U.S. Route 29 in South-Central Virginia: Transportation and Economic Development Study

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Prepared for: Virginia Department of Transportation

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Executive Summary

This is a report of a study, conducted at the request of Mr. Whittington W. Clement during his term as Virginia’s Commonwealth Secretary of Transportation, of the relationships between economic development and levels of transportation mobility and accessibility in South-Central Virginia.¹ The study was conducted by six graduate students enrolled in George Mason University’s Master’s in Transportation Policy Operations and Logistics as their course “Practicum in Transportation Policy, Operations and Logistics” capstone project. The Virginia Transportation Research Council generously provided funds for this study. The views expressed are those of the students.

The objective of the study was to conduct both primary and secondary research that would provide a better understanding of the relationships between economic development, levels of service, and accessibility along the U.S. Route 29 (US 29) corridor in South-Central Virginia. In particular, the study examines how US 29 may affect the economic development goals and plan of South-Central Virginia communities.

The report is divided into eight chapters. Chapter 1 introduces the topic and provides the background to the study, and states its objective. In Chapter 2, an overview of US 29 is provided with details of the roadway system features; summary of existing traffic data/levels of service and mobility; traffic monitoring data and commuting patterns.

A summary of the Virginia Department of Transportation’s (VDOT’s) recent US 29 Corridor Development Study (Combined Phases II/III) is presented in Chapter 3 with a comparison of selected Virginia jurisdictions along Interstate 81 (I-81) and US 29. Indices like population, unemployment rates and per capita income are used in the comparison, which reveals that an Interstate highway is a necessary but not sufficient determinant of economic growth. Chapter 4 reviews the comprehensive and economic development plans of the counties in the study area.

Chapter 5 presents the result of a review of the literature on the impact of transportation infrastructure investment on economic development. Empirical studies in this field reveal that transportation infrastructure investments have significant impact on economic development, subject to the presence of complementary inputs such as other forms of infrastructure (telecommunications, sewerage systems) and skilled labor.

A survey was conducted to collect the views of transportation, economic development and business stakeholders. A summary and analysis of the responses, and the methodology employed are presented in Chapter 6.

¹ The authors thank Marsha Fiol, VDOT Transportation Planning Division Administrator, Michael Nichols, VDOT Transportation Modeling Group Manager, Jeffrey Kessler, VDOT Lynchburg District Planning Engineer, and Roger Stough, Northern Virginia Chair for Regional Governance, School of Public Policy, George Mason University, for their help on this study.
Chapter 7 presents the results of an accessibility analysis that measures the “connectedness” of areas in Virginia to key economic activities: airports, ports, interstate highway and economic opportunities. The results were subsequently mapped and revealed spatial patterns that suggest significantly low accessibility for the south-central counties of Virginia.

The study utilized the review of the Comprehensive Plans, survey of stakeholders and measures of accessibility to arrive at the following findings and recommendations.

Findings

1. Currently, US 29 operates at a high level of service, varying from a LOS of “A” to “C”.
2. All of the County and City Comprehensive Plans within the study area need updated transportation elements.
3. Funding to implement proposed US 29 improvements is limited.
4. The economic and transportation goals of the various counties and cities in the region are somewhat different.
5. Interstate access is important for economic development.
6. However, transportation access is but one factor among many that foster development.
7. The survey revealed strong stakeholder support for the VDOT’s US 29 Study and its recommendations.
8. US Route 29 in Charlottesville is viewed as a significant barrier to economic development in South-Central Virginia.
9. Based on the accessibility analysis, the South-Central Virginia counties have low accessibility, particularly to airports, interstates and economic activity.
10. Accessibility can be a robust and meaningful new system performance measure.
11. Interstate 73 (I-73) holds promise for additional access to South-central communities.

Recommendations

1. The Counties should increase access to their local plans, through the web or other mechanisms.
2. VDOT should explore the addition of an accessibility measure in their statewide planning process.
3. Access management should be a priority in transportation planning for all areas along US 29 that are not already designated limited access.
4. A US 29 transportation and economic model should be constructed and maintained for the study area.
5. VDOT should foster and encourage multi-jurisdictional collaboration.
6. The stakeholders in South-Central Virginia should support I-73.
7. The stakeholders should attempt to create a corridor “identity”.
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Chapter 1
Introduction

Mr. Whittington W. Clement, the former Virginia Commonwealth Secretary of Transportation requested a study on the relationships between economic development and levels of transportation mobility and accessibility in South-Central Virginia. A central issue is the potential economic impact of suggested broad-range transportation improvements contained in the Route 29 Corridor Development Studies (VDOT, 2003a,b,c). In general, business and community leaders in the region perceive a significant need to enhance mobility and safety along U.S. Route 29 (US 29). The study area follows the US 29 corridor through the counties of Nelson, Amherst, Campbell, and Pittsylvania, and the independent cities of Lynchburg and Danville (Figure 1.1).

1.1 Objective of the Study

The objective of the study is to conduct both primary and secondary research that might provide a better understanding of the relationships between economic development in the South-central region, levels of service, and accessibility along the US 29 corridor. In particular, the study examines how US 29 may affect the economic development goals and plan of South-Central Virginia communities.

The topics presented in this report are updated traffic data, level of service and mobility measures on existing US 29, a literature review of salient research on the relationship between transportation mobility and economic growth, and a review and comparison of the comprehensive plans and economic development strategies of local government. Input was solicited from business, government and community leaders through a survey questionnaire. The survey comments are summarized for the report. Also, an assessment of regional transportation accessibility was undertaken. This assessment may represent a pragmatic method of examining potential economic impacts of suggested broad-range transportation improvements along the US 29 corridor of South-Central Virginia.
Notes:
From: Nelson/Albemarle County Line (1)
To: Virginia/North Carolina Border (2)
Total Distance: 117 Miles
Jurisdictions: Nelson County, Amherst County, City of Lynchburg, Campbell County, Pittsylvania County, and City of Danville

Source: Microsoft Streets and Trips 2002.

Figure 1.1: US 29 Corridor study area

References

Virginia Department of Transportation (2003a) Route 29 Corridor Development Study (Combined Phases II/III) Existing Conditions Report.
Virginia Department of Transportation (2003b) Route 29 Corridor Development Study (Combined Phases II/III) Recommendations Report.
Virginia Department of Transportation (2003c) Route 29 Corridor Development Study (Combined Phases II/III) Technical Report.
Chapter 2
U.S. Route 29: An Overview

2.1 Roadway System Features

U.S. Route 29 is a major statewide primary highway that traverses the entire Commonwealth of Virginia, from Washington, D.C., through Northern and Central Virginia, to the Virginia-North Carolina border.

In the study area, US 29 has three distinct identities with divergent characteristics. First, for most of its length, it is a rural, multi-lane facility with operating speeds of 60 mph. Secondly, in and near the urban and suburban areas around Lynchburg and Danville, US 29 functions as a multi-lane thoroughfare, with reduced speed limits, serving adjacent land development with multiple access points, and thirdly as a multi-lane, limited access highway. There are approximately 27 existing miles designated as limited-access. U.S. Route 29 is the only multi-lane, North-South, border-to-border, through highway in Central Virginia. The other multi-lane, North-South highways through Virginia are Interstate 95 (I-95) to the East and Interstate 81 (I-81) to the West. U.S. Route 29 also connects with many other principal arterials and National Highway System routes in the Commonwealth, such as U.S. Route 58 (US 58), U.S. Route 460 (US 460), Interstate 64 (I-64), U.S. Route 33 (US 33), VA 3, U.S. Route 15 (US 15), U.S. Route 17 (US 17), and Interstate 66 (I-66). Through the study section, US 29 also serves as the primary conduit for distributing traffic to secondary routes, and as access to property through all of the jurisdictions (with the exception of the segments designated as limited access (VDOT, 2003b)).

U.S. Route 29 is functionally classified as a principal arterial, as defined by Federal Highway Administration (FHWA) guidelines. Principal arterials are characterized as roads that are to provide mobility for personal and commercial travel and not primarily as access to property. The principal arterial system is stratified into the Interstate System and all non-interstate principal arterials. Principal arterials are at the highest level in the hierarchy of functional road classifications (Federal Highway Administration, 2000). Since 1995, US 29 has also been designated as part of the National Highway System (NHS). The NHS was mandated by Congress in order to extend the benefits of the Interstate Highway System and focus federal resources to areas that are not directly served by it. Essentially, NHS routes are America’s most important roads. In fact, US 29 has been identified in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 as one of twenty-one congressionally-designated high-priority corridors. Nationwide, these corridors total 4,320 miles (Slater, 1996).
2.2 Summary of Existing Traffic Data/Levels of Service and Mobility

The US 29 corridor, from the North Carolina/Virginia border to the Albemarle/Nelson County line is the designated study area. The total distance is 117 roadway miles. These termini were chosen because of the specific regional concerns about the impacts of the US 29 corridor on the economic vitality of Virginia’s Central and South-Central Piedmont. Albemarle County was not included in this review because of its accessibility to I-64 corridor and economic dissimilarity to the other jurisdictions on the corridor.

2.3 Traffic Monitoring Data

The latest traffic volume information was obtained from VDOT (Table 2.1, Figure 2.1). The quality and accuracy of the data is considered to be very good. Most of the data was collected from continuous count stations that record traffic and classify vehicles 24 hours a day, seven days a week. The 2003 data indicate that traffic volumes range between 8,250 in Pittsylvania County, north of Danville and 39,000 in Campbell County, near the south city limits of Lynchburg. Truck volumes make up a significant percentage of traffic at various locations on the corridor. Near Danville, at the North Carolina border, trucks account for 21 per cent of the total traffic. On the north-end of the corridor, in Nelson County, truck volumes amount to 13 percent of total traffic (VDOT, 2003a).

Table 2.1: U.S. Route 29 corridor 2003 traffic volume data and level of service

<table>
<thead>
<tr>
<th>Route</th>
<th>Jurisdiction</th>
<th>M.P.</th>
<th>AADT</th>
<th>Peak Hr</th>
<th>Dir Factor</th>
<th>4Tire</th>
<th>Trucks</th>
<th>BUS</th>
<th>LOS NBL</th>
<th>LOS SBL</th>
<th>Pk Hr Volume North</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>US 29 Danville</td>
<td>1.33</td>
<td>10734</td>
<td>0.098</td>
<td>0.5181</td>
<td>78</td>
<td>21</td>
<td>1</td>
<td>A</td>
<td>A</td>
<td>507</td>
</tr>
<tr>
<td>2</td>
<td>US 29 Pittsylvania</td>
<td>20.23</td>
<td>16000</td>
<td>0.078</td>
<td>0.53</td>
<td>82</td>
<td>17</td>
<td>1</td>
<td>A</td>
<td>A</td>
<td>661</td>
</tr>
<tr>
<td>3</td>
<td>US 29 Pittsylvania</td>
<td>33.07</td>
<td>8250</td>
<td>0.1114</td>
<td>0.5125</td>
<td>82</td>
<td>17</td>
<td>1</td>
<td>A</td>
<td>A</td>
<td>471</td>
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<tr>
<td>4</td>
<td>US 29 Campbell</td>
<td>65.86</td>
<td>27454</td>
<td>0.0961</td>
<td>0.5794</td>
<td>91</td>
<td>8</td>
<td>1</td>
<td>B</td>
<td>C</td>
<td>1101</td>
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<tr>
<td>5</td>
<td>US 29 Lynchburg</td>
<td>68.01</td>
<td>39000</td>
<td>0.076</td>
<td>0.598</td>
<td>92</td>
<td>8</td>
<td>0</td>
<td>B</td>
<td>C</td>
<td>1192</td>
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<td>6</td>
<td>US 29 Amherst</td>
<td>90.38</td>
<td>15000</td>
<td>0.08</td>
<td>0.511</td>
<td>87</td>
<td>12</td>
<td>1</td>
<td>A</td>
<td>A</td>
<td>613</td>
</tr>
<tr>
<td>7</td>
<td>US 29 Nelson</td>
<td>105.4</td>
<td>12337</td>
<td>0.1112</td>
<td>0.5306</td>
<td>87</td>
<td>12</td>
<td>1</td>
<td>A</td>
<td>A</td>
<td>644</td>
</tr>
</tbody>
</table>

