPLAN Pro 2004				

Table 6.2 displays the one-time economic impact of I-73 construction on the I-73 corridor region. From 2012 to 2020, the construction of I-73 is estimated to generate a total of $4.42 billion in the region. This total is the sum of $2.75 billion[35] in direct spending and $1.66 billion of the ripple economic impact from the interstate construction. The construction industry, as expected, will experience the largest one-time benefits. These ripple impacts[36] are distributed among local suppliers. Area retailers and service providers also benefit from the construction as workers spend their income at local establishments.

The construction is estimated to directly create an average of 3,415 new jobs per year from 2012 to 2020, causing a ripple effect that will result in 1,887 additional jobs per year in the region. In total, I-73 construction is expected to result in the creation of 5,303 jobs per year during the construction phase.

In terms of wealth effect, the construction of I-73 can generate a total of $2.0 billion in wages and salaries in the I-73 corridor region. Of this total, $1.2 billion will be paid directly to people working on the construction of I-73. Another $750 million represents wages and salaries that result from the ripple effects of construction activities.

In terms of regional distribution, the northern I-73 corridor is expected to account for 71%[37] of the total economic impact from construction with the southern corridor receiving 29% of the one-time economic impact of construction. Specifically, the total direct construction spending in the southern corridor is estimated to be $806 million during the construction phase, generating $1.3 billion of economic benefits. The annual job creation in the southern corridor is

[35] This figure does not include spending on rights of way. In addition, the IMPLAN model estimates that only 78% of the construction spending on highways is spent locally. For example, some of the design work is done outside the region.
[36] Ripple impacts are defined as the secondary economic impacts derived from the direct spending. In this study, ripple impacts are the sum of indirect (secondary impacts enjoyed by suppliers) and induced impacts (secondary economic impacts as a result of household income). See Appendix 1 for more explanation.
[37] This percentage is estimated based on the construction spending broken out by segments in the VDOT report. VDOT provided construction costs for four segments of I-73. The first three segments are located entirely in the northern corridor. The majority of the fourth segment is located in the south corridor with 5.5 miles south of Syndorsville, which is located in Franklin County.

expected to average 1,553,[38] with 1,000 jobs associated directly with I-73 construction and 553 jobs resulting from economic ripple effects.

Table 6.3: Economic Impact of I-73 Construction on I-73 Corridor

		Direct	Ripple	Total
Northern Corridor	Spending ($MM)	$1,946	$1,176	$3,122
	Employment Compensation ($MM)	$878	$530	$1,408
	Employment	21,734	12,009	33,743
Southern Corridor	Spending ($MM)	$806	$487	$1,293
	Employment Compensation ($MM)	$364	$220	$583
	Employment	9,005	4,976	13,980
Total	Spending ($MM)	$2,752	$1,663	$4,415
	Employment Compensation ($MM)	$1,241	$750	$1,991
	Employment	30,739	16,984	47,724

Note: Figures may not sum due to rounding

Source: IMPLAN Pro 2004

6.2. Travel Efficiency and Cost Savings

While the economic impact of construction activity only lasts during the construction phase, I-73 will generate sustained economic impacts for the I-73 corridor communities—those impacts are analyzed in this section.

All businesses located in the I-73 corridor region can benefit from I-73[39] as a result of reduced travel cost and improved efficiency. Different industries benefit to varying degrees. Industries requiring a significant amount of traveling, such as retail, real estate, and manufacturing, could see a bigger impact in terms of productivity improvement. Other industries, such as personal services, may see limited improvement.

The cost savings is usually estimated through a simulation model based on the amount of traffic and the total time saved traveling on I-73 versus the current road system. The cost savings also includes vehicle operating cost savings as a result of traveling on I-73.[40] According to VDOT (as reported by Timmons in Appendix 3), the present value of the cumulative total benefits of I-73 is estimated to be $1.47 billion. This translates into $110.4 million (2004 dollars) in annual cost savings for all vehicles that travel on I-73 over the 30-year timeframe estimated by VDOT.[41] However, part of the savings will benefit businesses outside of the region that are passing through the

[38] 1,553 is the result of 13,980 being divided by 9. 13,980 is the total job creation over 9 years, and 1,553 is annual average job creation.

[39] Businesses outside the I-73 corridor will also benefit. Estimating those benefits is beyond the scope of this study.

[40] Chmura contracted Timmons Group for traffic modeling and projections. Timmons determined that the traffic projection in the final VDOT location study is still current and appropriate to use in this impact analysis.

[41] In the final version of the I-73 Location Study: Benefits Cost Analysis Technical report, VDOT used a 30-year timeframe and 7% discount rate to arrive at the $1.47 billion present value. Chmura calculations indicate this number is equivalent to $110.4 million annual savings. In its report, VDOT concluded that the benefits include travel-time savings, accident-cost savings, and vehicle operating-cost savings. The majority of the benefit is travel efficiency saving (69%). The estimated benefit in the cost benefit analysis does not include economic development impacts such as service businesses and distribution centers.

region. Based on the I-73 origin-destination data summarized in the Timmons report, an estimated 16% of the total traffic volume has both origins and destinations outside the region.[42] As a result, the cost savings for regional businesses amounts to an estimated $92.7 million per year in 2004 dollars.[43]

Factoring in inflation,[44] the cost savings and travel efficiency gains for the region is estimated to reach $141.2 million for 2020 and $161.0 million for 2025. After the construction of I-73 is complete, the value of travel efficiencies and cost savings is assumed to be 0.4% of the total regional output.[45] If businesses use their cost savings to expand, the cost savings could potentially support over 800 new jobs, or $48.7 million in employment compensation in the I-73 corridor region in 2020.[46] In 2025, the potential job increase stays the same and the employment compensation is estimated to be $55.5 million.

In terms of regional distribution, about 80%[47] of the economic benefits due to travel efficiency and cost savings are estimated to occur in the northern I-73 corridor, while the remaining will likely occur in the southern corridor (Table 6.4). In 2020, I-73 is expected to result in $29.5 million of additional sales and income for businesses and residents located in the southern I-73 corridor. The benefit is expected to increase to $31.9 million in 2025.

Table 6.4: Travel Efficiency and Cost Saving

	2020	2025
Northern Corridor	$111.7	$129.1
Southern Corridor	$29.5	$31.9
Total	$141.2	$161.0

Source: VDOT and Chmura Economics & Analytics

The VDOT cost savings estimate is comparable with that found in other studies. The VDOT benefit yields a cost-benefit ratio of 1.11. An economic impact study on the Appalachian Highway System yielded a cost-benefit ratio of 1.18,[48] consistent with the results found here. The VDOT calculation indicates that for every dollar of I-73 investment, the annual cost savings for I-73 corridor region businesses is 6.5 cents. This is similar to an estimate for the Delta Development Highway System.[49] In that study, an $18.5 billion highway investment generated $1.1 billion in savings in travel efficiency, resulting in 5.9 cents in cost savings per dollar of investment.

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[42] If the traffic origin is out of the region, but the destination is in the region, Chmura assumes that the destination business will benefit from the cost saving of I-73.

[43] $92.7 = $110.4 * (1-16%).

[44] The average inflation rate from 2000 to 2006 is 2.6%. Chmura uses this average as the assumption for future years.

[45] Source: IMPLAN Pro 2004. In 2004, the total economic output of the region is estimated to be $21.8 billion. Chmura assumes the total output of the region grows by 2.6% per year.

[46] This increased output accounts for 0.4% of the total output. In 2004, total employment of the I-73 corridor (based on the IMPLAN model) was 201,701. 201,701*0.04% = 807. In addition, employee compensation is 34.5% of total output. So, when travel efficiency provides a total economic impact of $141.2 million in 2020, 34.5% of it will be employee compensation. $141.2 million *34.5% = $48.7 million.

[47] This percentage is estimated based on average traffic volume in Table 5.1.

[48] Source: Appalachian Development Highways Economic Impact Studies, prepared by Wilbur Smith Associates, 1998.

[49] Source: Delta Development Highway System Plan. Prepared by Wilbur Smith Associates for Delta Regional Authority.

Nationally, Nadir and Mamuneas (1996) found that interstate highway investments have lowered costs of production and distribution, averaging 24 cents annually for each dollar invested in the non-local road system. Though the cost savings ratio of I-73 appears to be significantly smaller than the national study, its magnitude is reasonable. Nadir and Mamuneas studied the national highway network as a whole. As a result, their estimate captures every business benefiting from the national highway network, resulting in a higher estimate of cost savings. According to Nadir and Mamuneas, when the same the type of analysis is estimated at the state or regional level, the effect of cost savings is usually half of the national average. In addition, the national study included many major interstates that pass through major population centers. These highways generally have a much larger traffic volume, resulting in larger cost savings. I-73 is located in relatively rural areas of Virginia, so it is not surprising that its cost savings are lower than the state average but in line with the effect of other rural highways such as those in the Appalachian region or the Mississippi Delta region.

6.3. Economic Impact of Service Businesses

6.3.1. Job Creation in Service Businesses

The most direct and visible new jobs created by I-73 will be in businesses along I-73 serving motorists. Entrepreneurs and established corporations will build gas stations, hotels, and restaurants near interchanges along the interstate to serve drivers who pass through as well as locals who live nearby. To estimate the potential service businesses that could be located along I-73 in Virginia, this study utilizes a "model-by-analogy" approach. Essentially, Chmura considers previous regression models built with service business data on completed interstates in urban, suburban, and rural regions. These models estimate the quantitative relationship between the number of service businesses and a few key factors. In particular, Chmura utilizes a study of businesses at rural interchanges for North Carolina because it most resembles Virginia in economic size and structure. The following five variables have an impact on the development of service businesses at interchanges along an interstate highway:

1. Average daily traffic (ADT) on the interstate
2. ADT on cross roads
3. Distance to the nearest major urban center
4. Design type (diamond or cloverleaf) of the interchange
5. Distance to the next interchange or intersecting interstate

Based on the projected traffic on I-73 and roads crossing I-73, the distance to towns, and interchange design, Chmura classified the 21 interchanges along I-73 into development stage categories: residential, light tourist service, economically competitive, economic integration, and heavy tourist service (Table 6.5).[50]

Residential interchanges generally are located in a rural setting, have lower traffic volume, and are not close to a town. They normally have some development in single-family homes and nothing else. A few intersections in Franklin and Henry Counties are classified as residential.

Light tourist service interchanges usually have one gas station, one small motel, and support moderate traffic flow. Several intersections in the counties of Roanoke, Franklin, and Henry are classified as this type. Economically

[50] Appendix 3 lists the criteria and business activities of each intersection category.

competitive interchanges usually have two to four gas stations, one to two fast-food restaurants and two or more hotels. They typically have high traffic flow and are within three miles of nearby towns.

Economic integration interchanges are located close to a town and have a high level of traffic. These interchanges have more gas stations, hotels, and restaurants because they serve motorists as well as local residents. Most intersections in Roanoke City, Roanoke County, and close to the town of Rocky Mount and the city of Martinsville belong to this category.

Heavy tourist intersections have the highest traffic volume and are in close proximity to another interstate. Three intersections on the northern end of I-73, close to I-81, belong to the heavy tourist category. Each heavy tourist intersection can support more than six hotels, over six restaurants, and multiple gas stations.

Table 6.5: I-73 Corridor Proposed Intersection Location and Type

Interchange Number			2020	2025
1	I-581 at Route 101 (Hershberger Rd.)	Roanoke City	Heavy Tourist	Heavy Tourist
2	I-581 at Valley View Rd.	Roanoke City	Heavy Tourist	Heavy Tourist
3	I-581 at U.S. Route 460 (Orange Ave.)	Roanoke City	Heavy Tourist	Heavy Tourist
4	I-581 at Williamson Rd.	Roanoke City	Economic Integration	Economic Integration
5	I-581 at Elm Ave.	Roanoke City	Economic Integration	Economic Integration
6	U.S. Route 220 at Franklin Rd.	Roanoke City	Economic Integration	Economic Integration
7	U.S. Route 220 at Wonju St.	Roanoke City	Economic Integration	Economic Integration
8	U.S. Route 220 at Route 419	Roanoke County	Economic Integration	Economic Integration
9	U.S Route 220 at Route 679 (Buck Mountain Rd.)	Roanoke County	Light Tourist Service	Economically Competitive
10	U.S. 220 near Route 668 (Yellow Mountain Rd.)	Roanoke County	Residential	Residential
11	Route 657 at Red Valley	Franklin County	Residential	Residential
12	Route 697 southwest of Burnt Chimney	Franklin County	Light Tourist Service	Light Tourist Service
13	Route 40 at Hodgesville	Franklin County	Economic Integration	Economic Integration
14	Route 619 northwest of Sontag	Franklin County	Residential	Residential
15	U.S. Route 220/Route 618	Franklin County	Residential	Residential
16	Route 890/108 north of Figsboro	Henry County	Residential	Light Tourist Service
17	Route 57 southwest of Dyers Store Rd.	Henry County	Light Tourist Service	Light Tourist Service
18	U.S. Route 58 east of the Route 648/Route 620 intersection	Henry County	Economic Integration	Economic Integration
19	Route 650 near Tanyard Creek Crossing	Henry County	Residential	Residential
20	Route 87 north of the Route 750 intersection	Henry County	Economic Integration	Economic Integration
21	U.S. Route 220 south of intersection with Route 689	Henry County	Residential	Residential

Source: I-71 Final Environmental Impact Statement. Volume 1. Chapter 2: Alternative (2.6), and Chmura Economics & Analytics

Based on the traffic forecasts of VDOT, a few intersections are projected to advance in development stage category from 2020 to 2025 due to increases in traffic flow. For example, the interchange of I-73 at Route 890/108

north of Figsboro is projected to move from residential in 2020 to light tourist service in 2025. As a result of these changes, the I-73 corridor region will generally support more service businesses in 2025 than in 2020.

Table 6.6 lists the projected service establishments that can be supported by I-73. In 2020, it is estimated that I-73 can support 141 businesses comprised of 44 hotels, 43 gas stations, 32 fast food restaurants, and 22 full-service restaurants.[51] More business establishments (155) are projected for 2025. Not surprisingly, more than half of the projected service businesses will be located in the city of Roanoke. This occurs because Roanoke has the most interchanges, these interchanges are expected to have the heaviest traffic, and several I-73 interchanges in Roanoke are close to state highway I-81 which will bring more motorists.

Table 6.6: Projected Business Establishments in Service Businesses

		City of Roanoke	Roanoke County	Franklin County	Henry County	I-73 Corridor
	Number of Interchanges	7	3	5	6	21
2020	Hotels	30	4	4	6	44
	Gas Stations	25	5	5	8	43
	Fast-food Restaurants	21	3	3	5	32
	Full-service Restaurants	16	2	2	2	22
2025	Hotels	30	5	4	9	48
	Gas Stations	25	7	5	11	48
	Fast-food Restaurants	21	5	3	6	35
	Full-service Restaurants	16	2	2	4	24

Source: Chmura Economics & Analytics

One interchange between Rocky Mount and Martinsville or between Martinsville and the North Carolina state line can host a truck stop. Normally, a truck stop is located more than 20 miles from another interstate highway, further away from town, and has moderate traffic on the surrounding road. The interchanges between Rocky Mount and Martinsville or south of Martinsville fit these criteria and one of them may develop into a truck stop.

In terms of job creation, service businesses are estimated to support 2,455 jobs in 2020 and 2,688 jobs in 2025 (Table 6.7). To arrive at this estimate, Chmura calculated the average employment per business in the I-73 corridor.[52] For example, an average gas station in 2006 in the I-73 corridor employs eight workers and an average motel employs 23 workers. The average number of workers is 20 for fast-food restaurants and 22 for full-service restaurants. By jurisdiction, the city of Roanoke is likely to land more than half of the jobs along I-73, followed in number by Henry County, Franklin County, and Roanoke County. Though no interchanges are physically located in the cities of Salem and Martinsville, due to their close proximity to I-73 it is plausible that some service businesses may chose to locate a little further away from interchanges and in those cities. Moreover, both cities will benefit from the ripple economic impacts analyzed later.

[51] Due to the fact that I-73 is an upgrade of several current roads in the area, the projected businesses are not entirely new. Some businesses may have existed, especially along the current I-581 in the city of Roanoke.
[52] Chmura uses quarterly census of employment and wages (or ES202) data to calculate the average business size.

Table 6.7: Projected Employment in Service Businesses		City of Roanoke	Roanoke County	Franklin County	Henry County	I-73 Corridor
	Number of Interchanges	7	3	5	6	21
2020	Hotels	685	91	91	137	1,005
	Gas Stations	198	40	40	63	341
	Fast-food Restaurants	411	59	59	98	627
	Full-service Restaurants	350	44	44	44	482
	Total	1,645	234	234	342	2,455
2025	Hotels	685	114	91	206	1,096
	Gas Stations	198	56	40	87	381
	Fast-food Restaurants	411	98	59	118	686
	Full-service Restaurants	350	44	44	88	526
	Total	1,645	311	234	498	2,688

Source: Chmura Economics & Analytics

6.3.2. Economic Impact of Service Businesses

While spending by motorists at service businesses can bring millions of dollars to the economy, service businesses also have ripple effects throughout the region. These ripple effects are summarized as indirect and induced. Indirect effects are generated because there are many local industries supporting restaurants, gas stations, and other visitor-service businesses. Money spent by customers in roadside restaurants and hotels also increases the sales of the suppliers for these industries. This effect is called the indirect effect. The induced effect is caused by increased income of workers employed by service businesses. These workers will in turn spend some of their income in the region, thus injecting more money into the economy.

The annual economic impact of visitor spending on the I-73 corridor region is estimated to be $310 million in 2020 (Table 6.8). Of this, $201 million is direct spending on food, lodging, and gas at service establishments. Over $109 million is derived from indirect and induced economic impacts. This effect indicates that for every $1 spent by I-73 motorists, the overall economic impacts can reach $1.54. The economic impacts are larger in the 2025 projection, reaching $381 million, due to more businesses coming to the I-73 corridor between 2020 and 2025.

In terms of job creation, spending at I-73 business services can potentially generate 3,164 jobs for the region. Of these, 2,455 jobs will be located at service businesses while 709 jobs will be created by ripple spending effects. In 2025, the total jobs generated by service businesses could reach 3,466.

The jobs created by service businesses will also bring new income to the region, thus benefiting residents. Based on the IMPLAN estimate, the total employment compensation in 2020 will be $104 million. Of this, $68 million is compensation for individuals working at service businesses and $36 million is compensation for jobs due to ripple effects. In 2025, the total employment compensation is estimated to be $130 million.

In 2020, about 85% of the economic impact, in terms of total spending, employment compensation, and job creation, is expected to occur in the northern corridor because the northern corridor is more densely populated and thus has a higher concentration of service businesses. This percentage is expected to drop to 81% in 2025, as interchanges in the southern corridor receive more developments from 2020 to 2025. Specifically, in 2025, service businesses in the southern corridor are estimated to directly employ 498 workers, generating total spending of $48

million. Adding the ripple effect, the total economic impact generated by service businesses in the southern corridor is estimated to be $73 million and 645 jobs.

Table 6.8: Economic Impact of Service Businesses on the I-73 Corridor

Region			Direct	Ripple	Total
North Corridor	2020	Spending ($MM)	$172	$93	$265
		Employment Compensation ($MM)	$58	$31	$89
		Employment	2,112	608	2,721
	2025	Spending ($MM)	$204	$110	$314
		Employment Compensation ($MM)	$68	$37	$105
		Employment	2,190	631	2,821
South Corridor	2020	Spending ($MM)	$29	$15	$44
		Employment Compensation ($MM)	$10	$5	$15
		Employment	342	101	443
	2025	Spending ($MM)	$48	$26	$73
		Employment Compensation ($MM)	$16	$9	$25
		Employment	498	147	645
I-73 Corridor	2020	Spending ($MM)	$201	$109	$310
		Employment Compensation ($MM)	$67	$36	$104
		Employment	2,455	709	3,164
	2025	Spending ($MM)	$251	$136	$387
		Employment Compensation ($MM)	$84	$46	$130
		Employment	2,688	778	3,466

Note: Figures may not sum due to rounding.
Source: IMPLAN Pro 2004 and Chmura Economics & Analytics

6.4. Development Potential for Distribution Centers

Distribution centers are increasingly becoming an important business for communities along an interstate highway in this era of big-box retailers, widespread internet commerce, and just-in-time inventory systems. Distribution centers are usually located close to major population centers, allowing easy access to potential markets. Since distribution centers often require significant space,[53] they are often located in less populated areas where land is relatively cheap. A study of retail distribution centers in the United States[54] found that though 84.1% are located in metropolitan areas, the majority of distribution centers (61.2%) are located in places with population density lower than 500 people per square mile. The most likely location for a distribution center is the fringe of a metropolitan area. Retail distribution centers not only create hundreds of jobs for communities, these jobs also come with higher wages. Based on 2006 fourth quarter data, average annual wages for Virginia workers in the wholesale industry,

[53] Based on an EEOC study, many distributions centers are more than one million square feet in size.
[54] Source: Retail Distribution Centers: How New Businesses Process Impact Minority Labor Markets. http://www.eeoc.gov/stats/reports/retaildistribution/index.html

which includes distribution centers, were $60,940. During the same period, wholesale industry wages were higher than average manufacturing wages of $45,471.

The development of distribution centers along I-81 in western Virginia provides a good example of the potential for I-73. Interstate 81 provides easy access to major east coast population centers such as Washington D.C., Baltimore, and Philadelphia; yet it does not directly pass through these population centers. Over the years, many major big-box retailers such as Home Depot, Kohl's, Best Buy, Wal-Mart, Target, and Marshalls have established distribution centers in Virginia along I-81. The average size of these distribution centers is close to 900,000 square feet.

Franklin and Henry Counties in the I-73 corridor have the greatest potential for distribution centers. The population density is too high for the city of Roanoke and Roanoke County to be competitive in landing distribution centers, yet Franklin and Henry fit the profile of counties with a concentration of distribution centers. Both counties are in the outlying areas of a metropolitan area and the population density for each is well under 200 people per square mile. Low density implies that low-cost land will be available along I-73 for potential distribution centers. The two counties are located within a 2-hour drive of Roanoke and Greensboro, North Carolina, and within a 5-hour drive of South Carolina and Ohio. From Greensboro it is a short drive to the Charlotte and Raleigh-Durham metropolitan areas. Also, I-73 can enable more direct access than I-81 to the Midwest and coastal regions of the Carolinas. Though other rural counties along I-73 will compete for distribution centers, the central location of Franklin and Henry Counties, combined with low population density and low-cost land, gives them an advantage in landing a distribution center.

The new FedEx hub in Greensboro, North Carolina could increase economic development activity for the I-73 corridor, especially the counties in the southern part of the corridor that are close to the North Carolina border. FedEx is building its mid-Atlantic distribution hub in Greensboro, to be completed in 2009.[55] It is one the six major distribution hubs for FedEx. Other retailers, especially those with a large internet presence (such as Dell or Amazon), tend to locate their order fulfillment centers close to a courier hub to facilitate faster delivery to their customers. With the completion of I-73, communities such as Henry County and Martinsville City will be within a one-hour drive to Greensboro, making them good candidates for retail distribution centers that utilize FedEx service.

In light of the fact that I-73 in Virginia is much shorter than I-81 and is further from mega-metropolitan areas, the region might not be able to attract a cluster of distribution centers like those on the northern end of Virginia's I-81. With proper targeting and incentives, however, there is potential for I-73 in Virginia to land a couple of distribution centers serving mid-sized metropolitan areas such as Roanoke; Lynchburg; Danville; and Greensboro, North Carolina. At this time, sufficient information does not exist for Chmura to conclude whether the southern or northern corridor is more likely to land distribution centers. The economic impact of a distribution center will be the same for the I-73 corridor regardless of whether it is located in the south or north.