Notes:
AADT – Typical daily traffic for all the days of the week, Sunday to Saturday, over the period of one year
Peak Hour – Estimate of traffic volume traveling during the peak hour
Dir Factor – Estimate of traffic volume traveling in the peak direction during the peak hour.
LOS – Level of Service
4 Tire – Percentage of traffic made up of motorcycles, passenger cars and pick-up trucks
% Trucks – Percentage of traffic made up of 2 axle trucks, 3+ axle trucks, and trailer trucks with one or more than one trailer
BUS – Percentage of buses
Worker commuting patterns are important for understanding travel preferences and regional needs. While this study did not undertake travel-demand modeling of travel pattern alternatives, important information can be gleaned from commuting values as reported by the U.S. Census Bureau (Virginia Employment Commission, 2005). Several items are of particular interest. First, of 6,558 reported commuters in Nelson County, 2,723 traveled within the county and another 2,458 traveled north to Albemarle County and Charlottesville, VA. Therefore, in 2000, 79 per cent of Nelson County residents typically commuted within or north of the county. Of 28,570 commuters in the City of Lynchburg, approximately 46 per cent traveled within the city limits. Approximately 85 per cent of Campbell County commuters traveled within Campbell County or to the City of Lynchburg; relatively few traveled South in 2000. In the City of Danville, of 17,556 commuters, 9.1 per cent traveled to North Carolina, 83.3 per cent traveled within the City, and 12.5 per cent traveled to Pittsylvania County. Relatively few commuted regularly to Campbell County, Lynchburg, or points north on US 29. The Route 29 Corridor Development Study Technical Report (VDOT, 2003b) states that the majority of trips (approximately 80 per cent) in the US 29 vicinity begins and ends in their study area.
2.5 Traffic Operations

Level of service qualitatively measures operating conditions on a highway section or intersection as a function of variance from ideal conditions: A is best, and F is worst. For a rural, multi-lane highway, service level is measured by free-flow speed, number of lanes, number of passenger-cars per hour per lane (pc/hr/ln), heavy-vehicle percentages, terrain, and grade. Using this methodology, the level of service is calculated to be A for a large percentage of the US 29 corridor. This equates to a free-flow speed of around 60 mph, with little restriction on maneuverability. Only at locations along the highway within the southern suburbs of Lynchburg in Campbell County does the level of service diminish to “C”, characterized by noticeable increases in density and reduced maneuverability (VDOT, 2003b, p. 6).

References

Virginia Department of Transportation (2003b), Route 29 Corridor Development Study (Combined Phases II/III) Existing Conditions Report.
Chapter 3
Summary of the US 29 Corridor Development Study (Combined Phases II/III)

The Route 29 Corridor Development Study, Phases II/III (Corridor Development Study) was commissioned by VDOT in 1999. The study examined multimodal transportation along US 29 between I-64 in Charlottesville, VA and the North Carolina border south of Danville. This detailed $1.9 million study provided three reports and relatively specific recommendations for improving US 29 mobility. The reports include the Route 29 Corridor Development Study (Combined Phases II/III) Existing Conditions Report, the Route 29 Corridor Development Study (Combined Phases II/III) Technical Report, and the Route 29 Corridor Development Study (Combined Phases II/III) Recommendations Report. All are dated 2003.

Over a period of five years, the Corridor Development Study researchers evaluated conditions within the corridor and developed substantive recommendations for US 29 transportation improvements. The process incorporated broad-based transportation planning and analysis; public hearings for the collection of public, business and government comments; development workshops with local, state and federal officials; identification of transportation needs and alternatives; planning-level engineering, economic analysis and environmental reviews; alternatives development, and lastly, recommendations in the form of the Route 29 Corridor Transportation Plan (Corridor Plan, DOT, 2003b). The specific goals for transportation improvement along the corridor were identified as (VDOT, 2003b, p. 4):

- Keep people and goods moving smoothly and efficiently within and through the corridor.
- Reduce accidents and enhance travel safety.
- Expand transportation choices.
- Expand the market reach of existing and prospective companies in the corridor.
- Expand the area from which a skilled labor pool can be drawn.
- Help steer growth to desired areas.
- Preserve and enhance the attractiveness of the region to tourists and residents.
- Provide better traveler information and services.
- Ensure that the US 29 Corridor, as a viable part of the National Highway System, helps the nation compete in the global economy and moves people and goods in an energy-efficient manner (also responds to the ISTEA legislation passed by the U.S. Congress establishing the National Highway System).

U.S. Route 29 roadway segments were identified for upgrades as freeway, parkway with grade separated interchanges, and parkway with at-grade separations in a limited number of specified locations. The total estimated cost for preliminary engineering, right-of-way,
and construction in year-2000 dollars ranged from $5 million for a no-build option to $896.5 million for implementation of all recommendations within the Corridor Plan (VDOT, 2003b, p. 19). At an inflation rate of 3 per cent, the total cost of implementation by 2020 could exceed $1.4 billion. The VDOT Six-Year Improvement Program FY2005–2010 funding allocation for primary roadway projects in the Lynchburg District was approximately $127 million (VDOT, 2004). The current proposed FY2006–2011 funding allocation is approximately $141 million (VDOT, 2005). Obviously the allocations are not keeping pace with the funding necessary to implement the Corridor Plan. Additional methods to complete proposed improvements, such as public-private partnerships, should be considered to address the program pace and funding.

The Corridor Transportation Plan indicates 14 specific segments of US 29 for recommended roadway and intersection improvements. It calls for the elimination of 1360 intermittent access points; 36 interchanges and 18 intersections would replace these access locations. The Corridor Plan also provides recommendations for enhanced rail service, transit, rideshares, tourism, road signage, safe bicycle and pedestrian travel, transportation information technologies, and integrated transportation/land use planning and policy (VDOT, 2003a).

Under the rail element, it is stated: “in general, the freight rail system in the corridor is in good condition and meets existing needs” (VDOT, 2003b, p. 10). The passenger rail was found to be limited to one train per day with individual cars often congested. It was recommended that one additional Amtrak train be supplied in the southern counties of US 29 and one train for the proposed TransDominion Rail Service for daily routes to and from Washington D.C. (VDOT, 2003c, p. 177). Currently, Amtrak schedules one service run from Washington D.C. to Lynchburg per day. The TransDominion Service, as noted, is proposed. Amtrak, the Virginia Department of Rail and Public Transportation, and Norfolk Southern Corporation have developed a concept to provide two round trip trains per day from Bristol, VA to Washington D.C. (Commonwealth of Virginia, House Document No. 37, 2005). Known as the TransDominion Express, the service would stop at 19 stations along the route, traveling up to a maximum 79 mph. Rail improvements located along the US 29 corridor, through Lynchburg to Roanoke, would enhance this concept and allow a Washington D.C.–to-Bristol travel time of 7 hours and 30 minutes. It has been estimated that 5 per cent to 10 per cent delays in freight movement could occur from the additional passenger service (Ibid., p. 8). However, improvements to the US 29 rail corridor could also provide additional capacity for freight that may be diverted from future I-81 improvements. To date, full funding for the suggested capital rail improvements has not been available.

To support increased population growth and an aging population, the Corridor Transportation Plan called for a 30 per cent increase in transit service in the cities of Danville, Lynchburg, and Charlottesville. To support tourism, the Corridor Plan called for a Virginia Welcome Center near Danville and the North Carolina border, a wayside in Nelson County, and compatible signage for services and tourist attractions. In support of this effort, a new Welcome Center was recently constructed and opened by the City of Danville. The transportation technology recommendations include installation of
information-transfer infrastructure, weigh-in-motion truck facilities, and flashing-light safety signage for bicycle and pedestrian travel. The planning and policy recommendations specify adoption of the Corridor Transportation Plan within County Comprehensive Plans, initiation of localized circulation studies, and implementation of access management principles within zoning and subdivision ordinances.

### 3.1 Comparative Economic Review, I-81 and US 29

In many of the interviews conducted with key players in business and government along the US 29 corridor, participants have expressed the view that the lack of access to an interstate highway has a negative economic impact on the south-central region. In order to further evaluate this belief, an effort has been made to compare selected cities and counties along the I-81 corridor with the South-Central Virginia cities and counties along the US 29 corridor. Data was gathered from various sources regarding current population growth, unemployment rates, percentage of high school graduates, per capita income and primary employment sectors (Table 3.1 and Figure 3.1).

**Table 3.1: Comparison of economic performance indicators I-81 and US 29 corridors**

<table>
<thead>
<tr>
<th>County or City</th>
<th>Corridor Location</th>
<th>Population Growth</th>
<th>Unemploy. Rate</th>
<th>%High School Graduates</th>
<th>Per Capita Income</th>
<th>Largest Employ. Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danville(City)</td>
<td>US 29</td>
<td>−2.60%</td>
<td>10.30%</td>
<td>68.50%</td>
<td>$22,660</td>
<td>Services −39%</td>
</tr>
<tr>
<td>Pittsylvania Co.</td>
<td>US 29</td>
<td>−0.60%</td>
<td>6.70%</td>
<td>67.30%</td>
<td>$22,660</td>
<td>Manufact. −41%</td>
</tr>
<tr>
<td>Lynchburg</td>
<td>US 29</td>
<td>1.20%</td>
<td>4.60%</td>
<td>78.00%</td>
<td>$24,340</td>
<td>Services −41%</td>
</tr>
<tr>
<td>Washington Co.</td>
<td>I-81</td>
<td>−0.20%</td>
<td>4.90%</td>
<td>72.30%</td>
<td>$24,334</td>
<td>Services −34%</td>
</tr>
<tr>
<td>Amherst Co.</td>
<td>US 29</td>
<td>−2.30%</td>
<td>4.70%</td>
<td>70.60%</td>
<td>$21,841</td>
<td>Services −22%</td>
</tr>
<tr>
<td>Roanoke(City)</td>
<td>I-81</td>
<td>1.10%</td>
<td>4.50%</td>
<td>76.00%</td>
<td>$27,033</td>
<td>Services −42%</td>
</tr>
<tr>
<td>Campbell Co.</td>
<td>US 29</td>
<td>−0.80%</td>
<td>3.90%</td>
<td>73.40%</td>
<td>$24,340</td>
<td>Manufact. −27%</td>
</tr>
<tr>
<td>Nelson Co.</td>
<td>US 29</td>
<td>3.20%</td>
<td>3.10%</td>
<td>69.00%</td>
<td>$26,344</td>
<td>Services −41%</td>
</tr>
<tr>
<td>Rockingham Co.</td>
<td>I-81</td>
<td>4.60%</td>
<td>2.60%</td>
<td>73.60%</td>
<td>$23,270</td>
<td>Services −28%</td>
</tr>
<tr>
<td>Staunton Area</td>
<td>I-81</td>
<td>1.00%</td>
<td>2.90%</td>
<td>77.60%</td>
<td>$25,680</td>
<td>Services −29%</td>
</tr>
<tr>
<td>Frederick Co.</td>
<td>I-81</td>
<td>10.90%</td>
<td>2.80%</td>
<td>77.70%</td>
<td>$29,063</td>
<td>Services −35%</td>
</tr>
<tr>
<td>Roanoke(County)</td>
<td>I-81</td>
<td>2.80%</td>
<td>3.00%</td>
<td>85.80%</td>
<td>$32,911</td>
<td>Services −44%</td>
</tr>
</tbody>
</table>

Notes: Refer to Table 3.1 for identification of cities and counties 1-12.

Figure 3.1: I-81 vs. US 29 unemployment rates

3.2 Population growth

Demographic data indicates that the cities and counties along the I-81 corridor generally had higher rates of population growth since the 2000 census (Figure 3.2). The City of Winchester led the way with an overall growth rate of 10.9 per cent, and the Harrisonburg area grew by 4.6 per cent. For the most part, however, there were either modest gains or losses for the remaining jurisdictions. For example, along I-81, Roanoke County grew by 2.8 per cent, the Staunton area increased by 1 per cent, the City of Roanoke grew by 1.1 per cent, and the Bristol area population decreased by –0.2 per cent. Along the US 29 Corridor, Nelson County’s population grew by 3.2 per cent and the City of Lynchburg gained 1.2 per cent. Modest declines were seen in Danville at –2.6 per cent, Pittsylvania lost –0.6 per cent, Amherst County decreased by –2.3 per cent, and Campbell County lost –0.8 per cent in population. The growth in Winchester and Harrisonburg are noteworthy. Some of that expansion may not be attributable to Interstate access, but to the presence of James Madison University in Harrisonburg or the proximity of Winchester to the population and growth centers in Northern Virginia (Weldon Cooper Center, 2005).
3.3 Unemployment Rates

Higher than desirable rates of unemployment are most prevalent in the Danville-Pittsylvania County areas; as of February 2005, the unemployment rate was 10.3 per cent in Danville and 6.7 per cent in Pittsylvania County (Figure 3.1). The lowest rates of unemployment were seen along central and northern sections of I-81. In Roanoke County, Frederick County, Staunton, and Harrisonburg; unemployment ranged between 2.5 and 3 percent. Washington County on the southern end of the I-81 corridor had an unemployment rate of 4.9 per cent. The remainder of the US 29 corridor had relatively moderate unemployment figures. Lynchburg had a rate of 4.6 per cent, Amherst County was at 4.7 per cent, Campbell County was at 3.9 per cent and Nelson County had a rate of 3.1 per cent.

Generally the unemployment figures are indicative of moderate to good economic success in all of the selected cities and counties with the exception of the Danville-Pittsylvania County area. The present average unemployment rate for the state of Virginia as a whole is 3.6 per cent. The national unemployment rate for February 2005 is at 5.8 per cent.
3.4 Per Capita Income

Per capita income levels are, for the most part, reflective of unemployment levels and the percentage of high school graduates (Figure 3.3). The income levels in Winchester and in Roanoke County are 22 per cent to 30 per cent higher than those found in the Danville-Pittsylvania County area (Virginia Economic Development Partnership, 2005).

![I-81 vs U.S. 29-Per Capita Income(2002)
Selected Corridor Cities and Counties](image)

*Figure 3.3: I-81 vs. US 29 per capita income*

3.5 Interstate corridors and economic growth

The construction of an interstate highway has the potential to bring new businesses, jobs and economic growth to the regions that they go through. Businesses often prefer the accessibility and reduced transportation costs afforded by easy access to interstate interchanges. Interstate access is one of the primary factors that companies consider when they are choosing new sites. Transportation access is vitally important to manufacturers that depend on “just-in-time” delivery of components and raw materials. Retail businesses, industrial development, and travel and tourism developments tend to crowd together around interstate interchanges. The Interstate 85 (I-85) corridor, from Atlanta, GA to Raleigh-Durham, NC is often held up as a shining example of the kind of development that an interstate highway can bring. The 400-mile long corridor is blanketed with retail businesses, distribution centers and high-tech companies. On Interstate 77 (I-77) in South-West Virginia, near Wytheville, new motels, restaurants and
gasoline service plazas cluster around interstate entrance ramps. These service sector businesses are a new and significant source of tax revenue for Wytheville. For FY 1998–99, the city collected $1.2 million in lodging and meals taxes, more than twice the amount collected in local real estate and personal property taxes. During the peak tourist season, more than 1,000 residents work in Wytheville’s motels and restaurants and in Wythe County more than 1,500 persons are employed in travel and tourism related businesses.

3.6 Conclusion

Do interstate corridors always equal economic expansion? There is considerable evidence that interstate highways contribute to economic growth. The Commonwealth of Virginia’s highest growth areas are adjacent to the I-95, I-66 and I-64 corridors. Figure 3.4 indicates noteworthy population increases over a 43-year timeframe for the I-81 jurisdictions compared to the US 29 jurisdictions. However, the presence of an interstate highway is not always accompanied by economic progress (Figures 3.5 and 3.6).

![Population Trends-U.S. Route 29 and I-81 Corridors](image)

Figure 3.4: Population trends – US 29 and I-81
Figure 3.5: Covington City population – I-64

Figure 3.6: Campbell County population – US 29
For example, Alleghany County, the Town of Clifton Forge and the City of Covington are along I-64 West, between I-81 and the West Virginia border. All of those localities lost population since the 2000 census and have high unemployment rates. On the other end of the spectrum, Culpepper County and Fluvanna County, that don’t have immediate interstate access, saw their populations grow by 14 and 21 per cent, respectively since the 2000 census. There are other factors that are perhaps equal to or even more important than interstate accessibility, these include an adequately trained, available and affordable workforce; the availability of land, buildings, and a public works and telecommunications infrastructure that will service and support new business locations (Schnabel, 2000).

References

Virginia Department of Transportation (2003a) Route 29 Corridor Development Study (Combined Phases II/III) Existing Conditions Report.
Virginia Department of Transportation (2003b) Route 29 Corridor Development Study (Combined Phases II/III) Recommendations Report.
Virginia Department of Transportation (2003c) Route 29 Corridor Development Study (Combined Phases II/III) Technical Report.
Chapter 4
Review of the Comprehensive and Economic Development Plans Of the Study Area

To further understand the study area, this chapter reviews the comprehensive plans and economic development plans of the study area. The Code of Virginia, § 15.2-2223 as amended, stipulates the purpose and scope for development and adoption of comprehensive plans for every governing body within the Commonwealth of Virginia (Legislative Information System, 2005a). Comprehensive plans are developed from detailed studies of current and future jurisdictional characteristics, such as land use, economic and demographic parameters, the environment, cultural resources, etc. They are intended to guide community decisions and promote harmonious development. The county comprehensive plans reviewed for this study include Pittsylvania, Campbell, Amherst, and Nelson.

On April 12, 2004, Governor Mark R. Warner approved Senate Bill 353 that requires a transportation element within a comprehensive plan (Legislative Information System, 2005b). This element must include infrastructure needs and recommendations pertaining to bridges, roadways, ports, airports, pedestrian and bicycle components, and other transportation facilities. The legislation became effective on July 1, 2004. Upon request, VDOT is also required to provide technical assistance to localities.

The Virginia Transportation Research Council is currently compiling and reviewing comprehensive plans of Virginia jurisdictions. Their research will determine the adequacy of transportation elements within the Plans Statewide as well as establish a basis for future plan reviews and revisions.

4.1 Amherst County Comprehensive and Economic Development Plan Review

The County of Amherst is presently developing a comprehensive plan (Amherst Plan) as a guide for the future. Up to now, involvement in the planning process has included the County Planning Commission, the Board of Supervisors, county staff, a 25-member citizens group representing various interests, consultants and 250 interested citizens. Community meetings were held in the fall of 2004 to solicit input. The most recurring issues at the public meetings were: (a) the need to attract travel and tourism; (b) growth generated by the Madison Heights Bypass; (c) congestion and strip development along existing US 29; (e) the need for more industrial/manufacturing development, and (f) low job opportunity for residents.

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Task groups made up of citizens, business leaders and local and state government have been formed to address all of the major topic areas covered by the Amherst Plan. Focus areas involve the environment, transportation, economic development, land use, community facilities and services, cultural resources and aesthetics (County of Amherst, 2005).

The economic development task force will address tourism, marketing, community readiness, work force development and other relevant topics to the county’s economic well-being. The participants include local and regional developers, Chamber of Commerce members and citizens. The transportation task force is making recommendations on issues such as land use and access standards for properties near the new US 29 Bypass, identification of future street needs and locations, the level of service and safety of all other existing roads, and the future use and access management of existing US 29. This group is made up of citizens, representatives from VDOT, the regional transportation planning agency, home-owner associations, and private sector engineering companies. At last report, all task groups have adopted a vision statement and some goals for each component of the proposed Amherst Plan (County of Amherst, 2005).

Amherst County advertises itself as having a pro-business attitude with a lower cost of doing business than adjacent metropolitan areas, access to major southern and north-eastern markets, and an advanced telecommunications network. The real-estate tax rate is set at $0.61 per $100 of assessed valuation. Major employers are Glad Manufacturing (Plastic bags), Dacam (Packaging Machinery), clock movements (Hermle Black Forest Clocks), corrugated paper products, and a private college (Sweet Briar College) (Virginia’s Region 2000, 2005).

4.2 Campbell County Comprehensive and Economic Development Plan Review

In 2003, a Comprehensive Economic Development Strategy (CEDS) was prepared for Campbell County, VA. Campbell County is on the southern side of the City of Lynchburg and includes the towns of Altavista, Brookneal and Rustburg. A CEDS is required as a qualification for eligibility for assistance from the Virginia Economic Development Administration. Funding may be available for use in public works projects, economic initiatives and planning grants. In addition to the goals presented in the CEDS project, the Campbell County Comprehensive Plan outlines the “official” economic objectives of the County.

The CEDS study results indicate that Campbell County has a relatively strong and diverse economy, but has suffered a 15 per cent loss in total jobs over the past decade. Most of the decline has been in manufacturing jobs, which makes up a large proportion of the jobs in Campbell County (over 30 per cent), followed by services (15 per cent) and retail trade (14 per cent). This is three times the statewide average of manufacturing jobs in the Commonwealth as a whole. To a large extent, the growth areas are the suburbs to the south and south-west of the City of Lynchburg (County of Campbell, 2005).
Regarding transportation as an element of the economic plan, the county has two major north/south corridors, US 29 and U.S. Route 501 (US 501), and a principal arterial, US 460, which runs East/West. The fact that there is no interstate highway is seen as a leading negative feature of the transportation component. Businesses generally believe that improvements to the US 29 corridor would be the best transportation benefit for the economic health of the region. Another major minus for the transportation infrastructure is the relatively limited airport services available. The Lynchburg Regional Airport is seen as inadequate. Large companies with complex travel requirements often prefer locations with more available flights and destinations.

The US 29 corridor is the primary economic growth corridor in the county. A sewer and water extension is on the top of the list of economic development enhancement priorities, along with improving workforce skills.

The County completed a US 29 corridor management study in 2001 (Campbell County, 2004). It is a sub-heading in the Economic Development section of the Campbell Plan, but there is no mention of an implementation strategy. The stated goal is “to promote long term economic growth in the corridor while maximizing traffic flow and safety” (County of Campbell, 2003). The study identified 589 access points and 63 median crossovers in the 14-mile section, from just North of Altavista to the Lynchburg Airport. The study called for a reduction in the number of median breaks, overlay zoning that would encourage shared access and selected improvements to the corridor. There may be opportunities for further support and input from VDOT regarding implementation of recommendations contained in the corridor management study (Ibid., 2003).

The corridor management study identified a recommended corridor circulation plan. It supports the need for access location improvements and recommends that transportation funds be applied specifically for access improvements. It identifies approximately 15.5 miles of new construction access/service roads near US 29, approximately 8.5 miles of existing roadway upgrades, and 14 designated access point interchange/intersection improvements over the next 20 years. The planners indicate that the construction of access roads in close proximity to US 29 will make twice the amount of land available for development and improved building location, green space and amenities. The circulation plan discourages the use of transportation funds for projects not identified in the plan. Other recommendations include no net increase in corridor crossovers, closure of detrimental crossovers, business marketing in concert with corridor improvements, and considerations to enhance the aesthetics of US 29 to promote a corridor gateway into Campbell County.