If the region lands one or more distribution centers after I-73 is completed, the economic impact can be sizable (Table 6.9). On average, distribution centers employ 200 workers and can directly generate about $14 million in economic output in 2020. Adding ripple impacts, the total economic impact of a distribution center can reach $22 million in output and 277 jobs in 2020. In terms of wealth effects, the jobs created by a distribution center could generate an estimated $13 million in employment compensation in 2020. Of this total, $8 million is compensation

[55] Source: The website of Greensboro News-Record, at http://www.news-record.com.

for individuals working at the distribution center and $5 million is employment compensation due to ripple effects. Barring additional distribution centers by 2025, the economic impact will be very similar in 2025.

Table 6.9: Economic Impact of a Distribution Center on the I-73 Corridor				
		Direct	Ripple	Total
2020	Spending ($MM)	$14	$9	$22
	Employment Compensation	$8	$5	$13
	Employment	200	77	277
2025	Spending ($MM)	$14	$9	$23
	Employment Compensation	$8	$5	$13
	Employment	200	77	277
Note: Figures may not sum due to rounding.				
Source: IMPLAN Pro 2004				

6.5. Other Benefits

While extensive economic literature on the impact of interstate highways enables Chmura to project growth opportunities in service businesses, distribution centers, and cost savings for current businesses, I-73 can also bring other benefits to the region. Some of these benefits include increased appeal of the region for expanding and relocating firms, increased property values, and increased safety. Many studies that address these benefits are anecdotal in nature. As a result, while acknowledging that these benefits exist, Chmura does not attempt a formal projection of the benefits.

Interstate 73 will benefit manufacturers and agricultural businesses in the corridor by providing improved access to markets. Examples of these markets include the Roanoke metropolitan area (MSA) and the Greensboro MSA. When I-73 is complete from Michigan to South Carolina, I-73 can provide improved access to population centers in the Midwest and Carolinas. Due to a lack of data on current flows of commodities, the exact benefit is yet to be determined.

The presence of an interstate highway can increase the appeal of the region to expanding and relocating firms. Traditionally, highway connectivity is a key consideration for many firms. However, with the development of computer and communication technology as well as the declining roles of manufacturing in the national economy, its importance relative to other factors has diminished over time. Proximity to markets, quantity and quality of workforce, and quality of life factors are increasingly important. However, interstate highways are still critical for certain industries. Aside from service businesses and distribution centers, manufacturing plants also tend to locate close to interstate highways for transporting supplies and finished products. The I-73 corridor already has a strong manufacturing base with manufacturing employment more concentrated than in Virginia as a whole. Coupled with low wages and a low cost of living, I-73 communities should be appealing to expanding manufacturing firms. Population growth in the region can also be aided by I-73. The study on I-81 has shown that localities in the I-81 corridor have grown faster in population than other rural Virginia counties. Though there might be other factors contributing to the faster growth, the presence of an interstate highway has a positive effect on population growth. Jobs created by service businesses and other relocating/expanding firms can lure people to the area. In addition, an interstate highway reduces commuting time and enhances the attractiveness of a region as a destination for residential development.

I-73 will also improve access to Smith Mountain Lake, which may fuel population growth. Smith Mountain Lake, which lies between Franklin and Bedford Counties, has been popular with retirees from the northeast United States. I-73 will provide an almost direct link between Smith Mountain Lake and major metropolitan areas in the northeast.

I-73 will also have a positive effect on tourism in the region. A large part of the tourism boost is captured by the service businesses development along I-73, but other tourism attractions in the corridor will also benefit. In addition to being a popular retirement destination, Smith Mountain Lake is a popular vacation spot containing multiple resorts, golf courses, and ample opportunities for water sports. Furthermore, the nearby Martinsville Speedway is a tourist attraction with over 300,000 annual visitors. Other attractions, such as the Virginia Museum of Natural History, could also benefit from I-73. In 2007, the museum opened its new facility and is expecting 84,000 visitors in 2008 and 90,000 visitors in 2009. Based on current literature and traffic patterns on I-73, the interstate could boost visits to the museum by as much as 50%. To realize that potential, the museum needs to market itself in welcome centers and roadside signs.[56]

Other benefits of I-73 include fewer accidents and better safety on the roads. As noted earlier in this report, driving on interstate highways is safer for a number of reasons. Interstate highways are typically wider, have more lanes, and are straighter than other highways. More importantly, interstate highways have controlled access through on-ramps while vehicles on other non-interstate highways have to pass through non-access-controlled intersections with more traffic hazards. The proposed route would mean neither school buses nor school-age children would have to use I-73; instead they could use local roads. Traffic accidents not only incur enormous monetary costs, the emotional cost due to the loss of human life can be even more traumatic to communities in the corridor.

Finally, I-73 can also improve the quality of life for area residents. I-73 can make it more convenient for residents to reach destinations for work, shopping, recreation, and entertainment. It can increase the appeal of the region to future residents.

[56] A study in the Journal of Travel Research found that as much as 10% of the pass-through visitors to a locality make unplanned visits to nearby tourism attractions when sufficient information is provided, such as maps at welcome centers and signs on the road. The projected average daily traffic around Martinsville on I-73 is about 18,000. Excluding heavy traffic (20%), and including only pass through traffic (84%) and pleasure visitors (60%), results in a 50% increase at the museum. Source: The Influence of Unplanned Attraction Visits on Expenditures by Travel-Through Visitors, by Richard Perdue, Journal of Travel Research, Vol 25, Number 1, 14-19 (1986).

7. Fiscal Impact

In addition to creating jobs and injecting millions of dollars into the corridor's economy, I-73 will also produce tax revenue for cities and counties located in the I-73 corridor region and for the Commonwealth of Virginia. For the state, three main tax sources are sales tax, personal income tax, and corporate income tax. Revenue from each category will increase as a result of new jobs and businesses associated with I-73. For counties and cities along the I-73 corridor, there are four major revenue sources: sales tax, meal tax, lodging tax, and business license taxes and fees (BPOL tax).[57] In addition, I-73 can potentially attract more population to the region, thus increasing local real estate and personal property taxes (though this revenue is not estimated in this report).

7.1. State Fiscal Impact

During the construction phase, the state can collect corporate income tax from companies involved in the construction of I-73, including architecture firms and construction companies. The state also collects personal income tax from wages and salaries paid to individuals working on the project. After the construction is complete, the state will collect corporate income tax from service businesses and potential distribution centers located along I-73. Similarly, people working in these businesses will be subject to personal income tax. In addition, the state of Virginia will assess 4% sales tax on receipts from service businesses such as gas stations, hotels, and restaurants.

Chmura utilizes the following methodology to estimate corporate and personal income taxes. In Section 6, Chmura estimates the total output value of construction, service businesses, and a distribution center. The IMPLAN model provides profit margins and the relative weight of wages and salaries in total output for each industry in the I-73 corridor. For example, for construction businesses in the I-73 corridor region, the IMPLAN model shows that profits account for 7% of the total output while wages and salaries account for 45%. For restaurants, these percentages are 8% and 32%. From this information, Chmura estimates the total profits and total wages and salaries that can be attributed to I-73. The state corporate income tax rate is 6% and the average personal income tax rate is 5%.[58]

[57] Minor taxes such as utility tax (electricity and telephone) are not estimated. The counties in the I-73 corridor have business, professional, and occupational licenses (BPOL) tax only for a very limited set of industries. The counties do not have a meal tax. Only tax revenues from direct impacts are estimated.

[58] Virginia has a progressive state income tax system where higher income individuals pay higher percentages of their income as income tax. The rate is 4.9% for an individual with $30,000 in taxable income and 5.2% for an individual with $50,000 in taxable income. As a result, 5% is a reasonable average assumption.

Table 7.1: State Tax Estimate				
Construction	Corporate Income Tax	Personal Income Tax	State Sales Tax	Total
2012	$1,146,904	$6,449,245		$7,596,149
2013	$1,167,118	$6,562,914		$7,730,032
2014	$1,186,465	$6,671,707		$7,858,173
2015	$1,205,946	$6,781,252		$7,987,198
2016	$1,226,161	$6,894,920		$8,121,081
2017	$1,245,508	$7,003,714		$8,249,221
2018	$1,264,855	$7,112,507		$8,377,362
2019	$1,286,264	$7,232,894		$8,519,159
2020	$1,308,044	$7,355,364		$8,663,408
Service Businesses				
2020	$1,902,555	$3,373,845	$8,034,178	$13,310,578
2025	$2,392,253	$4,218,948	$10,042,956	$16,654,157
Distribution Center				
2020	$48,247	$389,322		$437,569
2025	$50,653	$408,739		$459,392
Source: Chmura Economics & Analytics				

Table 7.1 presents the tax revenues for the state. The construction of I-73 is estimated to bring state government an average of $8.1 million per year during the construction phase. The majority of state tax revenue will come from personal income tax, averaging $6.8 million per year. Corporate income tax is estimated to average $1.2 million per year.

After construction is complete, the state is expected to collect sales tax, corporate tax, and personal income tax from service businesses and other business along I-73. In 2020, the total state tax revenue from service businesses is estimated to be $13.3 million. Sales tax is estimated to account for more than half of the total tax revenue. As traffic volume on I-73 increases, the state tax revenue is expected to reach $16.7 million in 2025. In addition, one distribution center in the I-73 corridor is expected to generate less than half a million dollars in tax revenue for the state.[59]

7.2. Local Fiscal Impact

Chmura utilizes the following methodology to estimate local tax revenue. Since all local taxes are based on total receipts, the direct spending impact estimated in Section 6 provides a good basis for calculating tax revenue. While the local sales tax is 1% of total receipts for all localities, different jurisdictions in I-73 have different meal, lodging, and business, professional, and occupational licenses (BPOL) tax rates. Chmura calculates the regional average tax rate with current employment as a weight. Local tax revenues for the northern corridor and southern corridor are estimated separately.

[59] Chmura did not break out the state tax benefit from the northern corridor or southern corridor since it is the state government that is the recipient of these tax revenues.

During the construction phase, the counties and cities located in the I-73 corridor can collect BPOL taxes from construction spending. It is estimated that the average BPOL tax revenue is $0.3 million for localities located in the northern corridor, and $0.2 million for the southern corridor (Table 7.2 and Table 7.3).

Table 7.2: Local Tax Estimate-Northern Corridor

Construction	BPOL Tax	Sales Tax	Meal Tax	Lodging Tax	Total
2012	$239,596				$239,596
2013	$243,819				$243,819
2014	$247,861				$247,861
2015	$251,931				$251,931
2016	$256,154				$256,154
2017	$260,195				$260,195
2018	$264,237				$264,237
2019	$268,710				$268,710
2020	$273,260				$273,260
Service Businesses					
2020	$272,951	$1,721,907	$2,405,493	$4,757,567	$9,157,918
2025	$322,612	$2,035,194	$2,794,974	$5,632,825	$10,785,605
One Distribution Center					
2020	$62,760				$62,760
2025	$65,891				$65,891
Source: Chmura Economics & Analytics					

Table 7.3: Local Tax Estimate-Southern Corridor

Construction	BPOL Tax	Sales Tax	Meal Tax	Lodging Tax	Total
2012	$183,037				$183,037
2013	$186,263				$186,263
2014	$189,350				$189,350
2015	$192,459				$192,459
2016	$195,685				$195,685
2017	$198,773				$198,773
2018	$201,861				$201,861
2019	$205,277				$205,277
2020	$208,753				$208,753
Service Businesses					
2020	$46,008	$286,637	$371,190	$257,583	$961,418
2025	$76,329	$475,545	$599,825	$445,727	$1,597,426
One Distribution Center					
2020	$43,601				$43,601
2025	$45,775				$45,775
Source: Chmura Economics & Analytics					

After the construction of I-73 is complete, local governments will collect sales tax and BPOL tax from all service businesses. In addition, meal taxes can be collected from restaurants and lodging taxes can be collected from hotels located along I-73. In 2020, the service businesses in the northern corridor are estimated to generate $9.2 million in revenue for local governments. More than half of this revenue comes from lodging tax, followed in size by

meal and sales tax. With increased traffic in 2025, service businesses can bring $10.8 million in tax revenue for local governments.

In the southern corridor, service businesses are expected to generate $1.0 million in tax revenues for local governments. Unlike the northern corridor, the largest revenue item is meal tax, followed by sales and lodging taxes. There are two reasons for this. First, the southern corridor is expecting less motels and hotel development than the northern corridor. Second, localities in the southern corridor have a lower lodging tax rate than those in the northern corridor. With increased traffic in 2025, service businesses can bring $1.6 million in tax revenue for local governments.