The corridor plan does not address the potential costs for preliminary engineering, right-of-way, utilities and construction of the circulation plan. Conceptual planning level estimates by the George Mason study team place this cost in the range of $90 million to $138 million by the year 2015.
4.3 City of Lynchburg Comprehensive and Economic Development Plan Review

The City of Lynchburg is approximately 50 square miles and has a limited amount of vacant land and is on hilly terrain. Business sites requiring large flat parking areas are limited. Chapter 7 of the City of Lynchburg Comprehensive Plan 2002–2020 (Lynchburg Plan) covers economic development and redevelopment. Quality transportation services are recognized as an important community asset for attracting new businesses and industry. Economic development is one of the City Council’s vital priorities, which are the top ten areas for city staff to focus resources. These concerns were initially identified in 2000 and reaffirmed in 2001. Current economic development priorities are retention and expansion of existing businesses and redevelopment of the downtown area. Chapter 8 of the Lynchburg Plan describes a master plan for downtown and riverfront development. To support the preparation of the Lynchburg Plan a consultant called Economics Research Associates (ERA) developed and tested an economic impact assessment model to be used primarily to evaluate development proposals. There is no transportation component in the model. The city has identified focus areas along major corridors where business sites will be encouraged and publicized. The Office of Economic Development has been directed to prepare a separate Economic Development Strategic plan in order to have a comprehensive single source document that will incorporate all of the short term and long-term economic priorities and strategies. Coordination of land use planning and transportation planning is listed as an objective of an economic development strategy (City of Lynchburg, 2002).

Chapter 14 of the Lynchburg Plan describes transportation issues in the city. “Gateway” issues related to the US 29 bypass and its effect on downtown are important concerns. Transportation projects of particular municipal interest include the cross-town connector, the US 29 (Madison Heights Bypass), and access to Kemper Street Station, which is the city’s newly renovated main transfer point for Amtrak passenger rail service and for inter-city bus service. The city does not presently have a current transportation master plan (TMP). One of the Lynchburg Plan goals is to develop a TMP that would establish short and long-term transportation priorities and provide consistency between city and VDOT planning activities. The focus of the Lynchburg Plan regarding surface transportation is the improvement of several more functionally important principal city streets.

Another important consideration in the Lynchburg Plan is greater utilization and development of the Lynchburg Regional Airport. The objective is to better serve regional jet service and air-freight, expand access via transit, and create an industrial park nearby. There is scant mention of the local transit company and how its services complement mobility and accessibility (Ibid, 2002).

4.4 Nelson County Comprehensive and Economic Development Plan Review

The Nelson County Comprehensive Plan (Nelson Plan) was approved by the Nelson County Board of Supervisors and adopted on October 8, 2002 (Nelson County, 2002).
The Nelson County Planning Commission prepared the Nelson Plan with the assistance of the Thomas Jefferson Planning District Commission and the Design Resources Center of the University of Virginia.

The Nelson Plan contains specific elements for economic development and transportation. The economic goals include facilitating a diverse economy in specified development areas, encouraging new development support for county costs associated with growth, diversification through tourism, and highlighting and sustaining the County’s agricultural heritage and economy.

Sub-tasks of the economic development goals include emphasis on discouragement of strip development while promoting limited access, aesthetic signage, sufficient building setbacks, vegetative buffering, tourism, greenways, and protection for historic elements. Particular tasks involve support for regional transportation improvements for supply and distribution of agricultural and wood products.

The Nelson Plan specifies two transportation goals. The first goal encourages a safe and efficient transportation system to serve the County and provide for regional mobility. The second goal emphasizes improvements to mobility within identified development areas.

The transportation element encourages safe county roads, public education, truck safety, rail freight movement, limiting cut-through traffic conditions, improving mobility for the elderly and handicapped, and support for bicycle and pedestrian enhancements. Of particular note, the transportation element documents the need for encouraging large-scale industry in close proximity to US 29, while limiting the overabundance of direct access where possible.

Also identified in the Nelson Plan are transportation components such as the JAUNT rural transit service, Norfolk-Southern rail line, US 29 interchange and intersection improvements, existing and proposed park and ride lots, and other future transportation needs.

Other components particular to US 29 include:

- The Nelson Plan specifies 14 locations for interchange and intersection improvements. Though vaguely identified, the locations appear to be similar to the 14 recommended access improvements of the US 29 Corridor Development Study.
- It calls for “designation of Route 29 from Woods Mill to the Albemarle County line and Route 664 [US 664] as scenic byways” (Nelson County 2002, p. 11).
- The Route 29 Corridor Development Study recommends bicycle lanes between Charlottesville and Lovingston.
- An overpass or similar on US 29 between downtown Lovingston and developments on the West side of US 29.
- Rural residential development North of Lovingston to U.S. Route 641 (US 641).
- Rural small town development in Lovingston.
- Light industrial/mixed commercial development in the Callohill area.
- Secondary light industrial/mixed commercial for US 29 at Kingswood, at U.S. Route 739 (US 739) and US 29, and near an existing truck stop/mobile home sales lot.
- Light industrial at Colleen, U.S. Route 655 (US 655) and US 29, and at the Colleen Industrial Park.

Other headlined goals discussed in the Nelson Plan include protection of natural resources, protection of the County’s scenic and rural character, maintaining economic strength, enhancing the quality of life, maintaining a development pace while accounting for services and infrastructure, and supporting quality affordable housing for all incomes.

How will the County ensure that the Nelson Plan goals are met? In accordance with the Code of Virginia, §15.2-2224, B, the County promotes various methods for implementation. They include the Zoning Ordinance, Subdivision Ordinance, County Zoning Map, Capital Facilities Impact Reviews (rezing application reviews), Capital Improvement Program and developer proffers.

Of particular interest are five development models within the Nelson Plan’s Land Use element that are described and designated for particular development areas. The model descriptions and schematic representations exhibit the desired character and setting for the designated areas. The five models include rural small town, rural village, neighborhood mixed use, mixed commercial and light industrial. Desired transportation elements are described within each model. For instance, the rural small town development model incorporates a layout to encourage balanced travel mobility by automobile, transit, bicycling, walking and various parking amenities. A heightened sense of community and aesthetic development is encouraged in the models. Due to the rural character of Nelson County, pedestrian travel is currently limited. The mixed commercial and light industrial development models are encouraged to be located near and dependant upon major roads, highway and interchanges, while the rural village and neighborhood mixed-use models are designated for primary roadways, crossroads and some major highways.

4.5 Pittsylvania County Comprehensive and Economic Development Plan Review

The Pittsylvania County Board of Supervisors adopted the County Comprehensive Plan on March 16, 1986 (County of Pittsylvania, 1991). Various entries suggest the importance of good transportation planning. The Pittsylvania Plan states that the “more efficient and extensive the transportation system, the more likely urban growth and expansion are to occur other factors being equal.” (Pittsylvania County, 1991, p. I-105) Also, the “transportation system greatly influences an area’s rate and direction of growth.” (Ibid., II-15) It identifies the existence of highways and large population centers as primary factors in determining patterns of commercial activity (Ibid., II-7). The planners are acutely aware of congestion and access issues as they describe strip
development occurring along US 58 East of Danville to the Halifax County line and the transportation problems generated from such development.

The Pittsylvania Plan indicates that the West Piedmont Planning District has the best access to rail. Rail provides direct connections to New York, New Orleans, Detroit and Maine. Interstate bus service in 1986, provided by Greyhound and Trailways, are noted as having destinations throughout the nation from Gretna and Chatham. The Pittsylvania Plan lists over 20 motor freight carriers that service the commercial sector. Drivers, they note, are within five hours travel-time to ports in Norfolk or businesses in Washington D.C., three hours from Richmond, and within approximately one hour from Chatham, the government seat of Pittsylvania County, to Raleigh, Winston-Salem and Greensboro, N.C.. The Plan describes US 29 as a “major North-South transportation artery” (Ibid., II-11). It states that the trucking options and bus service provide the area with “an excellent transportation system and fast freight service” (Ibid.). Bus and freight carrier services in the area have changed significantly since 1986.

The Pittsylvania Plan contains the following transportation element objectives: encourage a collaborative planning atmosphere, ensure growth area interconnectivity and mobility based on the land use plan, improvement of routes connecting residential and development centers, enhance the safety and capacity of major routes into Danville, reserve right-of-way as appropriate, limit cut-through traffic issues, provide building setback regulations, meet VDOT construction standards, provide vegetative buffering and environmental protection, minimize noise and pollution effects, encourage rail connectivity, and acquire industrial access road funding as appropriate.

The future transportation plan element, identified within the Pittsylvania Plan, is a listing of projects taken from the 1984 State Six-Year Improvement Program and the 1984 State Highway Plan for the West Piedmont District. It recommends approximately 20 projects for future construction. Of these projects, four were directly related to US 29. Further, due to the significance of the US 29 north-south corridor, the County endorsed continuing efforts to improve US 29 throughout Virginia.

An economic element within the Pittsylvania Plan identifies Pittsylvania County’s economic goals at that time. They include establishing a program to create jobs, enhance income, promote new and established industry and the development of industrial parks, expand opportunities for citizens with an emphasis on the handicapped, and improve the overall tax base.

The Pittsylvania Plan also contains an extensive discussion on the County’s future land use. The planners specifically identified formal land use controls and active enforcement as the primary feature for implementation. Of particular note is that the Pittsylvania Plan identifies specific areas where substantial growth is to take place. The locations include the vicinity of Hurt, Gretna, Chatham, Blairs, Mount Cross, and Ringgold. The first four locations are adjacent to or in close proximity to US 29.
As previously noted, the Pittsylvania County Comprehensive Plan was adopted in 1986 and amended in 1991. Many components of the Plan have become outdated. Pittsylvania County representatives recently hired a consulting firm to revise the plan. This revision is anticipated to be complete in 18 to 22 months.

4.6 City of Danville Comprehensive and Economic Development Plan Review

The City of Danville is an independent municipality located in south-central Pittsylvania County. After the 1980 census, the City of Danville and Pittsylvania County were designated as a Metropolitan Statistical Area by the Census Bureau. This qualified the area to establish a Metropolitan Planning Organization. The City of Danville and Pittsylvania County are members of the West Piedmont Planning District Commission. One of the responsibilities of the West Piedmont PDC is to produce a Comprehensive Economic Development Strategy for the counties and cities they serve. A CEDS document is required by the U.S. Department of Commerce, Economic Development Administration in order to establish an Economic Development District. Economic initiatives involving the funding of public works projects and planning grants are available through the EDA. The CEDS planning process is ongoing with updates and revisions made to the plan on an annual basis.

There are two major components of the regional economic plan: first, there is a list of overall performance goals and associated short- and long-term strategies to meet those goals. Secondly, there is a prioritized list of economic development projects, with a cost estimate, an identified funding source, and a forecast economic impact in number of jobs created. Some of the economic goals in the CEDS document are: (1) retain and expand existing industries; (2) provide land development infrastructure; (3) increase educational opportunities; (4) encourage “pro-business” thinking; (5) improve regional transportation infrastructure, including promotion of I-73 construction, support upgrade of US 29, complete US 58 corridor program and complete projects on Interstate-785 (I-785) corridor. The FY 2005 Economic Development Strategy has over 100 projects listed for the four counties and two cities in the West Piedmont PDC. Many of the higher-priority projects are infrastructure related, such as fiber-optic construction, telecommunication infrastructure, utility renovations and expansions. Other projects are related to workforce development, commercial and industrial park development, and travel and tourism marketing (West Piedmont Planning District Commission, 2004).

4.7 Conclusion

The County Comprehensive Plans review reflects variations in the vision and potential approach of the corridor jurisdictions toward transportation planning. Nelson County has systematically expressed a desire to promote a quality of life and infrastructure that is compatible with the county’s rural and scenic character. This vision is a reflection of Nelson County’s potential support for, among other alternatives, US 29 improvements with “Parkway” design characteristics. However, parameters as the February 2005
unemployment rate for the city of Danville and Pittsylvania County (10.3 per cent and 6.7 per cent, respectively), and the decline in population since 2000, support an emphasis for economic priorities. It is immensely important to these jurisdictions that economic opportunities reach full potential. Hence, these jurisdictions are encouraging development of a safe and efficient US 29 to enhance the flow of people and goods.