The potential distribution centers will generate BPOL taxes. Each distribution center in the northern corridor can bring over $60,000 in BPOL tax revenues for local governments. On the other hand, each distribution center in the southern corridor can generate over $40,000 in BPOL tax revenues for local governments. The difference largely reflects the different BPOL tax rates.

7.3. Potential Payback Period for Investment

The VDOT cost-benefit analysis report, using a 7% discount rate, calculates that the cumulative benefits of I-73 for 30 years will outweigh the agency costs (the initial capital cost minus the salvage value). Based on the VDOT number, the payback time for the initial investment is 22 years.

However, the benefits in the VDOT calculation only consider travel efficiencies and cost savings. It is extremely conservative in the sense that it does not include other benefits such as the economic benefits of service businesses and potential distribution centers. The direct impacts of these businesses can reach over $215 million in 2020 and $255 million in 2025.[60] The total cost of I-73, as estimated by VDOT, totals $4.0 billion (in 2017 dollars). The economic impact of the construction phase plus the economic impact of the first 10 years of ongoing operation totals $8.1 billion (in 2017 dollars).[61] Adding these benefits, the potential payback period can be reduced to less than 10 years.

[60] This includes the direct impacts of service businesses ($201 million in 2020 and $251 million in 2025) and a distribution center ($14 million in 2020 and 2025).
[61] This calculation uses a 7% discount rate—the sameamount used in the VDOT cost-benefit analysis.

8. Assessment of Risks

The economic impact of I-73 attempts to project the regional economy ten to twenty years from now in terms of output, job, and income growth. These projections are based on a set of assumptions. As a result, the projection is subject to forecasting risks as actual events may vary from the assumptions. Unpredictable events create the potential for either larger (upside) or smaller (downside) effects than indicated here. Some of these factors are discussed below.

8.1. Downside Risks

For the service businesses and associated employment to materialize, certain conditions need to be met. One major requirement is the availability of water and sewer services to the site. While this is not an issue for interchanges in Roanoke City or Roanoke County, as those interchanges are in existence, it may require additional investment for the counties of Franklin or Henry to bring water and sewer to rural interchanges. If water and sewer systems are not in place, it will deter the development of service businesses such as hotels, restaurants, and gas stations.

Continued rises in oil prices could reduce the traffic projection and thus the economic impact. In 2004, when the VDOT location study was finalized, the price of oil was $41.40 per barrel. The average price of oil in the first nine months of 2007 was $64.50 per barrel. The price of oil increased 56% while overall inflation rose 9% during the same period. Without the discovery of new oil reserves and with the demand for oil forecasted to increase, it is likely that the price of oil will continue to rise. Higher oil prices could have a negative effect on the projected economic impact as high oil prices can reduce automobile travel.

The impact analysis is based on the assumption that no recession will occur during 2020 and 2025. The downside risk is that if there is a recession, the projected service businesses and overall cost savings would be less than estimated in this study. In addition, a recession would also slow the pace of business expansion and relocation.

The traffic projection cited in this report is based on the assumption that I-73 in Virginia is a non-toll road. Should a toll be imposed on the road, Chmura expects the traffic volume on I-73 would be smaller, as would the resulting economic impact of travel efficiency and service businesses. The likelihood of landing a distribution center may also be diminished as tolls impose additional costs for businesses using the road.

There is downside risk in the projected construction impact. Chmura utilizes IMPLAN assumptions to estimate the percentage of construction outlays that is spent on local construction and architecture firms. IMPLAN calculates the assumption based on the current industry structure and capacity. It is possible that, for a large project like the construction of I-73, more contractors outside the area may be used which could reduce the economic impact projected in Section 6.1.

8.2. Upside Risks

One factor that could result in higher economic impact from I-73 is the expansion and relocation of firms in industries other than service businesses. Chmura has built into the projection a distribution center in the I-73 corridor, but several other industries can potentially take advantage of the interstate access. For example, the Southside Virginia region has a competitive manufacturing industry, especially wood products manufacturing. It is possible that firms in other regions could take advantage of the location of I-73, along with low wages and low cost of living, by locating plants in the region. Relocating to this area allows firms access to east coast and Midwest

markets, as well as furniture clusters in North Carolina. In this study, Chmura does not assume the relocation or expansion of manufacturing firms in the I-73 corridor. As a result, there are upside risks for the projection.

In addition, it is possible that traffic projections on I-73 might be too low. The traffic projection made by VDOT focused only on I-73 in Virginia. VDOT did not assume that the full I-73 (from Michigan to South Carolina) is complete in making its projection. With the completion of the FedEx hub in Greensboro, it is expected that truck traffic volume on Virginia I-73 will increase, as I-73 provides quicker access from Greensboro to states such as West Virginia, Ohio, Maryland and Pennsylvania. As a result, it is possible that the traffic volume will be higher than currently projected. When the entire I-73 is complete, the economic impact will be higher than that projected in this report.

Another upside risk is potential residential development in the I-73 corridor region. As discussed in Section 6.5, the region around Smith Mountain Lake is becoming popular as a retirement destination. The presence of I-73 may accelerate that development. Residential development will create jobs in construction, retail, and service industries. The local government will see an increase in property tax, sales tax, and meal and lodging taxes.

9. Conclusion

The construction and ongoing operations of I-73 will inject hundreds of millions of dollars into the I-73 corridor and provide jobs for workers in construction, retail, service, and warehouse industries. This study estimates that the construction of I-73 will inject an annual average of $490.1 million in total economic impact (direct plus ripple impacts) into the local economy from 2012 through 2020. The construction will also generate 5,303 jobs each year during this period.

After the completion of I-73, both existing businesses and potential new businesses can benefit from the highway. For existing businesses located in the I-73 corridor, I-73 can help improve travel efficiency and provide cost savings. These cost savings amount to $141.2 million in 2020 and $160.0 million in 2025 (Table 9.1).

The most immediate new businesses as a result of I-73 are the service businesses clustering around interchanges along I-73. These service businesses will serve motorists on I-73 and local residents. Chmura estimates that a total of 141 service businesses can be supported by I-73 in 2020 that can generate an economic output of $210 million, directly employing 2,455 people. Adding ripple economic effects, business services can generate an economic impact of $309.6 million and create 3,164 jobs in the I-73 corridor.

It is likely that I-73 development can support distribution centers in Franklin or Henry Counties. The total economic impact of the distribution center is estimated to be $22.4 million and 277 jobs in 2020.

I-73 will benefit manufacturers and agricultural businesses in the I-73 corridor by providing easy access to markets. The presence of an interstate highway can increase the appeal of the region to expanding and relocating firms. I-73 will also contribute to the stability of the existing manufacturing base, allowing for higher levels of employment retention, in addition to making the region more attractive to manufacturers seeking interstate locations, due to the efficiencies derived from such locations. I-73 will also have a positive effect on population and tourism growth in the region.

State and local governments of the region are also expected to reap considerable fiscal benefits from this project. It is estimated that when the project is complete, state government will receive $13.7 million in 2020 in sales tax and corporate and individual income tax on an annual basis. The local governments in the I-73 corridor will receive annual tax benefits totaling $9.8 million in 2020 in the form of local sales tax, BPOL tax, meal tax, and lodging tax. The tax revenue for 2025 will be higher.

Table 9.1 summarizes the economic impact of I-73 on the corridor region.

Table 9.1: I-73 Economic Impact Summary	Total Economic Impact ($MM)	Total Employment Compensation ($MM)	Total Job Creation	State Tax Revenues ($MM)	Local Tax Revenues ($MM)
Average Annual One-time Construction Impact (2012-2020)					
Northern Corridor	$346.9	$156.4	3749	$5.7	$0.3
Southern Corridor	$143.7	$64.8	1553	$2.4	$0.2
I-73 Corridor	**$490.6**	**$221.3**	**5,303**	**$8.1**	**$0.5**
On-going Impact (2020)-Northern Corridor					
Cost Saving (Productivity)	$111.7				
Service Businesses	$265.4	$89.2	2,721	$11.4	$9.2
One Distribution Center	$22.4	$12.8	277	$0.4	$0.1
Total Northern Corridor 2020	**$399.5**	**$101.9**	**2,998**	**$11.8**	**$9.2**
On-going Impact (2020)-Southern Corridor					
Cost Saving (Productivity)	$29.5				
Services Businesses	$44.1	$14.8	443	$1.9	$1.0
Distribution Center	$22.4	$12.8	277	$0.4	$0.0
Total Southern Corridor 2020	**$96.0**	**$27.5**	**720**	**$2.3**	**$1.0**
On-going Impact (2020)-I-73 Corridor					
Cost Saving (Productivity)	$141.2				
Service Businesses	$309.6	$103.9	3,164	$13.3	$10.1
One Distribution Center	$22.4	$12.8	277	$0.4	$0.1
Total I-73 Corridor 2020	**$473.1**	**$116.7**	**3,441**	**$13.7**	**$10.2**
On-going Impact (2025)-Northern Corridor					
Cost Saving (Productivity)	$129.1				
Service Businesses	$313.7	$105.4	2,821	$13.5	$10.8
One Distribution Center	$23.5	$13.4	277	$0.5	$0.1
Total North Corridor 2025	**$466.3**	**$118.8**	**3,098**	**$13.9**	**$10.9**
On-going Impact (2025)-Southern Corridor					
Cost Saving (Productivity)	$31.9				
Service Businesses	$73.2	$24.6	645	$3.2	$1.6
One Distribution Center	$23.5	$13.4	277	$0.5	$0.0
Total Southern Corridor 2025	**$128.6**	**$38.0**	**922**	**$3.6**	**$1.6**
On-going Impact (2025)					
Cost Saving (Productivity)	$161.0				
Service Businesses	$386.9	$129.9	3,466	$16.7	$12.4
Distribution Center	$23.5	$13.4	277	$0.5	$0.1
Total I-73 Corridor 2025	**$571.4**	**$143.3**	**3,743**	**$17.1**	**$12.5**
Source: Chmura Economics & Analytics					

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Appendix 1: Timmons Group Traffic Study

I-73 Traffic and Transportation Data Compilation and Review

September 2007

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Background

Interstate 73 was identified by the U.S. Congress as a high priority corridor in the Federal transportation funding bill of 1991, the Intermodal Surface Transportation Efficiency Act (ISTEA). It was defined as a north-south corridor from north of Detroit to Charleston, S.C.

The Virginia Department of Transportation (VDOT) began the process for I-73 in Virginia with a feasibility study in December 1993. An initial series of public information meetings was held in 1994 and work began on a Draft Environmental Impact Statement (DEIS) in 1997. Additional public meetings took place in 1998. The DEIS was completed in November 2000. During a formal comment period in December 2000, public hearings were held to gather additional input on the DEIS.

In May 2001, members of the Commonwealth Transportation Board (CTB) decided to build I-73 in Virginia and selected a location for the road. VDOT evaluated input received during the DEIS comment period before beginning work to complete the FEIS for the corridor selected by the CTB. The Board revised the routing for the southern portion of I-73 in June 2001.

In July 2004 the Commonwealth Transportation Board voted to re-route a 12-mile section of the I-73 corridor through Roanoke, Roanoke County and northern Franklin County. The route was altered to avoid a neighborhood in southeast Roanoke that was determined to be eligible for historic designation. No other section of the 70-mile corridor is affected by the change. The map on page 4 reflects the current location for I-73.

VDOT completed the Final Environmental Impact Statement (FEIS) in December 2006 for the selected location. The document was forwarded to the Federal Highway Administration (FHWA) for approval. FHWA issued a Record of Decision in late March 2007. With this decision, design, right of way acquisition and eventual construction of I-73 can begin, depending on funding.

At this time, VDOT has not developed, nor has the CTB approved a formal funding and construction schedule to build I-73. No timetable for construction has been set, although about $13.3 million, including about $8.8 million in Federal earmarks, has been allocated in VDOT's Six-Year Improvement Program for design and construction of I-73.

Current estimates indicate designing the entire, new 70-mile roadway could cost approximately $330 million while construction costs could top nearly $4 billion (2017 construction costs).

In the meantime, VDOT continues to work on a series of improvements along Route 220, including installation of median guardrail, closing of some crossovers, building turn lanes and installing changeable message signs to provide real-time traffic information to drivers.

While Congress recognized and designated the I-73 corridor as a nationally significant facility, they did not identify or appropriate funding for the planning, design and construction of the facility. Consequently, some states have made more progress with I-73 than others due primarily to funding availability.

In Michigan much of the corridor (approximately 80%) designated by Congress for I-73 is already freeway standard with limited access, grade separated interchanges and appropriate

median widths for both urban and rural conditions. The existing freeway section of the corridor consists of I-75 and U.S. Routes 27/127. There is funding allocated for improvements to interchanges and the median along the existing I-75/U.S. Route 27/127 corridor. The most difficult part to completing I-73 in Michigan is in the southeast part of the state where I-73 ties into Ohio.

In Ohio an I-73 toll feasibility study for the Turnpike Commission in Ohio has been completed. The results were not sufficiently strong enough to influence the Turnpike Commission to advance I-73 as a toll road at this time. The Ohio DOT has provided some I-73 components along the U.S. Route 23 alignment, which is the I-73 corridor in Ohio.

In West Virginia I-73, also known as the King Coal Highway generally follows existing U.S. Route 52 from Williamson to Bluefield. Most of this corridor has been through the NEPA process. Much of it has been designed and segments are currently under construction; however, King Cole Highway is not being designed or built to freeway standards. Appalachian Corridor Development Funds are the primary source of funding within the state.

In North Carolina approximately 60% of I-73 is Interstate or near Interstate standards. The current issue is funding. North Carolina DOT has identified and programmed all of the I-73 segments in the state with the exception of a portion of US 220 in Rockingham County. The area of U.S. Route 220 near the Virginia state line will remain as is until travel demand increases or Virginia's I-73 is completed. The intent along this section is to improve U.S. Route 220 to near Interstate standards as demand and need warrant the improvement.

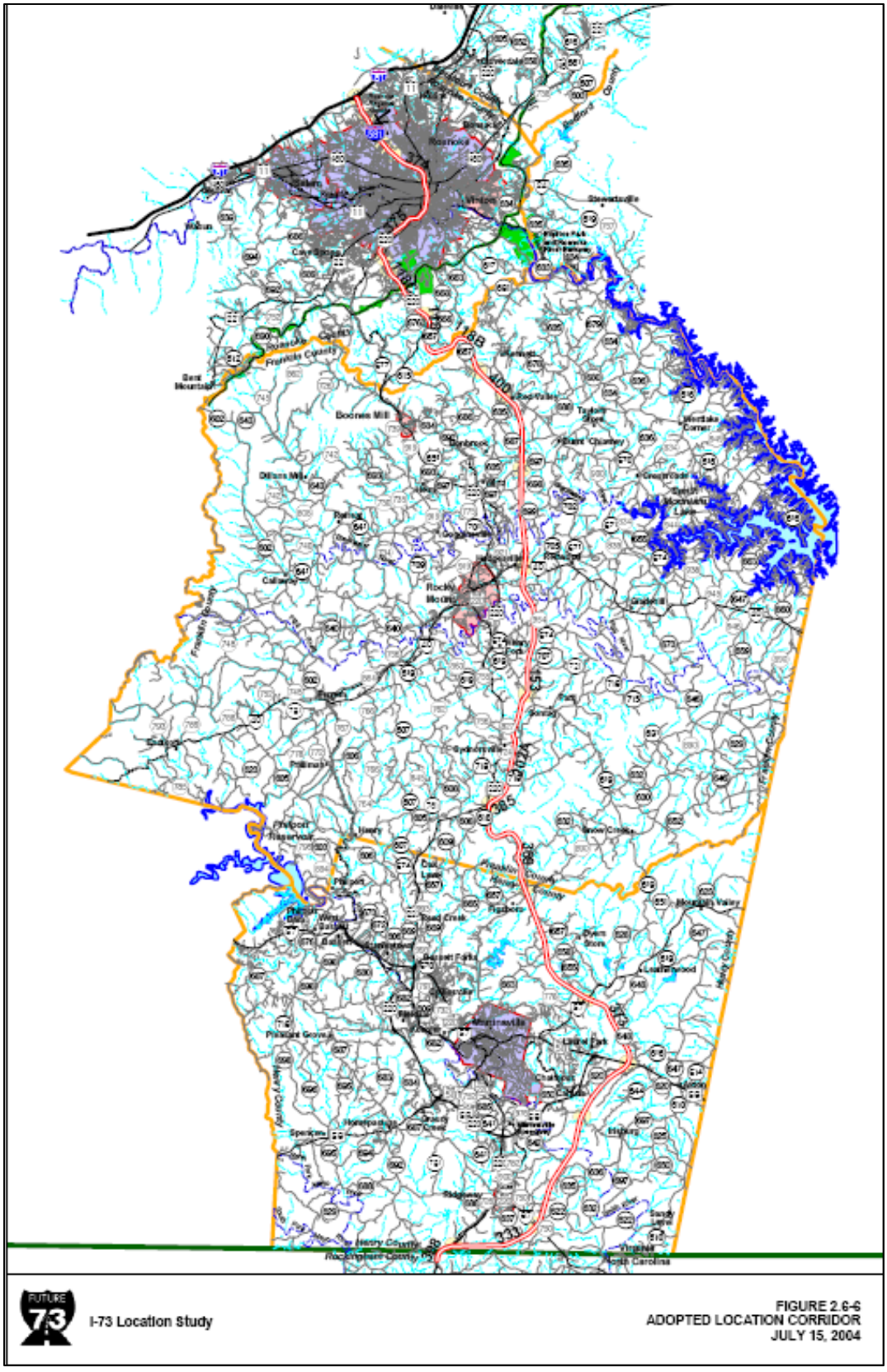
In South Carolina, a feasibility study has been completed and a broad corridor has been identified. South Carolina DOT is moving ahead with the NEPA process and is hoping to finish their FEIS before the end of 2007. An effort is underway to designate all of I-73 as a project of regional and national significance so that it can be put among the top priorities to receive funding. State officials believe I-73 will boost tourism as well as economic development, which will diversify the economy and create new jobs.

I-73 Corridor
From South Carolina to Michigan

*Map provided by the National I-73/74 Corridor Association

I-73 Corridor

Virginia Portion



Traffic Forecasts

To analyze potential traffic impacts for the project alternatives, 2020 and 2025 average daily (ADT) estimates were generated. These forecasts were calculated utilizing a travel demand model designed specifically for the I-73 study. The I-73 model was based on a model used in a previous VDOT study and modified using information obtained from the Roanoke Metropolitan Planning Organization regional model and other refinements to assure that a sufficient representation of the roadway network statewide and in the study area was included.

Traffic counts provided by VDOT and other sources were used to validate the model's outputs. The 1997, 2020, and 2025 forecasted traffic volumes produced by the model are summarized in the table below:

I-73 Corridor - Average Daily Traffic Volumes

	Route and Location	1997	2020	2025
1	I-81 – South of I-581	48,800	74,200	76,600
2	I-81 – North of I-581	57,900	72,500	73,700
3	I-81 – North of U.S. Route 220	36,600	49,500	50,500
4	I-581 – South of I-81	76,000	99,800	107,800
5	I-581 – North of U.S. Route 460	75,100	106,600	115,100
6	I-581 – Route 11 to U.S. Route 460	89,300	126,900	137,100
7	I-581 – Route 24 to U.S. Route 11	76,200	108,200	116,900
8	U.S. Route 220 – Route 24 to Wonju St.	58,300	98,700	106,600
9	U.S. Route 220 – Wonju St. to Route 419	48,600	69,300	74,800
10	U.S. Route 220 – South of Route 419	32,300	18,800	19,300
11	U.S. Route 220 – South of Boones Mill	27,100	6,300	6,300
12	U.S. Route 220 – South of Rocky Mount	17,500	4,800	4,800
13	U.S. Route 220 – South of Sydnorsville	19,600	6,500	6,500
14	U.S. Route 220 – South of Franklin County	21,400	13,400	13,400
15	U.S. Route 220 – South of Bassett Forks	20,400	15,200	15,200
16	U.S. Route 220 – North of Ridgeway	12,900	17,900	19,500
17	U.S. Route 220 – North of N. Carolina state line	11,400	14,900	16,100
18	U.S. Route 460 – East of Alt U.S. Route 220	37, 800	13,800	15,100
19	U.S. Route 460 – I-581 to Alt U.S. Route 220	21,900	44,700	46,400
20	Route 24 – East of U.S. Route 220	12,200	20,100	20,100
21	U.S. Route 221 – West of U.S. Route 220	18,100	33,700	41,900
22	Route 40 – West of Rocky Mount	4,500	21,200	21,900
23	Route 40 – East of Rocky Mount	7,900	4,900	5,000
24	Route 122 at Route 40 – East of Rocky Mount	5,400	9,000	9,500
25	Route 57 – West of U.S. Route 220	12,500	6,800	7,100
26	Route 57 – East of Martinsville	9,700	11,800	11,800
27	U.S. Route 58 – West of U.S. Route 220 Bypass	8,000	7,400	7,400
28	U.S. Route 58 – East of U.S. Route 220 Bypass	17,900	8,600	8,900

It should be noted that the model outputs indicated that heavy vehicle percentages along the corridor fluctuated between 11% and 19%. The lower percentages were noted in the highly urbanized areas in the northern section of the corridor while the southern sections realized higher heavy vehicle percentages: this is primarily a function of the overall volume density associated with these areas.

Traffic Analysis

An analysis of the forecasted traffic volumes assuming both no-build and build conditions was performed to assess the operational characteristics of the selected corridor.

A no-build analysis was performed to provide a baseline of conditions against which the improved corridor was compared. The No-Build Alternative included all planned minor intersections, interchange and roadway improvements that address local problems, as well as routine maintenance improvements that maintain the continuing operation of the existing roadway. It also includes committed and funded roadway and transit projects programmed in the 1998-1999 Statewide Transportation Improvement Program. Secondary road improvements currently programmed are also included.

The results of the build analysis represent the CTB-selected corridor. The potential traffic impacts were evaluated for the horizon years 2020 and 2025. The levels of service for each of the analyzed segments are summarized in the table below. A detailed explanation of "level of service" (LOS) is included in Appendix A.

I-73 Corridor - LOS Analysis for Individual Segments

Route and Location			No-Build		Build	
		1997	2020	2025	2020	2025
1	I-81 – South of I-581	D	B	C	C	C
2	I-81 – North of I-581	E	C	C	C	C
3	I-81 – North of U.S. Route 220	C	B	B	C	C
4	I-581 – South of I-81	C	C	D	D	D
5	I-581 – North of U.S. Route 460	C	D	F	D	D
6	I-581 – Route 11 to U.S. Route 460	D	F	F	C	C
7	I-581 – Route 24 to U.S. Route 11	D	F	F	C	C
8	U.S. Route 220 – Route 24 to Wonju St.	D	E	F	D	D
9	U.S. Route 220 – Wonju St. to Route 419	B	C	D	C	C
10	U.S. Route 220 – South of Route 419	C	C	D	A	B
11	U.S. Route 220 – South of Boones Mill	B	B	C	A	A
12	U.S. Route 220 – South of Rocky Mount	A	A	A	A	A
13	U.S. Route 220 – South of Sydnorsville	A	A	A	A	A
14	U.S. Route 220 – South of Franklin County	A	A	B	A	A
15	U.S. Route 220 – South of Bassett Forks	A	A	B	A	A
16	U.S. Route 220 – North of Ridgeway	A	A	B	A	A
17	U.S. Route 220 – North of N. Carolina state line	A	A	B	A	A
18	U.S. Route 460 – East of Alt U.S. Route 220	C	C	D	C	D
19	U.S. Route 460 – I-581 to Alt U.S. Route 220	B	B	B	B	B
20	Route 24 – East of U.S. Route 220	A	C	D	C	D
21	U.S. Route 221 – West of U.S. Route 220	E	E	E	E	E
22	Route 40 – West of Rocky Mount	C	C	E	C	E
23	Route 40 – East of Rocky Mount	D	E	E	C	E
24	Route 122 at Route 40 – East of Rocky Mount	C	C	C	C	C
25	Route 57 – West of U.S. Route 220	E	E	E	E	E
26	Route 57 – East of Martinsville	D	D	D	C	C
27	U.S. Route 58 – West of U.S. Route 220 Bypass	A	A	A	A	A
28	U.S. Route 58 – East of U.S. Route 220 Bypass	A	A	B	A	A

In addition to the capacity/level of service analysis that was performed, the I-73 analysis included a no-build vs. build comparison for the following operational parameters:

- Travel time
- Congested flow speed
- Vehicle miles traveled

Each of these operational parameters are more applicable to a macro scale analysis of the I-73 corridor whereas the previously presented levels of service are micro-level analysis and apply to a specific location within the corridor.