All of the counties appear to support access limitations in the US 29 corridor for enhanced traffic flow and safety. They are all working to identify potential areas along US 29 best suited for accommodating future growth.

As noted in the chapter introduction, a transportation element is required in future comprehensive plans. VDOT is recommending that the transportation elements include an inventory of the transportation network, an evaluation of network performance and deficiencies, and recommendations for additions or improvements to the transportation system.

References

Campbell County (2001) Route 29 Corridor Management Study.  
5.1 Highway Infrastructure and Economic Development

This chapter deals, from a theoretical standpoint, with the main implications that should be considered when examining a past or prospective highway investment. In particular, our focus is on observing the relationship between provision of infrastructure and economic development. Undoubtedly, many difficulties are on the path of whoever strives to evaluate the relationship and consequences between the two. First, economic development can be defined in several ways (see, for example, Blum, 1982; Rietveld and Bruinsma, 1998). Provision of public infrastructure involves a complex interplay of public-good provision, political decision-making, and sometimes involves the private sector. It generates externalities and is characterized by long time periods. Although transportation is a necessary condition for economic development, it is not a sufficient condition (McCann and Shefer, 2004). Complementary conditions and inputs such as the economic climate, the cost of the factors of production, the natural endowments of a region, collectively determine the ultimate impact of infrastructure investments. Other factors include public policy and how it supports investment in infrastructure such as business incentives, connection to existing transportation networks, and the provision of other types of infrastructure such as telecommunications, sewer systems, power and water (McCann and Shefer, 2004).

This chapter will first provide a brief review of the main economic effects that can be observed. Subsequently, we will discuss how they can be decomposed according to three criteria, and how transportation infrastructure interacts with the territory. Finally, we will briefly present a set of methodologies that can be carried out for evaluating transportation infrastructure investment.

5.2 Direct and Indirect Effects of Transportation Infrastructure Investments on Economic Development

Many studies can be found in academic literature, trying to explain the relationship between transportation infrastructure provision and economic development. Generally, there is consensus that “good infrastructure endowment increases the productivity of private investment and correspondingly reduces private cost” (Biehl, 1991, p. 13). The consequences of these advantages are higher per-capita GDP and employment. Consequently, these economic variables positively seem to depend on infrastructure provision. In other words, infrastructure might (and should) be considered one of the main factors that determine the potential for regional development.
Nevertheless, other factors should be considered, such as location, agglomeration and sectoral structure. In particular, it comes as an immediate conclusion that location is a partial proxy for accessibility, either in terms of geographical location and economic location (measured, for example, in terms of transportation or communication costs), being therefore intertwined with infrastructure provision.

Provision of new (or better) infrastructure also generates several impacts on transportation. The effects on socio-economic variables might in fact be considered as a by-product of the transportation benefit. In particular, new infrastructure provides possibility for driving shorter distances or achieving higher speeds (because of lower road congestion). These benefits translate in changes in the generalized transport costs related to the utilization of the infrastructure. Consequently, further benefits or, more in general, changes are achieved. Among these are the following ones (Rietveld and Bruinsma 1998):

- Reductions in the cost of fuel, capital and labor.
- Increases in the firms’ productivity. Consequently, increased value-added leads to GDP increase.
- Changes in accessibility. For an analysis of the accessibility implications of infrastructure deployment, (see Chapter 7).
- Effects on employment.

In addition to the above (direct) effects, there is a set of indirect effects that should be considered, as a consequence of infrastructure improvement. The inter-relationship between socio-economic variables is visually described in Figure 5.1.

Transportation infrastructure impacts several aspects of the economic system. The following considerations discuss its potential effects on different issues (Rietveld and Bruinsma 1998). Although based on the hypothesis of new infrastructure, they still represent a valid starting point in evaluating the effects of infrastructure improvements.

*Production Processes*

It is an agreed-on assumption that new infrastructure increases productivity. The main reasons for which production benefits are achieved are, among others:

- A reduction in the costs of the movement of input and output goods. This should be considered also in terms of the costs of logistic networks.
- Increased chances for exploiting economies of scale.
- Better functioning markets.

However, one problem that should be considered in this framework is that of inverse causality. In fact, the direction of the relationship between infrastructure and productivity is not always clear. Finally, an important distinction should be made. While infrastructure does lead to a permanent increase in production, it does not bring around a constantly higher growth rate. This result is of course the result of one-time improvements, which
bring to higher benefits from operating in the affected area (in the form of cost reduction, etc.). On the other hand, higher growth rates would be related to the dynamicity of an industry or an area.

**Figure 5.1: Direct and indirect effects of transportation infrastructure (Rietveld and Bruinsma 1998, p. 49)**

*Interregional Trade and Industrial Location*

Introduction of new infrastructure also changes the functional relationships among nearby regions/areas. Neighboring regions can experience both positive and negative effects. In fact, industrial relocation comes into play once the physical structure or the cost/opportunities set changes, since the interaction among regions is determined by relative costs (for example, labor or transportation costs). In particular, this phenomenon can be decomposed in two factors: a) generation of new economic activities; b) relocation of old activities.

However, studies have indicated that availability of transportation alone will not determine the demand for land (for industrial purposes). Indeed, other conditions also apply:

- Firms will locate in good proximity to skilled labor, a condition that in turn implies that there has to be good passenger transportation available for labor to get to work.
Again, for labor to have chosen these locations one would presume the prior existence of commuter transportation.

- Transportation costs have to be a significant proportion of operating expenses before a firm will decide where to locate on the basis of how close/far it is from its markets and suppliers. For firms that produce time-sensitive and high-value goods, such as in the high-tech industry, transportation may always be a factor in location-decision making.
- In addition to proximity to markets and suppliers, firms will tend to clusters in particular locations (such as the Dulles technology corridor and the scientific research corridor in Maryland), in order to be closer to firms with whom they have interdependencies, or share resources (some of which may be transportation-related).

**Distribution Systems**

New infrastructure can modify a large set of logistics-related factors, such as “route choice (including port choice), mode choice, location of distribution centers, . . . , choice of logistical strategies” (Rietveld and Bruinsma 1998, pp. 61–62). In Chapter 7 an analysis of accessibility measures is presented.

**Housing/Labor Markets and Land Prices**

One result of infrastructure provision or improvement may be a reduction of unemployment. This result could be related to the benefits derived from the lower degree of “spatial friction.” In fact, it is easier for individuals to reach the workplace. On the other hand, in the long run, a spreading (sprawl) of the residential choices may occur, which would again increase the commuting distances. Also, a secondary effect can be a change in the firm location choices. Generally, the difficulty in modeling the spatial and locational effects of transportation infrastructure provision is due to the dual effect it generates on the territory: on the one hand, it influences production, as an input factor; on the other hand, the “network properties” transportation infrastructure has, which tend to shift market areas and modify other socio-economic functions. No clear relationship can be found between new infrastructure and land prices. Several studies (see, for example, Camagni and Capello 2005) show an increase in land prices even years before the actual construction of new/modified infrastructure. On the other hand, these increases may instead understate other benefits.

Moreover, the type of infrastructure being built is also important in determining its effects on the territory. The subsequent section will present a classification scheme for infrastructure, based on the way it geographically and functionally interacts with the areas interested.

### 5.3 Type of Infrastructure Based on Interaction with the Region

As earlier stated, the effects of infrastructure on the territory also depend on the way it interacts with it, under different aspects (geographically and functionally). Different types
of infrastructure provision can be identified. Distinctions in this field undoubtedly influence the considerations that need to be made in that regard. Helping in this endeavor, Plogmann (1980) and Vickerman (1991) present a basic classification of how new infrastructure impacts regional development. In particular, the authors classify infrastructure in the following types (also shown in Figure 5.2):

- **Type A**: infrastructure that passes through the region examined without major impact (that is, with only few access points or no train stations). This effect is called *pure corridor effect*.
- **Type B**: infrastructure improving access to and from the region examined (*crossroad effect*).
- **Type C**: infrastructure built directly within the region.

![Figure 5.2: Type of infrastructure on the basis of its relationship with the territory (Vickerman 1991, p. 61)](image)

This classification criterion, however, should not be considered too strictly, as, generally, infrastructure provided in one region also affects outside regions, occasionally also in remote regions. An example of such a phenomenon is given by Luo (2004). While investigating the ideal location for improvements to the Chinese transportation network, in order to improve access and the economy of Western China, the author finds that better results would be obtained by improving transportation infrastructure not directly on site (in Western China), but by enhancing the main hubs of the road network that give access, from the more developed Eastern China, to the West.

Further, locations that provide access to a large system of mobility for freight, people, and information can be considered to be *gateways* (Rodrigue, 2004). The characteristics of gateways are:

1. An accumulation of transportation infrastructure and termini;
2. Ability to provide entry and exit into a catchment area, which could be an industrial corridor;
3. The region/city/state would be adversely affected, economically, with the absence of one (access to markets, suppliers, etc would be cut off, would be expensive and inefficient).
In fact, transportation shapes regional spatial organization, creating interdependent sets of cities within a specific region (such as the South-Central Virginia counties). Three distinct forms of spatial structure tend to emerge:

- A set of locations of specialized industries such as manufacturing and mining, which agglomerate around sources of labor, raw materials, etc.
- A set of service industry locations, including administration, finance, retail, insurance, etc—agglomerate around a system of central places.
- A pattern of transport nodes and links, such as a road, railway and ports which services major centers of economic activity.

Effects of infrastructure on the territory are therefore complex. The next section will illustrate a possible decomposition of these effects, according to three criteria: time, industry and space.

5.4 Decomposition of Highway Investment Effects

Highway investment has effects on the housing location choices of firms and households. The minimization of commuting costs is one of the driving forces behind residential choices. On the other hand, the residential choices of households influence those of firms and factories. This section briefly presents a decomposition of these effects, on the basis of three criteria: time, industry and space (Rephann and Isserman, 1994).

Temporal Effects

When studying effects of highway investment, two periods are usually considered: the construction period and the post-construction one. During the construction phase, public expenditure made locally stimulates the region. However, once the project is completed, the duration and timing of the post-construction effects is difficult to assess. One view is that the effects are immediate and continue to influence the level and distribution of economic activity (Gaegler et al., 1979). Another view is that the economic effects of highways are actually observed only after a lag of several years. Lags from four to seven years have been empirically estimated (Wilson et al., 1986).

Industrial Effects

In industrial terms, the distribution of the industrial installments varies from the construction to the post construction stages. During the construction, due to high (public) expenditure, the effects on local industries are significant, while, in the post-construction stage, the multiplier effect is significantly reduced. The short-range transportation cost reductions associated with improved highway services tend to redraw trade and service boundaries in favor of counties that have highway connections (Blum, 1982; Kuehn and West, 1980). Also, increased through-traffic can create additional demand for non-local travel and tourism services (Lichter and Fuguitt, 1980).
Spatial Effects

Highways effects can be observed on two spatial scales: a) the local scale; and b) the regional scale. Normally, the effects of highways on the development of rural or non-metropolitan areas decreases with increasing distance from core or metropolitan areas. The threshold limit seems to be around a twenty-five mile radius, after which not much is left (Lichter and Fuguit, 1980). Alternatively, areas with a population higher than 25,000 inhabitants seem to enjoy the economic benefits of highway investments.

5.5 Methods for Evaluating and Analyzing Infrastructure Impact

A wide array of methodological approaches has been employed in analyzing the impacts of transportation infrastructure provision. A large literature provides examples, case studies and methodological reviews on the issue (see, for example, Biehl, 1991; Johansson, 1993, 1998; Rietveld and Bruinsma, 1998). Isserman (1990, p. 76) provides a classification of the methods of common/possible application in solving infrastructure impact problems. This is shown in Table 5.1.