Origin – Destination Analyses

An origin and destination analysis for selected roadway links was conducted as part of the traffic analysis for the proposed I-73 Corridor. The analysis was conducted for two locations along proposed I-73, one just north of Martinsville and a second south of Roanoke. Origin-destination data was analyzed for both north- and southbound traffic flows at each of these locations.

A table summarizing the anticipated origins and destinations of projected I-73 traffic along the CTB-approved alignment is summarized in a table on the following page.

For northbound traffic leaving Martinsville on the proposed I-73 facility, 50 percent to 70 percent are from areas south of the Virginia border and 50 percent to 70 percent are bound for out of state destinations north and west of Virginia on either I-81 or the proposed I-73.

Similarly, in the reverse, for southbound travelers leaving the study area just above Martinsville, 35 to 50 percent are from West Virginia or other areas served by I-73 in the mid-west. Another 15 to 20 percent of these travelers are from points north along I-81. Of these same southbound travelers, 50 percent to 70 percent are destined for areas south of the Virginia border.

The origin and destination link analysis confirms the Congressional goals for I-73 to serve as a new transportation facility that will facilitate passenger and freight movements from the southeast coast to the mid-west and points north.

I-73 Corridor
Origin-Destination Analysis Summation

Screenline North of Martinsville — Northbound I-73									
	Origins			Destinations					
	I-73 South	Martinsville	Surrounding Other Areas	I-73 North	I-81 N.W.	Roanoke/ Salem	Rocky Mount	Surrounding Area	Martinsville
ALC	60%	15%	25%	38%	16%	12%	12%	20%	2%

Screenline South of Roanoke — Northbound I-73										
	Origins						Destinations			
	Central Virginia	I-73 South	Martinsville	Surrounding Areas	Rocky Mount	Roanoke/ Salem	I-73 North	I-81 N.W.	Roanoke / Salem	Surrounding Area
ALC		40%	13%	16%	31%		28%	12%	45%	15%

Screenline North of Martinsville — Southbound I-73								
	Origins					Destinations		
	I-73 W. Va.	I-81 N.W.	Rocky Mount	Roanoke / Salem	Surrounding Areas	I-73 South	Martinsville	Surrounding Area
ALC	39%	16%	12%	12%	21%	61%	15%	24%

Screenline South of Roanoke — Southbound I-73									
	Origins				Destinations				
	I-73 N.W.	I-81 N.W.	Roanoke / Salem	Surrounding Areas	I-73 South	Martinsville	Rocky Mount	Surrounding Area	Roanoke / Salem
ALC	28%	12%	46%	14%	40%	13%	31%	16%	

Cost Benefit Analysis

A cost-benefit analysis was performed in March 2005 and submitted as part of the Final Environmental Impact Statement (a cost-benefit analysis was not included in the original DEIS). The table below summarizes the division of the 70-mile corridor into individual segments taken from the Draft Environmental Impact Statement:

I-73 Corridor
Cost-Benefit Analysis Inputs

Section	Location	ALC Segment	Length	Cost ($ Millions, 1999)	Work
1	I-81 to Elm Avenue	374	6.3 Miles	$193.3	Improve existing freeways and interchanges
2	Elm Avenue to Buck Mountain (Route 668)	375 118C	7.1 Miles	$250.6	Widen existing freeway and structures to interstate standard
3	Buck Mountain to Sydnorsville	118 118B 400 153 202A	27.5 Miles	$396.1	New alignment – east of Boones Mill and Rock Mount
4	Sydnorsville to VA/NC Border	385 369 373 333 398	30.8 Miles	$458.31	New alignment – east of Martinsville and Ridgeway

The data above, plus additional segment and geometric data, was input into MicroBENCOST, a software application developed by the Texas Transportation Institute. This software uses cost-benefit methodologies recommended by various government agencies, including FHWA. The results are summarized below:

I-73 Corridor
Summary of User Benefit and Cost
(millions of 2004 dollars using 7% discount rate)

Measures	Section 1	Section 2	Section 3	Section 4	VA Corridor
Capital Costs	$ 213.489	$ 276.773	$ 437.512	$ 506.112	$ 1,433.886
Benefits	$ 290.016	$ 293.132	$ 558.703	$ 323.522	$ 1,465.374
Agency Costs	$ 189.075	$ 242.961	$ 412.59	$ 474.122	$ 1,318.757
NPV	$ 100.941	$ 50.171	$ 146.104	$ (150.599)	$ 146.617
BCR	1.534	1.206	1.354	0.682	1.110

The capital cost estimates totaling $1.4 billion (see above) represent the 1999 cost estimate from the previous table assuming a 7% discount rate over a 5 year period. A breakdown of the "capital costs" and "benefits" is included in Appendix B. A breakdown for "agency costs" is not provided; this information could not be extracted from the input or output data that was provided in conjunction with the benefit cost analysis.

The corridor as a whole shows a positive net present value (NPV) and a benefit-cost ratio (BCR) greater than 1.0. This indicates that the I-73 Corridor is an economically viable investment. It is noted that Section 4, located in the southern part of the state south of Sydnorsville, has a both a negative NPV and a BCR less than 1. These are the result of low traffic volumes, negligible time savings, large capital investment, and increased maintenance costs (of both eastern and western bypasses). However, this section is ultimately necessary to provide a contiguous and viable corridor.

In addition, a sensitivity analysis was performed assuming two scenarios: (1) a 10% reduction in forecasted traffic volumes; and (2) a reduced discount rate based on historical trends and November 2004 Treasury bond yields. Under both of these scenarios, the I-73 Corridor produced a positive NPV and a BCR greater than 1.0, further indicating the corridor is viable economic investment.

Proposed Interchange Locations

The Approved Location Corridor (ALC Alternative) represents an alignment of the preferred design options from the various analyzed "Build" alternatives. As adopted by the CTB, the I-73 alignment includes 21 potential interchange locations throughout the study area. Of these 21 interchanges, eight (8) are existing interchanges located along I-581 and 13 are planned along the newly adopted corridor.

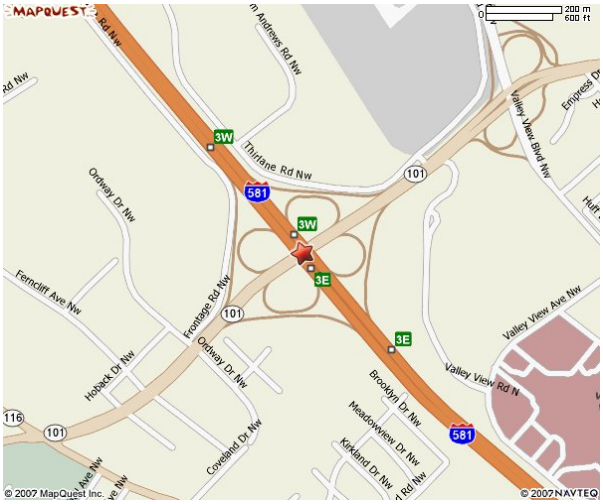
The highest daily ramp volumes under the ALC Alternative are forecast at the U.S. Route 58 interchange with 2,700 vehicles forecast to exit southbound I-73 to U.S. Route 58 and 2,800 vehicles forecast to enter I-73 northbound from U.S. Route 58. Forecast ADT volumes on U.S. Route 58 east and west of the proposed I-73 are 9,700 and 8,900 respectively in the year 2025. These volumes are approximately 40 percent less than those anticipated for the No-Build Alternative, indicating that the ALC Alternative would improve traffic conditions on this roadway east of Martinsville.

I-73 Corridor - Proposed Interchange Locations

1	I-581 at Route 101 (Hershberger Rd.)	Roanoke City
2	I-581 at Valley View Rd.	Roanoke City
3	I-581 at U.S. Route 460 (Orange Ave.)	Roanoke City
4	I-581 at Williamson Rd.	Roanoke City
5	I-581 at Elm Ave.	Roanoke City
6	U.S. Route 220 at Franklin Rd.	Roanoke City
7	U.S. Route 220 at Wonju St.	Roanoke City
8	U.S. Route 220 at Route 419	Roanoke County
9	U.S Route 220 at Route 679 (Buck Mountain Rd.)	Roanoke County
10	U.S. 220 near Route 668 (Yellow Mountain Rd.)	Roanoke County
11	Route 657 at Red Valley	Franklin County
12	Route 697 southwest of Burnt Chimney	Franklin County
13	Route 40 at Hodgesville	Franklin County
14	Route 619 northwest of Sontag	Franklin County
15	U.S. Route 220/Route 618	Franklin County
16	Route 890/108 north of Figsboro	Henry County
17	Route 57 southwest of Dyers Store Rd.	Henry County
18	U.S. Route 58 east of the Route 648/Route 620 intersection	Henry County
19	Route 650 near Tanyard Creek Crossing	Henry County
20	Route 87 north of the Route 750 intersection	Henry County
21	U.S. Route 220 south of intersection with Route 689	Henry County

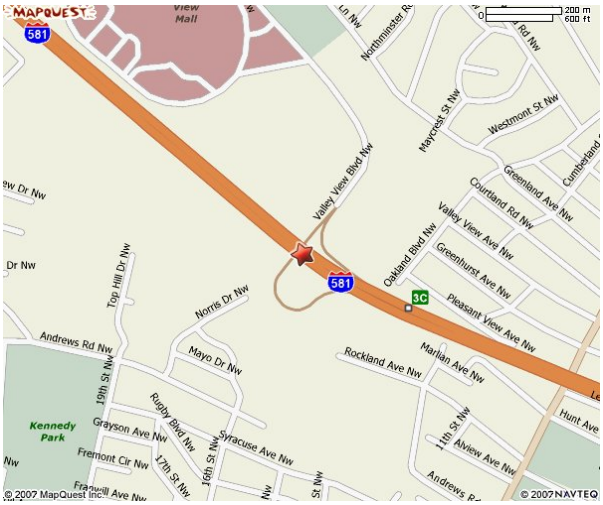
1. I-581 at Route 101 (Hershberger Road)

- Located in Roanoke City
- Cloverleaf design requires upgrade
- Gives access to Valley View Blvd. NW to Valley View Mall and Aviation Dr. /Roanoke Regional Airport.



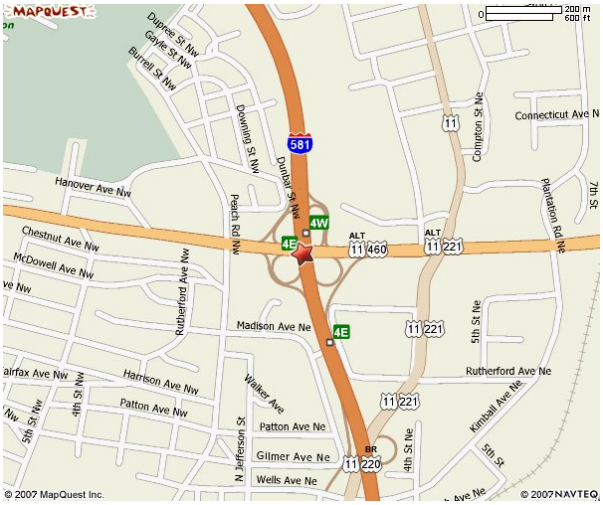
2. I-581 at Valley View Road

- Located in Roanoke City
- Flyover design requires upgrade
- Partial interchange: no access to I-581 Northbound
- Plans for the construction of new ramps from Valley View Blvd. onto northbound and southbound I-581



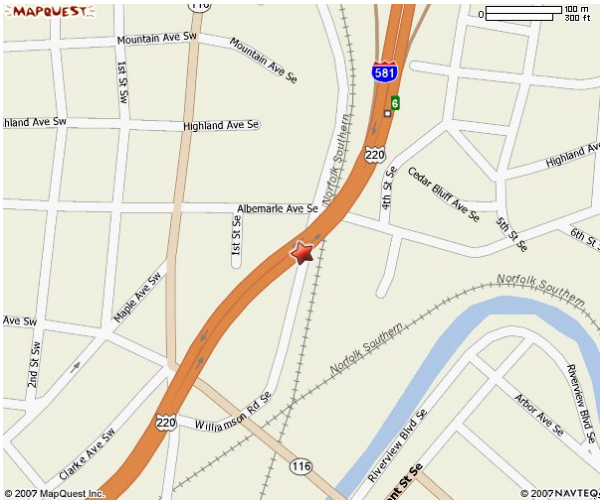
3. I-581 at U.S. Route 460 (Orange Avenue)

- Located in Roanoke City
- Cloverleaf design requires upgrade
- Gives access to Roanoke Civic Center



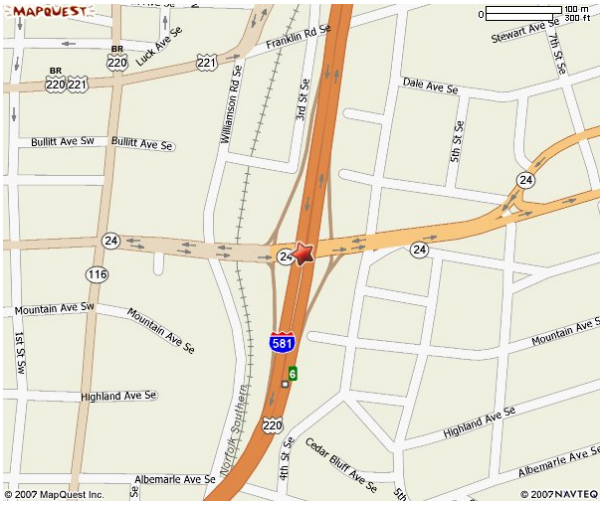
4. I-581 at Williamson Road

- Located in Roanoke City
- Partial cloverleaf design requires upgrade
- Partial interchange



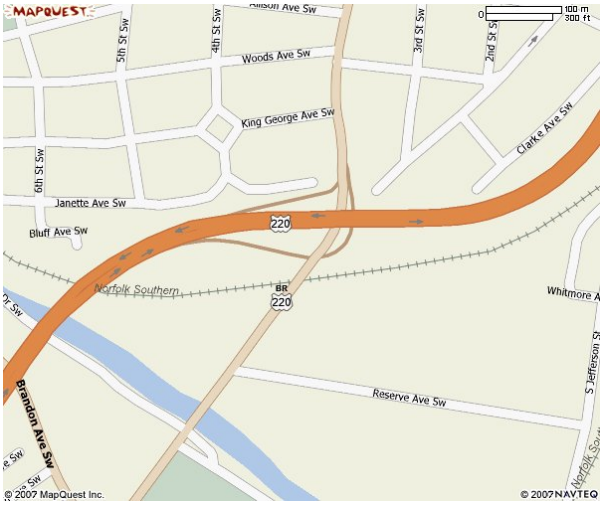
5. I-581 at Elm Avenue (State Route 24)

- Located in Roanoke City
- Diamond design, requires upgrade
- Interim safety improvements to this interchange planned to be completed in the next six years. Steps receiving conceptual analysis include widening the Elm Avenue Bridge, shrinking medians, widening interstate off-ramps to 3 lanes, widening the northbound on-ramp and tweaking signals.



6. U.S. Route 220 at Franklin Road

- Located in Roanoke City
- Half-diamond design, requires upgrade



7. U.S. Route 220 at Wonju Street

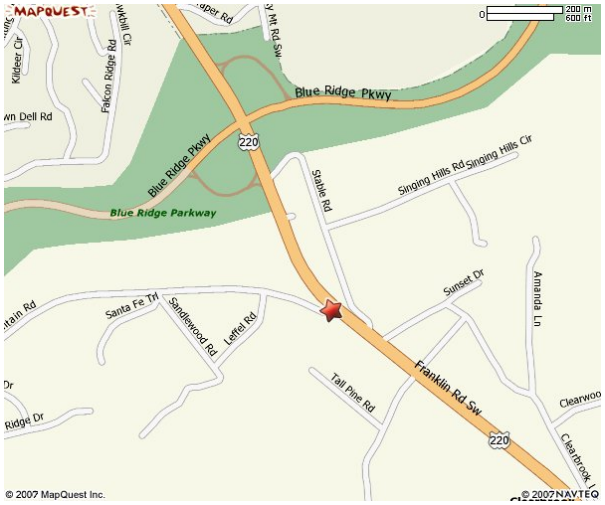
- Located in Roanoke City
- Partial cloverleaf design, requires upgrade

8. U.S. Route 220 at Route 419

- Located in Roanoke County
- Diamond design, requires upgrade

9. U.S. Route 220 at Route 679 (Buck Mountain Road)

- Located in Roanoke County
- Diamond design

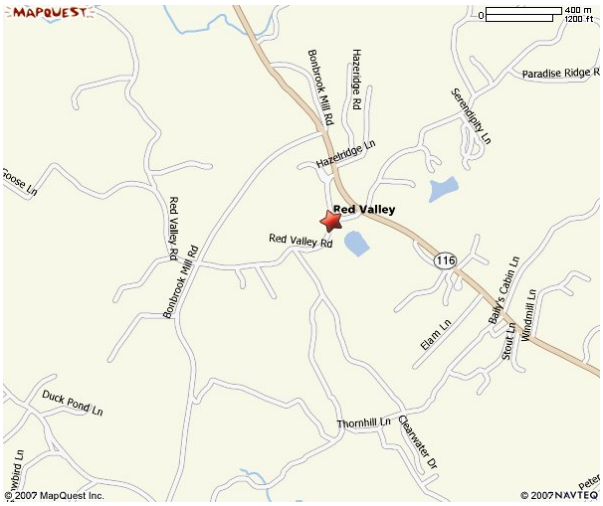


10. U.S. Route 220 near Route 668 (Yellow Mountain Road)

- Located in Roanoke County
- Diamond design

11. Route 657 at Red Valley

- Route 657 is also known as Red Valley Road
- Located in Franklin County
- Diamond design



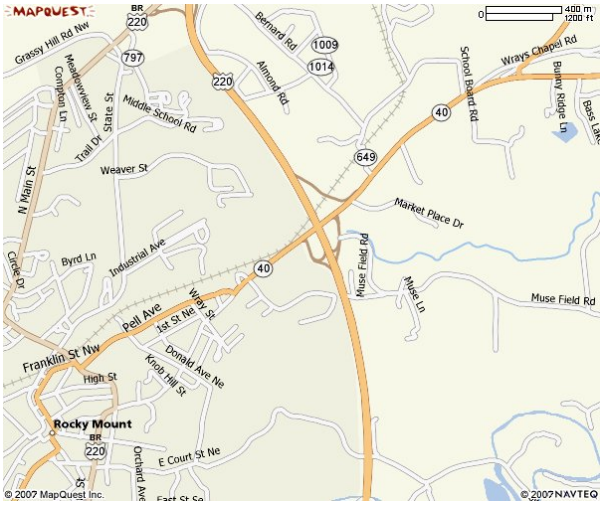
12. Route 697 southwest of Burnt Chimney

- Located in Franklin County
- Diamond design

no map

13. Route 40 at Hodgesville

- Located in Franklin County
- Diamond design



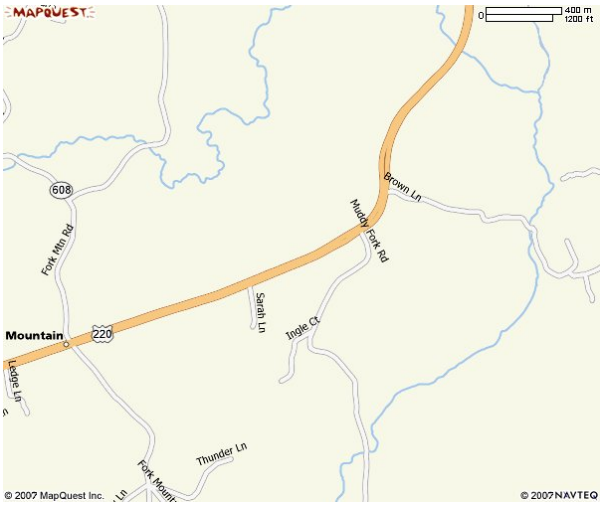
14. Route 619 northwest of Sontag

- Located in Franklin County
- Diamond design

no map

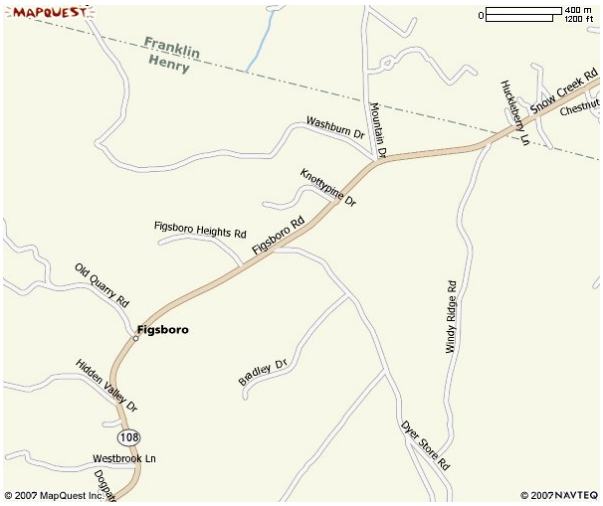
15. U.S. Route 220/Route 618

- Route 618 is also known as Muddy Fork Road
- Located in Franklin County
- Diamond design



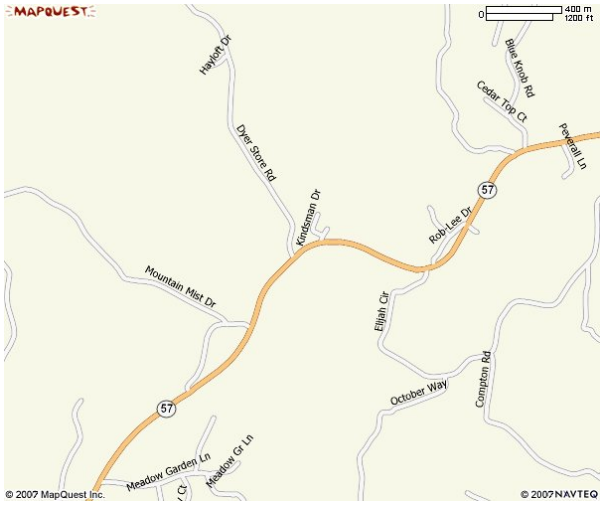
16. Route 890/108 north of Figsboro

- Located in Henry County
- Cloverleaf design



17. Route 57 southwest of Dyers Store Road

- Located in Henry County
- Diamond design



18. U.S Route 58 east of Route 648/Route 620 Intersection

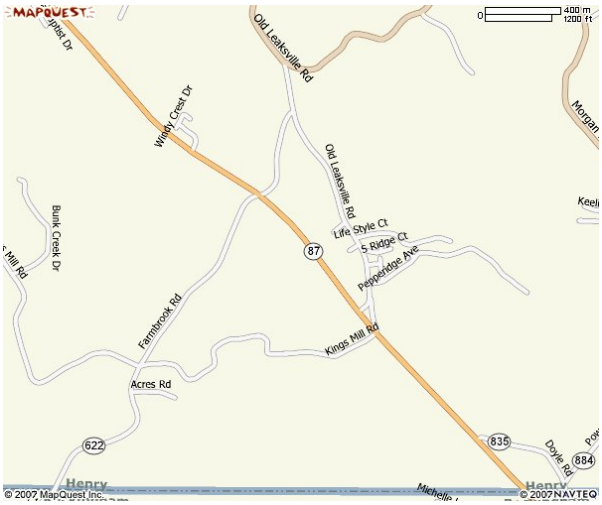
- Located in Henry County *no map*
- Diamond design