Table 5.1: Methods for evaluating infrastructure impact

<table>
<thead>
<tr>
<th>Data aggregation</th>
<th>Approach</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate data</td>
<td>Modeling</td>
<td>Production factors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Location models</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General equilibrium models (with transport as component)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Land-use/transport models</td>
</tr>
<tr>
<td>Other</td>
<td>Quasi-experimental method (Isserman 1990)</td>
<td></td>
</tr>
<tr>
<td>Disaggregate data</td>
<td>Modeling</td>
<td>Stated choice models</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revealed choice models</td>
</tr>
<tr>
<td>Other</td>
<td>Quasi-experimental method</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expert judgment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transport cost approach</td>
<td></td>
</tr>
</tbody>
</table>

Source: Isserman (1990, p. 76)

Being able to classify methods of possible utilization is of course important, since data availability, time and political constraints, as well as other factors, influence the set of approaches that can be carried out from time to time. For example, on the one hand, quasi-experimental methods would eliminate the need for data collection. On the other hand, they would imply a careful selection of the control regions (for a description of the statistical selection tools, refer to OECD, 2002). At the same time, the utilization of surveys (see Chapter 7) involves several issues, regarding the bias given by:
- Unwillingness to admit if past location choices were wrong.
- Overestimation of the importance of congestion issues, in particular in hope of obtaining more involvement from federal or local governments.
- Decision-making on the base of perceptions that are not always true in reality.

The next section will be devoted to an introduction to Cost-Benefit Analysis (CBA), as a method for evaluating the value added that an infrastructure project can potentially generate.

Cost-Benefit Analysis as a Infrastructure Project Evaluation Tool

Cost-Benefit Analysis is a multicriteria analysis method, in which direct user benefits are examined. In the case of infrastructure provision projects, the variables considered might be (OECD, 2002):

- Travel time savings;
- Vehicle operating costs reduction;
- Safety improvements.

Additional net benefits that can be included are:

- Induced traffic;
- Mode split effects;
- Trip reliability;
- Trip quality (comfort, convenience…).

A particular aspect of CBA is the treatment of income and employment derived from the expenditure in an infrastructure project. These variables are usually considered to be a cost in CBA, but some argue that they also have an impact that can be treated as a benefit. Because of the very nature of CBA, project-related employment can not be considered as a benefit as well. However, some studies agree that beneficial impacts originating from project expenditure should be considered in CBA. However, this issue raises additional problems: how to measure the actual impact of a project on employment? Further, how is this impact localized regionally? In the evaluation of a project’s benefits on a local economy, is the employment impact necessarily located in the area?

5.6 Concluding Remarks

Determining the relationship between infrastructure provision and economic development requires complex multi-factor assumptions in its evaluation. This is because transportation infrastructure in particular, also generates externalities, has a long life span and its impact and consequences lag implementation by a significant magnitude of time.
Provision of public infrastructure involves a complex interplay of public-good provisioning, political decision-making and more often than not, the involvement of the private sector. Infrastructure by itself does not guarantee economic prosperity;

Although transportation is a necessary condition for economic development it is not a sufficient condition. Complementary conditions and inputs such as the economic climate, the cost of the factors of production, and the natural endowments of a region collectively determine the ultimate impact of infrastructure investments. Other factors such as public policy supports for investment in infrastructure, business incentives, connections to existing transportation networks, and the availability of other types of infrastructure also play a critical role in determining the degree to which transportation investments will yield economic.

In summary the analysis of the relationship between infrastructure provision and economic development is complex and uneasy. A multitude of evaluation methods can be applied, which require a deep knowledge of the type of obstacles to be faced, and the type of information that can be collected.

In order to acquire a better knowledge of the mechanisms underlying infrastructure provision and economic development, the next section will illustrate the results of an interview-based survey that was carried out by the research team.

References


Chapter 6
Methodology and Survey Analysis

The main goal of this project is to explore the relationship between the US 29 corridor and economic development in the South-side counties of Virginia. The methodology employed included a qualitative survey of selected stakeholders in the region, and an accessibility analysis of the South-side counties to airports, ports, interstate highways, and economic activities (Chapter 7). The key hypothesis of this research is that the planned improvement to US 29 is central to the economic vitality of the south-side counties.

6.1 Survey Methodology

The survey was conducted across a spectrum of County officials and members of business community in the four counties of Pittsylvania, Amherst, Nelson, Campbell and the cities of Lynchburg and Danville. The purpose of the survey was to collect stakeholder opinion on US 29 highway and the planned improvements. The survey was qualitative in nature and aimed at recording the professional opinion of the stakeholders in the region. Twelve individuals were interviewed either by phone or by personal interview. Also, one respondent provided a written reply to the questions. All the interviewees received the questions before the interview was conducted. The time frame for the survey was four weeks. This proved inadequate for face-to-face interview, coupled with the financial constraints of traveling from Northern Virginia to the South-side counties to conduct the interviews. Table 6.1 summarizes the responses to the survey.

Table 6.1: Summary of responses

<table>
<thead>
<tr>
<th>Question 1: Are you aware of Route US 29 Corridor Development Study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eleven respondents were aware of the study.</td>
</tr>
<tr>
<td>One respondent had not seen the study.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2: What will be the effect of planned improvement?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six respondents believed it will have a positive impact on their counties.</td>
</tr>
<tr>
<td>One respondent thought the result will be mixed due to loss of traffic from the bypass.</td>
</tr>
<tr>
<td>One respondent did not know, since he had not seen the report.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 3: Do recommendations of study reflect county goals?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seven respondents agreed the recommendations generally reflected county goals.</td>
</tr>
<tr>
<td>Not applicable for one respondent (had not seen the study).</td>
</tr>
</tbody>
</table>
Question 4: What are the population/economic growth projections in the next ten years?  
For Amherst County, growth will be slow but positive.  
Lynchburg population growth will be overall flat.  
Campbell County population growth will be 8 per cent over the next ten years.  
Pittsylvania County population growth will be flat.  
Danville population growth will be relatively flat at 2 per cent.

Question 5: What Business sectors are likely to grow in the area?  
Pittsylvania County: Information Technology (IT), tech manufacturing and fiber-optic engineering network.  
Amherst County: road construction, retail and professionals.  
Lynchburg: machine shops, biometrics and automation equipments.  
Danville: plastics, polymers, food processing and distribution.  
Campbell County: plastics, printing and metal machinery.

Question 6: What are the barriers to economic growth in the region?  
Six respondents listed the lack of interstate highway and air access as the major barriers to growth.  
Two respondents saw the low education level in some counties as a barrier to growth.  
One respondent pointed to the low density of population as a drawback for growth.

Question 7: How central is US 29 to the economic vitality of South-side counties?  
All 12 respondents said it is “central” and “critical” to the economic vitality of the region.

Question 8: Does congestion on US 29 inhibit economic growth?  
Six respondents did not think that congestion was “very bad”, but that it is a problem of perception regarding the problem around Charlottesville.  
Four respondents agreed congestion inhibited growth due to the reluctance of businesses to move South of Charlottesville.

Question 9: Would the level of service on US 29 affect economic development goals?  
Eight respondents believed it would affect economic development goals.

Question 10: Are there other highway investments that will aid county goals in the region?  
Pittsylvania County: no highway investment, but a regional fiber-optic system is being installed.  
Amherst County: U.S. Route 29 is the main project into place.  
Lynchburg: East-West corridor to access I-85; improving access to Lynchburg expressway and air transportation.  
Danville: a bridge connecting Piedmont Drive, and completion of the US 58 corridor to make air travel cheaper.  
Campbell County: none, probably rail.
Question 11: Is the level of collaboration among state and counties sufficient?
Eight respondents concurred that the level of collaboration is good but could be better.
Two respondents thought that the level of collaboration is not sufficient.

Question 12: Suggested improvements:
Need for roundtables with headquarters staff.
More funding.
VDOT could be more responsive.
Improved communication and interaction.
Need to invite economic developers to the Metropolitan Planning Organization (MPO).
Need to force more collaboration from VDOT.
North Carolina should be included in the planning.

Question 13: Would special tax districts or other funding mechanism be acceptable to residents/businesses?
Seven respondents believed it would be hard to sell, and would not be well received.

6.2 Survey Analysis

The result of the survey indicated that most of the stakeholders interviewed, except for one, were aware of the US 29 corridor study sponsored by VDOT. The US 29 study identified a wide range of improvements to enhance traffic flow, safety and accessibility to interstate highways and other transport nodes like airports and ports.

All the county officials, except for one who had not seen the report, believed the improvements on US 29 would have a positive impact on their counties. One respondent stated that the results would be mixed due to the loss of through-traffic due to the proposed bypass. The majority of the respondents agreed that the study generally reflected the goals of their counties. The county officials among the respondents projected that population growth will be even and in most cases flat.

A set of questions sought the views of respondents on the business sectors likely to grow in the area. Responses ranged from manufacturing to food processing and distribution. Six of the respondents listed the lack of interstate highway and air access as the major barriers to economic growth in the area, while others cited low education levels and low density as major issues. All the respondents agreed on the centrality of US 29 to the economic vitality of the region.

Interestingly, most of the respondents did not consider the US 29 highway as congested. They pointed to the area around Charlottesville as the only slightly-congested point. They however agreed that a “perception” of bad congestion has persisted, such that businesses do not want to establish South of Charlottesville. All the respondents agreed that congestion is not an issue South of Charlottesville and that improvement of the situation at that end will affect economic development in the region. The respondents provided a
list of highway and some non-highway investments that might aid achieving the economic goals in the region.

Most of the respondents were of the opinion that the level of collaboration between State and Counties is good and could be better. One respondent specifically called for VDOT to force more collaboration especially with the officials of Charlottesville. Some respondents, however, thought that the level of collaboration is not sufficient and should be improved. Suggestions for improvement included more funding, roundtables and the inclusion of North Carolina in the planning, amongst others. There was unanimity, amongst those who responded to the issue of special tax districts, that it would not be feasible.
Chapter 7
Accessibility Analysis

"Accessibility . . . is a slippery notion . . . one of those common terms which everyone uses until faced with the problem of defining and measuring it." (Gould, 1969)

7.1 Introduction

In order to use “accessibility” to explore the relationship between economic growth and transportation in the US 29 corridor, one must first define what accessibility means in this context. Accessibility refers to “the number of opportunities . . . available within a certain distance or travel time” (Hanson, 2004). Accessibility is different from mobility, which refers to the “ability to move between activity sites”, or could also mean the ease of travel (Hanson, 2004). In other words, within the context of economic development, transportation accessibility can be used to explore the level of transportation service that is provided to an area by examining the level of connectivity of the area to activities.

In the US 29 corridor, using accessibility as a descriptive measure of connectivity is logical. The policy debate in the corridor revolves around the extent to which the area in South-Central Virginia is connected to the rest of the state (and beyond) in such a way that economic development in the area can take place. The US 29 corridor has seen many projects in the past few years to upgrade service levels, and further investments are being proposed. How accessible is the area currently, and what levels of accessibility are desired? Should the corridor be upgraded to Interstate Highway service levels, or are more gradual investments adequate to provide a level of accessibility necessary to achieve economic goals? This section will attempt to provide an evaluative framework for approaching these very important policy questions. It is important to note that this is a preliminary analysis. Should VDOT seek to expand and improve this analysis, recommendations are included at the end of the chapter for making the analysis more robust and accurate. That said, the approach documented is quite robust to begin with, and provides, at least preliminarily, some interesting results.

Relationship to economic development

While mobility or investments in transportation infrastructure are worthwhile goals, the connectedness of an area to markets, labor force, raw materials, and suppliers is more central to the transportation and economic development relationship (FHWA, 2001). In many cases, accessibility is a precursor for economic development, but is not the only reason development does or does not occur. Also, the sensitivity of economic development may be different depending on the business sector in question. For example, the manufacturing sector is quite sensitive to accessibility of raw materials, but the
service sector could be more sensitive to the accessibility to airports or major population centers. In any event, accessibility is important, and areas with high connectivity have advantages over other areas that do not (all else being equal).