19. Route 650 near Tanyard Creek Crossing

- Located in Henry County *no map*
- Diamond design

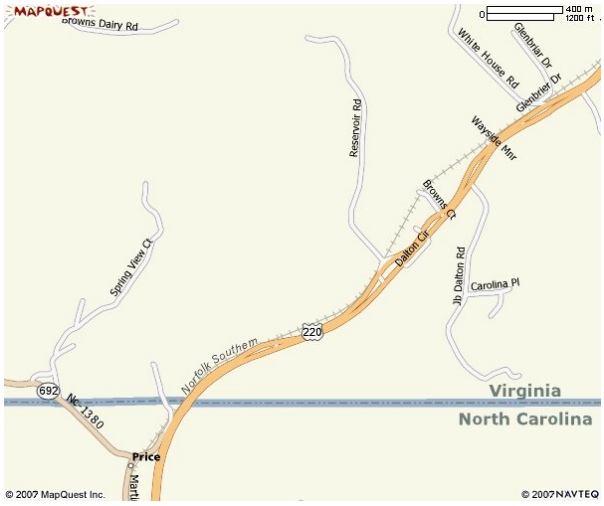
20. Route 87 north of the Route 750 Intersection

- Located in Henry County
- Diamond design



21. U.S. Route 220 south of intersection with Route 689

- Located in Henry County
- Trumpet design



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Appendix A
Level Of Service Information

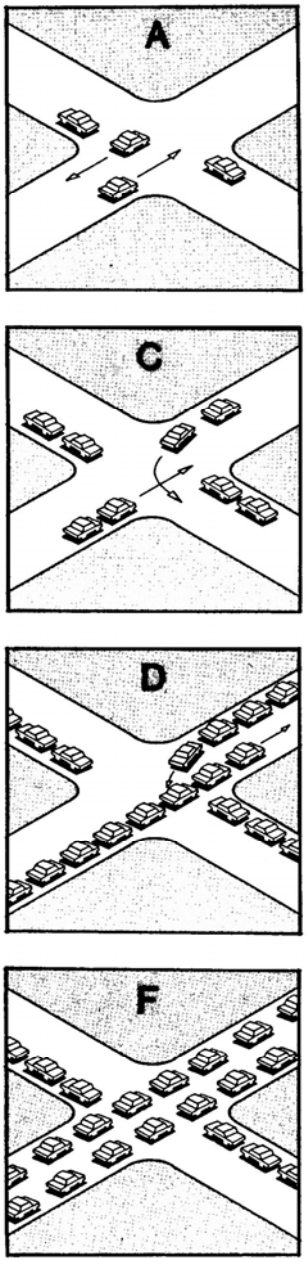
Level of service, or LOS, is a scale that is used to describe the functional operation of a roadway segment or intersection. The Highway Capacity Manual methodologies govern how the capacity analyses are conducted and how the results are interpreted. Level of service is defined in terms of **delay**, a measure of driver discomfort, frustration, fuel consumption and lost travel time. Typically, LOS A through C represents acceptable operating conditions and LOS D through F represents marginal to unacceptable results; the scale is comparable to what is used in academic settings.

The figure below provides a graphic illustration of the traffic conditions associated with each of the level of service categories.

LEVEL OF SERVICE DEFINITIONS

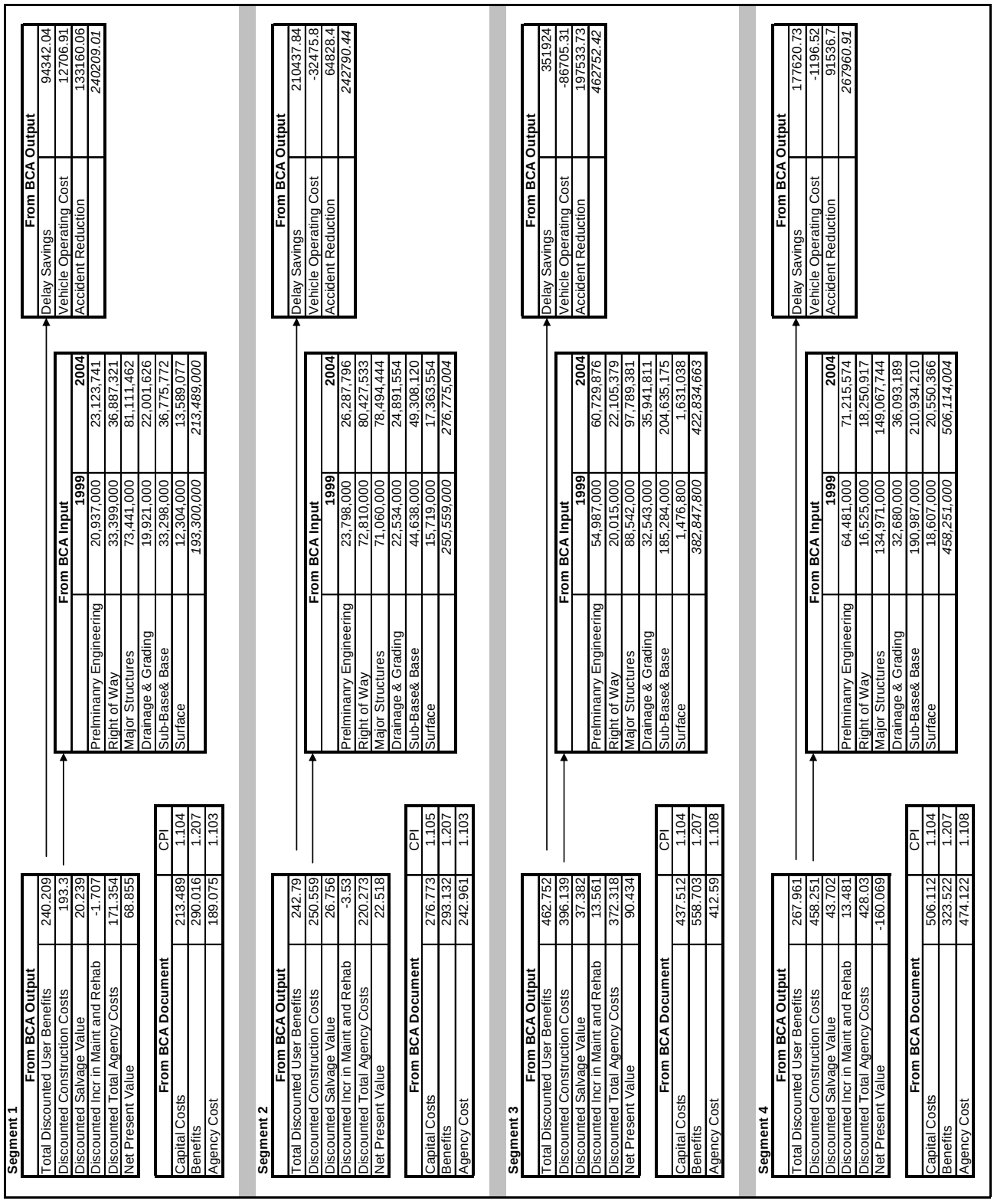
L.O.S.	ROADWAY SEGMENTS OR CONTROLLED ACCESS HIGHWAYS	INTERSECTIONS
A	Free flow, low traffic density.	No vehicle waits longer than one signal indication.
B	Delay is not unreasonable, stable traffic flow.	On a rare occasion motorists wait through more than one signal indication.
C	Stable condition, movements somewhat restricted due to higher volumes, but not objectionable for motorists.	Intermittently drivers wait through more than one signal indication, and occasionally backups may develop behind left turning vehicles, traffic flow still stable and acceptable.
D	Movements more restricted, queues and delays may occur during short peaks, but lower demands occur often enough to permit clearing, thus preventing excessive backups.	Delays at intersections may become extensive with some, especially left-turning vehicles waiting two or more signal indications, but enough cycles with lower demand occur to permit periodic clearance, thus preventing excessive back-ups.
E	Actual capacity of the roadway involves delay to all motorists due to congestion.	Very long queues may create lengthy delays, especially for left turning vehicles.
F	Forced flow with demand volumes greater than capacity resulting in complete congestion. Volumes drop to zero in extreme cases.	Backups from locations downstream restrict or prevent movement of vehicles out of approach creating a storage area during part or all of an hour.

SOURCE: A Policy on Design of Design of Urban Highways and Arterial Streets - AASHTO, 1973 based upon material published in Highway Capacity Manual, National Academy of Sciences, 1965.



Appendix B

Cost-Benefit Information



source: VDOT *I-73 Final Environmental Impact Statement*, November 2006, Appendix G.

Appendix 2: Glossary

IMPLAN Professional—an economic impact assessment modeling system. It allows the user to build economic models to estimate the impacts of economic changes in states, counties, or communities. It was created in the 1970s by the Forestry Service and is widely used by economists to estimate the impact of specific events on the overall economy.

Input-Out Analysis—an examination of business-business and business-consumer economic relationships capturing all monetary transactions in a given period, allowing one to calculate the effects of a change in an economic activity on the entire economy (impact analysis).

Direct Impact—economic activity generated by a project or operation. For construction, this represents activity of the contractor; for operations, this represents activity by tenants of the property.

Overhead—construction inputs not provided by the contractor.

Indirect Impact—secondary economic activity that is generated by a project or operation. An example might be a new office building generating demand for parking garages.

Induced (Household) Impact—economic activity generated by household income resulting from direct and indirect impacts.

Ripple Effect—the sum of induced and indirect impacts. In some projects, it is more appropriate to report ripple effects than indirect and induced impacts separately.

Multiplier—the cumulative impacts of a unit change in economic activity on the entire economy.

Appendix 3: Interchange Development Categories

Table A3: Interstate Interchange Classifications		
Category	Development	Requirement
0	Minimum Forest Agriculture agriculture-residential	no requirements
1	Residential single family homes medium sized lots	traffic < 2,000 ATD not close to town rural setting
2A	Light Tourist Service 1+ gas station 1 small motel	traffic > 4,000 ATD water service moderate visibility within 10 mile of town
2B	Economically Competitive 2-4 gas stations 1-2 fast food restaurants 2+ hotels	traffic > 8,000 ATD water & sewer town < 3 mile more than 5 mile from next exit
2C	Economic Integration 4+ gas stations 3+ fast food restaurants 2+ full-service restaurants other business/malls	traffic > 12,000 ATD water and sewer town < 2 miles
3A	Heavy Tourist 6+ hotels 3+ full-service restaurants 3+ fast food restaurants 3+ gas stations	water and sewer 2-3 miles from intersecting interstate
3B	Truck Stop 3+ gas stations/truck stop 1-2 fast food restaurants no malls 1-2 hotels	3-5 miles from town 20+ miles from intersecting interstate traffic < 6,000 1-2 per 100 miles
Source: Hartgen, et al. "Growth at Rural Interchanges: What, Where, Why. Transportation Research and Record, 1359		

An explanation of different types of interchanges follows.

Residential interchanges generally are located in a rural setting, have lower traffic volume, and are not close to a town. They normally have some development in single-family homes and nothing else. A few intersections in Franklin and Henry Counties are classified as residential.

Light tourist service interchanges usually have one gas station and one small motel, supporting moderate traffic flow. Several intersections in the counties of Roanoke, Franklin, and Henry are classified as this type. Economically competitive interchanges usually have two to four gas stations, one to two fast-food restaurants and two or more hotels. They typically have high traffic flow and are within three miles of nearby towns.

Economic integration interchanges are located close to a town and have a high level of traffic. These interchanges have more gas stations, hotels, and restaurants because they not only serve motorists but also local residents. Most intersections in Roanoke City and Roanoke County, as well as intersections close to the town of Rocky Mount and the city of Martinsville, belong to this category.

Heavy tourist intersections have the highest traffic volume and are in close proximity to another interstate. Three intersections on the northern end of I-73, close to I-81, belong to the heavy tourist category. Each heavy tourist intersection can support more than six hotels, over six restaurants, and multiple gas stations.