7.2 Accessibility as a planning performance measure

Accessibility measures, as stated above, represent the level of connectedness of specific geographies to activities. These measures can be extremely useful at the system-wide level, since one can compare relative levels of accessibility. Many urban and regional transportation agencies have used a form of accessibility measurement or indexing to demonstrate the extent to which persons or areas have access to transportation facilities and activities. For example, the Orange County Transportation Authority in California used an accessibility measure to assess the relative accessibility of residents to their transit system (FHWA, 2001). The Metropolitan Transportation Commission (MTC), the MPO for the San Francisco Bay Metropolitan Area used an accessibility measure to assess whether their long range transportation plan increased or decreased accessibility levels for low-income transportation users in their planning area (FHWA, 2001).

The documentation of accessibility as performance measures being applied at the statewide level, however, appears much more limited. Though there are discussions in national forums for improved performance measures to be used in statewide transportation planning, few have been implemented and put to practical use. Florida DOT uses a form of accessibility measure in statewide planning to assess the amount of the population that is within a particular distance of its highway or rail system. This approach is used by other states: a review of State Departments of Transportation (DOTs) performance measurement web sites showed that California, Nevada, and Oregon are also pursuing measures to promote access to transportation facilities. While this type of measure is one form of accessibility, the Florida measure helps assess the availability and proximity of populations to the transportation system, but does not measure the ability of these populations to opportunities to engage in activities (Florida DOT, 2004).

7.3 Description of accessibility measure

Accessibility Measure Structure

Several accessibility measures were reviewed for this project (Bhat, 2001; Jones, 1981). It was determined that the most straightforward and practical measure for this study would be to use a gravity-based, or cumulative-opportunity measure. The form of the measure is as follows:

$$A_i = \frac{\sum_j O_j / T_{ij}}{c}$$

Where:

- $A_i$ = Accessibility index for region $i$;
- $O_j$ = Opportunities in zone $j$;
$T_{ij} =$ Travel time from zone $i$ to $j$; 
$c =$ decay function constant.

This form has been adapted from Rietveld and Bruinsma (1998) and Liu and Zhu (2004).

The above accessibility index will be calculated for each analysis zone ($i$ in the equation above), for each opportunity type. In the interest of the limited scope of this project, the opportunity types have been limited. The following measures represent $O_j$ in the equation above. The chosen opportunity types with the correspondent data sources are shown below in Table 7.1.

Table 7.1: Opportunity types and relative measures and data sources

<table>
<thead>
<tr>
<th>Opportunity Type</th>
<th>Measure ($O_j$)</th>
<th>Data Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port activity</td>
<td>Port tonnage</td>
<td>Bureau of Transportation Statistics: National Transportation Statistics 2004</td>
</tr>
<tr>
<td>Interstate Highway</td>
<td>Interstate Highway availability</td>
<td>Virginia Statewide Model</td>
</tr>
<tr>
<td>Economic activity</td>
<td>Employment</td>
<td>Virginia Statewide Model</td>
</tr>
</tbody>
</table>

Level of geographic analysis

The accessibility index will be calculated using the Transportation Analysis Zone (TAZ) structure from the Virginia Statewide Model (VSM) (VDOT, 2005). The structure can be seen in Figure 7.1. This geographic analysis structure was chosen due to its fairly detailed structure, and to the availability of complementary data, such as travel time and employment data.
Figure 7.1: Virginia Statewide Model zone structure

The TAZs refer to the $i$’s and $j$’s in the equation above. There are 1582 TAZs in the data set. Travel time data used in the study is model year 2000 congested travel times between all zone pairs ($T_{ij}$ in the equation above), and was provided by VDOT. The same congested travel time was used to calculate the accessibility indices for all the opportunity types.

An example of how the accessibility index is calculated is shown in Figure 7.2. To conduct the analysis, databases were integrated in TransCAD, a geographic information system (GIS) software platform, and was then exported to text file format. Custom computer scripts were written to calculate the accessibility indices, and then the results were imported back into TransCAD for results consolidation and mapping.

To better understand how this accessibility index is calculated, an example will be presented. Let’s say we have a very small zone system, five zones, and only one of them has an airport: Zone 4 with 100,000 enplanements in 2004. The travel time has been provided and is shown in the following illustration. What is the accessibility index for Zone 1?
The calculation of the Accessibility index for Zone 1 is as follows:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Enplanements ($O_j$)</th>
<th>Travel Time from Zone 1 ($T_{ij}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>100000</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zone</th>
<th>$O_j/T_{ij}$^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

**Equation**

$$A_i = \sum_j O_j T_{ij}^c$$

Where:

- $A_i =$ Accessibility index for region $i$;
- $O_j =$ Opportunities in zone $j$;
- $T_{ij} =$ Travel time from zone $i$ to $j$;
- $c =$ decay function constant.

So, for Zone 1, the Accessibility Index is 250. This represents the calculations for only one zone. The calculations would be repeated for all zones in the analysis area. In the VSM, there are 1582 zones in the analysis, meaning that for each accessibility index, there are 1582 x 1582, or 2,502,724 calculations.

7.4 Application in Study Area

**Accessibility to Airport Activity**

Most of those surveyed for this project (as discussed in Chapter 6) mentioned airport accessibility as critical to economic development. Airport access is critical to business travelers, to quickly make service or sales calls, and to basically be connected to the
larger business community. This section details the data used in calculating the airport accessibility measure and discusses the results.

Data
The measure of airport activity, as presented above, is enplanements. Enplanements refer to the number of passengers that boarded airplanes. Data for this study was acquired from the Federal Aviation Administration for all airports in the U.S. for 2004 (FAA, 2004). The data set was then narrowed to include only commercial airports (military, general aviation, and heliports were excluded). The data was further limited to the top 250 airports in terms of total yearly enplanements, which was chosen to make the dataset more manageable, and because the Lynchburg, VA airport would be included in the analysis. Of the top 250 airports in the U.S., 23 airports in Virginia, Tennessee, North Carolina, West Virginia, Maryland, and Pennsylvania were selected to be included in the analysis. The logic of the selection was that these were airports that could logically provide commercial air service to Virginia residents. Figure 7.3 and Table 7.2 show the study area airports, and the number of enplanements per airport.

Table 7.2: Airports included in the study

<table>
<thead>
<tr>
<th>Airport ID</th>
<th>Name</th>
<th>City</th>
<th>State</th>
<th>Total Enplanements (2004)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHL</td>
<td>Philadelphia Intl</td>
<td>Philadelphia PA</td>
<td>13,054,494</td>
<td></td>
</tr>
<tr>
<td>CLT</td>
<td>Charlotte/Douglas Intl</td>
<td>Charlotte NC</td>
<td>12,248,829</td>
<td></td>
</tr>
<tr>
<td>BWI</td>
<td>Baltimore-Washington Intl</td>
<td>Baltimore MD</td>
<td>10,556,262</td>
<td></td>
</tr>
<tr>
<td>IAD</td>
<td>Washington Dulles International</td>
<td>Washington D.C.</td>
<td>9,848,297</td>
<td></td>
</tr>
<tr>
<td>PIT</td>
<td>Pittsburgh International</td>
<td>Pittsburgh PA</td>
<td>6,920,958</td>
<td></td>
</tr>
<tr>
<td>RDU</td>
<td>Raleigh-Durham International</td>
<td>Raleigh/Durham NC</td>
<td>4,184,262</td>
<td></td>
</tr>
<tr>
<td>ORF</td>
<td>Norfolk Intl</td>
<td>Norfolk VA</td>
<td>1,696,512</td>
<td></td>
</tr>
<tr>
<td>GSO</td>
<td>Piedmont Triad International</td>
<td>Greensboro NC</td>
<td>1,383,914</td>
<td></td>
</tr>
<tr>
<td>RIC</td>
<td>Richmond International</td>
<td>Richmond VA</td>
<td>1,279,349</td>
<td></td>
</tr>
<tr>
<td>TYS</td>
<td>Mc Ghee Tyson</td>
<td>Knoxville TN</td>
<td>751,342</td>
<td></td>
</tr>
<tr>
<td>MDT</td>
<td>Harrisburg International</td>
<td>Harrisburg PA</td>
<td>675,537</td>
<td></td>
</tr>
<tr>
<td>PHF</td>
<td>Newport News/Williamsburg International</td>
<td>Newport News VA</td>
<td>372,064</td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>Roanoke Regional/Woodrum Field</td>
<td>Roanoke VA</td>
<td>278,117</td>
<td></td>
</tr>
<tr>
<td>CRW</td>
<td>Yeager</td>
<td>Charleston WV</td>
<td>243,853</td>
<td></td>
</tr>
<tr>
<td>AVL</td>
<td>Asheville Regional</td>
<td>Asheville NC</td>
<td>239,402</td>
<td></td>
</tr>
<tr>
<td>TRI</td>
<td>Tri-Cities Regional Tn/Va</td>
<td>Bristol/Johnson/Kingsport</td>
<td>218,543</td>
<td></td>
</tr>
<tr>
<td>CHS</td>
<td>Charlottesville-Albemarle</td>
<td>Charlottesville VA</td>
<td>164,844</td>
<td></td>
</tr>
<tr>
<td>UNV</td>
<td>University Park</td>
<td>State College PA</td>
<td>132,186</td>
<td></td>
</tr>
<tr>
<td>FAY</td>
<td>Fayetteville Regional/Grannis Field</td>
<td>Fayetteville NC</td>
<td>113,130</td>
<td></td>
</tr>
<tr>
<td>EWN</td>
<td>Craven County Regional</td>
<td>New Bern NC</td>
<td>62,038</td>
<td></td>
</tr>
<tr>
<td>LYH</td>
<td>Lynchburg Regional/Preston Glenn Field</td>
<td>Lynchburg VA</td>
<td>48,013</td>
<td></td>
</tr>
<tr>
<td>HTS</td>
<td>Tri-State/Milton J.Ferguson Field</td>
<td>Huntington WV</td>
<td>44,550</td>
<td></td>
</tr>
</tbody>
</table>
Figure 7.3: Airports included in the study
Results
The results of the airport accessibility analysis can be seen in Figure 7.4. Only the results using a decay factor (or $c$) of 2 have been included in this section, but the results for decay factors 1 and 1.5 are included in the appendix. The results show low accessibility in the central part of the state, with high accessibility around the Washington, D.C. metropolitan area, and Richmond and Hampton Roads areas. The South-side Virginia counties rated low to moderately low in airport accessibility.

Surprisingly, the area in far South-West Virginia (near the town of Wytheville) shows very high airport accessibility. This could be a result of several issues. The first is that on closer inspection, the area is quite close in travel time to Charlotte, which holds one of the largest airports in the study. Also, I-77 provides direct connectivity from this area of Virginia to the Charlotte airport. Second, the travel-time matrix may be incorrectly calculated between this area of the state and Charlotte (and perhaps other airports). The study team pinpointed potential errors in these travel times by inspecting specific travel times and checking for reasonableness. If the travel time to the Charlotte airport is shown as being much closer (in travel time) than in reality, this would cause the accessibility index to be abnormally high. This issue will be addressed in more detail in the conclusion to this chapter.

Accessibility to Port Activity

Access to port activity is essential for businesses that rely on ports for the delivery of raw materials, components for assembly, or goods from abroad to be sold in the U.S. The ports are also essential for the export of goods produced in the U.S. to be sold or used abroad. This section will present the results of the port accessibility analysis and discuss the results.

Data
The measure chosen to represent port activity was total tonnage moved through the port. The data was acquired from the Bureau of Transportation Statistics National Transportation Statistics 2004 (BTS, 2004). The database included the top 50 ports in the U.S., and ports in the region of analysis were selected for inclusion in the accessibility calculations. The selected ports and the tonnage moved through those ports can be seen in Figure 7.5 and Table 7.3.
Figure 7.4: Airport accessibility index results
Figure 7.5: Ports included in the study
Table 7.3: Ports included in the study

<table>
<thead>
<tr>
<th>Port Name</th>
<th>State</th>
<th>Total Tonnage (million tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>NJ</td>
<td>145.89</td>
</tr>
<tr>
<td>Huntington</td>
<td>OH</td>
<td>77.64</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>PA</td>
<td>41.68</td>
</tr>
<tr>
<td>Baltimore</td>
<td>MD</td>
<td>40.18</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>PA</td>
<td>33.25</td>
</tr>
<tr>
<td>Norfolk Harbor</td>
<td>VA</td>
<td>31.20</td>
</tr>
<tr>
<td>Paulsboro</td>
<td>NJ</td>
<td>27.28</td>
</tr>
<tr>
<td>Marcus Hook</td>
<td>PA</td>
<td>26.16</td>
</tr>
<tr>
<td>Charleston</td>
<td>SC</td>
<td>25.20</td>
</tr>
<tr>
<td>Savannah</td>
<td>GA</td>
<td>23.37</td>
</tr>
<tr>
<td>Cleveland</td>
<td>OH</td>
<td>12.62</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>KY</td>
<td>11.83</td>
</tr>
<tr>
<td>Ashtabula</td>
<td>NY</td>
<td>10.43</td>
</tr>
</tbody>
</table>

Results
The results of the port accessibility index can be seen in Figure 7.6. Again, the areas in the central part of Virginia show low accessibility to port activity, with the areas around Hampton Roads and the D.C. area with high accessibility, due to the Hampton Roads and Baltimore ports, respectively. There is a surprising patch of high accessibility along the southern border with North Carolina. This is most likely due to anomalies in the travel time matrix (similar to the airport accessibility index presented above). Troubleshooting this apparent false reading was not possible given the time constraints of this study. It appears that South-Central Virginia again faired poorly in this analysis. However, Danville is included in the questionable high accessibility area discussed above, and conclusions regarding it can not be reliably made.

Accessibility to Interstates

Almost all respondents to the survey in Chapter 6 indicated that the lack of interstate access in South-Central Virginia was a primary cause of economic under-performance. Increasingly, businesses are including interstate highways as prerequisites in their site location decision-making process. An approach was therefore created to calculate an interstate accessibility index for Virginia. This section will present the results of the interstate accessibility analysis and discuss the results.
Figure 7.6: Port Accessibility Index Results
Data
The data for interstate accessibility was derived from the location of the interstates in the study area. The sections of highways chosen are shown in Figure 7.7. While enplanements and tonnage were used for the analyses conducted above, a measure of access was needed to conduct the interstate accessibility calculations. It was determined that a binary system would be suitable for this purpose, meaning a zone either has direct access or does not. Where an interstate highway was within or adjacent to a zone, an arbitrary value of 10,000,000 was assigned representing the accessibility value. This scale of value was chosen to avoid extremely small numbers in the results of the zonal accessibility indices. The TAZs selected are also shown in Figure 7.7. For TAZs with no interstate, a value of zero was entered. This process allowed the study team to use the same analysis framework for interstate access as it did for ports and airports.

Results
The results of the analysis can be seen in Figure 7.8 and are not surprising. The areas of high accessibility are within the interstate corridors in Virginia, with low accessibility values falling in areas without interstates. It is important to note that areas with good connectivity to the interstate system, but no interstate within or adjacent to the zone, would result in high or medium high accessibility values, and can be seen in the areas immediately buffering the interstate corridor. The South-Central Virginia area fairs poorly in this analysis, particularly the extreme southern portion, since access to an interstate becomes increasingly difficult for areas in the southern portion of US 29. However, more influence was expected from I-73 in North Carolina, particularly in the Danville area, but did not significantly affect the accessibility index results.

Accessibility to Economic Activity

Access to economic activity in this analysis is intended to represent access to markets. For businesses to sell their products, they must have access to substantial markets to be successful. Having access to such markets was identified by several of the survey respondents in Chapter 6 as being critical to business development in South-Central Virginia.

Data
Many different measures could have been used in this part of the analysis. The number of employees was selected mainly because it was readily available within the VSM-TAZ dataset. It is highly suggested that an expanded and improved version of this analysis include additional measures, which will be discussed in the conclusions and recommendations section. The employment data is from the year 2000, and is based on purchased data from Woods and Poole, an economic database vendor (VDOT, 2005).
Figure 7.7: Interstates and TAZs included in interstate accessibility study
Figure 7.8: Interstate accessibility index results
Figure 7.9: Economic activity accessibility index results
Results
The results of the economic activity accessibility analysis can be seen in Figure 7.9, and are not surprising. The map identifies mainly major employment centers, and corresponds quite well to a map of urban areas in the state. Certainly the more rural areas of Virginia fair poorly and the urban centers quite well. South-central Virginia fairs moderately, since the zones in Lynchburg and Danville indicate high to moderately-high accessibility.

7.5 Suggested Improvements and Conclusions
This chapter has presented an approach to calculate cumulative opportunity accessibility measures that could be used in the context of statewide transportation decision-making. The approach could be used to test alternatives and to assess the extent to which a specific investment (such as a new or expanded highway), or a set of investments (such as a transportation plan) improves accessibility for both the system as a whole, or for specific areas.

Suggested Improvements
The method created for this analysis is quite robust, calculating the connectedness of each TAZ in the VSM to airport, port, interstate and employment activities. As stated previously, however, this analysis should be considered to be preliminary, since several improvements could be made to make the analysis more meaningful and accurate. Some suggestions for such improvements are discussed below.

Data issues: reasonableness of the travel time matrix
In the conduct of the analysis, it became apparent that there were anomalies in parts of the congestion travel time matrix. It is possible that the matrix given to the study team represented something other than just straight congested travel time, but could have incorporated additional impedance functions or costs. To ensure that the analysis is as accurate as possible, reasonableness checks should be performed on the travel time matrix output to ensure reliable travel time estimates for use in accessibility analyses.

Measures of activity: additional measures
The accessibility analyses would be greatly improved if indices were calculated using additional measures, or in some cases sub-classes, of the opportunity types. Some examples are included in the table below:

Table 7.4: Opportunity type measures

<table>
<thead>
<tr>
<th>Opportunity type</th>
<th>Additional measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port activity</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>20 ft equivalent unit (TEU)</td>
</tr>
<tr>
<td>Economic activity</td>
<td>Employment by sector</td>
</tr>
<tr>
<td></td>
<td>Revenue production</td>
</tr>
<tr>
<td>Interstate activity</td>
<td>Measure of level of service, capacity</td>
</tr>
</tbody>
</table>
**Modes: Include more modes in analysis**
While this analysis focused just on highway travel times, it would be useful to include other modes in the analysis, particularly areas where intercity or commuter transit or rail transportation plays a significant role in passenger and freight movements. Methods have been used in urban transportation planning to effectively combine multimodal travel times and costs into single representations of access and could possibly be adapted for use in a statewide context.

**Sensitivity analysis: test the decay factors**
This analysis used three values for decay factors in the index formulation: 1.0, 1.5, and 2. Only the results from the decay factor of 2 were presented in this chapter, the others can be found in Appendix A. That is not to say that 2 is the correct value, in fact the decay function will likely be different depending on the sensitivity of the traveler or shipper to increases in travel time. In other words, the value placed by consumers on transportation will vary by the type of activity. A sensitivity analysis may help in determining which values make sense for different types of activities.

**Conclusions**
As stated previously, this analysis should be viewed as preliminary, as a proof of concept. It is therefore difficult to make broad policy conclusions regarding the results; however, some preliminary conclusions can be made regarding the relative accessibility of South-Central Virginia. When looking at all of the accessibility indices side by side, it is apparent that the area does have lower connectivity to most activities than many areas in Virginia. This is not a surprise to the business leaders and stakeholder in this area. However, as opposed to focusing singly on mobility measures, this chapter has presented a framework within which the south-central counties and cities, and for that matter the entire state can analyze the potential for increases in accessibility due to alternative investment scenarios.

**References**
8.1 Findings

Currently, US 29 operates at a high level of service. Traffic data updated in the report confirms that a large percentage of US 29 has a level-of-service of “A”, with the exception of the southern suburbs of Lynchburg and adjoining areas of Campbell County, which has level of service “C”.

All of the County and City Comprehensive Plans within the study area need updated transportation elements. These elements should include an inventory of the transportation network, an evaluation of the network performance and deficiencies, and recommendations for additions or improvements to the transportation system.

Funding to implement proposed US 29 improvements is limited. Lynchburg District Fiscal Year 2005–2010 and proposed FY 2006–2011 funding for primary projects is significantly less than needed to implement the US 29 Corridor Plan improvements.

It must be recognized that the economic and transportation goals of the various counties and cities are somewhat different. A mutual understanding of these differences is an important step toward accommodation for all jurisdictions. Multi-jurisdictional communication and collaboration would likely help in achieving balance among these differing goals.

Interstate access is important for economic development. Economic indicators provide strong evidence that location along interstate highways can contribute to economic vitality.

However, transportation access is but one factor among many that foster development. Other key factors play at least as important a role in economic development as location along an interstate corridor. One example is the importance of a regional fiber-optic network to serve information-oriented business.

The survey revealed a strong stakeholder support for the US 29 Study and its recommendations. Many of the respondents used words like “critical”, “central” or “important” to describe the vital nature of the US 29 corridor to the economic vitality of their counties.

U.S. Route 29 in Charlottesville is viewed as a significant barrier. Most of stakeholders interviewed share the view that the US 29 at the current level of service around the Charlottesville area will continue to dampen economic development in the region.
The South-Central Virginia counties have low accessibility. The accessibility analysis framework, while preliminary, did show that the South-central counties in Virginia do have lower connectivity and accessibility to most activities (particularly airport, interstate and economic activity) than many other areas in Virginia.

Accessibility can be a robust and meaningful new system-performance measure. The accessibility analysis proved quite robust, and with some improvement, has the potential to be a meaningful planning performance measure that goes beyond just mobility.

Interstate-73 holds promise for additional access to South-central communities. Construction of the 65-mile long I-73 corridor from Roanoke (I-581) to the North Carolina border appears to be the best opportunity for the Danville area to have close access to an Interstate corridor in Virginia.

8.2 Recommendations

The Counties should increase access to their local plans. It is recommended that all of the counties place their Comprehensive Plans and Economic Development Strategies on their websites to allow access and ease of public viewing.

VDOT should explore the addition of an accessibility measure in their statewide planning process. With the additional capabilities associated with the Virginia Statewide Model, VDOT should explore measures that address the issue of system-wide accessibility beyond just mobility measures.

Access management should be a priority in transportation planning for all areas along US 29 that are not already designated limited access. Access management can be described as the provision of entry and exit from a highway for adjacent land uses utilizing methods that improve or preserve the efficiency of the transportation system.

A US 29 transportation and economic model should be constructed and maintained for the study area. The jurisdictions should consider building and maintaining such a model (in conjunction with VDOT) to help analyse and prioritize transportation projects along the corridor. Funding could be developed through a consortium.

VDOT should foster and encourage multi-jurisdictional collaboration. VDOT and the municipalities have taken great strides to inform and involve the communities in future planning for US 29. Steps should be taken to implement a continuous web-oriented forum for submittal of comments and ideas from the businesses community, residents, travelers and freight interests.

The stakeholders in the corridor should support I-73. The South-Central Virginia communities should advocate strongly for the construction of the 65-mile long I-73 corridor from Roanoke (I-581) to the North Carolina border.
The stakeholders should create a corridor “identity.” The stakeholders in the study area should consider a regional or corridor-based economic development strategy that attempts to develop a regional identity; one that could target a particular growth sector or industry, the Interstate-270 Technology Corridor in Maryland or the Dulles corridor in Northern Virginia, for example. This could be pursued in conjunction with major corridor initiatives, such as the Regional Backbone Initiative, which will put an extensive, 700-mile fiber-optic network in place in South-Central Virginia.
Appendix A
Complete Accessibility Map Results